

In Reply Refer To:
FWS/R4/ES

August 8, 2006

Mr. David Paulison, Director
Federal Emergency Management Agency
500 C Street, S.W.
Washington, D.C. 20472

Dear Mr. Paulison:

In 1997, the U.S. Fish and Wildlife Service (Service) completed a biological opinion (BO) under section 7 of the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 United States Code [U.S.C.] 1531 *et seq.*) for the Federal Emergency Management Agency (FEMA) on the National Flood Insurance Program's (NFIP) actions in the Florida Keys (Keys). In addition, the Service amended the BO in 2003. This process was legally challenged in the District Court Southern District of Florida. On March 29, 2005, the Court issued an Order ruling the Service and FEMA violated the Act and the Administrative Procedure Act (APA) (79 Stat. 404; 5 U.S.C. 500 *et seq.*). Specifically, the Court found:

- (1) the Service and FEMA violated Act section 7(a)(2) and APA's prohibition against actions that are arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with the law by failing to protect against jeopardy;
- (2) the Service and FEMA failed to ensure against adverse modification of critical habitat for the endangered silver rice rat; and
- (3) FEMA failed to develop and implement a conservation program for listed species under section 7(a)(1) of the Act.

On September 9, 2005, the Court also granted the plaintiff's motion for an injunction against FEMA issuing flood insurance on any new residential or commercial developments in suitable habitats of federally listed species in Monroe County, Florida. The Court ordered the Service to submit a new BO within nine months from the September 9, 2005, date. In addition, the Court granted a two-month extension requiring the BO to be submitted by August 9, 2006. In compliance with the Court's order, this document transmits the Service's BO on FEMA implementation of the NFIP in Monroe County, Florida and its effects on eighteen federally listed threatened or endangered species. FEMA and the Service have appealed portions of the March 29, 2005, and September 9, 2005, rulings, and the appeal is still pending.

The threatened and endangered species in the Florida Keys include:

American crocodile (*Crocodylus acutus*),
Garber's spurge (*Chamaesyce garberi*),
Key deer (*Odocoileus virginianus clavium*),
Key Largo cotton mouse (*Peromyscus gossypinus allapaticola*),
Key Largo woodrat (*Neotoma floridana smalli*),
Key tree-cactus (*Pilosocereus robinii*),
Lower Keys marsh rabbit (*Sylvilagus palustris hefneri*),
Schaus swallowtail butterfly (*Papilio aristodemus ponceanus*),
silver rice rat (*Oryzomys argentatus*),
Stock Island tree snail (*Orthalicus reses reses*),
eastern indigo snake (*Drymarchon corais couperi*),
bald eagle (*Haliaeetus leucocephalus*),
loggerhead sea turtle (*Caretta caretta*),
green sea turtle (*Chelonia mydas*),
leatherback sea turtle (*Dermochelys coriacea*),
hawksbill sea turtle (*Eretmochelys imbricata*),
Kemp's ridley sea turtle (*Lepidochelys kempii*) and
piping plover (*Charadrius melanotos*).

In addition, critical habitat of the American crocodile, silver rice rat, and piping plover has been designated in the Florida Keys. No other federally listed species referenced above have critical habitat designations; therefore, no other critical habitats will be affected.

This BO is based on information in the June 16, 1997 BO and April 18, 2003 amendment. It also incorporates documentation provided by FEMA, the State of Florida Department of Community Affairs (DCA), Monroe County, and the cities of Islamorada, Marathon, Layton, Key Colony Beach, and Key West. The BO includes information compiled through telephone conversations, field investigations, and other sources of information. A complete administrative record of this consultation is on file at our South Florida Field Office.

Consultation History

On August 25, 1994, the United States District Court for the Southern District of Florida filed a memorandum opinion and final declaratory judgment for *Florida Key Deer v. Stickney* (Case No. 90-10037-CIV-MOORE). The Court directed the Federal Emergency Management Agency (FEMA) to consult with the Service to determine whether implementation of the NFIP in Monroe County, Florida was likely to jeopardize the continued existence of the endangered Florida Key deer.

On July 25 and 26, 1995, the Service and FEMA met to discuss the NFIP, its administration, its implementation, and the section 7 consultation on the program. During this meeting, the two agencies outlined their roles and responsibilities and duties during the consultation. During this meeting, the Service outlined the section 7 process as it would apply to the FEMA consultation. In particular, the Service recommended including all threatened and endangered species in the

consultation, rather than just the Key deer, to avoid having to re-initiate consultation on the other threatened and endangered species later.

On September 7, 1995, the Service sent a letter to FEMA, which summarized the July 1995 meeting and identified the species that the NFIP “may affect.” This letter initiated formal consultation on the NFIP. In the letter, the Service asked FEMA for an extension of the regulatory consultation period due to the complexity of the consultation. The Service also asked FEMA for additional information that would help with the consultation.

On October 5, 1995, the Service spoke with several FEMA representatives to discuss the status of the consultation. The FEMA representatives confirmed that they still needed to provide the information the Service requested in its September 7, 1995, letter. They explained that the delay in delivering the information was caused by the large number of severe weather emergencies along the Gulf Coast States during the fall of 1995.

On January 25, 1996, FEMA sent a letter to the Service explaining the delay in responding to the Service’s September 7, 1995, letter. In their letter, FEMA wrote that they understood the consultation to be “the admission of communities into the NFIP as well as the suspension and readmission of such communities, under 44 CFR part 59.” FEMA agreed to extend the 135-day consultation period due to the importance of the consultation and agreed to help the Service gather and evaluate information during the consultation.

From April 29 through May 1, 1996, the Service held a meeting to discuss the recovery needs of the threatened and endangered species of the Florida Keys. The meeting was attended by experts on the various threatened and endangered species in the Florida Keys and the managers of public and private lands important to those species. The Service used to this meeting to gather the best scientific and commercial information available on the biology and status of the threatened and endangered species of the Keys, opportunities to recover them, and best management practices to promote their recovery. The meeting’s attendees also discussed how FEMA actions would affect listed species.

On May 8, 1996, the Service met with representatives from FEMA and the National Wildlife Federation (NWF) to discuss the status of the section 7 consultation on the NFIP. The Service explained that the scope of the consultation included 10 of the 17 threatened and endangered species in the Florida Keys, rather than only the Key deer. The Service also presented a schedule for completing the draft BO and agreed to provide a draft document to both FEMA and NWF by July 15, 1996. The Service agreed to meet in Washington D.C. on September 10, 1996, to review the conclusions in the BO and to develop any reasonable and prudent alternatives, incidental take statements, and conservation recommendations that might be appropriate.

On July 10, 1996, the Service requested from FEMA and NWF a time extension to provide a draft BO. A new date of July 22, 1996 was agreed upon.

On July 22, 1996, the Service provided copies of the draft BO to FEMA and NWF.

On August 23, 1996, the Service received written comments from FEMA on the draft BO. The most significant concern that FEMA identified was that the draft Opinion did not accurately describe FEMA's administration of the NFIP in Monroe County, Florida. Furthermore, FEMA believed this inaccuracy resulted in overstating their role in the decline of listed species in Monroe County.

On September 10 and 11, 1996, the Service met with representatives of FEMA and the Department of Justice (DOJ) to review FEMA's comments on the draft BO and begin discussions on appropriate Reasonable and Prudent Alternatives (RPA). The Service agreed to incorporate the changes recommended by FEMA in their comment letter. FEMA agreed to provide the Service with a description of their administration of the NFIP in Monroe County, for incorporation into the revised draft BO.

On September 12, 1996, the Service met with representatives of FEMA, NWF, Department of the Interior (DOI) and DOJ to discuss the status of the section 7 consultation and receive input from the NWF about RPAs.

On October 3, 1996, the Service, FEMA, NWF, DOJ and DOI held a conference call to discuss the status of the section 7 consultation.

On June 16, 1997, the Service issued the BO on FEMA's administration of the NFIP in Monroe County, Florida. The Service concluded that the continued administration of the NFIP was likely to jeopardize the continued existence of the Garber's spurge, Key deer, Key Largo cotton mouse, Key Largo woodrat, Key tree-cactus, Lower Keys marsh rabbit, Schaus swallowtail butterfly, rice rat, and Stock Island tree snail; and was not likely to jeopardize the eastern indigo snake. The Service also concluded that critical habitat for the rice rat was likely to be destroyed or adversely modified.

In June and July 1998, the Service met with representatives of Monroe County in Marathon to discuss implementing the RPA. FEMA agreed to hire consultants to reconcile the county's parcel mapping process with the listed species maps produced by the Service. A unified system was developed for the county that identifies the list of real estate parcel numbers located within listed species habitat or potential habitat. Individuals requesting building permits in those areas are required to consult with the Service. The Service initiated a system to review such permits and their effects on habitat (Permit Review System).

In an August 5, 1998, letter from the Service to Monroe County, the Service identified exempted actions not requiring coordination with the Service. The exempted actions were those that did not take place in native habitat, or were undertaken due to natural disaster or calamity.

On September 24, 2002, the Service and FEMA met to discuss and evaluate compliance with the 1997 opinion. The agencies met with representatives from local governments, including Monroe County and the City of Marathon to review a suite of projects requiring Service technical assistance/coordination. The agencies identified no deficiencies in reviewing content, timeliness, or review consistency.

On April 18, 2003, the Service issued its amended BO for the effects of the NFIP on threatened and endangered species in the Florida Keys. In that opinion, the Service concluded that full implementation of the NFIP in Monroe County would jeopardize the continued existence of several species unless a site-specific assessment is completed for each proposed development within suitable habitat in the area where flood insurance is available. The Service added the American crocodile to the species evaluated in the BO.

On March 29, 2005, Judge K. Michael Moore, United States District Court, Southern District of Florida, Miami, Florida, in the case of Florida Key Deer et al. versus Michael D. Brown, et al., granted the plaintiffs' Motion of Summary Judgment. The focus of the ruling was the Service's 2003 BO (BO) and its reasonable and prudent alternatives (RPAs). The Court determined:

- “(1) that the Service’s preparation of the 2003 BO was arbitrary, capricious or otherwise not in accordance with the law;
- (2) that the 2003 RPAs failed to protect against jeopardy;
- (3) that FEMA’s failure to engage in any independent analysis of the sufficiency of the 2003 BO and the 2003 RPA was arbitrary, capricious or otherwise not in accordance with the law; and
- (4) that FEMA was in violation of the Act section 7(a)(1) for failing to develop and implement a conservation program for the Listed Species.”

On September 9, 2005, Judge Moore granted the plaintiff's motion for an injunction against FEMA issuing flood insurance on any new residential or commercial developments in suitable habitats of federally listed species in Monroe County, Florida. The Court also ordered that the Service submit a new BO within 9 months and subsequently extended the deadline another two months and also retained jurisdiction until the defendants comply with the March 29, 2005 Order. FEMA and the Service have appealed portions of the March 29, 2005, and September 9, 2005, rulings, and the appeal is still pending.

On October 20, 2005, the Service sent Monroe County and affected municipalities a letter explaining the ruling and informing them that the Court ruled the 2003 RPA was invalid. That included 2003 RPA(c) that required Monroe County to consult with the Service before issuing building permits in suitable habitat for threatened and endangered species. Therefore, Monroe County was no longer required to consult with the Service before issuing building permits in suitable habitat and the Service no longer needed to provide technical assistance review of building permit applications.

On January 26, 2006, the Service sent FEMA a request for additional information to assist the Service in evaluating the effects of the flood insurance program on listed species in the Florida Keys.

On March 21, 2006, the Service and FEMA met to discuss and evaluate the status of the BO, the status of the requested additional information, and actions necessary to comply with the Courts order.

The Service has determined the bald eagle, roseate tern, loggerhead sea turtle, green sea turtle, leatherback sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, American crocodile, American crocodile critical habitat, piping plover, piping plover critical habitat, and Garber's spurge are not likely to be adversely affected by the action. In some cases, the action will not affect these species because they are on protected lands where development will not occur. For example, there are seven bald eagle nests currently active in the Keys. Six are on national refuges and one is located at the Naval Air Station, Key West. Important roseate tern nesting habitat is protected on public lands, and also can be found on spoil islands, or existing rooftops of commercial or public buildings.

McNeese 2006 suggests that disturbances such as lighting, pets, and noise and direct development or blocking of nesting areas could adversely affect sea turtles. The Service agrees these factors can adversely affect turtles. McNeese 2006 points out the low percentages of nesting sea turtles in the Keys, when compared to the mainland, 0.41 percent of the total for loggerhead and 0.009 percent for the green sea turtle in the period 1988 through 2004. Accordingly, development in the Keys would have a minimal impact. Moreover, the Corps of Engineers in direct consultation with the Service must issue permits for proposed projects that might directly develop or block turtle nesting areas.

Land-related impacts to sea turtles occur when they leave the water to lay eggs. The greatest threats are nest disturbance or destruction and predation of eggs or young as they return to the water. Monroe County and the municipalities within the county have regulations in place that impose required setbacks on new construction to avoid disturbance of nesting turtles or their nests. Regulations are also in place that control lighting near beaches. Lighting for buildings is known to disorient hatchling turtles on beaches adjacent to the developed areas as they emerge from the nest and crawl to the water. These regulations are designed to avoid this problem.

Virtually all (99.95 percent) of the piping plover critical wintering habitat in Monroe County is protected. There are plans to purchase the less than 0.1 percent of critical habitat in private ownership.

Land acquisition efforts by many agencies have continued to provide protection for crocodile habitat in South Florida. Forty-four public properties, owned and managed by Federal, State, or county governments, as well as two privately owned properties managed at least partially or wholly for conservation purposes contain potential crocodile habitat within the coastal mangrove communities in South Florida. About 95 percent of nesting habitat for crocodiles in Florida is under public ownership (Mazzotti, personal communication, 2001).

Information gained from the site visits for permits and other activities since the issuance of the April 18, 2003 BO amendment indicates that American crocodile occurs primarily on sites under public ownership and managed for conservation, such as the Service's Crocodile Lake NWR. Because these habitats are not subject to residential and commercial development, the NFIP does not have any impacts in these areas.

Information gained from the site visits for permits and other activities since the issuance of the June 16, 1997 BO indicates that Garber's spurge occurs primarily on sites under public

ownership and managed for conservation, such as the Service's National Key Deer Refuge (NKDR). The plant also occurs on road right-of-ways. Because these habitats are not subject to residential and commercial development, implementation of the NFIP is not likely to adversely affect the Garber's spurge and this species will not be considered further in this consultation. There is no change in our assessment of this species since the 2003 BO.

The facts above support a conclusion that the implementation of the NFIP in Monroe County is not likely to adversely affect the species discussed above or their critical habitat. Moreover, during the implementation of the technical assistance review outlined in the 1997 and 2003 RPA for this Federal action, after review of over 6,500 projects, it became clear the NFIP action was not likely to have measurable adverse effects on these species or their critical habitat. As a result, implementation of the NFIP is not likely to adversely affect these species or their critical habitat, and they will not be considered further in this consultation.

BIOLOGICAL OPINION

This section of the document provides a description of the action, an overview of the action area, a listing of the species that have been included in the BO, and a summary of relevant biological and ecological information on the species included in the BO.

DESCRIPTION OF PROPOSED ACTION

The action being considered in this BO is the administration of the NFIP in participating communities in Monroe County, Florida, by the Department of Home Land Security's FEMA. The NFIP, which was created in 1968, is a Federal program enabling property owners in participating communities to purchase flood insurance in exchange for a participating State and community adopting floodplain management regulations that reduce future flood damages. If a community adopts and enforces floodplain management regulations to reduce future flood risk to new construction in floodplains, the Federal government will make flood insurance available within the community. Community participation in the NFIP is voluntary.

The Flood Disaster Protection Act of 1973 (42 U.S.C. 4002)(the 1973 Act) requires property owners to purchase flood insurance as a condition of receiving any Federal or federally related financial assistance to acquire or improve land or structures that are located in areas identified as having special flood hazards. The 1973 Act prohibited Federal officers or agencies from approving financial assistance for acquisition or construction purposes in areas identified as having special flood hazards unless the structure is covered by flood insurance (42 U.S.C. 4012a).

Furthermore, section 202(a) of the 1973 Act prohibits Federal officers or agencies from approving any form of loan, grant, guaranty, insurance, payment, rebate, subsidy, disaster assistance loan or grant for acquisition or construction purposes within the Special Flood Hazard Areas (SFHAs) of non-participating communities (42 U.S.C. 4106). For example, this would prohibit mortgage loans in non-participating communities when guaranteed by the Department of Veterans Affairs, insured by the Federal Housing Administration, or secured by the Rural Economic and Community Development Services. In the case of disaster assistance under the

Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5121-5206) (Stafford Act), this prohibition only applies to assistance in connection with a flood.

The above requirement to purchase flood insurance as a condition of Federal or federally related financial assistance to acquire or improve land or structures in SFHAs is referred to as the Mandatory Flood Insurance Purchase Requirement (sometimes also referred to in this BO as the mandatory purchase requirement). FEMA has no oversight authority over this requirement.

This BO is not an evaluation of the effects of the NFIP on threatened and endangered species in SFHAs throughout the United States. Instead, this is a programmatic consultation limited to the NFIP as administered in participating communities in Monroe County, Florida.

As indicated above, the NFIP reduces the risk of flood damage by requiring States and local governments to adopt and enforce NFIP floodplain management regulations as a condition of making NFIP flood insurance available in the community. While FEMA is responsible for identifying the flood hazard, the participating communities in Monroe County, Florida are responsible for administering floodplain management regulations that meet or exceed the minimum requirements of the NFIP. The administration of the NFIP generally involves the following sequence of actions for new structures and substantially improved structures:

- (1) FEMA prepares Flood Insurance Rate Maps and provides these flood maps to participating communities in Monroe County. When FEMA develops new or revises existing flood hazard data during a flood study process, FEMA also provides this flood hazard data to communities.
- (2) In order to participate in the NFIP, communities in Monroe County must adopt and enforce floodplain management regulations that meet or exceed the minimum requirements of the NFIP.
- (3) Prior to issuing building permits for new buildings and substantially improved buildings in SFHAs, participating communities in Monroe County review construction plans to ensure compliance with regulatory requirements the community adopted to participate in the NFIP; for example, Monroe County checks construction plans to ensure they are consistent with base flood elevations.
- (4) Communities must review proposed development to assure that all necessary permits have been received from governmental agencies from which approval is required by Federal or State law.
- (5) Once the community has issued a permit, the construction can begin.
- (6) When the owner of the permitted structure applies for federally regulated financing, he is generally required under the mandatory purchase requirement to purchase flood insurance; in the Keys, most of those insurance policies are issued under the NFIP. The National Flood Insurance Act of 1968, as amended, requires that the program charge full

actuarial rates (non-subsidized rates) reflecting the complete flood risk on new structures or substantially improved structures.

Action Area

The Service considers the action area as the Keys, extending from Key Largo south to Key West in Monroe County, Florida (Figure 1). The mainland portion of Monroe County is not considered in this BO because it is almost entirely contained within Everglades National Park or Big Cypress National Preserve and not subject to development and hence the NFIP.

To analyze the effects of the action, we defined the boundaries of the action area more precisely than in the previous biological opinions using Geographic Information System (GIS) analyses of spatial information on the distribution of threatened and endangered species in the Keys, vegetative land cover, and areas in the Coastal Barrier Resources System (CBRS) as designated by the Coastal Barrier Resources Act (16 U.S.C. 3501 et seq.). We excluded areas that are included in the Coastal Barrier Resources System and Otherwise Protected Areas from the action area because FEMA does not issue flood insurance in those locations. Public and privately managed conservation areas are also excluded from the action area because they are also not likely to be subject to the NFIP. We used GIS analyses to identify those areas in the Keys that (1) support threatened and endangered species or designated critical habitat, (2) have not been cleared for residential, commercial, or other purposes, and (3) could qualify for the NFIP in Monroe County.

The action area is composed of six political entities each with their own government and land use regulations: un-incorporated Monroe County, the Village of Islamorada, the City of Layton, the City of Key Colony Beach, the City of Marathon, and the City of Key West. Unincorporated Monroe County includes the islands of Key Largo, and the Lower Keys from Big Pine Key through Stock Island. The Village of Islamorada includes Plantation Key through Lower Matecumbe Key. Layton includes a section of Long Key, and Marathon includes Grassy Key through Vaca Key (Marathon). Key West includes all of the island of Key West and the northern half of Stock Island. Both the Village of Islamorada and the City of Marathon have incorporated since the 1997 BO on FEMA's administration of the NFIP was completed.

Description of Action Area

The Keys are a 130-mile arc of islands extending from Soldier Key to Key West. The Keys are divided into three physiographic zones characterized by their shape, orientation, and underlying rock formations: the Upper Keys (Soldier southeast to Newfound Harbor Keys), the Lower Keys (East Bahia Honda to Key West), and the distal atolls (Boca Grande Key Group, Marquesas Keys and Dry Tortugas) (Hoffeister and Multer 1968). The distal atolls are protected islands that are more isolated from the other two groups of Keys and are not considered in this BO. For a list of what habitats the nine listed species addressed in this BO use, see Appendix 1.

The Upper Keys consist of long narrow islands that are situated in a northeast to southwest direction and parallel the reef tract. These elevated, almost continuous islands are composed of Key Largo limestone. The Upper Keys are aligned in such a way that they block almost all

direct tidal interaction between Florida Bay and the reef tract, thus creating two different environments (Schomer and Drew 1982). Water flow was further restricted when an overseas railroad was built from 1904 to 1907. Over 17 miles of bridges and 20 miles of causeways were built where natural water passages previously existed.

The Lower Keys are a triangular group of islands lying at right angles to the Upper Keys in a northwest-southeasterly direction. The directional movement of tidal scour causes their orientation, which is a result of the tidal time and height differences between the Gulf of Mexico and the Straits of Florida. Several channels cut between the Lower Keys to connect the Gulf and Florida Bay. These passageways allow for greater water exchange between the two water bodies than the Upper Keys.

Most of the land area in the Keys lies between 2.0-3.0 feet above high tide. Two locations (located in the Upper Keys) have an elevation of 16 feet or more; here topography of the islands change from the typically flat island to elongated with southeast and northwest sides sloping to the Atlantic Ocean and Florida Bay.

Intertidal flats border the islands and give way to shallow water areas that gently slope to deeper water. Florida Bay lies beyond the flats on the northwest side of the Keys. Seaward towards the Straits of Florida, a band of living reefs parallel the coastline.

Overview of the NFIP

In 1968, the United States Congress passed, and the President signed into law, the National Flood Insurance Act (42 U.S.C. 4001 *et seq.*), which created the NFIP. The primary purposes of the 1968 Act creating the NFIP are to:

1. Better indemnify individuals for flood losses through insurance;
2. Reduce future flood damages through State and community floodplain management regulations; and
3. Reduce Federal expenditures for disaster assistance and flood control.

Section 1315 of the 1968 Act, as amended, is a key provision that prohibits FEMA from providing flood insurance unless the community adopts and enforces floodplain management regulations that meet or exceed the minimum criteria established in the NFIP regulations. Participation in the NFIP is based on an agreement between local communities and the Federal government. If a community adopts and enforces floodplain management regulations to reduce future flood risks to new and substantially improved structures in SFHAs, the Federal government will make flood insurance available within the community as a financial protection against flood losses. Flood insurance is to provide an alternative to disaster assistance to reduce the escalating costs of this assistance for the repair of flood-damaged structures and replacement of their contents. Over 20,000 communities currently participate in the NFIP nationwide. A community's decision to participate in the NFIP is voluntary.

In addition to providing flood insurance and reducing flood damages through floodplain management regulations, another important component of the NFIP is to identify and map the

nation's floodplains. Mapping flood hazards creates broad-based awareness of the flood hazards and provides the data needed for floodplain management programs and to actuarially rate new or substantially improved structures for flood insurance. The flood maps provide information on where flood insurance is required under the Mandatory Flood Insurance Purchase Requirement.

As already discussed, because of the Mandatory Flood Insurance Purchase Requirement, federally regulated lending institutions may not make, increase, extend, or renew any loan secured by improved real estate located in a SFHA in a participating community unless the secured building and any personal property securing the loan are covered by flood insurance. Federally regulated lending institutions can make conventional loans in a SFHA of a non-participating community. However, lending institutions are required to notify the purchaser or lessee of improved real property, situated in a SFHA, whether Federal disaster assistance will be available when such property is being used to secure a loan that is being made, increased, extended, or renewed.

Federal officers or agencies cannot approve any form of loan, grant, guaranty, insurance, payment rebate, subsidy, disaster assistance loan or grant, for acquisition or construction purposes within a SFHA in a participating community unless the building and any personal property to which such financial assistance relates is covered by flood insurance.

There are significant Federal financial limitations in communities with SFHAs that do not participate in the NFIP. Federal officers or agencies cannot approve any form of loan, grant, guaranty, insurance, payment, rebate, subsidy, or disaster assistance loan or grant, for acquisition or construction purposes within a SFHA of a non-participating community. For example, this requirement prohibits mortgage loans guaranteed by the Department of Veterans Affairs, insured by the Federal Housing Administration, or secured by the Rural Economic and Community Development Services. In the case of disaster assistance under the Stafford Act, this prohibition only applies to assistance in connection with a flood.

Flood Insurance Rate Maps

FEMA publishes maps designating SFHAs and the degree of flood risk in those areas. The SFHA in each community is identified on a Flood Insurance Rate Map (FIRM) prepared by FEMA. The limits of the SFHA depend on the area inundated during the Base Flood (a flood having a one percent chance of being equaled or exceeded in any given year; also referred to as a 100-year flood). FEMA conducts Flood Insurance Studies (FISs) that estimate both hydrologic and hydraulic conditions to identify SFHAs and determine Base Flood Elevations (BFE).

States and communities use the flood maps for their floodplain management programs. The flood maps are also used for calculating flood insurance premiums and for determining whether property owners are required by law to obtain flood insurance as a condition of obtaining mortgage loans or other Federal or federally related financial assistance under the Mandatory Flood Insurance Purchase Requirement.

SFHAs are mapped as either A zones or V zones. Areas within riverine and lacustrine (lake) floodplains and coastal floodplains landward of V zones are identified on the flood maps with

one of the A zone designations (AE, A1-30, AO, AH, or A). V zones (Zones VE, V1-30, V), also known as Coastal High Hazard Areas, are mapped along the nation's coastlines. V zones, which include high velocity flows, breaking waves, and often debris, contain severe risks that present special challenges in ensuring that new development does not result in increased flood damages.

The FIRM maps for Monroe County were initially issued on June 20, 1970. The most recent version of the FIRM maps is a countywide format for Monroe County and all the incorporated areas dated February 18, 2005. The FIRM maps for the Keys currently include AE, A0, VE, and X zones (Table 1).

Table 1: Codes for zones and their definitions – FEMA Flood Insurance Rates Maps

Code	Definition
Code	Definition
AE	Base Flood Elevations have been determined. Mandatory Flood Insurance Purchase Requirements apply.
AO	Zone AO Flood Depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. Mandatory Flood Insurance Purchase Requirements apply.
VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined. Mandatory Flood Insurance Purchase Requirements apply.
X (mapped as a shaded area)	These are also areas of 0.2 percent annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1 percent annual chance flood. Flood insurance is not required, but is available.
X (mapped as an unshaded area)	Areas determined to be outside the 0.2percent annual chance floodplain. Flood insurance is not required, but is available.

Community participation

Before FEMA can issue flood insurance policies, the community must participate in the NFIP. A “community” is a governmental body with the statutory authority to enact and enforce zoning, building codes, subdivision, and other control measures. The authority of each unit of government varies by State. Eligible communities can include cities, villages, towns, townships, counties, parishes, States, and Indian tribes (44 CFR 59.1). When the community chooses to join the NFIP, it must adopt and enforce minimum floodplain management requirements for participation and apply the criteria uniformly to all privately and publicly owned land within the designated SFHA in the community (The complete requirements for community participation in the NFIP are outlined in 44 CFR 60.1-60.5). Additionally, communities may and are encouraged to adopt floodplain management criteria more restrictive than the NFIP minimum criteria.

As a part of the 1968 Act creating the NFIP, Congress prohibited FEMA from issuing flood insurance to property owners within a community that had not adopted at least the minimum floodplain management criteria established under the NFIP. If local floodplain regulations are

not in place, or if community regulations do not meet the minimum NFIP criteria, a community cannot participate in the NFIP. Similarly, if a community fails to maintain its floodplain regulations or adopts regulations that do not meet established guidelines, that community will be suspended from the program.

The applicable minimum criteria for new structures vary depending on the level of floodplain analysis performed within the community. For each additional level of detail provided in the FIS, additional minimum requirements for community floodplain management regulations are established. NFIP regulations contain specific elevation and structural performance requirements for new buildings constructed within the SFHA. NFIP minimum criteria establish different requirements for properties in A zones and V zones, but specific elevation and structural performance requirements are included for all buildings in the SFHA. Included in the V Zone standards is the requirement that natural features, which act to reduce flooding such as frontal sand dunes and mangrove stands, cannot be altered. These requirements form the foundation of floodplain management in a community. Many states and individual communities have adopted more restrictive regulations than NFIP minimum requirements.

Existing development must meet NFIP minimum requirements only in specific situations. Buildings constructed on or after the date of the initial FIRM, or after December 31 1974, whichever is later, are actuarially rated for flood insurance (these buildings are generally referred to as post-FIRM). Existing pre-FIRM buildings (built before the initial FIRM maps) must meet NFIP criteria only when the building is “substantially improved” or “substantially damaged.” This means that if the cost of improvements or the cost to repair the damage equal to or exceeds 50 percent of the market value of the building, the building must be brought up to current floodplain management standards – the same requirements that apply to new construction.

The community must ensure that any structures built in the SFHA include materials and methods that will minimize future flood damage and will not adversely impact other development. In addition to requiring permits for structures, a participating community in the NFIP must also require permits for all development in the SFHA, including, but not limited to, filling, grading, paving, and dredging.

The floodplain management requirements within the SFHA are designed to prevent new development from increasing the flood threat and to protect all structures from anticipated flood events. Although these NFIP requirements function as a baseline for floodplain management for many communities, the ultimate power to regulate development – including the provision and approval of permits, inspection of property, and citing violations – remains in the communities, not the federal government.

FEMA ensures compliance with the established NFIP regulations by reviewing and approving each community’s adopted floodplain management regulations and maintaining a dialogue with the community. Through Community Assistance Visits (CAVs) and Community Assistance Contacts (CACs), FEMA, and states on behalf of FEMA, oversee community activities and monitor implementation of the program. If, in reviewing a community’s activities, FEMA identifies program deficiencies or violations, FEMA has the option to place the community on formal probation. Initially, FEMA will notify the community of these issues and provide the

community with time to rectify them. If the community makes adequate progress in addressing the issues within a specified period, probation will not be applied. If the community does not address the issues, formal probation will be initiated (at a minimum probation lasts for one year and may be extended in one-year increments).

During the time a community is on probation, new policies can be sold and existing policies renewed, but policyholders are surcharged a \$50 additional premium. If, during the probationary period, the community does not address FEMA's concerns, the community can be suspended from the NFIP. During suspension, existing policies cannot be renewed and new policies cannot be sold. In addition, the Federal financial limitations described above apply.

In 1990, FEMA established the Community Rating System (CRS) as an incentive program that provides flood insurance premium reductions to communities that go beyond the minimum requirements of the NFIP. The CRS was codified in the National Flood Insurance Reform Act of 1994. If communities take additional actions to reduce flood losses, facilitate accurate insurance ratings, and promote awareness of flood insurance, they can reduce their insurance rates through the Community Rating System.

Through the Community Rating System, communities can receive credit for

- (1) protecting natural floodplain functions, such as providing flood storage, reducing erosion, improving water quality, and providing habitat for diverse species of flora and fauna;
- (2) advising people about flood hazards, flood insurance, and ways to reduce flood damage;
- (3) mapping additional areas,
- (4) preserving open space;
- (5) enforcing higher regulatory standards, and managing storm water;
- (6) addressing repetitive losses, relocating or retrofitting flood-prone structures, and maintaining drainage systems; and
- (7) implementing flood-preparedness activities, such as flood warning, levee safety, and dam safety.

Flood Insurance

Flood insurance coverage is available to all owners and occupants of insurable property (a building and/or its contents) in a community participating in the NFIP. Almost every type of walled and roofed building that is principally above ground and not entirely over water may be insured if it is located in a participating community. In the 1968 Act, to encourage participation in the NFIP by communities and the purchase of flood insurance by individuals, Congress provided subsidized insurance premiums for those buildings constructed prior to the issuance of a FIRM (pre-FIRM buildings).

The National Flood Insurance Act of 1968, as amended, requires that full actuarial rates (non-subsidized rates) reflecting the complete flood risk be charged on all buildings constructed or substantially improved on or after the effective date of the initial FIRM for the community or

after December 31, 1974, whichever is later. Substantial improvement means “any reconstruction, rehabilitation, addition, or other improvement of structures, the cost of which equals or exceeds 50 percent of the market value of the structure before the “start of construction of the improvement.” When the NFIP was created, the U.S. Congress recognized that insurance for “existing buildings” constructed before a community joined the NFIP would be prohibitively expensive if the Federal government did not subsidize the premiums. Congress also recognized that individuals who did not have sufficient knowledge of the flood hazard built most of these flood-prone buildings. Thus, in exchange for the availability of subsidized insurance for existing buildings, communities are required to protect new construction and substantially improved structures through adoption and enforcement of floodplain management regulations.

FEMA works closely with the insurance industry to facilitate the sale and servicing of flood insurance policies. Flood insurance under the NFIP is sold to owners of property located in NFIP communities through two mechanisms: 1) through State-licensed property and casualty insurance agents and brokers who deal directly with FEMA; and 2) through private insurance companies with a program created in 1983 known as the “Write Your Own” program. All companies offer identical coverage and rates as prescribed by the NFIP. Some private flood insurance is available particularly for commercial and industrial property. Most flood insurance coverage is provided by the NFIP, however. There are about 4.8 million flood insurance policies in force nationwide.

A purchaser of flood insurance must wait 30 days from the date the application for insurance is completed and the premium presented before the policy becomes effective. A change in the waiting period from 5 days to 30 days was included as part of the National Flood Insurance Reform Act of 1994 to address a problem encountered where individuals with properties on larger rivers could wait until properties many miles upriver were flooding before purchasing coverage. There are some exceptions to the 30-day waiting period, such as when a new flood insurance policy is required in connection with making a federally backed loan.

Individuals can purchase the following amounts of coverage:

- (1) Residential: \$250,000 in building coverage and \$100,000 in contents coverage.
- (2) Non-residential: \$500,000 in building coverage and \$500,000 in contents coverage.

The insured must file a Proof of Loss within 60 days of the loss. Under all NFIP policies, the insured pays a portion of the loss through the application of a deductible.

Coastal Barriers Resources Act

The Coastal Barriers Resources Act of 1982, as amended (16 U.S.C. 3501 *et seq.*)(CBRA), established the John H. Chafee Coastal Barrier Resources System (CBRS), which is a system of undeveloped coastal barriers along the Atlantic and Gulf of Mexico coasts. Congress established CBRA to minimize loss of human life, to eliminate wasteful expenditures of Federal revenues, and to prevent damage to fish, wildlife, and other natural resources. As a result, CBRA prohibits

most expenditure of Federal funds that encourage development within the undeveloped, unprotected area in the CBRS, including the sale of Federal flood insurance under the NFIP.

The Coastal Barrier Improvement Act of 1990 (Public Law 101-591) expanded many existing CBRS units and added new ones. The NFIP flood insurance ban affects structures built or substantially improved after November 1, 1990, in CBRS areas added by the Coastal Barrier Improvement Act, which also recognized Otherwise Protected Areas. These areas are lands already protected by public agencies or conservation organizations. Structures built in these areas to support recreation or conservation are eligible for flood insurance, but residences built on private inholdings are not.

Areas designated by CBRA are identified by the DOI and recommended to Congress. The Service is charged with implementing the law. On the date that Congress approves additional CBRA designations, Federal assistance prohibitions apply to the new areas. In cooperation with the DOI, FEMA transfers the CBRA boundaries to FIRMs using congressionally adopted source maps entitled CBRS. FIRMs clearly depict the different CBRA areas and their effective dates with special map notes and symbols. Although FEMA shows CBRA areas on the FIRMs, Congress is the only entity that may authorize or initiate a revision to CBRA boundaries.

In 1988, the DOI's Coastal Barrier Study Group recommended including 19,831 acres of land of the Keys under CBRA in its report to Congress, with 13,059 of these acres in the Lower Keys. In Monroe County, 8 percent of total land area is in regular CBRS areas, 9 percent is in Otherwise Protected Areas, and 83 percent is in non-CBRA areas.

STATUS OF THE SPECIES/CRITICAL HABITAT

The Use of Best Scientific and Commercial Information by the Service

The Service uses the most current and up-to-date scientific and commercial information available. The nature of the scientific process dictates that information is constantly changing and improving as new studies are completed. The scientific method is an iterative process that builds on previous information. As the Service becomes aware of new information, we will consider it in our decisions, evaluations, reviews, and analyses as it relates to the base of scientific knowledge and any publications cited in our documents.

Specifically, there is one document cited in this BO that the Service acknowledges has been affected by new scientific information. The Service has taken these new sources of information into account when using this document to help guide our analysis and decisions. This document is the South Florida Multi-Species Recovery Plan (MSRP) of 1999 (Service, 1999).

South Florida Multi-Species Recovery Plan

The MSRP was designed to be a living document and it was designed to be flexible to accommodate the change identified through ongoing and planned research and would be compatible with adaptive management strategies. These principals are set forth in both the transmittal letter from the Secretary of the Interior and in the document itself. As predicted, this

is what occurred since the MSRP was published. The Service uses the MSRP in the context that it still presents useful information when taken in conjunction with all the new scientific information.

Species Included in this Biological Opinion

The Service has determined that the proposed action may affect the following nine species that are provided protection under the Act:

Table 2: Species Included in this Biological Opinion

Common Name	Scientific Name	Listed As
Eastern indigo snake	<i>Drymarchon corais couperi</i>	Threatened
Key deer	<i>Odocoileus virginianus clavium</i>	Endangered
Key Largo cotton mouse	<i>Peromyscus gossypinus allapaticola</i>	Endangered
Key Largo woodrat	<i>Neotoma floridana smalli</i>	Endangered
Key tree-cactus	<i>Pilosocereus robinii</i>	Endangered
Lower Keys rabbit	<i>Sylvilagus palustris hefneri</i>	Endangered
Schaus swallowtail butterfly	<i>Papilio aristodemus ponceanus</i>	Endangered
Silver rice rat	<i>Oryzomys argentatus</i>	Endangered
Stock Island tree snail	<i>Orthalicus reses reses</i>	Threatened

The entire range of the Key deer, Key Largo cotton mouse, Key Largo woodrat, Key tree-cactus, Lower Keys rabbit, silver rice rat, and Stock Island tree snail is exclusively within the action area. The range of the Schaus swallowtail butterfly extends outside the action area to the adjacent northern-most county, Miami-Dade County. The range of the eastern indigo snake is broader, and includes many southeastern States. In the action area, critical habitat has been designated for the silver rice rat.

This biological opinion does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 CFR. 402.2. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

Silver rice rat – Critical Habitat: Critical habitat for the silver rice rat includes Little Pine Key; Water Keys; Big Torch Key; Middle Torch Key; Summerland Key north of U.S. Highway 1; Johnston Key; Raccoon Key; and Lower Saddlebunch Keys south of U.S. Highway 1, but not including lands in Township 67S, Range 27E, section 8 and the northern 1/5 of section 17. All lands and waters above mean low tide are included in this designation (50 CFR 17.95) (Figure 2).

Species/critical habitat description

The sections that follow summarize the status of these species across their entire range and the status of critical habitat. These summaries provide the biological and ecological information the Service believes is relevant to the analyses we will present in the Effects of the Action section of this BO.

Eastern indigo snake

Species/critical habitat description

The eastern indigo snake was listed as a threatened species on January 31, 1978 (Service 1978). This snake was listed because of dramatic population declines caused by habitat loss, over collecting for the domestic and international pet trade, and mortalities caused by rattlesnake collectors who gas gopher tortoise burrows to collect snakes (Service, 1982). No critical habitat has been designated for the eastern indigo snake.

The indigo snake ranges from the southeastern United States to northern Argentina (Moler, 1992). This species has eight recognized subspecies, two of which occur in the United States: the eastern indigo and the Texas indigo (*D. c. eebennus*) (Conant, 1975; Moler, 1985a). At one time, the eastern indigo snake occurred in the coastal plain of the southeastern United States, from South Carolina to Florida and west to Louisiana.

The eastern indigo snake is the largest non-venomous snake in North America, obtaining lengths of up to 104 inches (Ashton and Ashton, 1981). Its color is uniformly lustrous-black, dorsally and ventrally, except for a red or cream-colored suffusion of the chin, throat, and sometimes the cheeks. Its scales are large and smooth (the central 3 to 5 scale rows are lightly keeled in adult males) in 17 scale rows at midbody. Its anal plate is undivided. Its antepenultimate supralabial scale does not contact the temporal or postocular scales.

In the Keys, adult eastern indigo snakes seem to have less red on their faces or throats compared to most mainland specimens (Lazell, 1989). Several researchers have informally suggested that Lower Keys eastern indigo snakes may differ from mainland snakes in ways other than color.

Life history

Distribution and habitat: Historically the eastern indigo snake occurred throughout Florida and in the coastal plain of Georgia. The species has been recorded historically in Alabama and Mississippi. It may have occurred in southern South Carolina, but its occurrence there cannot be confirmed.

Georgia and Florida currently support the remaining, endemic populations of the eastern indigo snake (Lawler, 1977). In 1982, only a few populations remained in the Florida panhandle. In these areas, the species is considered rare. Nevertheless, based on museum specimens and field

sightings, the eastern indigo snake still occurs throughout Florida, though not commonly seen (Moler, 1985a).

In the Keys, eastern indigo snakes have been collected from Big Pine and Middle Torch Keys, and are reliably reported from Big Torch, Little Torch, Summerland, Cudjoe, Sugarloaf and Boca Chica Keys (Lazell, 1989). P. Moler (Personal communication, 1996) documented eastern indigo snakes on North Key Largo. Since surveys have not been conducted in the Keys, the eastern indigo snake may occur on other keys as well.

Over most of its range in Florida, the eastern indigo snake frequents diverse habitats such as pine flatwoods, scrubby flatwoods, flood plain edges, sand ridges, dry glades, tropical hammocks, edges of freshwater marshes, muckland fields, coastal dunes, and xeric sandhill communities. On the central Atlantic coast, eastern indigo snakes occur in orange groves and near ditches and canals. In south Florida, these snakes are found in pine flatwoods and tropical hammocks or in most undeveloped areas (Kuntz, 1977), although they may use open areas more than hammocks. Eastern indigo snakes also use agricultural lands and various types of wetlands, with higher population concentrations occurring in the sandhill and pineland regions of northern and central Florida. In the Keys, indigo snakes use similar habitats.

Smith (1987) radio-tagged hatchling, yearling, and gravid eastern indigo snakes and released them in different habitat types on St. Marks National Wildlife Refuge in Wakulla County, Florida, in 1985 and 1986. Smith monitored the behavior, habitat use, and oviposition sites selected by gravid female snakes and concluded that diverse habitats, including high pineland, pine-palmetto flatwoods, and permanent open ponds, were important for the eastern indigo snake's seasonal activity. Habitat use differed by age class and season. Stumps, ground litter, and saw palmetto debris were frequently used as refugia. Adult indigo snakes often used gopher tortoise burrows (*Gopherus polyphemus*), while juveniles chose smaller root and rodent holes. The indigo snakes used gopher tortoise burrows as oviposition sites in high pineland areas, while stumps were chosen in flatwoods and pond edge habitats.

Eastern indigo snakes need a mosaic of habitats to complete their annual cycle. Interspersion of tortoise-inhabited sandhills and wetlands improves habitat quality for the indigo snakes (Landers and Speake, 1980, Auffenberg, Franz 1982). Eastern indigo snakes require sheltered "retreats" from winter cold and desiccating conditions. In laboratory experiments, they appear to be especially susceptible to desiccation (Bogert and Cowles, 1947). Wherever the eastern indigo snake occurs in xeric habitats, it is closely associated with the gopher tortoise, the burrows of which shelter the indigo snakes from winter cold and desiccating sandhill environment (Bogert and Cowles, 1947; Speake et al. 1978). This dependence seems especially pronounced in Georgia, Alabama, and the panhandle area of Florida, where eastern indigo snakes are largely restricted to the vicinity of sandhill habitats occupied by gopher tortoises (Mount, 1975; Diemer and Speake, 1983; Moler, 1985b). In wetter habitats that lack gopher tortoises, eastern indigo snakes may take shelter in hollowed root channels, hollow logs or the burrows of rodents, armadillo, or crabs (Lawler, 1977; Moler, 1985b). In south Florida, indigo snakes occur along canal banks, where they use crab holes in lieu of gopher tortoise burrows (Lawler, 1977).

Outside of peninsular Florida, eastern indigo snakes are generally restricted to the vicinity of xeric habitats that support populations of gopher tortoises, although they move seasonally into more mesic habitats. Throughout peninsular Florida, the eastern indigo snake occurs in all terrestrial habitats, which have not suffered high-density urban development. They are especially common in the hydric hammocks of north Florida and in similar habitats throughout peninsular Florida (Moler, 1985a).

The average range of the eastern indigo snake is 11.9 acres during the winter (December-April), 106.0 acres during late spring early summer (May-July), and 240.7 acres during late summer and fall (August- November) (Speake et al., 1978). Adult male eastern indigo snakes have larger home ranges than adult females and juveniles; their ranges may encompass as much as 553 acres and 390 acres in the summer (Moler, 1985b). By contrast, a gravid female may use from 3.4 acres to 106 acres (Smith, 1987).

Feeding: The eastern indigo snake is a generalized predator and will eat any vertebrate small enough to be overpowered, though it has a predilection for rattlesnakes (*Crotalus* spp.). The snake's food items include fish, frogs, toads, snakes (venomous as well as nonvenomous), lizards, turtles, turtle eggs, small alligators, birds, and small mammals (Babis, 1949).

Reproduction: Eastern indigo snakes breed between November and April, with females depositing 4 to 12 eggs during May or June (Moler, 1992). Young hatch in about 3 months from late May through August with peak hatching activity occurring between August and September, while yearling activity peaks in April and May (Smith, 1987). There is no evidence of parental care although the snakes take 3 to 4 years to reach sexual maturity (Moulis, 1976).

Female indigo snakes can store sperm and delay fertilization of eggs: there is a single record of a captive snake laying five eggs (at least one of which was fertile) after being isolated for more than 4 years (Carson, 1945). There is no information on how long eastern indigo snakes live in the wild. In captivity, the longest an eastern indigo snake lived was 25 years, 11 months (Shaw, 1959).

Population dynamics

The eastern indigo snake does not typically show up in standard herptile census methods such as drift fences (Enge, 1997). No population estimates exist for south Florida, but anecdotal accounts from field researchers indicate that observations of the eastern indigo snake are rare.

Status and distribution

Reason for Listing: When the indigo snake was listed, the main cause of its population decline was over collecting for the pet trade, but today habitat loss may be a more important factor.

Range wide Trends: There is no available data on range wide trends or more locally. Eastern indigo snake populations in the Keys are peripheral populations that have adapted to the conditions of more isolated and tropical environments. The indigo snake is suspected to be in very low numbers in the Keys and according to Lazell (1989), the remote, isolated, and possibly

distinct Lower Keys populations have been wholly neglected. Cox and Kautz (2000) designated extreme north Florida and extreme south Florida (including the Florida Keys) as “peripheral areas within the known range.” The home ranges of individual snakes are large, generally ranging from 80 to 400 acres. The eastern indigo snake uses a majority of the habitat types available in the Keys, but tends to prefer open, undeveloped areas (Kuntz, 1977). Suitable eastern indigo snake habitat includes all habitat types in the action area except developed lands, mangroves, salt marsh, and deep-water areas. Anecdotal sightings are rare, but a few have been substantiated. It is apparent that the eastern indigo snake has always been rare in the Keys, and that their preferred habitat lies further north on the mainland.

Threats: At the time of listing, the main factor in the decline of the eastern indigo snake was attributed to exploitation for the pet trade. Because of effective law enforcement, the pressure from the collectors has declined, but remains a concern (Moler, 1992).

Summary analysis– Changes since 1997 and 2003 BOs

In the Keys, the primary threat to the eastern indigo snake is habitat loss and fragmentation due to development. Residential housing is also a threat because it increases the likelihood of snakes being killed by property owners and free-roaming pets. There is no notable change in our understanding of the eastern indigo snakes in the Florida Keys since the 1997 and 2003 BOs were completed.

Key Deer

Species/critical habitat description

The Key deer is a member of the Cervidae family of the order Artiodactyla class Mammalia. It was first recognized as a subspecies distinct from the races of *O. v. osceola* and *O. v. virginianus* when Barbour and Allen (1922) described it. The population has been geographically and reproductively isolated in the Lower Keys since the last glacier melted at least 4,000 years ago.

By the late 1940s, over hunting and wanton killing by early Keys visitors and residents had reduced the Key deer population to a dangerously low level, estimated at 50 to 80 individuals. By the early 1950s, only 25 deer remained (Dickson, 1955). Immediate efforts to enforce existing hunting bans and to protect the deer from human disturbance allowed the Key deer's numbers to increase slowly. National Key Deer Refuge was set up in 1957, and the Key deer was officially listed as federally endangered on March 11, 1967 (Service 1967). There is no current designation of critical habitat for the Key deer.

The Key deer is the smallest subspecies of the North American white-tailed deer. Adult males average 80 lbs, adult females 63 pounds (lbs.) and fawns weigh about 32 lbs at birth. Height at the shoulder averages 27 inches (in) for adult bucks and 25 in for adult does (Hardin et al., 1984).

The body appears stockier than that of other deer (Klimstra et al., 1978a); the legs are shorter, and the skull is shorter and relatively wider (Klimstra et al., 1991). Pelage varies from deep

reddish-brown to grizzled gray, and a distinct black cross or mask is often present between the eyes and across the brow (Klimstra, 1992). Antler size and number of points for male Key deer are less than for other whitetails (Folk and Klimstra, 1991a). Bucks typically grow spikes until their second year, when forked antlers are produced; they attain 8 points usually by the fourth year.

Besides their size, Key deer possess a number of characteristics unique from other white-tailed deer, including high salt-water tolerance (Jacobson, 1974), low birth rate, low productivity (Folk and Klimstra, 1991b), more solitary nature, and weak family bonds (Hardin, 1974). According to Ellsworth et al. (1994), the Key deer population is the most genetically divergent deer population in the southeastern United States.

The deer lives in a complex of native upland and wetland habitats interspersed in a matrix (mixture) of light to dense urban development. The number of Key deer has increased substantially over the past 40 years, due principally to a ban on hunting and protection and management of habitat within the NKDR and surrounding lands. Natural stochastic (random) events and the influences of human development, as manifested through habitat loss, fragmentation, and degradation, continue to negatively affect Key deer survival with vehicular mortality representing the largest known source of documented Key deer mortality (Lopez, 2001).

Life history

Distribution: The Key deer's range probably historically extended from Key Vaca to Key West (Klimstra et al., 1978b). Florida Key deer occupy 20 to 25 islands in the Lower Florida Keys within the boundaries of the NKDR, with about 75 percent (453 to 517 deer in 2001) of the overall population found on Big Pine Key (Lopez et al., 2004a). The NKDR and the Great White Heron National Wildlife Refuge encompass much of this range. They are managed for the Key deer and other wildlife.

The principal factor influencing the distribution and movement of Key deer in the Keys is the location and availability of freshwater. Key deer swim easily between keys and use all islands during the wet season, but suitable water is available on only 13 of the 26 islands during the dry season (Folk, 1991).

Habitat: Key deer use all habitat types including pine rocklands, hardwood hammocks, buttonwood salt marshes, mangrove wetlands, freshwater wetlands, and disturbed/developed areas (Lopez, 2001). The deer use uplands more than wetlands (Lopez et al., 2004b). Key deer use these habitats for foraging, cover, shelter, fawning, and bedding. Pine rocklands hold freshwater year round and are especially important to Key deer survival. About 34 percent of the range is pine rocklands and hardwood hammocks (Lopez et al., 2004c). Over 85 percent of the fawning occurs in pine rocklands and hardwood hammocks (Hardin, 1974). Five of 26 islands occupied by Key deer have significant pine rocklands. Key deer also use residential and commercial areas extensively where they feed on ornamental plants and grasses and can seek refuge from biting insects.

Behavior: Key deer have well-defined patterns of activity and habitat use, and established trails from years of daily use are visible in many areas within Key deer habitat (Klimstra et al., 1974). Roadkill hotspots are evident from the Service's long-term mortality database, further illustrating the habitual movement patterns of Key deer.

The social structure of the Key deer varies throughout the year with the reproductive cycle. Bucks associate with females only during the breeding season and will tolerate other males when feeding and bedding only during the nonbreeding season. Does may form loose matriarchal groups consisting of an adult female with several generations of her female offspring, but these associations are not stable (Hardin et al., 1976).

Home ranges of Key deer are variable (Lopez, 2001). On Big Pine Key and No Name Key, average annual home range size (95 percent probability area; ages combined) for males and females was estimated to be 546 acres and 104 acres, respectively, during the period 1998 to 2000. Home range sizes were significantly larger in 1968 to 1972 (males, 959 acre, females 250 acres) (Silvy, 1975; Lopez, 2001). Males tend to disperse from their natal (birth) range as fawns or yearlings. Adult males range over larger areas during the breeding season and may shift to an entirely new area (Silvy, 1975; Drummond, 1989; Lopez, 2001). Territorial behavior is limited to a buck's defense of a receptive doe from other bucks, rather than the defense of a specific territory (Klimstra et al., 1974). Aggressive male behaviors (combat) between rutting males are common in Key deer, especially during the fall breeding season or rut. A recent study indicates that Key deer home ranges have become smaller and tolerance for other deer has increased in recent years as the result of development and feeding (Lopez et al., 2005).

Urbanization: Key deer have become more urbanized over the last 45 years, a trend reported in Folk and Klimstra (1991c). Key deer are regularly fed at several private locations on Big Pine Key, which has resulted in increased tameness (Folk and Klimstra, 1991c; Lopez et al., 2005). Peterson et al. (2004) assessed the effects of residential feeding and watering on Key deer behavior on Big Pine Key. Deer were found to aggregate around homes that provided food and water, and such deer showed increased levels of tameness.

Past research has shown that the Key deer on Big Pine Key are habituated to human noises, lights, and vehicular traffic (urbanized) (Folk and Klimstra, 1991c). Folk and Klimstra (1991c) observed that Key deer "often bedded in open sites within 7 feet of a road and were not disturbed by cars, pedestrians, and cyclists. Loud noises from within 131 feet, such as circular saws, lawn leaf-blowers, and wood chippers brought little response." Several studies have documented that deer in general quickly become habituated to noise and lights. Bashore and Bellis (1982) found that deer quickly became accustomed to noise and lights on Pennsylvania airfields. Krausman et al. (1993) investigated the effects of low-altitude jet aircraft noise on the behavior and physiology on captive mule deer and mountain sheep, finding that all study animals became habituated to noise levels ranging from 92 to 112 decibels. According to Dr. Phil Frank, former NKDR manager, Key deer research biologist, and co-author of several papers on Key deer, less than 10 percent of Key deer on Big Pine Key are believed to exhibit "wild," or natural, characteristics (Frank, 2005, pers. comm.).

Feeding: The Key deer is capable of exploiting a variety of foods over a range of habitat conditions. Diet varies seasonally with resource availability and changes in nutritional requirements of deer (Klimstra and Dooley, 1990; Carlson et al., 1993). Key deer forage on over 160 plant species including red mangrove (*Rhizophora mangle*), blackbead (*Pithecellobium keyense*), acacia (*Acacia pinetorum*), Indian mulberry (*Morinda royoc*), and pencil flower (*Stylosanthes hamata*). Red and black mangroves (*Avicennia germinans*) constitute 24 percent by volume of the diet of the Key deer (Klimstra and Dooley, 1990). Key deer require a freshwater source for survival (Folk et al., 1991).

Population dynamics

Population size: The Key deer population on Big Pine Key and No Name Key has increased by about 240 percent since 1972. Collectively, 453 to 517 deer occupy Big Pine and No Name Keys; the highest recorded estimate for these two islands (Lopez et al., 2004a). The Key deer population was estimated at 360 to 375 individuals in 1972, the last official survey (Silvy, 1975), and has increased, but estimates of density and structure are lacking (Lopez, 2001). Based on habitat condition and the presence of density-dependent disease in the population, the Key deer may be at or near ecological carrying capacity (Lopez, 2001; Nettles et al., 2002; Lopez et al., 2004a). The total Key deer population is now about 650, perhaps at or near historic highs, and has remained stable in recent years (Lopez, 2006, pers. comm.).

Key deer are wide ranging and use virtually all available habitats, including developed areas (Lopez, 2001). The increase in the population is believed to be due to the protection of Key deer from hunting through law enforcement, habitat protection, and the positive response of the deer population to low levels of urban development (Lopez et al., 2004a).

Population variability: Key deer produce fewer young per female than any other white-tailed deer population in North America. Fecundity (number of fetuses per female) and productivity (percent of females reproducing) are low, mean age of first breeding is high, and twinning is infrequent, resulting in relatively low reproductive potential. The sex ratio of Key deer is initially weighted towards males; with a 1.75 to 1 fetal ratio and 2 to 1 fawn ratio. However, significantly higher male mortality at maturity serves to balance adult sex ratios more evenly. Annual deer mortality is a function of deer density and population size (Lopez et al., 2003).

Status and distribution

Reason for Listing: The Key deer was listed as an endangered species because of the loss of its habitat to residential and commercial construction and because of high, human-related mortality and human disturbances.

Range wide trends: The protection afforded the Key deer through prohibitions on hunting, habitat management, and habitat protection through acquisition has resulted in an apparent significant increase in (240 percent) in the Big Pine Key deer population. Despite the apparent increase in population levels of Key deer, there has been a contraction of the range of Key deer from 1970 to 1999 (Lopez, 2001). Key deer have become increasingly abundant on Big Pine Key and adjacent islands, but have decreased to near extirpation on more distant islands such as

Cudjoe and Sugarloaf Keys (Lopez, 2001). Although Key deer were never abundant on Cudjoe and Sugarloaf Keys, they previously existed at such low numbers that local extirpation was thought to be likely in the near future (Lopez, 2001). This contraction in the range had decreased the overall viability of the Key deer population by increasing the probability that a stochastic event, such as a hurricane or disease epidemic, may have had catastrophic impacts to the core population on and around Big Pine Key. Recent relocation efforts, however, and the overall population increase have helped address this concern. The population now is at or near historical highs.

As part of the Service's Key deer recovery plan, 39 Key deer have been relocated to two islands within their existing range in the last couple of years. The Service moved 24 individuals (14 does, 10 bucks) from Big Pine Key to Sugarloaf Key and 15 individuals (9 does and 6 bucks) from Big Pine Key to Cudjoe Key. Sugarloaf Key and Cudjoe Key have supported a small number of Key deer in the past. Both islands were home to about five resident deer each. A survey of resident deer on Cudjoe Key prior to relocation produced two deer observed (Parker, 2006, pers. comm.). The relocations appear to be going well. In 2005, 62 percent of the 23 does showed evidence (lactation, fawn present, etc.) of reproduction (Parker, 2006, pers. comm.).

Threats:

Habitat loss - Loss of habitat resulting from development is the most significant and obvious threat to Key deer (Klimstra et al., 1974). The human population on Big Pine Key has increased an estimated 77 percent from 1980 to 1990. An estimated 116 acres per year of Key deer habitat was cleared on Big Pine Key in the early 1970s. Development has been reduced in recent years due to inadequate level of service on the roads and insufficient disaster evacuation time, but habitat loss from development remains a threat. Fencing associated with development may cause direct Key deer habitat loss by preventing access to areas used for breeding, feeding, and sheltering.

Fencing - Fencing of private property associated with residential and commercial development has reduced habitat availability for the Key deer. Native habitat that is fenced is no longer available for use by the Key deer and the fencing may block access to other areas. This loss of habitat has reduced the availability of food, water, and shelter as well as fawning areas needed by deer to survive and reproduce. Large networks of fencing have fragmented Key deer habitat and restricted movement, which has further reduced the availability and value of these areas to Key deer. Although the Monroe County Comprehensive Land Use Plan regulates fencing, many areas important to Key deer continue to be impacted by fences. An additional concern is the injury or loss of deer because of attempting to jump these fences.

Fire suppression - Fire suppression promotes ecological succession in pine rockland communities, resulting in increased hardwood cover, dense brush, decreased herbaceous cover, reduced light penetration, and a general deterioration of habitat quality for Key deer (Klimstra, 1986; Carlson et al., 1993). Exotic plant species such as Australian pine (*Casuarina equisetifolia*), Brazilian pepper (*Schinus terebinthifolius*), and latherleaf (*Colubrina asiatica*) are invading Key deer habitat, out competing native vegetation, and reducing habitat quality.

Exotics infestation - Exotic vegetation and underbrush restrict Key deer movements and concentrate their movements along established trails. Since useable habitat is limited, Key deer must move more to access preferred areas, which involves crossing streets and roads. This results in more Key deer crossing roads at fewer access routes or walking along roads, increasing their vulnerability to traffic. Invasive exotic vegetation out competes native vegetation, resulting in areas of formerly high quality habitat becoming unusable.

Disease - As the population density nears carrying capacity, density dependent disease becomes an increasing problem (Lopez, 2001). Deer mortalities are necropsied and tested for infectious diseases. Several diseases have been detected, but only haemonchosis (anemia attributable to blood loss from blood-sucking parasites) is believed to have affected population dynamics in recent years (Nettles et al., 2002).

Vehicular mortality - Residential and commercial development over the past 20 years has increased the number of vehicles and vehicular traffic in the Keys. The main thoroughfare for the Keys U.S. 1 runs through much of the Key deer habitat. This additional traffic has increased the likelihood of Key deer/vehicle collisions. Vehicular mortality is the greatest known source of Key deer deaths, and could impact the population by removing large numbers of animals. Telemetry data suggests that about 50 percent of deer mortality is attributed to road kills and most of that occurs on U.S. 1 (Lopez, 2001). Although lower speed limits have been imposed in an attempt to reduce traffic mortality, speeding motorists (Lopez, 2001; Frank, 2005, pers. comm.) may also cause continuing deaths in some areas.

Since the 1960s, the Service has kept records on Key deer mortality and more than 73 percent of the cases are due to vehicular mortality (Silvy, 1975; Lopez et al., 2003; Service unpublished data). During the last 10 years (1996 to 2005), over half the vehicular mortalities have occurred along a 3.5-mile segment of U.S. 1, which bisects the southern end of Big Pine Key. Due to the high occurrences of Key deer-vehicle collisions along this road segment, Service and biologists from the Florida Department of Transportation (FDOT) have attempted to address this mortality issue on U.S. 1.

Key deer move between and over islands more often during the dry season and breeding season to find freshwater and females. During cycles when deer numbers are high, vehicular mortalities may be a less significant negative impact to the Big Pine Key deer population than during low population periods. However, as habitat continues to be degraded and Key deer carrying capacity is reached, vehicular mortality may become more important. Catastrophes, such as hurricanes, might reduce Key deer numbers to the extent that road mortalities could adversely affect the population (Lopez, 2001).

Big Pine Key Habitat Conservation Plan (HCP): Big Pine Key is the largest of the Lower Keys and forms the center of the Key deer's range, supporting about 68 percent of the population (Lopez, 2001). Like Big Pine Key, No Name Key contains relatively large areas of the preferred upland habitat with freshwater resources. Together, those keys support about three-fourths of the Key deer population (Lopez, 2001; Peterson et al., 2004). Vehicular mortality is the greatest known source of deer mortality within the action area, especially on Big Pine and No Name Keys.

To address vehicle mortality and habitat loss associated with development on Big Pine and No Name Keys, the Service has issued a section 10(a)(1)(B) permit (Incidental Take Permit [ITP]) to Monroe County, FDOT, and the Florida Department of Community Affairs (DCA) under the Act (June 2006). Issuance of the ITP will authorize take of Key deer, Lower Keys marsh rabbit, and eastern indigo snake on Big Pine and No Name Keys, Monroe County, Florida. The take of these species will be incidental to land clearing for development and recreational improvements. The applicants have developed a habitat Conservation Plan (HCP) that sets guidelines for development activities on Big Pine and No Name Keys to occur progressively over the permit period (20 years) and provides a conservation and mitigation strategy to minimize and mitigate for impacts to protected species and their habitat.

The HCP allows for the loss of a maximum of 168 acres of potential Key deer habitat and compensation will be provided by the acquisition at a minimum of three mitigation units for every one-development unit of suitable habitat on Big Pine and No Name Keys. The Service has determined that this level of incidental take would not jeopardize the survival and recovery of the species.

Summary analysis– Changes since 1997 and 2003 BOs

The Key deer herd has increased substantially over the past 40 years, due principally to a ban on hunting and from protection and management of habitat within NKDR. The population is at or near historical highs and has remained stable since 2003. Furthermore, recent relocation efforts have returned the species to parts of its historic range. Hurricanes, disease, development, increasing tameness, and habitat loss, fragmentation, and degradation, continue to threaten the Key deer population, but the overall health of the species is strong. Road mortality represents the largest known source of documented Key deer mortality (Lopez, 2001), and a crossing constructed by FDOT along U.S. 1 has helped address this problem.

A recent HCP for Big Pine and No Name Keys identified potential effects from development over a 20-year period, as well as offsetting compensation that will protect remaining habitat and the species. Big Pine and No Name Keys support the majority of the Key deer populations, and the Service separately determined the development addressed in the HCP, along with the habitat compensation associated with it and other habitat and species protection measures in place would not jeopardize survival and recovery.

Key Largo cotton mouse

Species/critical habitat description

The Key Largo cotton mouse is an island subspecies of the cotton mouse (*P. gossypinus*), a widespread species in the southeastern United States. The Key Largo cotton mouse was first described by Schwartz (1952a) as a medium-sized mouse with large ears and protuberant eyes. Its back is reddish to dusky brown; its under parts are white. Its body length ranges from 170-6.6-7.4 in, tail length ranges from 2.8-3.4 in, and hind-foot length ranges from 0.82-0.90 in.

Life history

Distribution: The Key Largo cotton mouse formerly inhabited all of the hardwood hammock forests of Key Largo. It is now believed to be restricted to that portion of Key Largo north of the U.S. 1/S.R. 905 intersection, known locally as North Key Largo (Frank et al. 1997). This species also occurred at the south end of Key Largo, at Plantation Key, near Tavernier. Attempts to collect this species in southern Key Largo have been unsuccessful in recent years (Service 1999, Frank et al. 1997). The Key Largo cotton mouse was introduced to Lignumvitae Key in 1970. Its status on that key is uncertain, and it has not been successfully documented there since 1977, when a park ranger observed one individual.

Habitat: The Key Largo cotton mouse builds leaf-lined nests in logs, tree hollows, and rock crevices. The holes occupied by these mice measure 1.2 to 3.5 in. in diameter. They are often partially covered by leaves or bark. Their holes are usually located at the bases of trees, or near or in woodrat nests, although Key Largo cotton mice also use recently burned areas where bracken fern (*Pteridium aquilinum*) dominates ground layers.

Behavior: Key Largo cotton mice feed on leaves, buds, seeds, and fruits. The Key Largo cotton mouse breeds throughout the year. Two to three litters are produced annually, averaging four young per litter. The Key Largo cotton mouse's average life expectancy is 5 months, although it may live for 2 to 3 years.

Population dynamics

In 1997, the population occurred throughout North Key Largo and was apparently viable (Frank et al. 1997), although no precise survey data exist. There is no new survey information or other data since that time, and therefore no updated information on the condition of the species is available.

Status and distribution

Reason for Listing: The Key Largo cotton mouse was recognized by the Service in a notice of review on July 28, 1980 (Service 1980). It was listed as endangered for 240 days on September 21, 1983, through an emergency listing action (Service 1983). The emergency listing was necessary to provide full consideration of the welfare of this species during Service consultation on a loan from the Rural Electrification Administration to the Florida Keys Electric Cooperative. The loan was for construction of a project that would result in accelerated habitat loss. The cotton mouse was proposed as endangered with critical habitat on February 9, 1984 (Service 1984) and was listed as endangered species on August 31, 1984 (Service 1984). The proposed critical habitat was withdrawn on February 18, 1986 (Service 1986).

Range wide Trends: The Key Largo cotton mouse was formerly distributed throughout Key Largo, but is now restricted to hardwood hammocks on North Key Largo (Frank et al. 1997). The majority of high quality hammock habitat available on North Key Largo has been protected through acquisition and is being managed for conservation by the Service and State of Florida. Because of these efforts and current land use regulations in place by Monroe County, the threat

of occupied habitat loss from development on North Key Largo is low. Within this range (North Key Largo), suitable cotton mouse habitat is about 2,103 acres, of which 1,872 acres are in public ownership (89 percent).

Threats

Factors other than habitat loss appear to be a major cause for concern for the cotton mouse. Without active management, it will be difficult for cotton mice to maintain stable populations in areas adjacent to developed lands. Although much of the land currently occupied by the cotton mouse is protected, the secondary impacts from development, perhaps most notably domestic and feral cats, may represent the greatest long-term threat to the persistence of the cotton mouse. Frank et al. (1997) failed to document the cotton mouse at the southern end of North Key Largo. Trapping for the Key Largo woodrat in the Port Bougainville area from 2002 to 2005, however, resulted in the incidental capture of cotton mice in the area. Fire ants were found in some of the areas that were trapped in the old Port Bougainville project area. It was difficult to determine cotton mouse abundance for the area because trap disturbance by raccoons was very high during the trapping sessions.

The domestic cat is the most widespread terrestrial carnivore on earth, and the fact that cats negatively affect a vast array of wildlife species, especially bird and small mammals, is well-documented (Churcher and Lawton, 1989). Cats are flexible in food habits and social organization and hunt even when fed daily by humans (Liberg, 1985). Studies of food habits of feral cats have shown that mice often compose a large proportion of the diet (Churcher and Lawton, 1989). The feral and free-roaming domestic cats on North Key Largo undoubtedly impact cotton mouse populations. The direct and indirect impacts of cats on the cotton mouse population are difficult to quantify. Not only will the cats prey on the cotton mice but also they may cause behavioral changes. Studies suggest that prey behavioral changes in response to predation risk can result in significant effects on prey-body growth rate and reproductive output. The non-lethal impacts of predation risk are most likely determined by a complex mix of predator abundance, prey food supply, habitat structure and the relative distribution of these in space (Arthur et al., 2004).

Feral and free-roaming domestic cats are a problem throughout Crocodile Lake National Wildlife Refuge and Key Largo Hammocks State Botanical Site. Cats have been removed from all areas of North Key Largo regardless of the proximity of the nearest inhabited dwelling. Concentrations of cats appear to be higher near the developed areas especially near Ocean Reef, Garden Cove, and the Ocean Shores development.

Recolonization of the Port Bougainville area may have been impeded by the establishment of a feral cat colony on State property near the Garden Cove Marina. It is unclear when this colony was established. The U.S. Department of Agriculture's Wildlife Services was contracted in 2005 to remove the cats from the area. Although the colony was removed, free-roaming domestic cats and the abandonment of new cats into the area will be a continuing problem. Feral cats are secretive, and unless they are actively tracked and or trapped, their presence will go unnoticed.

In addition to threats posed by cats, the apparent extirpation of this species from Key Largo south of the U.S. 1-S.R. 905 intersection has been generally attributed to land clearing followed by residential and commercial development (Brown 1978b; Hersh 1981). Habitat fragmentation, combined with a decreased range, makes the Key Largo cotton mouse more vulnerable to natural catastrophes such as hurricanes and fire (Service 1993c). Natural catastrophes have altered significant portions of north Key Largo hammocks.

The role of fire ants in the ecology of the North Key Largo hammocks is unknown. However, the fire ant has been documented to seriously impact wildlife populations in other areas (Killion and Grant 1993). Because the cotton mouse is ground nesting and nocturnal, it is likely that it would be vulnerable to fire ant predation while taking refuge in nests during the daytime. In addition, cotton mice bear helpless young, which would be vulnerable to fire ant predation.

Summary analysis– Changes since 1997 and 2003 BOs

The Key Largo cotton mouse was formerly distributed throughout Key Largo, but is now restricted to hardwood hammocks on North Key Largo (Frank et al., 1997). The majority of occupied habitat on North Key Largo is under public ownership and managed for conservation by the Service and the State of Florida. The status of the cotton mouse may be stable, but we have no detailed survey information, and some threats such as domestic and feral cats are a significant concern. Other threats include predation by exotic fire ants, and stochastic environmental events such as fires and hurricanes. Because of land acquisition efforts by Federal, State, and Monroe County and current land use regulations in place by Monroe County, the threat of occupied habitat loss from development on North Key Largo is low. The Key Largo cotton mouse shares habitat with the highly endangered Key Largo woodrat and the same threats are causes of concern for both species. Much more is known about the Key Largo woodrat and, given its precarious condition; it is possible the overall condition of Key Largo cotton mouse may have deteriorated as well.

Key Largo woodrat

Species/critical habitat description

The Key Largo woodrat is an island subspecies of the eastern woodrat (*N. floridana*), which occurs widely in the eastern United States. The Key Largo woodrat is gray-brown with white underparts, large ears, protuberant eyes, and a hairy tail. The head and body length ranges from 4.7-9.0 in, tail length ranges from 5.1-7.4 in, and hind foot length ranges from 1.3-1.5 in.

Life history

Distribution and Habitat: The Key Largo woodrat is endemic to the tropical hardwood hammocks of Key Largo. Historically, it occurred over the length of Key Largo south to near Tavernier, but the present range of the Key Largo woodrat includes only the northern portion of Key Largo (Frank et al. 1997). Within this range, suitable wood rat habitat is about 2,103 acres, of which 1,872 acres are in public ownership (89 percent).

Key Largo woodrats are active climbers. They seem to have definite trails and often use fallen trees to move over the forest floor. The Key Largo woodrat, like other members of the genus *Neotoma*, is known for its habit of building large stick nests. Woodrats construct their nests out of sticks, twigs, and various other objects that they assemble into mounds that can reach 4 ft high and 6-7 ft in diameter. They frequently build their nests against a stump, fallen tree, or boulder and may use old sheds, abandoned cars, rock piles, and machinery as nest sites. Their nests have several entrances and a single, central nest chamber. Normally, only one adult Key Largo woodrat inhabits a nest and one animal may use several nests. Goodyear (1984) found that Key Largo woodrats occupied some areas on North Key Largo without obvious stick nests, although she noted that the animals had at least a few sticks placed at the entrance to rock crevices they used for their nests. In the late 1990's, stick nests were no longer present on North Key Largo (Frank et al. 1997). In 2006, stick nests have been infrequently observed on North Key Largo by Service biologists.

Behavior: Key Largo woodrats feed on a variety of leaves, buds, seeds, and fruits. The Key Largo woodrat is capable of reproducing all year, although there are seasonal peaks: reproductive activity is highest during the summer and lower during the winter. Key Largo woodrats have litter sizes ranging from one to four young although a litter typically contains two young. Female woodrats can produce two litters per year. Both sexes reach sexual maturity in about 5 months. The life expectancy of the Key Largo woodrat is unknown, but is probably similar to other subspecies of *N. floridana* which may live for 3 years, but probably average less than 1 year in the wild.

Population dynamics

Population Size: The effort to monitor the status of the Key Largo woodrat population began in the 1970s and continued intermittently (Frank et al. 1997). Past studies and monitoring efforts indicate that the Key Largo woodrat population experienced a substantial decline sometime in the late 1980s and early 1990s (Frank et al. 1997). The following time line documents what is known about the decline in woodrat numbers.

In 1952, the Key Largo woodrat occurred on Key Largo, but was apparently most abundant on the northern end of the island even at that time. Stick nests were prominent features of the species. For example, one survey of stick nests examined 40 nests in a single location four miles north of U.S. 1 on C.R. 905.

In July 1971, 19 woodrats (10 males, 9 females) were relocated from North Key Largo to Lignumvitae Key. The introduction was apparently successful based on stick nest presence observed by Hersh (1978) and park rangers until at least 1985-1986.

Hersh (1978) conducted a study of the woodrat in 1976-1977 and found densities of 0.9 animals per acre on North Key Largo. Stick nests were common and used as a general indicator of woodrat presence. An index of 5.6 nests per woodrat was developed. Management recommendations from her study suggest old, mature hammock supports the highest Key Largo woodrat density.

Barbour and Humphrey (1982b) conducted a status survey in 1979 and estimated that there were 3,666 Key Largo woodrat stick nests and 645 individual Key Largo woodrats over an area of 222 acres. These estimates were based on 40 strip transects of 1 acre established along C.R. 905. They found Key Largo woodrats on Lignumvitae Key at comparable densities to North Key Largo, and estimated 85 woodrats occurred on the island at a density of 0.9 per acre. They concluded that Key Largo woodrat density was highest in mature forest, and that active stick nests were strong indicators of healthy Key Largo woodrat populations.

Goodyear (1984) used traplines placed in hammock the length of North Key Largo, and concluded that woodrats were found in areas with and without stick nests. She concluded that woodrats are not dependent on stick nests. She suggested that stick nest construction was more a function of habitat conditions. Habitats with abundant natural cover had fewer stick nests. She felt that disturbance could benefit woodrats in habitats with few natural cavities such as recently cleared early successional sites. Older hammocks with increased structural complexity were considered prime habitat.

Humphrey (1988) based his study on grid trapping conducted at six sites on North Key Largo in 1986. Low-density Key Largo woodrat sites were found on the north end of North Key Largo and averaged 1.3 per acre. Sites further south had higher woodrat densities, averaging 4.9 per acre. Humphrey concluded that woodrat densities were 7 times the levels reported by Hersh (1978) and three times the levels reported for woodrats. He also concluded that stick nests were poor estimators of Key Largo woodrat density and tended to underestimate density. Extrapolating average density over acres of habitat available, Humphrey (1988) estimated 6,500 woodrats in North Key Largo.

In 1995, Frank et al. (1997) initiated a transect and grid study of Key Largo woodrats on North Key Largo. Prior to this project, Humphrey monitored the Key Largo woodrat in 1986. Frank et al. (1997) found that in general, Key Largo woodrat densities had declined significantly since the 1986 project, and that stick nests were virtually absent from the habitat. Frank et al. (1997) expressed concern that low densities coupled with the absence of stick nests could indicate significant declines in the Key Largo woodrat population and suggested that intensive monitoring and management be initiated by State and Federal land managers. Key Largo woodrats are now absent on Lignumvitae Key as evidenced by both trapping and lack of sign.

In 1996, the University of Miami initiated a project on the Key Largo woodrat that expanded on the Frank et al. (1997) project using the same trapping locations and methods (Sasso 1999). The study did not document increases in either stick nests or woodrat densities, concluded that intermediate-aged hammock may provide better habitat conditions than old, mature hammock, and suggested a possible role for natural disturbance (e.g. hurricanes) in maintaining good Key Largo woodrat habitat.

Crocodile Lake NWR has continued woodrat monitoring on Key Largo using both transect and grid trapping annually since 1998. The most recent survey was conducted in 2000-2001 and included 15 transects and four 4.4 acres grids. Total trap nights was 10,400 with an average trap success of 0.004 percent, and an average Key Largo woodrat density of 1.5 individuals per acre .

Trapping initiated in January 2002 by Texas A&M University (TAMU) has documented low numbers of Key Largo woodrats and a high mortality rate of radio-collared individuals. In three months of trapping, TAMU accumulated 3,342 trap nights with a trap success of 0.004 percent and an average Key Largo woodrat density of 0.7 individuals per acre). The results of a population viability analysis projected a high risk of extinction for the Key Largo wood rat within the next 10 years.

The University of Georgia conducted the most recent study on the Key Largo woodrat in 2005. This study is focusing on substrate availability (e.g. rock and debris piles) and is determining if rock and debris piles are better indicators of woodrat presence than hammock age.

Status and distribution

Reason for Listing: The Key Largo woodrat was first listed as a threatened species in 1969 under the Endangered Species Conservation Act of 1969. However, this only afforded the woodrat protection on Service lands. The Key Largo woodrat was recognized as a candidate for listing in a notice of review on July 28, 1980 (Service 1980). The woodrat was listed as endangered for 240 days on September 21, 1983, through an emergency listing action (Service 1983). The emergency listing was necessary to provide full consideration of the welfare of this species during a Service consultation with the Rural Electrification Administration. The proposed action was construction of a project that would result in accelerated habitat loss. The Key Largo woodrat was proposed for listing as an endangered species with critical habitat on February 9, 1984 (Service 1984) and was finally listed endangered on August 31, 1984 (Service 1984). The proposed critical habitat was withdrawn on February 18, 1986 (Service 1986).

Range wide Trends: The status of the Key Largo woodrat is precarious, and populations are believed to have declined to the point where extinction is a possibility. We believe the total population of Key Largo woodrats is less than 200 individuals distributed over an area of about 2,147 acres. Because of the threat of extinction of this species and our lack of understanding on the specific mechanisms of this decline, the Service initiated a captive propagation project for the Key Largo woodrat in April 2002. This captive propagation project is a short-term solution to prevent the extinction of the Key Largo woodrat while habitat management and other options can be implemented.

Threats

The Service and State of Florida have protected the majority of high quality hammock habitat available for Key Largo woodrats on North Key Largo through acquisition and management. The most important measure to protect the Key Largo woodrat has been to prevent development on the remaining habitat on North Key Largo through the acquisition of nearly all suitable habitats remaining. Both State and Federal governments have spent about \$65 million to acquire 2,147 acres of hammock habitat on North Key Largo. Because of these efforts and current land use regulations by Monroe County, the threat of future occupied habitat loss from development on North Key Largo is low.

Factors other than habitat loss appear to be affecting the Key Largo woodrat. The past alteration of the hammock in southern North Key Largo fragmented available hammock habitat and reduced the quality of that habitat remaining. There is also an active solid waste transfer station within the occupied range of the Key Largo woodrat. The impact of this facility on the Key Largo woodrat is unknown. In addition to habitat fragmentation, man-made disturbance has resulted in enhanced access to the hammocks by exotic species that benefit from disturbance including feral and domestic cats, fire ants, and invasive exotic vegetation. These non-native species adversely affect the woodrat through predation, competition, and habitat alteration.

Efforts to manage the hammocks on North Key Largo have focused primarily on the maintaining an intact ecosystem. The refuge has taken a proactive approach to enhancing woodrat habitat. Concrete buildings at the old NIKE missile sight were demolished in 2004 and rubble piles were left as potential woodrat habitat. By 2005, the piles were already occupied by woodrats. Large rock piles have also been trucked into the area to provide additional structure as it reverts to hardwood hammock. In 2005, refuge volunteers began experimenting with the placement of artificial nest structures in the hammock near occupied habitat to provide additional nesting substrate in anticipation of hammock regeneration. Some of these structures have been visited by woodrats and a woodrat with a radiocollar has nested in one of them.

While the specific mechanisms responsible for the decline of the Key Largo woodrat are not known, several hypotheses regarding the problem are being considered:

1. *Natural habitat changes*: Successional changes towards more mature habitat may have degraded Key Largo woodrat habitat. The recent observation of Key Largo woodrats inhabiting refuse piles may support this idea. In addition, natural predators may be more abundant or forage more efficiently in mature hammock (easier for an owl to forage), or natural runways in the form of fallen logs may be reduced. Hersh (1978) suggested runways are a key habitat component for the Key Largo woodrat.
2. *Habitat loss and degradation*: Development in the 1960s and 1970s has degraded habitat conditions.
3. *Exotic predators*: Fire ants, feral and domestic cats, and black rats are all relatively recent invaders of North Key Largo and are each potential predators and competitors of Key Largo woodrats.
4. *Disease*: There is evidence that parasites carried by raccoons, the roundworm (*Baylisascaris procyonis*), has affected Allegheny woodrats (*N. magister*) in the northeast (LoGiudice 2001). There are large numbers of raccoons on North Key Largo, but tests for roundworms to date have been negative.

Summary analysis – Changes since 1997 and 2003 BOs

The Key Largo woodrat was formerly distributed throughout Key Largo, but is now restricted to hardwood hammocks on North Key Largo. The majority of occupied habitat on North Key Largo is under public ownership and managed for conservation by the Service and the State of

Florida. Despite the protected status of this habitat, the Key Largo woodrat continues to decline, and the outlook for recovery is poor. Current threats to the Key Largo woodrat include predation by feral and domestic cats, predation by exotic fire ants, and stochastic environmental events such as fires and hurricanes. Because of Federal, State, and county acquisition of wood rat habitat in North Key Largo and the current land use regulations by Monroe County, the threat of future occupied habitat loss from development on North Key Largo is low.

Key tree-cactus

Species/critical habitat description

The Key tree-cactus is a large, tree-like cactus with erect columnar stems, reaching 10 m in height. At maturity, the plants are either much-branched (in variation *robinii*), or remaining few-branched (in variation *deeringii*). The stems of the tree-cactus are cylindrical, green, succulent, and 2 to 4 inches thick, with nine to 15 prominent ribs. Areoles bear 15 to 30 acicular spines that are up to 0.78 inches long and are thickly pubescent when young. Flowers are solitary in the Upper areoles, nocturnal, and 2.0 to 2.3 inches long. The outer perianth segments of the flowers are green, with tips pointed (in variation *robinii*) or rounded (in variation *deeringii*). The inner perianth segments of the flowers are white. The style is slightly exserted (in variation *robinii*) or included (in variation *deeringii*). The fruit of the Key tree cactus is globose, depressed, and 1.4 to 1.6 inches in diameter. The coat of this fruit is thin, leathery, bright red, and splits open at maturity. The seeds are small, hard, shiny black, and set in a soft, white pulp (Benson 1982, Britton and Rose 1937, Small 1931).

Life history

Distribution: The Key tree-cactus grows in the coastal hammocks of the Keys (Avery 1982, Benson 1982, Britton and Rose, 1937 Small 1917, 1921) and in the coastal thickets of the Matanzas and Habana provinces in Cuba (Benson 1982, Britton and Rose 1937). The historical distribution of this species on the Florida Keys, which included populations that are now extinct on Key West, Boca Chica, and Windley Keys, has been substantially diminished by the destruction of populations occurring in the Lower Keys, particularly Key West (Avery 1982, Britton and Rose 1937, Small 1917, 1921). Construction and development activity has been directly responsible for the destruction of several major Key tree-cactus populations over the past seven decades (Austin 1980, Avery [no date], Britton and Rose 1937, Small 1921, 1924).

Habitat: The Key tree-cactus grows in a narrow range of plant associations, which include tropical hardwood hammocks and a thorn-scrub association known locally as a “cactus hammock.” The major requirements for successful growth of Key tree-cactus are an open canopy and freedom from frequent floods or frequent fires. Hardwood hammocks inhabited by the species are typically in an early stage of succession following disturbance (Avery [no date], Small 1917, 1921). Dominant tree species include *Bumelia salicifolia*, *Bursera simaruba*, *Coccoloba diversifolia*, *Ficus aurea*, *Krugiodendron ferreum*, *Metopium toxiferum*, and *Piscidia piscipula*. The Lower story of the canopy typically contains small trees of the dominant species and plants of *Amyris elemifera*, *Aterannus lucidus*, *Bumelia celastrina*, *Capparis flexuosa*, *Eugenia foetida*, *Guapira discolor*, *Pithecellobium guadelupense*, *Randia aculeata*, and

Zanthoxylum fagara (Austin 1980, Weiner [no date]). These hardwood hammocks are upland communities which are flooded only rarely (during major storms) and are mesic in character (Weiner [no date]).

The thorn-scrub, “cactus hammock” association occurs at relatively low elevations in the Keys and is prone to more flooding. Consequently, the canopy of this vegetative community is lower and more open than hardwood hammocks. *Conocarpus erectus* and *Ximenia americana* are the most typical dominant tree species (Weiner [no date]). *Cereus gracilis*, *Cereus pentagonus*, and *Opuntia dillenii* are common associates of Key tree-cactus in these habitats. Key tree-cactus exists on high sites within cactus hammocks that are rarely flooded. These sites support the hardwood hammock species listed above, but they are rarely extensive enough to allow typical development of hardwood hammocks.

The hardwood hammocks and cactus hammocks where the Key tree-cactus grows are all on coral rock. Key tree-cactus grows well on well-drained upland sites with little or no soil development. Mineral soil is, if present at all, a very thin (less than 0.4 inches) layer of rock rubble, calcareous sands or calcareous marl (Austin 1980). A layer of leaf litter one to two cm thick is typically present (Austin 1980). Deeper accumulations of soil may be found in pockets and crevices in the rock. These soils are classified as Histosols (Soil Conservation Service 1975). They are placed in the “catch-all” Rockland groups (Jones 1948). There is no detailed work on soil types in the Keys due to their small area, agricultural insignificance, and lack of well-developed soils. Hammocks on Key West and Boca Chica Key, where Key tree-cactus grew in the past, were developed on oolitic limestone. Soil conditions at these sites were not recorded, but were probably similar to those listed above.

Key tree-cactus exists in small, isolated patches or clumps. The patches may consist of a single plant, or a group of plants may cover an area of tens of square meters (Austin 1980, Small 1917). When many plants occur in a clump, most, if not all, of the separate stems likely represent vegetative offshoots of one or a few founders. Vegetative reproduction is common because of old stems being knocked to the ground.

Reproduction: Long distance dispersal and establishment of new tree-cactus populations is dependent upon the production of seed. However, reproduction within a single population (a clump) is mostly, if not entirely, vegetative. This reproductive strategy (formation of clonal clumps from rooted wind-thrown branches) also accounts, in part, for the clumped distribution of the species (Adams and Lima 1994). Pollination agents are unknown, but may include sphingid moths (Adams and Lima 1994). Seed dispersal by birds (*Cardinalis cardinalis*, for example) is indicated for this species (Austin 1980). The effective dispersers would be those fruit-eating birds, which favor openings in the woods.

The Key tree-cactus can flower year-round, but July, August, and September are peak flowering periods. Mature flowers develop in about 12-14 days, and many flowers may occur simultaneously on a single pseudocephalium (Adams and Lima 1994). Seed dispersal, based on one observation, occurs in August (Austin 1980; Avery [no date]).

Population dynamics

Population Size: The Key tree-cactus is known to occur at seven locations in the Keys. Three (two on Long Key and one on Big Pine Key) locations are protected on public lands managed for conservation. Of those four on private lands, one is protected from disturbance by a conservation easement and one population may be deceased (Klett, personal communication, 2006).

The Key tree-cactus has probably always been rare in Florida. The primary cause for this rarity seems to be the rather restrictive habitat requirements of the species. It grows only on lightly shaded, upland sites. This habitat is not common on the Keys, and, furthermore, is transient in nature. The habitat preferred by Key tree-cactus occurs primarily in naturally disturbed patches of hammock (Avery [no date], Small 1917, 1921). The location of these patches changes with time as disturbed areas re-grow and new sites are disturbed.

In the fall of 2004, Service staff noticed mortality in the population on Long Key. By November 2004, we recognized the problem as a widespread decline phenomenon afflicting most other subpopulations. Morbid trees showed a lack of living tissue (only woody pith) at the base. This pattern was observed to extend upwards, as an advancing edge of necrotic tissue, towards the branch tips. There is little information on the species autecology or synecology.

Status and distribution

Reason for Listing: The Key tree-cactus was federally listed as endangered on July 19, 1984 (Service 1984). The tree-cactus was listed because of severe population declines caused by destruction of upland areas in the Keys for commercial and residential development.

Range wide Trends: Key West once held a large population of this species (Britton and Rose 1937, Small 1917). The last plants apparently died when the final remnants of the original forest were cleared on the island during the 1920's (Small 1921). Plants on nearby Boca Chica Key (Britton and Rose 1937) presumably shared the same fate. Populations reported for Windley Key and Lower Matecumbe Key (Small 1917) were presumed to have been destroyed (Avery 1982); the population on Lower Matecumbe Key was recently rediscovered (Adams and Lima 1994). In recent years, a population of Key tree-cactus on Long Key was destroyed when the hammock where it grew, just east of the town of Layton, was cleared for development.

Key tree-cactus populations documented in 1994 (Adams and Lima 1994) occur on Upper Matecumbe Key (two populations), Lower Matecumbe Key (one population), Long Key (three populations), and Big Pine Key (two populations). Service records (2006b) document seven populations of tree cactus, only three occur on protected public lands: one at the NKDR and two at Long Key State Recreation Area. The other four populations occur on private lands. Of those four on private lands, one is protected from disturbance by a conservation easement and one population may be deceased (Klett, personal communication, 2006).

A recent population decline was detected in the fall of 2004, but neither correlative factors nor causation has yet been determined. By November 2004, Service personnel recognized the problem to be a widespread decline phenomenon that afflicted most subpopulations, with

mortality exhibited among larger subpopulations across the range. To date, the Service has been unable to determine the cause of this mortality and investigative efforts continue.

Threats

Development of occupied tree cactus habitat remains the most significant threat to the long-term conservation of this species. Of the remaining seven populations of tree cactus, only three occur on protected public lands: one at the NKDR and two at Long Key State Recreation Area. The other four populations occur on private lands. Of those four on private lands, one is protected from disturbance by a conservation easement. The Service is coordinating jointly with Monroe County to secure the protection of these populations through review when development is proposed for these properties.

Hurricanes also have the potential to adversely affect tree-cactus populations. Hurricane Georges hit Big Pine Key in October 1998 and caused severe damage to the tree-cactus population on the NKDR. Many of the larger cacti were damaged by high winds and adjacent vegetation. The long-term impacts of hurricanes on tree-cactus are difficult to predict, but because the number of locations where cacti occur has been reduced, the threat of hurricanes is significant. Recently, the 2005 hurricane season resulted in blow-down of portions of at least two additional plants that had otherwise survived the mortality pulse associated with the decline phenomenon. In both cases, windfall includes healthy cactus tissue (e.g., segments of branches) that is suspended in the foliage of adjacent plants (trees and shrubs). This windfall adds to the current stock of downed green tissue. Data indicates that suspended tissue rots in place.

Summary analysis– Changes since 1997 and 2003 BOs

The Key tree-cactus occurs at seven locations in the Keys. Three (two on Long Key and one on Big Pine Key) locations are protected on public lands managed for conservation. Of those four on private lands, one is protected from disturbance by a conservation easement and one population may be deceased (Klett, personal communication, 2006). The main threat to the continued existence of the two unprotected populations is habitat loss from development at the two remaining sites in private ownership. In addition, the remaining populations generally are in decline, which may stem in part from the effects of recent hurricanes. The “take” of plants on private property is not a violation of the Act (unless State law also prohibits take). Therefore, authorization to “take” plants on private property is not required under section 10(a)(1)(B) nor exempted under section 7. However, Federal agencies are required under section 7(a)(2) to make sure that their actions do not jeopardize the continued existence of listed plants.

Lower Keys marsh rabbit

Species/critical habitat description

The Lower Keys marsh rabbit, one of three subspecies of marsh rabbit (*Sylvilagus palustris*), is endemic to the Lower Florida Keys. The Lower Keys marsh rabbit was listed as an endangered species on June 21, 1990 (Service 1990). Lazell (1984) recognized the Lower Keys marsh rabbit as a distinct subspecies. Lower Keys marsh rabbits have short, brown fur and a grayish-white

belly. Their feet are small and their tails are dark brown and inconspicuous. Male and female Lower Keys marsh rabbits do not appear to differ measurably in size or color. This marsh rabbit differs from the peninsular Florida marsh rabbits (*S. p. paludicola*) in several cranial characteristics (Lazell, 1984). The Lower Keys marsh rabbit is the smallest of the marsh rabbit subspecies. There is no critical habitat designated for the Lower Keys marsh rabbit.

Life history

Distribution: The Lower Keys marsh rabbit's original range extended from Big Pine Key to Key West, encompassing a linear distance of about 30 miles. Historically, Lower Keys marsh rabbits probably occurred on most of the Lower Keys that supported suitable habitat, but did not occur east of the Seven-mile Bridge where it is replaced by *S. p. paludicola*. Faulhaber (2003) conducted a comprehensive survey for Lower Keys marsh rabbits. The Lower Keys marsh rabbit is known from many of the larger Lower Keys including Sugarloaf, Saddlebunch, Boca Chica, and Big Pine Keys and some smaller islands near these keys (Forys et al., 1996; Faulhaber, 2003). Historically, the species has existed on Middle Torch Key, Big Torch Key (Lazell, 1984), Cudjoe Key, and may have existed on Ramrod Key, and Key West, but has been extirpated from these areas. Presently, there is a large gap in the distribution of Lower Keys marsh rabbits from Cudjoe Key to the Torch Keys.

The following Keys were known to be occupied by Lower Keys marsh rabbit subpopulations within the period 1988 to 1995: Annette Key, Big Munson Key, Big Pine Key, Boca Chica Key, East Rockland Key, Geiger Key, Mayo Key, No Name Key, Porpoise Key, Saddlebunch Key, Saddlehill Key, and Sugarloaf Key (Forys et al., 1996). During subsequent investigations, conducted from 2001 to 2003, Lower Keys marsh rabbit subpopulations were not found on Big Munson Key, Porpoise Key, and Saddlehill Key. Reintroduction efforts during 2002 to 2004 resulted in the establishment of rabbits on Little Pine Key and Water Key (Faulhaber, 2003; Perry, 2005a). Additional Keys with potential rabbit habitat, as identified by Faulhaber (2003), are Big Torch Key, Cook Key, Cudjoe Key, East Water Key, Hopkins Key, Howe Key, Johnson Keys, Key West, Little Torch Key, Marvin Key, Middle Torch Key, Mud Key, Ramrod Key, Snipe Point, and Summerland Key. On the extreme ends of the range, eastern (Big Pine Key area) and western (Boca Chica Key area) populations exhibit strong genetic differentiation, and limited genetic exchange (Crouse, 2005).

The Lower Keys marsh rabbit occurs in small, disjunct populations whose survival depends on the emigration and dispersal of individuals. In order to persist, the emigration rates of the Lower Keys marsh rabbit have to be equal or greater than the death rates. This subspecies may be less fecund than others, thus naturally making it more susceptible to demographic and stochastic events (Forys, 1995). Since breeding occurs year round, urbanization has affected the Lower Keys marsh rabbit reproductive potential. In addition to natural threats, residential and commercial construction in the Keys have caused direct mortality to the marsh rabbit and disrupted their dispersal.

In 2002, a pilot study that reintroduced 13 Lower Keys marsh rabbits to Little Pine Key, an isolated island with a relatively large area 32 acres of suitable habitat, was conducted to assess the effectiveness of reintroductions in the recovery of the Lower Keys marsh rabbit (Perry,

2005a). High survival (81 percent) during the first 5 months and evidence of reproduction suggested reintroduction was a feasible management tool (Perry, 2005a). To evaluate the translocation techniques used, seven Lower Keys marsh rabbits were introduced to Water Key, an island with about 25 acres of suitable habitat. Survivorship on Water Key during the first 5 months (100 percent) and evidence of reproduction validated these translocation techniques as a viable tool for recovery biologists (Perry, 2005a). Long-term success of this reintroduction program will depend on availability of translocation candidates and possibly an *in-situ* captive breeding program (Perry, 2005a).

Habitat: Lower Keys marsh rabbits inhabit tidal, brackish, upland, and freshwater environments. The majority of suitable habitat area lies in a transitional zone between marine environments and uplands. Cover types that provide habitat include salt marsh, coastal prairie, coastal beach berms, buttonwood (*Conocarpus erectus*) woodlands, and salt marsh-buttonwood transition areas. They also use freshwater wetlands. Lower Keys marsh rabbits often include areas of mangrove (red mangrove, black mangrove, and white mangrove [*Laguncularia racemosa*]) woodlands within their home ranges, and regularly pass through mangrove when traveling between the other habitats. Similarly, data from recent studies suggests that the species may range into the edges of pinelands and other upland habitat, although the frequency and degree of use is currently unknown (Faulhaber, 2003). During long-range dispersal events, such as when a juvenile leaves its natal home range, it is likely that rabbits pass through all natural terrestrial and wetland environments of the Lower Keys.

Faulhaber (2003) estimated that there were 1,291 acres of occupied habitat, and 687 acres of potential (unoccupied) habitat. The median size of all of the 228 occupied and potential habitat patches as delineated by Faulhaber (2003) was 4.5 acres. These habitat patches occur in a fragmented composite of native and disturbed habitat, with few contiguous areas of native habitat greater than 12 acres (Forys, 1995). Known localities for the rabbit are on privately owned land, State-owned land, and Federal land within the NKDR, Great White Heron National Wildlife Refuge, and Naval Air Station Key West. Suitable habitat for this species is highly fragmented across all of the Lower Keys (Forys and Humphrey, 1999b).

Typical Lower Keys marsh rabbit habitat includes wet areas with dense cover. Herbaceous cover is a dominant feature within Lower Keys marsh rabbit home ranges. This herbaceous cover is a mixture of grasses, sedges, and forbs. Such ground cover provides shelter as well as critical foods and nesting sites. The Lower Keys marsh rabbit builds mazes of runs, dens and nests in herbaceous cover. Many of the grassy marsh and prairie rabbit habitats are in transitional plant communities that are similar in form and species composition to communities interspersed among mangrove forests of mainland Florida (Forys and Humphrey, 1994). These wetland communities lie in the middle of the salinity gradient in the Lower Keys. However, many areas occupied by the Lower Keys marsh rabbit appear to be rarely inundated by tides. In 1996, the total area of all suitable occupied habitat was about 625 acres (Forys et al., 1996). In 2003, there were about 3,140 acres of occupied and potential habitat (extracted from Faulhaber 2003 data), of which 2,467 acres (78.6 percent) are in public ownership (Service, 2003).

The coastal prairie and wetland system of the Lower Keys is floristically simple, dominated by relatively few species of grasses and forbs. These include cordgrasses (*Spartina* spp.), seaside

oxeye (*Borreria* spp.), glassworts (*Salicornia* spp.), seashore dropseed (*Sporobolus virginicus*) rushes (family Cyperaceae), saltwort (*Batis maritima*), and marsh fimbry (*Fimbristylis spadicea*). In freshwater marshes, cattails (*Typha* spp.), sawgrass (*Cladium jamaicense*), sedges (*Cyperus* spp.), and spikerush (*Eleocharis* spp.) are common components of the vegetation. Buttonwood is a typical woody component in rabbit habitats. All of the plant communities that provide rabbit habitats are adapted to fire, to some degree, and some may be fire dependent systems (Wade et al., 1980).

Perry et al. (2005) evaluated habitat selection of rabbits on Boca Chica Key (Naval Air Station Key West) during a dry season (winter). They assessed the predictive ability of habitat variables, including visual obstruction, canopy coverage, bunchgrass density, horizontal obstruction, percent bare ground, percent grass, percent forbs, and percent litter, in delineating the core areas of rabbit home range from areas not included in core areas. Of these variables, high visual obstruction, low percent canopy coverage, and high bunchgrass density best explained the presence of Lower Keys marsh rabbit home range cores. The effect of model parameters also differed by site, indicating that spatial variation was also important in predicting the presence of home range cores. Home range cores have a dense structure of low herbaceous cover, including bunchgrasses. They avoided areas with mature buttonwoods and high canopy cover. Forsyth (1995) identified high amounts of bunchgrass and other ground cover, presence of seaside oxeye, and proximity to large bodies of water as habitat components selected by Lower Keys marsh rabbits. Forsyth (1995) concluded that rabbits that inhabit salt marsh spend most of their time in the mid-marsh (seaside oxeye) and high-marsh areas (cordgrasses and marsh fimbry), both of which are used for cover and foraging, while most nesting occurs in the high-marsh area.

Behavior: Adult Lower Keys marsh rabbits of the same sex tend to maintain mutually exclusive home ranges. The home ranges of these rabbits average about 0.8 acre. Adult rabbits have permanent home ranges, while male subadults tend to disperse. Adults of both sexes have similar home range sizes, although the size varies widely among individuals. This individual variability may be due to differences in habitat quality, population density, or the status of an individual in a social hierarchy. Juvenile Lower Keys marsh rabbits appear to use a home range near their nest site.

Lower Keys marsh rabbits usually travel through a variety of habitats between their natal and permanent home ranges including areas with dense ground cover, mangroves, upland hardwood hammocks, and vegetation between road shoulders and water (Forsyth and Humphrey, 1994). Marsh rabbits are good swimmers and will swim when pursued (Tomkins, 1935). Dispersing rabbits are susceptible to high mortalities, particularly when there is a lack of habitat between populations, presence of free-ranging cats, and roads to cross. This species appears to be chiefly nocturnal, although they can be active on cloudy days and when they are protected by dense cover.

Reproduction: Marsh rabbits sexually mature at about 9 months of age. During this time, the majority of the males disperse. Sexually maturing females are not as likely as males to disperse. Like other marsh rabbit subspecies, Lower Keys marsh rabbits are polygamous, and generally breed throughout the year (Holler and Conway, 1979). Although Lower Keys marsh rabbits do

not display an apparent seasonal breeding pattern (Service, 1994), the highest proportion of females with litters occurs in March and September; the lowest proportion occurs in April and December.

The Lower Keys marsh rabbit is less fecund than other marsh rabbits. Marsh rabbits in mainland south Florida (*S. p. paludicola*) can produce 14 to 18 young per female per litter, while only one to three young (average of 1.77) have been observed per nest for Lower Keys marsh rabbits (Forys, 1995). The average for Lower Keys marsh rabbits is 3.7 litters per year, which indicates a much lower fecundity rate than for marsh rabbits in southern Florida, which average 5.7 litters per year. Some marsh rabbits experience total litter resorption that can affect their reproductive output. The loss of these ova can be related to maternal physiological changes in response to stressful events. Rates of litter resorption in the Lower Keys marsh rabbits are not known.

Feeding: Marsh rabbits are herbivores, feeding on grasses, succulent plants, and herbaceous shrubs. Lower Keys marsh rabbits feed on at least 19 different plant species, representing 14 families (Forys, 1995). The most abundant species in the rabbit's diet include seashore dropseed, glassworts, cordgrass, seaside oxeye, red mangrove, and white mangrove.

Based on their distribution, Lower Keys marsh rabbits appear to need only limited sources of freshwater to survive. In a study of several mammals from the lower Florida Keys, this rabbit has one of the highest capacities to concentrate urine (Dunson and Lazell, 1982). The Lower Keys marsh rabbit may be able to survive solely on dew and brackish water, but probably cannot use seawater to meet their need for water.

Population size: In 1995, the Lower Keys marsh rabbit population was 275 individuals (Forys et al., 1996). Since then, additional habitat areas have been found, but rabbits have also been extirpated from many previously occupied habitat patches. The actual number of rabbits is hard to estimate. The current population in 2006 is about 500 rabbits (Perry, 2006, pers. comm.). An index of abundance that has been estimated more accurately for the Lower Keys marsh rabbit is patch occupancy, the number of occupied habitat patches (Faulhaber, 2003). Occupancy rates (the proportion of suitable habitat patches that are occupied) can be compared among different subpopulation areas or different periods, in order to provide an index population decline or growth.

Habitat patch occupancy was documented by the presence of fecal pellets and other means by various researchers between 1988 and 1995. Overall, investigators identified and assessed occupancy in 142 patches during the period 1988 to 1995. Among those investigations, for example, Forys et al. (1996) assessed occupancy in 125 patches of suitable habitat (potentially occupied patches). Of the suitable habitat patches in her sample, 50 (40 percent) were occupied. Subsequently, Faulhaber (2003) attempted to delineate all patches of potential rabbit habitat, and catalogue whether they were occupied during 2001 to 2003. Faulhaber (2003) identified and surveyed 228 patches of occupied and potential habitat during that period, where rabbits occupied 102 patches (45 percent).

Based on the information available to us, the Lower Keys marsh rabbit currently exists on 118 patches, which average 5.1 acres in size (Perry, 2006). The average home range size of a marsh

rabbit is about 12.6 acres (Perry, 2006). However, Hurricane Wilma storm surge inundated occupied habitat in 2005 and is believed to have had a significant detrimental effect on the marsh rabbit (Perry, 2006). A patch occupancy study is currently underway (Perry, 2006).

Population structure: The Lower Keys marsh rabbit exists in a metapopulation structure (Forys, 1995; Forys and Humphrey, 1999a; Faulhaber, 2003). Rabbits occupy distinct patches of habitat. Clusters of adjacent patches comprise subpopulations. Rabbits living in these habitat patches are socially isolated from rabbits in other patches and subpopulations, but interact through dispersal (Forys et al., 1996). Distance among habitat patches is important because the ability of rabbits to recolonize vacant habitat patches depends upon the presence of viable habitat corridors. At the subpopulation level, interchange of rabbits may be rarer, depending on the distance between subpopulations. At the broadest scale, subpopulations may be so distant from other subpopulations that interchange may be nonexistent, and they constitute demes (isolated populations). For example, western subpopulations such as those on Boca Chica, Geiger, and Big Coppitt Keys are part of a metapopulation that is isolated from the metapopulation that encompasses Big Pine Key. Crouse (2005) identified strong genetic subdivisions between eastern and western populations.

A natural feature of metapopulation dynamics is periodic local extinctions (extirpation in patches) and recolonization (immigration from extant patches). The probability that a population can persist in isolation depends on its initial size and the capacities of the resource base. In general, small populations cannot persist in isolation from other populations. For a population to persist, adjacent subpopulations are generally required, as they provide necessary sources of genetic diversity and recolonization. Accordingly, there must be a capacity for dispersal among patches (Hanski and Gilpin, 1991).

Crouse (2005) analyzed patterns of genetic variation within and among island populations of the Lower Keys marsh rabbit, using mitochondrial sequence data (control region; 763 base pairs). Phylogenetic analyses of the mitochondrial sequences revealed that two main lineages exist within the subspecies, corresponding with eastern and western portions of the range. There was strong genetic separation between rabbit populations in terms of mitochondrial DNA haplotypes (19 base pairs). Mitochondrial DNA variation was low, as is typical for island populations. Apparently, the strong phylogenetic differentiation within the Lower Keys marsh rabbit is due to dispersal barriers. The ramification of the evidence of lack of dispersal among areas is that the Lower Keys marsh rabbit exists not as a single small population, but as two small populations. Thus, for the rabbit, small numbers phenomena may work against the subspecies probability of persistence at multiple spatial scales.

Population variability: Random population fluctuation is evident in the rabbit metapopulation; several subpopulations were so small and contained so few individuals of the same sex that they eventually became extirpated (Forys, 1995; Forys and Humphrey, 1999a). Lower Keys marsh rabbits, at a density below carrying capacity (Forys et al., 1996), currently occupy over two-thirds of the habitat identified in the Lower Keys. For a metapopulation to persist requires that some minimum extent of useable, occupied habitats are available, and configured so that interchange can occur among them. This subspecies is thought to be less fecund than other subspecies, making it relatively more susceptible to demographic and stochastic events (Forys,

1995), because the potential for rebounding from perturbations or capitalizing on opportunities may be relatively low. The Lower Keys marsh rabbit population may be strongly susceptible to chance environmental perturbations, such as hurricanes. For example, five out of six rabbits that were tracked by radio-telemetry on Boca Chica Key succumbed to Hurricane Wilma, which passed near Key West on October 24, 2005. On Boca Chica, the number of patches that were occupied during the previous dry season (winter) decreased by 33 percent after Hurricane Wilma passed (LaFever and Lopez. 2006).

Status and distribution

Reason for listing: The Lower Keys marsh rabbit was listed because of habitat loss and fragmentation, predation by cats, and vehicular mortality.

Rangewide trends: Threats to the Lower Keys marsh rabbit have resulted in a decrease in the number of populations, a decline in the size of the populations, and reduced connectivity among patches and subpopulations. The Lower Keys marsh rabbit occurs in increasingly smaller, more fragmented, and isolated populations. Persistence depends on a positive rate of reproduction along with the ability to disperse, so that immigrants can reverse periodical local extinctions through recolonization. The probability that a successful colonization event will occur is linked to the number of potential dispersers and thus population size. In order to persist in the wild, rates of immigration and reproduction must exceed emigration and mortality. Over time, the number of patches that are recolonized must equal or exceed the number of patches that are extirpated. In recent decades, the number of patches occupied by Lower Keys marsh rabbits has declined and the area of occupied range has contracted. With fewer occupied patches and lower potential for interchange between subpopulations, the probability of persistence over a modeled period is reduced.

A population viability analysis for the Lower Keys marsh rabbit was conducted in 1999 (Forys and Humphrey, 1999a). The researchers suggest that the Lower Keys marsh rabbit metapopulations exist in the classic metapopulation structure but are declining due, in part, to low survival. The analysis predicted that this species might become extinct in 20 to 30 years under the current conditions. The population viability analysis also predicted a high probability of extinction if mortality from either vehicles or free-roaming cats is not controlled. Of the Keys studied, persistence of the population on Big Pine Key was predicted to be greater than on other keys because of larger habitat areas. Forys and Humphrey (1999a) suggest that management efforts to save the marsh rabbit should focus on developing a plan to reduce cat use of marsh rabbit habitat. However, the researchers acknowledge that because controlling cats on privately owned land is a problem, intensive public education on the effects of cat predation may be one of the options.

The Lower Keys marsh rabbit occurs in small, largely disjunct subpopulations that cover a shrinking area. The number of patches of occupied habitat and the rate of occupancy continues to decline. Monitoring of patch occupancy has illustrated these annual declines (Service, 1999; Perry, 2005a). Results from rangewide monitoring efforts are available for four periods: 1988-1995 (various investigators; records on file), 2001-2003 (Faulhaber, 2003), winter 2003-2004, and winter 2004-2005 (Perry, 2006). Occupancy rates between these periods declined 6.0, 3.9,

and 2.0 percent, respectively. Among all three periods, the net loss of patches between periods averaged 6.3 patches.

Considering only patches with rabbits during one or both of the paired survey periods, patch occupancy declined at 9.5, 7.7, and 4.3 percent, respectively, between sequential periods. The sample size among these monitoring periods was, 84, 104, and 92, respectively. Sample sizes are the number of patches surveyed during sequential periods and found to be occupied during one or both of those periods. For all three comparisons, the average sample size (number of patches occupied in one or both years) was 93.3. The net loss of patches between the three periods averaged 6.7 patches. These rates of decline do not reflect potential effects of Hurricane Wilma in 2005, as the annual rangewide monitoring effort (winter 2005-2006) had not yet been conducted. Additionally, the rates of decline would be slightly greater if not offset by several patches that were occupied due to translocations. These translocations positively affected occupancy rates in the periods subsequent to movement and colonization. They included three patches colonized as of the 2001-2003 period (Faulhaber, 2003), and one patch colonized as of the winter of 2004-2005 period (Perry, 2005a).

Considering only results of the unbroken sequence of annual surveys, which includes the last three survey periods (two comparisons of annual transitions in occupancy), an average of 98 occupied patches were tracked among periods, the annual rate of attrition averaged 6 percent, and the net loss of patches averaged six per year. The largest number of occupied patches identified in any study period was during the 2001 to 2003 period, when 105 occupied patches were detected, including three patches to which rabbits were translocated.

These observations are consistent with the predictions of decline toward rapid extinction in the population viability analysis developed by Forys and Humphrey (1999a). Patches are being extirpated more than they are being recolonized. Accordingly, the dynamics of remaining occupied patches is driving the population trajectory. For example, based on the observations presented above, assuming an initial population of 100 patches and a fixed loss of six patches annually, all 100 patches would be extirpated (extinction would occur) in less than 18 years.

Assuming all else is equal, given the passage of 6 years since that study, the estimated range of years until extinction would be down to 14 to 24 years. The midrange of this persistence time prediction, 19 years, is close to the 18-year period based on observations from occupancy monitoring over the last several years.

LaFever and Lopez (2006) conducted a population viability analysis of the Lower Keys marsh rabbit metapopulation on Boca Chica Key (Naval Air Station Key West). Results were similar to those of Forys and Humphrey (1999a), which identified the Boca Chica metapopulation the most prone to extinction. LaFever and Lopez (2006) estimated the probability of persisting for 10 years, under the current conditions, was 41.6 percent. Like Forys and Humphrey (1999a), these investigators found that control of cat populations on Boca Chica Key would likely have the greatest benefit to Lower Keys marsh rabbit populations than any other management action considered.

The Service and collaborators have initiated a reintroduction program (Service, 1999). In 2002, 13 Lower Keys marsh rabbits were translocated to Little Pine Key, which resulted in successful establishment (Faulhaber, 2003). In 2004, seven rabbits were translocated to Water Key, which also resulted in successful establishment on that island (Perry, 2005a). In both cases, evidence of reproduction has been documented on the newly colonized islands (Perry, 2005a). These efforts have served, to a degree, to offset some of the trends discussed above, and ameliorate threats. For example, several patches were recolonized, and portions of the geographical range were reoccupied.

Threats: The Lower Keys marsh rabbit is vulnerable to predation by free-roaming cats, habitat loss and degradation, hurricanes, vehicular traffic, contaminants, dumping and trash accumulation, poaching, fire ants, and exotic vegetation. The greatest threats to the continued existence of the Lower Keys marsh rabbit are predation by cats, habitat loss and degradation, and hurricanes. These threats not only directly affect the viability of local subpopulations, but also reduce the probability of successful dispersal among the increasingly fragmented habitats. Connectivity among suitable habitat patches is necessary for Lower Keys marsh rabbit dispersal among patches (Forys and Humphrey, 1999a), and dispersal is a necessary process if rabbit metapopulations are to remain self-sustainable. In the past, humans often hunted the Lower Keys marsh rabbit; this is not known to be a current threat.

Free roaming cat mortality - Forys et al. (1996) reported that feral or domestic cats occurred in 14 of 19 rabbit subpopulations newly located during the course of their investigation. These medium-sized predators are especially effective at taking small mammals such as the Lower Keys marsh rabbit, and account for significant predation (Forys and Humphrey, 1999a). A detailed study of cat diets in the Keys was conducted, but rabbits were the largest component of feral cat diets in several studies that have been conducted elsewhere (Jones and Coman, 1981; Liberg, 1985).

Isolation from free-roaming cats appears to be the most important factor to help this species survive (Forys and Humphrey, 1999a). When different management scenarios were included in Forys and Humphrey's (1999a) PVA model, the persistence of the Lower Keys marsh rabbit was extended to 50 years if all predation by cats was removed. In the absence of controlling cat predation, persistence was not extended appreciably if all vehicular mortality was removed or reintroductions into vacant patches were conducted. For the Boca Chica Key study, area free-roaming cat caused mortality was 53 percent of total mortality and vehicular mortality accounted for about 33 percent. LaFever and Lopez (2006) findings on Boca Chica Key (Naval Air Station Key West) are consistent with the earlier population viability analysis (Forys and Humphrey, 1999a). Like Forys and Humphrey (1999a), these investigators found that cat predation is the greatest threat to rabbit persistence.

Habitat loss and degradation - Lower Keys marsh rabbit metapopulation exists as small, disjunct subpopulations, which require dispersal among subpopulations, because recolonization of temporarily extirpated subpopulations is periodically required in a metapopulation structure. The destruction and fragmentation of habitat may result in habitat patches that are too small to support the Lower Keys marsh rabbit.

In the past 50 years, more than half the area of the suitable habitat of the Lower Keys marsh rabbit has been destroyed to construct residential housing, commercial facilities, utility lines, roads, or other infrastructure. The dredging of canals and fill in tidal areas for waterfront access further destroyed and fragmented Lower Keys marsh rabbit habitat. Much of the remaining suitable habitat of the Lower Keys marsh rabbit has been degraded by altered hydrological and fire regimes, invasive exotic plants, repeated mowing, dumping of trash, or off-road vehicle use. Habitat fragmentation is as an important factor in Lower Key marsh rabbit demographics (Forys and Humphrey, 1999a). Urbanization has fragmented the sites occupied by this species and has eliminated many of the corridors that allow movement between the increasingly isolated subpopulations. For example, commercial and residential development along U.S. 1 effectively creates a barrier to movement of Lower Keys marsh rabbits between northern and southern Big Pine Key subpopulations. In more urbanized areas where the vegetative cover has been removed and mowed, dispersing marsh rabbits have no cover from cats, and face greater threats from vehicles.

Fire suppression - The lack of fire in both occupied and unoccupied habitat patches may degrade habitat quality because of floristic changes and succession, including woody encroachment. Buttonwood is often present in the Lower Keys marsh rabbit's habitat, as a component of, or totally dominating, the woody, upper canopy. Buttonwood appears to occur as a typical component of the flora in some settings, and appears to represent an opportunistic competitor in others. In either case, in the absence of disturbance, buttonwood may dominate the upper canopy and restrict other plants in that stratum and lower strata. In some areas, buttonwood may co-dominate such canopies with other woody species. Elsewhere, buttonwood dominates that layer nearly as a monoculture, and ranges in density from sparse (buttonwood savannah) to dense (closed canopy woodland). Where buttonwood forms a dense canopy, herbaceous cover is sparse due to shading and other forms of competition with the buttonwood.

The physical and ecological factors that control the distribution and abundance of buttonwood are not fully known, particularly in relation to the quality of Lower Keys marsh rabbit habitat. In these cases, a lack of natural disturbance, which has allowed for the reduction of the herbaceous layer and dominance of the buttonwood canopy over time, is indicated. Research conducted in Everglades National Park, (Wade et al., 1980) suggests that in the absence of fire, coastal prairies transform into buttonwood forest.

Salt marsh is regularly inundated by saline water, whereas coastal prairie rarely is. Nonetheless, salt marsh is also a fire-adapted ecosystem (Wade et al., 1980). In salt marsh as well as coastal prairie, buttonwood from adjacent transition zones may proliferate in the absence of fire. In the Lower Keys, salt marsh transition zones are also interspersed well into upland landscapes. There, as elsewhere, fire is suppressed in the surrounding matrix of habitats, which include pine rockland and hardwood hammock. Accordingly, fire rarely burns through rabbit habitat, including salt marsh-upland transition areas with buttonwood. Fire prescriptions in the current fire plan for the NKDR only target pine rockland. A prescribed fire regime could prevent late succession woody encroachment in the Florida Keys coastal wet prairie and promote regeneration of forbs and grasses that are important resources for Lower Keys marsh rabbits.

Fire suppression has not been identified as a specific threat. Coastal prairie and marsh-upland transition areas, including "buttonwood transition areas," represent the primary cover type inhabited by Lower Keys marsh rabbit. In the absence of fire, these areas appear to be vulnerable to encroachment by woody vegetation, and conversion to buttonwood woodland.

Hurricanes - The magnitude of threats from chance environmental catastrophes (environmental stochasticity), such as hurricanes, are enhanced due to the characteristics of small, poorly dispersed populations (demographic stochasticity). The 2005 hurricane season was an active one that included Hurricane Wilma, a class three hurricane that passed near Key West on October 24, 2005. Hurricane Wilma resulted in a storm surge that covered most of the land area in the Lower Keys. The surge displaced standing water, both fresh and brackish, in virtually all wetland areas. At the time, seven rabbits were radio collared on Boca Chica Key, as part of a research project. The fate of six of these could be followed subsequent to the storm. On October 27, 2005, five of the six were determined to be dead, all or most, due to drowning or other storm effects (LaFever and Lopez. 2006). A search at that time, however, also yielded sign (tracks and fecal pellets) of some surviving rabbits.

Many patches of occupied habitat on Boca Chica Key were monitored in November and December of 2005, after the passage of Hurricane Wilma, as part of a research project conducted by TAMU. Considering the 33 patches occupied during the winter monitoring period (2004-2005) and re-assessed in the post-Wilma period, patch occupancy declined 33.3 percent between periods, a net loss of 11 occupied patches.

It is possible that hurricane impacts to Lower Keys marsh rabbit habitat would be less extensive if it contained more topographic and vegetative diversity than that of Boca Chica Key, and provided more opportunities for refuge above the water. Hurricanes are a significant threat to the Lower Keys marsh rabbit and reduce the capacity to resist adverse impacts associated with other threats. Other indirect and delayed effects of hurricanes are unknown. Large amounts of trash, which degrade habitat quality, were concentrated in rabbit habitat by the receding waters following the hurricane. The ability of vegetation to resist hurricane effects will vary by species, plant community, and location. Similarly, the extent and rate at which plant resilience is manifested will vary.

Vehicular Mortality - Mortality of Lower Keys marsh rabbits from vehicular collisions has been documented as an important factor influencing the species (Forys and Humphrey, 1999a). Roads can interfere with movements within the home range and with dispersal preventing essential interchange between subpopulations (Forys and Humphrey, 1999a). Dispersing males are the most vulnerable to vehicular mortality. Dispersal is the means of populating sites where rabbits no longer exist. Recorded rabbit vehicular mortality totaled four on Naval Air Station Key West between 1992 and 1994 (Forys, 1995). Off-road vehicular activities also affect the rabbit through habitat degradation and direct mortality. At least one radio-collared rabbit was killed by an off-road vehicle on Naval Air Station Key West (Forys, 1995). There is limited vehicular mortality on Big Pine Key with three individuals reported killed since 1990.

Other threats - Nutrients from septic tanks and fertilizers degrade water quality in rabbit habitat. Illegal dumping and litter deteriorates habitat quality. Exotic fire ants are increasing in marsh habitat and they pose a threat to newborn rabbits.

Big Pine Key HCP: Lower Keys marsh rabbit suitable habitat on Big Pine and No Name Keys is estimated at 1,045 acres of which 892 acres are in public ownership (85 percent) (696 acres-Federal [NKDR], 182 acres-State, 14 acres-Monroe County). To address habitat loss and indirect effects (cat predation) associated with development on Big Pine and No Name Keys, the Service has issued a section 10(a)(1)(B) ITP to Monroe County, FDOT, and DCA pursuant to the Act. Issuance of the ITP will exempt take of Key deer, Lower Keys marsh rabbit, and eastern indigo snake on Big Pine and No Name Keys, Monroe County, Florida. The take of these species will be incidental to land clearing for development and recreational improvements. The applicants have developed a Habitat Conservation Plan (HCP) that establishes guidelines for development activities on Big Pine and No Name Keys to occur progressively over the permit period (20 years) and provides a conservation and mitigation strategy to minimize and mitigate for impacts to protected species and their habitat.

The HCP project area encompasses about 7,166 acres, including Big Pine Key (5,975 acres) and No Name Key (1,191 acres). Government owned lands constitute 69 percent of the HCP project area and these lands are protected under conservation status. The HCP allows for the loss of a maximum of 168 acres of potential Key deer and eastern indigo snake habitat and 36 acres of suitable marsh rabbit habitat. Compensation will be provided by the acquisition at a minimum of three mitigation units for every one-development unit of suitable habitat on Big Pine and No Name Keys. The Service has determined that this level of incidental take would not jeopardize the survival and recovery of these species. Furthermore, the Service considers the proposed FEMA action on Big Pine and No Name Keys, which will occur during the same timeframe, to be covered by and must comply with the terms of the HCP and therefore, to be a subset of the incidental take authorized for this species.

Summary analysis – Changes since 1997 and 2003 BOs

Recovery of the Lower Keys marsh rabbit will continue to be challenging due to the lack of available habitat, road construction causing habitat fragmentation and development, and increased mortality due to cats. This recovery potential will increase if active management of populations and habitats is undertaken (Forys, 1995). Since residential and commercial construction affected both occupied and unoccupied sites over the past three decades, opportunities for conservation of the rabbit have been reduced.

Schaus swallowtail butterfly

Species/critical habitat description

Schaus described the Schaus swallowtail butterfly in 1911 from specimens collected in May 1898, in the south Miami area. The Schaus swallowtail butterfly is a large blackish-brown swallowtail butterfly with contrasting markings that are mostly dull yellow (Klots 1951, Pyle 1981, Opler and Krizek 1984). Their antennae are black with a yellow knob that has a black tip.

Their forewings have a dull yellow median band from the apex to about midpoint of the inner margin, with a short side branch to costa about 1/3 distance from the apex. Their subterminal and terminal lines consist of lunular yellow spots from apex to anal angle. Their hindwings have a yellow median band continuing that of the forewing, and a submarginal row of large yellow lunular spots; the concavities of a deeply scalloped outermargin have yellow edging. Their blackish “tail” is straight-edged (not teardrop-shaped), and is bordered with yellow. The tails have a hollow red spot along the anal margin just above the anal angle, with bluish scaling. A small, inconspicuous red dash is sometimes present basad of the second yellow lunule from the anal angle (between vein M2 and Cu1).

The underside of a Schaus swallowtail’s wings is yellow with black shading mostly in the median and submarginal areas of the forewing and in the terminal area and tails of the hindwing. A dull brownish red median band extends from costa to inner margin of the hindwing, narrowing before touching these margins. There is extensive bluish scaling along the outer edge of the reddish band of the wing. The wingspan is 2.9 to 4 inches (Klots 1951; Pyle 1981; Covell 1985, personal communication).

The Schaus swallowtail butterfly is most easily confused with the giant swallowtail (*Papilio cresphontes*) Cramer, which is widespread in eastern North America and occurs in habitat occupied by the Schaus swallowtail butterfly. The two butterflies are easily separated by size and color: the giant swallowtail is larger than the Schaus swallowtail and is more nearly coal-black with brighter yellow lines. The giant swallowtail butterfly has a broader median forewing band that is more broken into spots, and is less separated from the submarginal band toward the apex. The giant swallowtail butterfly’s antennae are solid black and its tail is teardrop-shaped, yellow inside bordered with black edging. The reddish markings on the underside of its wings are less brownish and much less extensive than on the Schaus swallowtail butterfly (Opler 1984).

Life history

Distribution: The present distribution of the Schaus swallowtail butterfly is limited to undisturbed tropical hardwood hammocks in insular portions of Dade and Monroe Counties, from Elliott Key in Biscayne National Park in the northeast to northern Key Largo to the southwest (Service 1982b; Emmel 1985a). The last known mainland specimen collected from the south Miami area was collected at Coconut Grove, Dade County, in May 1924 (Service 1982b). One older specimen was reportedly collected at Key West (Service 1982b). A colony flourished from 1935 to 1946 on Lower Matecumbe Key (Service 1982b; Grimshawe 1940), with a single capture recorded there in 1964 (Service 1982b). The Schaus swallowtail butterfly has been known to occur on northern Key Largo from 1940 to present, although rare since the mid-1970s (Service 1982b). The Schaus swallowtail butterfly has been known to exist on the larger islands of Biscayne National Park since 1972 (Brown 1973; Covell and Rawson 1973). Individuals have also been seen in and adjacent to the Crocodile Lakes National Wildlife Refuge. Captive bred butterflies have been released on six sites in North Key Largo.

The majority of the Schaus swallowtail butterfly population occurs on Adams, Elliott, Old Rhodes, Swan, and Totten Keys within Biscayne National Park (BNP). Between 1985 and 1990,

the Elliott Key population fluctuated between 600 to 1,000 adults annually, with smaller populations of at least 50 to 100 individuals on each of the other Keys. Hurricane Andrew significantly reduced the BNP's population in 1993 to 58 identified individuals, however, in 1994 the population rebounded naturally to over 600 individuals and is presumed stable (Emmel 1995).

Within the major Keys of BNP (Elliott, Old Rhodes, Totten, and Adams Keys) and on northern Key Largo, the two food plants of the Schaus swallowtail butterfly seem adequate to support a healthy population. High numbers of individuals sighted in 1985 (Emmel 1985b, personal communication) indicate that the Schaus swallowtail butterfly's population exhibits periodic peaks. BNP also provides adequate cover for both Schaus swallowtail butterfly adults and food plants (Emmel 1985a, Service 1982b). This cover includes mature and well-drained tropical hardwood hammock with some natural and man-made openings such as narrow trails and clearings where nectaring and courting behavior can take place close to the more enclosed jungle-like forest where adults spend much of their time (Service 1982b).

There have been two possible, but unverified, sightings of Schaus swallowtail butterflies in the Lower Keys. The unverified sightings occurred 40 and 33 years ago. One Schaus swallowtail butterfly was seen on Big Pine Key in 1966 (Service 1982b) and another on Lignumvitae Key, a State Park, in 1973 (Covell 1976). The sighting on the latter Key seems possible because the butterfly's food plant, *Amyris elemifera* (torchwood), is present on Lignumvitae Key (Covell 1976). A 1984 survey from Elliott Key to Key West found no Schaus swallowtail butterflies south of North Key Largo (Emmel 1985a); although a verified sighting occurred on Upper Matecumbe Key in 1986 (Emmel 1986a). In 1985, over 400 Schaus swallowtail butterflies were seen in BNP, and a few were spotted at four sites in northern Key Largo (Emmel 1985b). In 1986, the population of adult Schaus swallowtail butterflies on Elliott Key was estimated at 750-1000 individuals; in the same year, there were an estimated 50-80 individuals (adults and immatures) on each of Old Rhodes, Totten, and Adams Keys (Emmel 1986a).

Habitat: The Schaus swallowtail butterfly occurs exclusively in mature subtropical dry forest (hardwood hammocks) that is now extensive only in the Upper Keys in Dade and Monroe Counties (Service 1982b). Adults of this species may fly in clearings and along roads and trails, or even out over the ocean for short distances (Rutkowski 1971, Brown 1973), but they typically remain in the hammocks proper (Rutkowski 1971). Nectaring activity usually occurs on blossoms of wild coffee, guava (*Psidium guajava*), or cheese shrub (*Morinda royoc*), along the margins of these hammocks; they rarely feed in areas open to direct sunlight (Service 1982b, Rutkowski 1971).

The Schaus swallowtail butterfly is restricted to a habitat where its primary food plant, torchwood, grows abundantly (Service 1982b). This habitat is limited to coastal southeast Florida and the Upper Keys, in mature tropical hardwood hammocks. Prior to human influences, populations of this butterfly were probably subject to naturally occurring population depressions caused by hurricane damage, drought, and rare freezes (Covell 1976). The influence of the Labor Day hurricane of 1935 on the Lower Matecumbe Key population was documented by Grimshawe (1940), though she was incorrect in claiming that the species became extinct (it was found there).

and on Key Largo in succeeding years) (Henderson 1945). However, Grimshawe's search was negative. Her experience demonstrates that this hurricane had a detrimental effect on the biota of the Keys southwest of Key Largo.

Behavior: Other characteristics of Schaus swallowtail butterfly habitats are that they are from 10 to 15 feet above sea level, away from tidal waters, and have a mature overstory of trees such as the food plants gumbo-limbo (*Bursera simaruba*), pigeon plum (*Coccoloba diversifolia*), black ironwood (*Krugiodendron ferreum*), West Indian mahogany (*Swietenia mahagoni*), and wild tamarind (*Lysiloma latisiliquum*) (Covell 1976). These plants grow on a substrate of Key Largo limestone, which characterizes the Upper Keys.

Temperature in Schaus swallowtail butterfly habitats range from 74 °F in the Miami area to 77°F in the Upper and Lower Keys. Annual rainfall in habitats in the Miami area ranges from 60 to 65 inches, in the Upper Keys it ranges from 45 to 50 inches, and in the southern Keys, it ranges from 35 to 40 inches.

Dense, mature subtropical hardwood hammock habitat on well-drained substrate with dappled sunlight penetration is essential for the continued survival of both the Schaus swallowtail butterfly and its primary food plant, torchwood (*Amyris elemifera*) (Emmel 1985a, Service 1982b, Covell 1976, Rutkowski 1971, Brown 1973, Loftus and Kushlan 1984). Neither the minimum area nor the optimum density of primary and secondary food plants is known.

The Schaus swallowtail butterfly is territorial to the extent that males have been observed to investigate other males entering their territories within hardwood hammocks (Emmel 1985a). Male butterflies have also been reported as they "patrolled the treetops at a height of 10 feet or more" during the "hot afternoon" on "bright days," sometimes "descending into open spaces to investigate any other *Ponceanus*" (Rutkowski 1971). Emmel (1985a) also notes that male Schaus swallowtail butterflies are remarkably adapted to flight within hardwood hammocks and are able to pick their way among branches and around spider webs.

The Schaus swallowtail butterflies spend much of their time within hammocks, particularly where sunlight penetrates to give a dappling effect (Emmel 1985a). Courtship has been observed along narrow trails cut through the hammock (Rutkowski 1971, Covell unpublished, 1985). Open areas such as trails or clearings within or near the dense hammock are requisite for courtship activity and nectaring. These open areas may be natural or man-made.

The Schaus swallowtail butterfly appears to be strictly diurnal. Rutkowski (1971) observed 2 female Schaus swallowtail butterflies on different days visiting cheese shrub blossoms just before 9:00 am his earliest observation, another female hovering over cheese shrub at 5:00 pm comprised his last observation during a day (Rutkowski 1971). He found both sexes "within the hammocks, fluttering in diffused light about a foot above the ground at blossoms of Guava ..." during the hottest part of the day (from 1:00 to 2:00 pm).

While no mass migration of the Schaus swallowtail butterfly has ever been reported, an individual was followed as it crossed a half-mile expanse of Biscayne Bay between two islands (Brown 1973). In 1986, a Schaus swallowtail butterfly was seen crossing about 1,200 ft from

Old Rhodes Key to Swan Key (Emmel 1986a). These observations suggest that these butterflies can travel across open water for a considerable distance among the Upper Keys and may be able to travel to and from the mainland.

Adult Schaus swallowtail butterflies are active primarily in May and June, with most sightings recorded between mid-April and mid-July (Service 1982b). A few August and September records suggest either delayed-emergence during a year, or a facultative second brood (Service 1982b, Brown 1976).

There is only a one-generation of Schaus swallowtail butterfly per year and adults are short-lived (Emmel 1985a). There is some evidence from rearing that diapause may extend for at least 2 years (Grimshawe 1940). If this occurs in natural populations, the Schaus swallowtail butterfly could survive extreme droughts in the season following its larval development by delaying emergence, perhaps until July-September or later (Rutkowski 1971). Some adults are active during July-September as well as during the normal flight period of late April through early July (Brown 1976).

Feeding: Young caterpillars use tender, young leaves of plants such as wild lime and will avoid tougher, older leaves although fifth (final) instar larvae have been observed eating tougher older leaves of torchwood (Service 1982b) and, in a laboratory, prickly-ash (Rutkowski 1971). Adults were seen taking nectar from blossoms of guava, cheese shrub, and wild coffee (Service 1982b, Rutkowski 1971). Guava seemed to be the nectar source preferred by individuals observed by Rutkowski (1971) and he suggested that the Schaus swallowtail butterflies will fly some distance from their hammock haunts to find blooming guava flowers. Emmel (1986a) observed frequent nectaring at seven plant species on Elliott Key: cheese shrub; blue porterweed (*Stachytarpheta jamaicensis*); sea grape; dog's tail (*Heliotropium angiospermum*); lantana (*Lantana involucrata*); salt-and-pepper (*Melanthera nivea*); and wild coffee.

Population dynamics

Population Size: Population numbers appeared to be widespread in Key Biscayne National Park and on northern Key Largo and apparently expanding in 2004, but in 2005 numbers appeared lower and localized (Salvato, personal communication, 2006). Emergence of adults is highly dependent on rain and timing is often of major significance in survey results. The poor results in 2005 were likely the result of dry conditions (Salvato, personal communication, 2006), and do not represent a general decline of the species.

Population Variability: The courtship of Schaus swallowtail butterflies has been partially described in the following observation: "At 10:15 am in a dimly lit trail through brushy hammock, I saw a female and two male *ponceanus* visiting flowers at opposite ends of a Guava tangle. The fresher of the two males eventually approached this slightly worn female while she was still feeding. He hovered over her. She then settled on the ground with wings flattened and vibrating, raising her abdomen. The male fluttered on the ground behind and then rose over her before flying away" (Rutkowski 1971).

Three courting pairs of Schaus swallowtail butterflies were observed in 1982 on Elliott Key (Covell unpublished, 1985) and photographed; details were not recorded. During part of the flight, the males were flying behind the females from 3 to 10 feet in the air. In the pair photographed, the male was worn and heavily damaged, but the female seemed fresh and whole.

Oviposition in the wild has also been described. The Schaus swallowtail butterfly deposits its eggs on torchwood and wild lime (Grimshawe 1940, Rutkowski 1971, Brown 1973, Loftus and Kushlan 1984). Either these food plants are usually at the edge of hammocks along trails impartially sheltered by the canopy or they are in the hammocks proper, at the edge of a clearing or a large opening in the canopy. Females deposit single eggs on the Upper surface of the tips of the leaves; however, there is one record of two eggs on a leaf (Service 1982b). Eggs and larvae are not found on plants in open sunlight; however, in contrast, the giant swallowtail, *Heracides cresphontes*, has been observed ovipositing on wild lime growing in the open (Service 1982b).

Information on survival rate of adults is mostly anecdotal. Earlier projections are that adults live only about 2 weeks, and suffer damage more quickly because of hazards of life in the dense brush of the hammock than similar species that inhabit open areas (Emmel 1985a).

There are no published studies on sex ratio, but Covell (1985) has found that males are seen in more abundance than females. Of 245 adult *ponceanus* in collections, 136 were males, 41 females, and 68 had no sex indicated. If these figures were indicative of natural sex ratios, males would outnumber females by more than 4:1. Covell, however, suspects something closer to 2:1, males to females. Female butterflies are typically more secretive than males, and in the case of Schaus swallowtail butterflies, a skewed distribution might be explained in that conscientious lepidopterists may tend to avoid killing females. This appears to be a heeding of the plea to spare females published by Klots (1951) in his popular Field Guide to the butterflies: *None but males should be collected, and then, at most, only one per collector.* A similar appeal is found in Kimball's book (1965).

Egg survival rate of 29.7 percent (11 of 37) was cited in one case for a group of eggs collected in the wild. Further mortality of hatching larvae resulted in a survival rate of only 5 percent in the group studied (Emmel 1985b, personal communication).

Grimshawe (1940) and Rutkowski (1971) described development from egg to adult. Eggs take 3-5 days to hatch. Grimshawe also describes pupation:

When ready to transform, the larva seeks a place of seclusion, each for itself, fastens its anal extremity with a button of silk, and throws a heavy girdle around the thorax, supporting the body in an upright, or vertical, position for the long sleep. The encased segments of the body of some of the chrysalides are rusty-brown color; others are gray, etched with moss-green and conforming generally with that of their supporting object. They take on a rigid cast and show no signs of life throughout the entire period of their sleep. Unlike the double and triple-brooded related species of Neotropical Florida, our butterflies remained in the chrysalis stage either one or two years. As an example, half the caterpillars transforming into the chrysalis stage July 7, 1935, emerged May 8, 1936; the other half remained, hatching May 13, 1937.

Rutkowski (1971) also noted the white osmeteria on the larvae, and drinking of water droplets by fifth-instar caterpillars.

Status and distribution

Reason for Listing: The Schaus swallowtail butterfly was listed as a threatened species on April 28, 1976, because of population declines that had been caused by the destruction of its habitat (tropical hardwood hammocks), mosquito control practices, and over-harvesting by collectors (Service 1976). The Schaus swallowtail butterfly was reclassified to an endangered species on August 31, 1984, because its numbers and range had declined dramatically since its first listing (Service 1984).

Rangewide Trends: Previous attempts to establish Schaus butterfly populations outside their current range have failed (Salvato, personal communication, 2006). The most recent investigations of Schaus swallowtail butterfly populations provided estimates that include 2003 on Elliott Key in Key Biscayne National Park and other areas (Emmel and Daniels, 2004). The range-wide population in 2003 was about 360 to 400 adults, including 255 on Elliott Key. Elliott Key contains the largest of all extant Schaus populations. Abundance estimates for Elliott Key in 1999-2003 were 212, 253, 115, 264, and 255, respectively, based on mark and recapture efforts. Emmel and Daniels (2004) indicated that this period was characterized by drought conditions and late onset of summer rains. Population numbers appeared to be widespread in Key Biscayne National Park and on northern Key Largo and apparently expanding in 2004, but in 2005 numbers appeared less common and localized (Salvato, personal communication, 2006). Emergence of adults is highly dependent on rain and timing is often of major significance in survey results. The poor results in 2005 were likely the result of dry conditions (Salvato, personal communication, 2006).

The Schaus swallowtail butterfly was formerly distributed throughout Key Largo, but is now restricted to hardwood hammocks on North Key Largo. The majority of high quality hammock habitat available on North Key Largo has been protected through acquisition and is being managed for conservation by the Service and State of Florida. Because of these efforts and current land use regulations in place by Monroe County, the threat of occupied habitat loss from development and mosquito spraying on North Key Largo is low. The status of the Schaus butterfly appears stable (Salvato, personal communication, 2006). The population is distributed throughout North Key Largo and is apparently viable.

Clearing of habitat for urban and agricultural purposes in and around Miami, Homestead, and Lower Matecumbe Key were likely instrumental in eliminating the Schaus swallowtail butterfly from its type locality in the extremes of its historic range. Food plants were probably either eliminated or reduced to small stands incapable of sustaining Schaus swallowtail butterfly populations (Service 1982b). Similar clearing has occurred within its known North Key Largo habitat, but now most of that habitat is protected.

Slight alterations of habitat, such as dirt roads and trails through the hammocks, seem to be harmful only in that they would permit easy access to collectors, who could catch butterflies

when they fly low along these trails. However, small clearings and trail edges seem to promote a proliferation of torchwood plants. Natural succession in such places, particularly following hurricanes and fires, could account for population increases in the species and its food plants (Baggett 1985). In addition, efforts to limit clearing of native vegetation by the county and municipalities have helped curtail the loss of suitable habitat. Furthermore, local government requirements to plant of native vegetation have provided additional habitat for the species.

As part of a recovery action for the Schaus swallowtail butterfly, 760 pupae were released in 1995 on seven protected sites (Emmel, personal communication, 1996). Depredation by birds accounted for an estimated 85-90 percent mortality rate. In 1996, this effort involved the release of 248 female and 155 male adult Schaus swallowtail butterflies on those same seven sites. All females were mated prior to release. Apparently, none of the seven reintroductions was successful in establishing a population outside the current known range of this species (Emmel and Daniels 2002, Salvato, pers. comm., 2006).

Threats

Habitat loss and deterioration due to development and invasion by exotic plants, and the application of pesticides to control mosquitoes, have historically been the likely causes for the decline of Schaus swallowtail throughout its range. Over-collecting was a primary threat in the past. Hardwood hammocks have been increasingly fragmented in the upper Keys because of roads and development activities. Traffic associated with paved roads through Schaus swallowtail butterfly habitat, particularly S.R. 905 on northern Key Largo, results in road-kills of adults.

Today, aerial application of insecticides for mosquito may be a key limiting factor on the distribution of Schaus swallowtail populations. Although most of North Key Largo is not sprayed for mosquitoes, pesticide application for mosquito control to the remainder of Key Largo and throughout the southern range of this species is widely believed to be a major factor in the decline of populations south of North Key Largo (Emmel 1986b). The Florida Keys Mosquito Control District applies insecticides to control adult and larval mosquitoes. The pesticides Dibrom, Baytex, and Teknar, used in the Keys for mosquito control, are toxic to the related giant swallowtail butterfly in the laboratory. The insecticides applied annually in Monroe County could adversely affect the Schaus swallowtail, including where adulticide drifts over otherwise protected Schaus habitat. Future advances in insecticide technology, coupled with existing effects to minimize habitat loss and plant native vegetation, could allow the species to repopulate parts of its historic range.

Collecting of immature stages as well as adults may have reduced numbers on Key Largo in the period 1969 to 1974; but again the lasting effects cannot be gauged (Covell 1976). Commercial exploitation has existed, but its extent cannot be assessed due to secrecy on the part of dealers.

Little is known about predation by spiders, lizards, birds, or other predators. Damage to wings occurs soon after adult emergence, and beak marks on some individuals indicate frequent bird attacks (Emmel 1985a). Flight behavior among the many obstacles in hammock habitat seems unusually deliberate, in that the butterflies can fly slowly and painstakingly to avoid the many

large orb spider webs and branches to a remarkable degree (Emmel 1985a). Emmel also states that butterflies are able to remember flight paths through hammocks and follow them repeatedly. Covell notes that larval predation is surely minimized by oviposition behavior (one egg per leaf and few per foodplant), bird-dropping appearance of the larvae (as in other *Papilio* larvae), secretive behavior of larvae, and bad-smelling scents from the osmeteria when larvae are disturbed (Grimshawe 1940, Rutkowski 1971). Crypsis in the pupa (Grimshawe 1940) as in other swallowtails is also a factor in avoiding predation. Nothing is known about parasites of this species. No information is available on diseases of the Schaus swallowtail butterfly. However, high egg mortality has been observed (Service 1982b, Rutkowski 1971).

Periodic climatic factors such as hurricanes, freezes, and droughts pose additional threats to the Schaus swallowtail butterfly. The Schaus swallowtail butterfly's range suffered a direct hit from Hurricane Andrew in 1992. The Schaus swallowtail could lose a significant portion of its remaining populations from hurricanes or frost. The range of this species has decreased substantially in recent decades. The current range could be reduced or eliminated by a single hurricane. The Schaus swallowtail is near the limits of its cold-tolerance in south Florida, and a single freeze could greatly reduce the population.

Summary analysis– Changes since 1997 and 2003 BOs

Population numbers appeared to be widespread in Key Biscayne National Park and on northern Key Largo and apparently expanding in 2004, but in 2005 numbers appeared lower and localized (Salvato, personal communication, 2006). Emergence of adults is highly dependent on rain and timing is often of major significance in survey results. The poor results in 2005 were likely the result of dry conditions (Salvato, personal communication, 2006), and do not represent a general decline of the species.

The Schaus swallowtail butterfly was formerly distributed throughout Key Largo, but is now restricted to hardwood hammocks on North Key Largo. The majority of high quality hammock habitat available on North Key Largo is protected through acquisition and is being managed for conservation by the Service and State of Florida. Because of these efforts and current land use regulations in place by Monroe County, the threat of occupied habitat loss from development on North Key Largo is low. The status of the Schaus butterfly appears stable. The population occurs throughout North Key Largo and is apparently viable. In addition, efforts to limit clearing of native vegetation at the county and municipality level have helped curtail the loss of suitable habitat. Furthermore, efforts made to plant native vegetation have provided additional potential habitat for the species. Taken together, these efforts could allow Schaus swallowtail butterflies to use other portions of its historic range if other limiting factors were addressed (e.g., effects of mosquito control).

Silver rice rat

Species/critical habitat description

The silver rice rat was originally described as a full species (Spitzer and Lazell 1978) based on two specimens trapped in a freshwater marsh on Cudjoe Key in 1973. The silver rice rat is distinguished from mainland rice rats based on lighter pelage color, lack of digital bristles on hind foot, and a narrow skull with elongate nasal bones (Spitzer and Lazell 1978).

Externally, the silver rice rat resembles other marsh rice rats in general form, being a medium-sized, semi-aquatic, generalized rat. However, the silver rice rat is distinct because it has no tufts of digital bristles projecting beyond the ends of the median claws in the hind foot, and silver-gray pelage laterally (Spitzer and Lazell 1978). The body weight of silver rice rats caught in the field range between 2.1 – 5.3 ounces; male rice rats are generally heavier than females (Spitzer 1983). External measurements of the holotype specimen for this species (United States National Museum 514995), which is an adult female, is; total body length 10 inches, tail 4.8 inches, hind foot 1.25 inches, and ear 0.7 inches (Spitzer and Lazell 1978).

Life history

Distribution: The silver rice rat occurs on twelve islands in the Lower Keys: Big Pine, Little Pine, Howe, Water, Middle Torch, Big Torch, Summerland, Raccoon, Johnston, Cudjoe, Upper Sugarloaf, and Saddlebunch Keys (Vessey et al. 1976; Goodyear 1984; Wolfe 1987; Forys et al. 1996; Perry, personal communication, 2005b). Based on the availability of suitable habitat and proximity to existing populations, the silver rice rat may also occur on several other islands in the Lower Keys including but not limited to Little Torch and Ramrod.

Habitat: The silver rice rat is restricted to a narrow range of wetland habitat types. Populations are widely distributed and they occur at extremely low densities. Forys et al. (1996) also found that the silver rice rat occurs at comparable densities in both scrub and fringe mangrove communities. Microhabitat data from that study and from Goodyear (1989) suggest that this species spends most of its time in red and black mangroves. The silver rice rat also requires a large home range. Spitzer (1983) recorded a 56.3 acres home range for a male silver rice rat on Summerland Key. Forys et al. (1996) observed movements of 1,066 feet in one day. The need for a large home range may indicate a limited supply of food or freshwater resources for the silver rice rat in the Lower Keys. A low reproductive rate may also be an indicator of limiting food resources in wildlife populations.

In surveys conducted by Goodyear (1987) and Wolf (1985), rice rats were not found on Big Pine and Boca Chica Keys despite the availability of large areas of apparently suitable habitat. However, in a more recent extensive survey, an individual was recently trapped on the northern tip of Big Pine Key (Perry, personal communication, 2005b). Because of the semi-aquatic habits of the silver rice rat, the extensive areas it traverses, and fluctuations typical in small mammal populations, it is possible that Boca Chica and Big Pine Keys could be colonized from existing populations on adjacent islands. Black rats and raccoons on both Boca Chica and Big Pine Keys could be factors in the absence or rarity of silver rice rats from these islands (Goodyear 1983).

Silver rice rats are not found in the Upper Keys presumably because of the lack of suitable habitat (Goodyear 1987). The first two captures of silver rice rats on Cudjoe Key were in a freshwater marsh vegetated mainly with sawgrass and cattails (Spitzer and Lazell 1978). Since

those original captures, however, no silver rice rats have been captured in freshwater marshes. Rather, all captures have been in salt marsh habitats (Goodyear 1987). Radiotelemetry and trapping data reveal the use of three topographic zones: low intertidal areas, low salt marsh, and buttonwood transitional salt marsh (Goodyear 1987). Silver rice rats use low intertidal and low salt marsh habitats during activity periods, and swales in the low salt marsh are primary foraging sites. Buttonwood transitional salt marsh is at a higher elevation than other salt marsh habitats, and is used for foraging and nesting (Goodyear 1987). The silver rice rat moves through small hammocks and buttonwood transitional zones. Goodyear (1987) provides a detailed description of the three topographic zones and their use by silver rice rats.

Behavior: Silver rice rats are nocturnal and have been reported to range extensively (Spitzer 1983). Spitzer (1983) estimated the home range of a male silver rice rat on Summerland Key to be 56.3 acres. This animal regularly traveled long distances during a single activity period, and traveled over 0.6 miles in a single night. There is no estimate on the average dispersal distance for silver rice rats; however, their home range size is estimated to be much larger than is known for other rice rats (5-10 times as large). The study by Perry et al. (2005) supports the observation of far ranging behavior by the species.

Feeding: Silver rice rats are generalized omnivores that eat a variety of plant and animal material (Wolfe 1982). The diet of the silver rice rat includes seeds of saltwort, coconut palm (*Cocos nucifera*), and invertebrates including isopods (Spitzer 1983). However, a much greater variety of foods is probably taken.

Population dynamics

Population Size: Perry et al., 2005 found that the silver rice rat population has apparently remained stable throughout its range in the last 10 years. The best available species population size is 5,000-20,000 individuals (Perry et al. 2005).

Population Variability: Silver rice rats construct simple spherical nests located near the ground. Nests are about 38 inches in diameter, and constructed primarily of grasses (*Distichlis*, *Sporobolus*), although the exact materials used in construction may vary (Spitzer 1983). Spitzer (1983) found that a single male silver rice rat on Summerland Key alternately used 16 different nest sites, often quite distant from each other, over a one-month period.

Reproduction in silver rice rats can occur throughout the year. It is likely influenced by a variety of ecological factors (Wolfe 1982). The reproduction peak occurs after the wet season, from October to November. The gestation period for silver rice rats is 21-28 days, with litter size ranging from 4 to 6. Spitzer (1983) studied a pregnant female silver rice rat during winter and observed litter sizes of 3 to 5. The average number of litters produced in a year has not been documented.

Forys et al (1996) found that juvenile rice rats comprised only 14 percent of the total number of individuals captured in their study. This is significantly less than results from studies of *O. palustris* in Mississippi and Louisiana (Wolfe 1985). Although there is high survivorship of silver rice rats in the Keys, the low proportion of juveniles in this population may indicate a low

reproductive rate. In addition, Forsyth et al. (1996) found that the sex ratio of adults was male biased (66 males:19 females).

Status and distribution

Reason for Listing: The silver rice rat was listed as an endangered species on April 30, 1991 (Service 1991). At that time, the silver rice rat was extirpated from one Key where it formerly occurred and believed to be extirpated from two additional Keys. The silver rice rat was listed as endangered due to destruction of wetland habitat by development, predation, competition, and habitat modification from various introduced mammals. In the final rule listing the silver rice rat as an endangered species, the Service determined that critical habitat designation was not prudent (Service 1991). A reexamination of potential threats to the silver rice rat led the Service to conclude the illicit takings arising from publication of critical habitat may not be so serious as to render designation of critical habitat imprudent. Critical habitat was designated on September 30, 1993 (Service 1993c). Critical habitat is designated on eight islands in the Lower Keys, and is restricted to a narrow range of wetland habitat types. Some areas have been excluded from critical habitat designation based on comments received on the proposed rule.

Rangewide Trends: Perry et al., 2005 captured rice rats on two new islands, Big Pine and Ramrod Keys, where no silver rice rats had been recorded in previous studies (Perry et al. 2005).

Threats

The primary threat to the silver rice rat is degradation and loss of wetland habitat where this species occurs (Barbour and Humphrey 1982a). Silver rice rats require expanses of high-quality salt marsh habitat. They are extremely limited in habitat occupancy, occurring in salt marsh and transitional buttonwood habitats. Construction activities typically result in the direct loss of habitat as well as secondary effects that extend into surrounding habitats. Related secondary effects include habitat fragmentation and an increase in the densities of black rats and domestic cats. Cats are predators of silver rice rats and there is evidence of interspecific competition between silver rice rats and black rats.

Domestic cats are abundant throughout the Lower Keys, and sometimes forage in the higher elevation salt marsh habitats also used by the silver rice rat. Because rodents are often the most abundant items in a domestic cat's diet (Eberhard 1954, Churcher and Lawton 1989), the potential for domestic cats to prey upon silver rice rats is high. Given the low densities of silver rice rats throughout the Lower Keys, an increase in cat predation could have an adverse effect on this species. Raccoons, however, may be a more significant cause of mortality than cats, especially because cats primarily stalk prey in the wetland-upland transition zone, and not the more wetland areas where the rice rat predominates (Perry et al. 2005).

Human habitation and solid waste accumulation encourage establishment of black rats. Goodyear (1992) has shown that silver rice rats and black rats exhibit extensive niche overlap, and that islands with high densities of black rats support few silver rice rats. Goodyear's data suggest that black rats may out-compete silver rice rats for food and habitat resources; in areas of suitable habitat, the occurrence of black rats may preclude the survival of silver rice rats. Black

rats may also prey upon newborn silver rice rats (Forys, personal communication 1995). Rodenticides, used to control black rats, also threaten the silver rice rat (Service 1993b).

Exotic fire ants, another secondary effect to human encroachment, may cause direct mortality of silver rice rats. Fire ants cause declines in populations of small mammals in Texas (Killion et al. 1990, Killion and Grant 1993). The ants are attracted to mucous, so newborn silver rice rats would be vulnerable to predation.

In some areas, the natural hydrologic cycles of silver rice rat wetland habitat have been altered by the construction of fill roads, borrow pits, and mosquito ditches. These alterations may encourage invasion by exotic vegetation, which may reduce the ability of the habitat to support rice rats.

Some small, isolated, and widely distributed populations of silver rice rats may also vulnerable to extirpation through random demographic fluctuations, loss of genetic variability caused by a small population size, and stochastic environmental events (e.g., hurricanes) that may affect the entire population.

Considering the limited range, habitat specificity, and low population density of the silver rice rat, it is unlikely that this animal was ever extremely abundant in the Lower Keys.

Critical habitat for the silver rice rat

Critical habitat: Critical habitat was designated on September 30, 1993, for the silver rice rat and includes areas containing contiguous mangrove swamps, saltmarsh flats, and buttonwood transition vegetation (Service 1993b). These vegetation types, as well as cattail marshes, contain the primary constituent elements of silver rice rat critical habitat. The major constituent elements of this critical habitat that require special management considerations or protection are:

- (1) mangrove swamps containing red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), white mangrove (*Laguncularia racemosa*), and buttonwood (*Conocarpus erectus*);
- (2) salt marshes, swales, and adjacent transitional wetlands containing saltwort (*Batis maritima*), perennial glasswort (*Salicornia virginica*), saltgrass (*Distichlis spicata*), sea ox-eye (*Borrichia frutescens*), Key grass (*Monanthochloe littoralis*), and coastal dropseed (*Sporobolus virginicus*);
- (3) and freshwater marshes containing cattails (*Typha domingensis*), sawgrass (*Cladium jamaicense*), and cordgrass (*Spartina spp.*).

The original critical habitat proposal included nine Keys totaling 10,062 acres on the following islands: Little Pine, Water (north of Big Torch, but not the Water Key west of Little Pine), Big Torch, Middle Torch, Raccoon, Summerland, Cudjoe, Johnston, and Saddlebunch Keys. About 5,003 acres of the proposed critical habitat was within the NKDR boundaries.

After a scientific and economic analysis, the Service concluded there was no justification for excluding areas from the proposed critical habitat based on economic reasons, although two areas should be excluded from critical habitat designation because they no longer supported

significant silver rice rat habitat. These two areas totaled 1,032 acres, with 460 acres on Summerland Key and 572 acres on Cudjoe Key. Both areas are located south of U.S. Highway 1, are urbanized and hence have little remaining suitable habitat left for the silver rice rat. Based on GIS mapping of the constituent elements and the habitat types codified in the 50 CFR §17.95(a), 8,645 acres encompass the critical habitat for this species, of which 6,712 acres are in government ownership (77.6 percent) and about 1,933 acres in private ownership (22.4 percent).

As of April 2006, GIS analysis shows about 264 acres of rice rat critical habitat have been developed. Federal, State, and local regulations largely prohibit development in wetland habitats where the species is found.

Critical habitat only affects Federal agency actions and does not apply to private, or, local or State government activities that are not subject to Federal authorization or funding. Federal agencies affected by the designation of silver rice rat critical habitat include the Service's NKDR, COE, and FEMA (Service1993b). Seven of the nine keys in critical habitat are within the NKDR boundaries. Although the NKDR is managed for Key deer, the habitat requirements and biological needs of the species do not conflict. Both the permitting program of the COE and the administration of flood insurance by FEMA are affected by the silver rice rat's critical habitat designation. The COE is required to insure that issuance of permits, under section 404 of the Clean water Act, does not likely result in the destruction or adverse modification of critical habitat for the silver rice rat. Permitting actions that may affect the silver rice rat or areas within silver rice rat critical habitat require section 7 consultation with the Service. FEMA provides flood insurance for residential and commercial activities, which in some cases may involve construction of structures in silver rice rat critical habitat.

Summary analysis– Changes since 1997 and 2003 BOs

The silver rice rat occurs in freshwater and tidal wetlands on several islands in the Lower Florida Keys. This species requires large, intact marsh systems for its conservation. A significant amount of occupied rice rat habitat has been protected through public acquisition and management, but areas also remain in private ownership. Although the wetlands inhabited by the rice rat are generally protected through wetland regulations, the threat of habitat loss still exists, albeit it is modest because of limitations on development implemented in the county. These construction activities also increased the number of predators and competitors, such as dogs, cats, raccoons, and black rats.

The silver rice rat population has apparently remained stable throughout its range in the last 10 years. The best available species population size is 5,000-20,000 individuals (Perry et al. 2005). In addition, Perry et al., 2005 captured rice rats on two new islands, Big Pine and Ramrod Keys, where no silver rice rats had been recorded in previous studies (Perry et al. 2005). Seven of the eight keys in critical habitat are within the NKDR boundaries. Although the NKDR is managed for Key deer, the habitat requirements and biological needs of the species and the silver rice rat do not conflict. Of the 8,645 acres of critical habitat, 6,712 acres are in public ownership (77.6 percent). As of April 2006, GIS analysis shows about 264 acres of rice rat critical habitat have been developed. Ninety-seven percent of critical habitat and its constituent elements remain intact.

Stock Island tree snail

Species/critical habitat description

Say first described the Stock Island tree snail in 1830 based on a snail that was probably collected from Key West. That specimen was lost and the species was later described by Pilsbry (1946) using a snail from Stock Island. The Stock Island tree snail is a subspecies in the genus *Orthalicus*. Pilsbry wrote that he believed *Orthalicus* (Subfamily Orthalicinae) migrated through tropical America on floating trees that were later blown ashore although he provides no specific evidence of this phenomenon.

Pilsbry (1946) described the Stock Island tree snail as having a shell that "...is rather thin and light, less solid than [other] races of [*Orthalicus*]. White to warm buff, this tint deepening near the lip or behind the later varices; stripes...purplish brown, running with the growth-lines, the stripes and the streaks often interrupted between the bands, and mostly not extending below the Lower one; growth-rest varices usually 2 to 4 on the last whorl; three spiral banks, the Upper and Lower interrupted, are indicated, but weaken with age. Apex white, aperture showing the varices, bands and streaks vividly inside; columella white, straightened above; parietal callus white or dilute chestnut in old shells. The characteristics that most distinguish this species from *O. reses nesodryas* are the white apex and white columella and parietal callus. These characteristics are chestnut-brown or darker in *O. reses nesodryas*. "

Life history

Distribution and habitat: Historically, Stock Island tree snails occurred only on Stock Island and Key West. Today, populations of snails occur throughout the Keys in hardwood hammocks. The majority of suitable habitat is now unoccupied. The Service has current records of 28 populations in the Florida Keys, many believed to be populations distributed by collectors. Snails feed on epiphytic growth on hardwood tree trunks, branches and leaves. The Stock Island tree snail survives best in hammocks of native trees that support relatively large amounts of lichens and algae. In the Keys, *Orthalicus* is limited to those portions of the islands that have minimum elevations of 5-11 feet.

Larger trees support more Stock Island tree snails than smaller trees because they provide the snails with an increased surface area for foraging (Deisler 1987). There is no evidence that Stock Island tree snails prefer certain tree types or species (Deisler 1987). However, Voss (1976) wrote that the tree snails generally prefer trees with smooth bark to trees with rough bark, because the snails would require less energy to crawl over smooth bark. He also believed Stock Island tree snails would prefer smooth bark because it would make it easier for them to form a secure mucous seal when they were aestivating, resulting in lower mortalities from dehydration or accidental dislodgement.

Stock Island tree snails are arboreal except when they move to the forest floor for nesting or traveling. Hammocks that contained organic soils or leaf litter are probably necessary for nesting activity and dispersal.

No data are available on minimal hammock size needed to support a viable population of tree snails. Suitable habitat would have to include an area large enough to provide for foraging and nesting requirements as well as provide for the microclimate (air temperature and humidity) needed by the Stock Island tree snail.

Behavior: The Stock Island tree snails are active mainly during the wet season. Besides the reproductive activities discussed above, most of the feeding and dispersion takes place during the wet season (May through November). Dry periods (usually December through April) are spent in aestivation in which the Stock Island tree snail forms a tight sealed barrier between the aperture and a tree trunk or branch. Snails may come out of aestivation briefly to feed during dry-season rains or go into aestivation during summer dry spells.

Feeding: Little is known about the feeding habits or food preferences of the Stock Island tree snail. Probable food items include a large variety of fungi, algae, and lichens found on many of the native hammock trees. Mixobacteria and some small mites may serve as a secondary food source. Feeding can occur anytime during the day or night with peak feeding activity occurring from late afternoon through the night to mid-morning and during or immediately after rainfall. Feeding Stock Island tree snails often follow a random twisting path that covers the entire bark surface but will move in a straight line if surface moisture is abundant.

Population dynamics

Population Size: Enthusiasts and collectors have introduced Stock Island tree snails to new areas and it is believed that other, unknown, populations exist. Today, populations of snails are found throughout the Keys in hardwood hammocks. The Service has current records of 28 populations, many believed to be populations distributed by collectors.

Population Variability: The snails are hermaphroditic, but cross-fertilization appears to be common. They mate and nest in late summer and early fall during the wettest part of the rainy season. They lay about 15 eggs per clutch in a cavity dug into the soil humus layer, usually at the base of a tree, and take anywhere from 24 to 105 hours to deposit their eggs (Deisler 1987, McNeese 1989). The eggs hatch during the onset of the rains the following spring. The Stock Island tree snails immediately proceeded upon hatching to climb adjacent trees. Most nesting snails appear to be about 2-3 years old. They may live for up to 6 years, with 2.11 years being the mean age for the Stock Island population at the time of Deisler's study (1987). The Stock Island tree snail's age can be estimated by counting the number of dark "suture-like" lines resulting from pigment deposition during long dry spells (the dry season).

Status and Distribution

Reason for Listing: The Stock Island tree snail was listed as threatened by the Service on July 1978 (Service 1978) because of population declines, habitat destruction and modification, pesticide use, and over-collecting (Service 1982c). Since its original listing, this threatened snail was thought to have been eliminated from its historic range on Stock Island by habitat destruction; however, snails were observed there two years ago in the botanical garden (Hughes, personal communication, 2006).

Rangewide Trends: McNeese, 1997 concluded that the Stock Island tree snail was extinct on Stock Island. However, snails were observed there two years ago in the botanical garden (Hughes, personal communication, 2006). Recently, a new population was discovered in Key Largo. At least three populations now exist in South Key Largo. Viable populations are apparently successful in North Key Largo. Today, populations of snails occur throughout the Keys in hardwood hammocks. The Service has current records of 28 populations, many believed to be populations distributed by collectors.

Threats

The greatest threat to the Stock Island tree snail is the loss and modification of its habitat, although natural disasters such as hurricanes and drought can have a significant effect. Iguanas were recently documented to feed upon tree snails (Townsend et al. 2005).

Summary analysis– Changes since 1997 and 2003 BOs

Loss of habitat from development has been a factor thought to have potentially affected the Stock Island tree snail, although much suitable habitat is currently unoccupied. The current range of the Stock Island tree snail includes natural hardwood hammocks in protected lands throughout the Keys and natural hardwood hammock fragments throughout the Keys where collectors and conservationists have relocated the species. The subspecies was believed to be extirpated from its historic range. However, snails were observed there two years ago in the botanical garden (Hughes, personal communication, 2006).

Furthermore, many new populations have been discovered including in Key Largo. At least three populations now exist in South Key Largo. Viable populations are apparently successful in North Key Largo. There are now 28 known or reported Stock Island tree snail locations in the Florida Keys.

ENVIRONMENTAL BASELINE

The Environmental Baseline summarizes the effects of past and present human and natural phenomena on the status of threatened and endangered species and their habitat in an action area. The Environmental Baseline also establishes the base condition for natural resources, human usage, and species usage in an action area, which are used as a point of comparison for evaluating the effects of a proposed action. This section also includes an evaluation of an RPA that was in effect from 1997 until 2005. An injunction on the issuance of new NFIP policies in the Keys has been in place since September 2005.

The actions of Federal, State, and local agencies, other than FEMA, have resulted in and may result in habitat loss, conversion, and fragmentation. Some of these actions have occurred or may occur in addition to the effects of the NFIP; for example, a homeowner who purchased flood insurance as a

requirement for receiving a mortgage would have also needed a permit from the U.S. Army Corps of Engineers if the house were being constructed in jurisdictional wetlands.

In the Environmental Baseline, the Service will:

- (1) provide an overview of these agencies, as well as FEMA, and their authorities,
- (2) summarize the effects of their actions on threatened and endangered species in the Keys, to the extent information is available,
- (3) summarize the status of the species as a result of these actions, and
- (4) describe the RPA in place from 1997-2005, including its effectiveness (see subsection entitled “Integration and Synthesis”).

To develop these analyses, the Service relied on published sources, documents provided by FEMA, and documents provided by the State of Florida and Monroe County including information on flood insurance policies, demographic patterns in the Florida Keys, and other social and economic information.

The NFIP in the Florida Keys

The Florida Keys are one of the areas in the United States most vulnerable to coastal flooding. The Florida Coastal Coordinating Council (1974) concluded that the Keys were becoming one of the greatest man-made natural disasters in history. The first land use planning began in Monroe County in 1960, with only a vague flood requirement stating “no building intended for residential purposes shall be moved into or constructed on land subject to periodic or frequent flooding” (Monroe County 1960). Until the mid-1970’s, residential construction had occurred in Monroe County without strong flood zone regulations.

In June 1970, Monroe County became eligible for flood insurance under the Emergency Program of the NFIP. In June 1973, Monroe County became part of the Regular Program of the NFIP after FEMA compiled flood plain maps and determined that Monroe County’s flood plain management regulations were consistent with FEMA’s regulatory criteria and the objectives of the National Flood Insurance Act (38 FR 15072). To be enrolled in the NFIP, Monroe County was required to adopt floodplain management regulations that met or exceeded the minimum requirements of the NFIP. After Monroe County entered the Regular Program, new construction and substantial improvements of buildings were charged actuarial rates for flood insurance.

The NFIP reduces the risk of flood damage by requiring participating communities in Monroe County to impose suitable land-use controls in floodplain areas as a condition for the county’s eligibility. In return for adopting floodplain management regulations to minimize the risk of flood damage, FEMA has provided Federal flood insurance coverage to property owners in the Keys. After participating communities in Monroe County enrolled in the NFIP, any new construction or improvements to existing structures in the SFHAs could not be financed with Federal funds or loan guarantees unless the property owner had flood insurance.

As discussed earlier, any new construction or improvements to existing structures within federally designated SFHAs cannot be financed with Federal funds or loan guarantees without flood insurance. This requirement has had a major role in the acquisition of this insurance, but it was not the only factor in the purchase of flood insurance. Although the mortgage requirement

has not resulted in all vulnerable property being covered in the NFIP, it has helped achieve a high degree of coverage.

In some cases, the availability of flood insurance has increased the construction of buildings, the demand for properties, and property values in flood zones (Miller 1977, Kusler 1982). Cross (1989) suggested the availability of flood insurance may have contributed to increased construction in coastal flood zones in the Florida Keys. This conclusion was based on factors such as the location of new residential construction and the increase in value of real estate since 1973. New residential construction located within the Lower Florida Keys has increased in the high velocity or V zones, since Monroe County joined the NFIP. Not only did property values in coastal flood zones increase, but over 61 percent of surveyed realtors and nearly two-thirds of homeowners believed it was easier to sell property in flood hazard zones with the availability of flood insurance (Cross 1989).

Nearly three quarters of homeowners surveyed in 1983 who purchased property in the Lower Florida Keys in the previous four years obtained flood insurance. After 1979, about 68.4 percent of homeowners who did not have mortgages still obtained flood insurance (Cross 1989). Those homeowners who chose not to purchase flood insurance believed it was too expensive and that they could afford losses caused by flood damage. At the same time, homeowners living within areas vulnerable to floods had a slightly greater tendency to purchase flood insurance (Cross 1989).

Between 1973 and 1978, FEMA issued 26 policies on Big Pine Key in Monroe County. By 1983, there were 37 policies on Big Pine Key. By 1984, the number of policies increased to 552 and by 1989, there were 1,186 policies in effect on Big Pine Key. About half of those policies were for structures built after Monroe County entered the regular program in 1973, while the other half were for structures built prior to 1973 (FEMA 1991). By 1989, there was no other source of commercial or residential flood insurance generally available in the Keys (FEMA 1991).

FEMA has provided the Service with information on flood insurance policy issuances, effective as of March 1, 2006 (Van Dyke, personal communication, 2006). By 1997, FEMA had 30,702 policies on individual buildings. FEMA issued through direct and “Write-your-own” companies 23,724 policies for residential and commercial units in “unincorporated” Monroe County and 6,978 for residential and commercial units in incorporated cities in the county. The following table provides tabulations by year from 1997 through 2005 of insurance policies in the Keys.

Table 3: Total NFIP Policies in the Florida Keys, 1997-2005

Year	Total Policies						
	Islamorad a	Key Colony	Key West	Layton	Marathon	Monroe County	Total
1997		687	6,231	60		23,724	30,702
1998	2	687	6,634	51		25,253	32,627
1999	114	712	6,855	51		25,715	33,447
2000	252	719	6,754	49		25,244	33,018
2001	403	802	6,783	56	28	24,599	32,671

2002	2,015	815	6,544	88	1,515	20,227	31,204
2003	2,010	835	6,462	88	1,952	19,195	30,542
2004	2,081	856	6,460	96	2,261	18,510	30,264
2005	2,203	874	6,414	96	2,412	17,967	29,966

NFIP policy totals in Table 3 show the number of policies on individual buildings by year and by community and includes both new and renewal policies. Table 3 also shows how the number of flood insurance policies on individual structures has actually decreased since 1999.

Table 4 below shows the number of new policies on individual buildings built by year and by community between January 1, 1997 and December 31, 2005. These new policies are likely attributed to the annual Rate of Growth Ordinance (ROGO) permits issued to the six communities in Monroe County each year between 1997 and 2005. ROGO is based upon the ability to safely evacuate the Florida Keys during a hurricane. The new policies are also likely attributed to replacement of manufactured homes and travel trailers with new manufactured homes and travel trailers, and redevelopment of existing buildings or substantial improvements to existing buildings (e.g., replacing an older motel with a new condominium, replacing an older home with a new home, or substantially improving an existing home.)

Table 4: New NFIP Policies in the Florida Keys, 1997-2005

Year	New Policies						
	Islamorad a	Key Colony	Key West	Layton	Marathon	Monroe Co.	Total
1997	21	10	132	2	13	244	432
1998	35	13	88	1	23	299	459
1999	31	21	143	1	20	259	475
2000	30	20	107	1	9	212	379
2001	24	31	51	0	13	175	284
2002	25	21	48	0	30	157	281
2003	32	17	67	1	26	181	324
2004	38	8	68	3	57	218	392
2005	21	16	73	2	120	184	416
Total	257	157	777	11	311	1929	3442

Unincorporated Monroe County, the Village of Islamorada, the City of Layton, the City of Key Colony Beach, the City of Marathon, and the City of Key West's Floodplain Management Ordinances

FEMA, through the NFIP, minimizes the risk of flood damage by requiring municipalities to impose suitable land-use controls in floodplain areas. In return for adopting land-use controls and floodplain management ordinances to minimize the risk of flood damage, FEMA provides Federal flood insurance coverage to property owners in these jurisdictions. Since 1973 when Congress established the mandatory purchase requirement, regulated lending institutions could not make, increase, extend, or renew any loans secured by improved real estate located in a

SFHA in a participating community unless the secured building and any personal property securing the loan were covered for the life of the loan by flood insurance.

The mandatory purchase requirement plays an important role in the acquisition of NFIP insurance, but it is not the only factor in the purchase of flood insurance. Although the mandatory purchase requirement has not been very effective in the purchase of flood insurance for all vulnerable property, it has promoted a high degree of coverage. However, even in non-mortgaged homes, Cross (1989) found that availability of flood insurance has been ineffective in slowing coastal development, especially in the most vulnerable velocity zones, and may stimulate growth instead.

To enroll in the NFIP, the county and municipalities passed ordinances that restrict land uses and establish construction standards to minimize the risk of flood damage to new and substantially improved structures insured by the NFIP.

- (1) Monroe County's flood plain management ordinances are found in Monroe County Code Chapters 9.5-315, 9.5-316, 9.5-317, 9.5-318, and 9.5-319;
- (2) the Village of Islamorada's flood plain management ordinances are found in Village of Islamorada Code Article III, Chapter 6, section 81;
- (3) the City of Layton's flood plain management ordinances are found in City of Layton Land Development Regulations, section 30;
- (4) the City of Key Colony Beach's flood plain management ordinances are found in City of Key Colony Beach Code Article VIII, Chapter 101, sections 90, 91, 92, 93, 94, 95, 96, 97, and 98;
- (5) the City of Marathon's flood plain management ordinances are found in Marathon Code section 9.5-4 and section 9.5 sections 315-324; and
- (6) the City of Key West's flood plain management ordinances are found in City of Key West Code Chapter 34, Article 2,

The purposes of these ordinances are to promote the public health, safety, and general welfare and to minimize public and private losses due to flood conditions in specific areas. For communities in Monroe County that participate in the NFIP, these ordinances also include adoption of FEMA's Flood Insurance Rate Maps and Flood Insurance Study, and floodplain management regulations that meet or exceed the minimum requirements of the NFIP. The adoption of FEMA maps and study and regulations are required as a condition for making flood insurance available.

These ordinances also identify standards for issuing building permits in special flood hazard areas and include requirements for residential construction, nonresidential construction, accessory structures, manufactured homes and high hazard areas (V-zones) to minimize flood damage. Examples of these standards include:

- (1) anchoring construction to prevent flotation, collapse and lateral movement;
- (2) designing sanitary sewage systems to minimize infiltration of flood waters and contamination from them during flooding;
- (3) prohibiting man-made alterations to sand dunes, dune ridges, mangrove stands, or wetlands that could increase potential flood damage;
- (4) locating all new construction landward of the reach of mean high tide;

- (5) displaying special flood warnings in special flood hazard areas;
- (6) elevating the lowest floor and any electrical and mechanical equipment to a height at or above the base flood elevation level; and
- (7) maintaining the lowest floor of an elevated structure for other uses than human habitation (i.e., exclusively for parking of vehicles and limiting storage of equipment other than household items such as furniture; any enclosed area must either contain breakaway walls or provide openings to allow the flood waters to enter and reach the level on the outside of the structure).

FEMA Monitors Community Compliance

In 2000, because on site inspections identified NFIP violations, FEMA implemented an inspection procedure in unincorporated Monroe County and the incorporated communities of Islamorada and Marathon to identify whether structures with an enclosed area below the lowest floor in SFHAs complied with the community's floodplain management regulations. FEMA also implemented an inspection procedure to ensure that property owners pay flood insurance premiums commensurate with their flood risk. Under this procedure, the communities identified over 2,800 insured buildings with a possible illegally built enclosure. The property owners of these buildings were required to obtain an inspection from community officials as a condition of renewing the Standard Flood Insurance Policy on the building. Although the community initially identified 2,800 buildings, over 3,400 have been inspected. The higher number of inspections is a result of Islamorada electing to inspect all structures within its jurisdiction. About 700 of the 3,400 inspected were determined to be violations. The communities have been taking enforcement actions to address these violations.

Section 1316 of the National Flood Insurance Act of 1968, as amended, allows a community to submit a declaration to FEMA for the denial of flood insurance to a structure that the local zoning authority or other authorized public body has determined to be in violation of local laws, regulations, or ordinances, which are intended to discourage or otherwise restrict land development or occupancy in floodplains. FEMA will make a determination to deny flood insurance upon a finding of a valid declaration of a violation. In addition to denial of flood insurance, this action would result in a denial of disaster assistance under the Stafford Act.

Flood insurance is restored upon a finding by FEMA that a valid rescission of a declaration of violation has been provided by a valid public body (in most cases this is the same local official who submitted the request for the declaration). The public body is required to submit documentation for the measures taken in lieu of denial of insurance to bring the structure into compliance with the local floodplain management regulations. Procedures for implementing section 1316 are established in 44 CFR Part 73.

Monroe County has used section 1316 as part of a pilot inspection procedure currently being implemented. This inspection procedure was established to provide Monroe County, Islamorada, and Marathon with an additional means to identify whether structures with an enclosed area below the lowest floor in Special Flood Hazard Areas comply with the community's floodplain management regulations and for FEMA to ensure that property owners pay flood insurance premiums commensurate with their flood risk. Monroe County has

submitted 39 declarations requesting denial of flood insurance on non-compliant structures, which FEMA has approved.

Other agency programs and actions in the Florida Keys

As we mentioned earlier, a large number of Federal, State, and local agencies manage or regulate public and private lands in the Florida Keys or implement programs that have an influence on population expansion, habitat loss and conversion, fragmentation, environmental pollution in ways that adversely affect threatened and endangered species. Consequently, the Service will summarize those actions and discuss their interaction with the direct and indirect effects of the NFIP.

U.S. Army Corps of Engineers: The U.S. Army Corps of Engineers (COE) administers a program that regulates the discharge of dredged or fill material into waters of the United States (which include wetlands) under section 404 of the Clean Water Act. Under the section 404 program, the COE reviews projects to ensure that authorizing the discharge of fill into waters of the United States is in the public interest. When an individual, agency, or organization wants to place fill into waters of the United States (including wetlands), they apply to the COE for a permit. Although there are some exceptions, the COE generally issues notices that are distributed for public review and comment, and then determines if the project is in the public interest before issuing the permit.

Most of the Keys that are within the 100-year flood plain are considered waters of the United States for the purposes of section 404 of the Clean Water Act. As a result, any activity that requires dredging or placement of fill material in waters of the United States (which include wetlands) could be regulated by the COE. The activities regulated by the COE's section 404 program have had significant effects on threatened and endangered species in the action area. Since the early 1980s, the COE has reviewed permit applications to place fill material in the Keys to construct residential housing units, roads, bridges, canals, piers, marinas, and boat docks. The COE has issued hundreds of permits that allowed construction of residential housing, commercial facilities, and roads throughout the Keys; in each instance, however, the COE has consulted with the Service to ensure that their actions were not likely to jeopardize the continued existence of threatened or endangered species, in compliance with the requirements of section 7 of the Act.

U.S. Fish and Wildlife Service: The Service provides technical assistance to other Federal agencies to help them comply with the Fish and Wildlife Coordination Act (16 U.S.C. 661 *et seq.*) and the Act. In the latter capacity, the Service provides comments and recommendations to the COE when it reviews applications for permits to dredge or fill in waters of the United States (which includes wetlands). The Service also consults with all Federal agencies (Navy, Air Force, Coast Guard, National Marine Fisheries Service, National Park Service, etc) to ensure that their actions are not likely to jeopardize the continued existence of threatened or endangered species, or destroy or adversely modify designated critical habitat.

The Service also manages four National Wildlife Refuges in the action area encompassing 23,735 acres, up from 23,235 acres in 1997. These Federal lands include the NKDR (8,542

acres), the Great White Heron National Wildlife Refuge (7,407 acres), Key West National Wildlife Refuge (2,019 acres), and Crocodile Lake National Wildlife Refuge (about 6,800 acres although acquisition is incomplete). The refuge system has increased by over 500 acres, primarily the NKDR, in the last 10 years.

The NKDR was established in 1957 to protect the Key deer. The pattern of boundaries of the administered lands is unique. The NKDR consists of several hundred individual tracts, some as large as a few hundred acres and as little as 0.2 ac. Most of the NKDR is on Big Pine Key and No Name Key, interspersed with housing developments and public roads. The rest of the Refuge lands occur on Big Torch Key, Middle Torch Key, Cudjoe Key, Upper and Lower Sugarloaf Keys, Knockemdown, Toptree Hammock, Howe, and Annette Keys. The NKDR protects about 58 percent of the remaining habitat for the endangered Lower Keys rabbit.

Crocodile Lake National Wildlife Refuge was established in 1980 to protect critical habitats, including prime feeding and nesting areas, of the American crocodile. The Crocodile Lake National Wildlife Refuge also protects other threatened and endangered species including the endemic Key Largo woodrat, Key Largo cotton mouse, Schaus swallowtail butterfly, and eastern indigo snake.

Florida Department of Environmental Protection: The Florida Department of Environmental Protection (FDEP) provides policy directives to State agencies and regional and local governments. FDEP also supervises regional water management districts, and delegates the authority to carry out programs to these water management districts, other State agencies, and local government agencies. To achieve these goals, FDEP conducts regulatory programs to control or prohibit air and water pollution and to clean up or restore polluted land and water resources. It also supports research on environmental issues, and provides educational and technical assistance to the public for preventing environmental damage.

Several divisions of FDEP have resource management responsibilities in the Keys:

- (1) Recreation and Parks;
- (2) Marine Resources;
- (3) State Lands, which acquires and manages State properties;
- (4) Law Enforcement;
- (5) Beaches and Shores, which has regulatory jurisdiction for construction and excavation activities on sovereign lands seaward of the high-water line in any State tidal waters or within 50 feet of the mean high water line;
- (6) Water Management, which manages changes in State surface water quality standards, including the quality of freshwater lenses in the Keys, and processes applications for dredge-and-fill permits for projects with more than 10 acres;
- (7) Waste Management, which attempts to improve point sources of discharges that affect water quality and underground storage tanks; and
- (8) Water Facilities, FDEP administers and manages the Looe Key and Key Largo National Marine Sanctuaries in cooperation with the National Oceanic and Atmospheric Administration (NOAA).

The current (April 2006) acreage of State-owned lands in Monroe County is about 80,356 acres, an increase of 7,751 acres under State ownership in 1997 of 72,605 acres (Smith, Personal

Communication, 2006). These acreages include submerged, aquatic environment lands, as well as uplands.

Department of Community Affairs: The Department of Community Affairs (DCA) is responsible for planning and regulating land use by approving local government comprehensive plans and land development regulations. Planning activities are integrated on the regional, State, and local level. The DCA also administers the Florida Land Management Act, which provides the statewide framework for comprehensive plans developed by counties.

The DCA administers the Florida Coastal Management Program, which is structured as a network of State agencies that improves the effectiveness and efficiency of implementing existing laws and programs in the coastal zone. The DCA also administers the Areas of Critical State Concern (ACSC), which identifies certain regions of the State for special protection based on perceived threats to significant natural resources and the need to protect public investments in facilities. The ACSC program ends about 250 feet below the mean high-water mark and places limits on upland development and the capital improvements in water quality it requires. ACSC are critical when there is a need to protect public resources from unregulated or inadequately regulated development.

The governor and cabinet can designate an area by rule, setting the boundaries of an ACSC and the principles to be used for guiding development activities. Once an area is designated, affected local governments have 180 days to submit land development regulations consistent with the principles set forth in the rule. If the local government fails to submit regulations, or if its proposals are insufficient, the State land planning agency may propose development regulations for the governor's and cabinet's approval. The governor and cabinet designated Monroe County and the City of Key West as ACSCs in April 1975.

Department of Agriculture and Consumer Services: Within the Keys, the Department of Agriculture and Consumer Services is primarily responsible for mosquito control, and its Bureau of Entomology and Pest Control administers the State's mosquito-control program. Its responsibilities include overseeing all local mosquito-control programs, reviewing and approving all county or mosquito-control district work plans and work budgets, and administering State funding programs. In addition, the Bureau of Pesticides registers all pesticides, including mosquito-control products, for sale and distribution. Using the bureau's authority, the Department may deny, cancel, or modify the conditions of any pesticide registration.

In Monroe County, the Mosquito Control Authority (see below) has lead responsibility for eradicating adult mosquitoes and for conducting larval mosquito control activities. The objectives are to: (1) protect human health and safety; (2) promote the State's economic development and facilitate the enjoyment of its natural resources by reducing the number of disease-carrying arthropods; and (3) conduct arthropod control consistent with protecting the environmental and ecological integrity of all State lands and waters.

Monroe County Mosquito Control District: The Monroe County Mosquito Control District (MCMCD) maintains a program of abatement for mosquitoes and other insect pests in the Keys. Its primary mission is to provide effective mosquito control that is responsive to the health and

safety of the county's residents and visitors, while minimizing adverse environmental impacts. The MCMCD operates from Key West to Key Largo, and serves all municipalities and the unincorporated area of the county.

Florida Keys Aqueduct Authority: Because of the limited drinking water sources in the Keys, almost all potable water is supplied via a pipeline owned and operated by the Florida Keys Aqueduct Authority (FKAA). This public water system uses well fields and treatment facilities in Dade County for its entire supply. The FKAA is the only public water system in the Keys regulated by the FDEP's Public Water System Supervision program.

The FKAA is currently involved, along with some of the municipalities, in constructing wastewater treatment plants in the Keys. These plants should improve the water quality in the Keys, both inland and near shore.

Monroe County Government and Municipalities: The Monroe County government manages most of the land in Monroe County. It is a non-chartered county and its authorities and powers emanate from the State legislature. The local government functions in accordance with the Florida constitution. A Board of County Commissioners (BOCC) performs the executive and legislative functions of the county government. The Monroe County government consists of five divisions: Management Services, Public Safety, Community Services, Growth Management, and Public Works.

There are five municipalities within Monroe County: the Village of Islamorada, the City of Layton, the City of Key Colony Beach, the City of Marathon, and the City of Key West. Monroe County and the municipalities manage individual resources and regulate land use following their adopted comprehensive plans, which are predicated upon specific Florida statutes and administrative codes. When comprehensive plans are updated, they are subject to review and amendment by the FDCA (Chapter 163, Part 2 F.S. and Chapter 9J-5 Florida Administrative Codes). Land Development Regulations adopted by the BOCC and/or city councils implement the comprehensive plans.

In 1992, Monroe County and the municipalities, in accordance with FDCA regulations, established Rate of Growth Ordinances (ROGO) based upon the ability to evacuate the Florida Keys safely during a hurricane. At that time, FDCA, Monroe County, and the local municipalities (Key Colony Beach, Key West, and Layton) agreed that 372 new residential permits could be allocated per year and be in compliance with hurricane evacuation criteria. This equated to 255 per year for unincorporated Monroe County, 92 per year for Key West, 22 per year for Key Colony Beach, and 3 per year for Layton. Over the 10-year planning period (1992 to 2002), this equated to 3,720 new residential units.

The 10-year allotments were issued all at one time for the City of Key West, Layton, and Key Colony Beach. The allotments for unincorporated Monroe County were allotted at a maximum rate of 255 per year. However, in 1998, when Islamorada incorporated, Monroe County's initial allocation of 255 was reduced by 28 units, which were given to Islamorada. In 1999, Monroe County's allocation was reduced another 30 units per year when the City of Marathon was incorporated. However, not all ROGO allocations per government entity are used per year. For

example the City of Key West, although allocated 92 ROGO units per year, has not issued any ROGO unit building permits in the last six years. Unincorporated Monroe County, whose allocation is 197 has issued only 155 ROGO unit building permits per year for the past several years. For future planning purposes the ROGO allocations per year are 197 for unincorporated Monroe County, 92 for the City of Key West, 30 for the City of Marathon, 28 for the City of Islamorada, 22 for the City of Key Colony Beach, and 3 for the City of Layton for an annual allocation of 372 ROGO units.

For assessment purposes, our evaluation is to the year 2020, which is a 15-year period, representing potential use of 5,580 ROGO units. It is important to state that a ROGO unit equates to one residential unit. For example, a single family home on one acre equates to one ROGO unit. Similarly, a five-unit condominium equals 5 ROGO units, even if the condominium occurs on one acre. In both examples, the listed species effect is the loss of the one-acre of potential suitable habitat, not the number of ROGO units.

Changes in the size of the human population in South Florida and Monroe County

Florida's population growth has been rapid since the late 1800's. Just before the turn of the twentieth century, the total population of southernmost Florida was 32,000 people. Nearly 20,000 of those people lived in Key West. By 1960, Florida had almost 5 million residents, by 1970, there were almost 7 million residents, and by 1980, there were almost 10 million residents. By 1990, the population of Florida had increased to almost 13 million people. In 2004, the population of Florida was estimated to be 17,397,161 million, an increase of 8.8 percent over the year 2000. About half of these people live in the southernmost counties of Florida.

Population growth in southeast Florida (Indian River County south to Monroe County) has increased at a much higher rate than the population of the nation (Stronge 1991). This region experienced the most rapid population growth during the 1950's with an 8 percent annual compound rate. During the 1960's and 1970's, the population continued to grow but at half of the previous rate. The population of Monroe County, excluding Key West, increased by 67 percent between 1970 and 1980 (Cross 1989), but the actual population size dropped between 1992 and 2000 and again from 2000 to 2004. In the 1980's, population growth in the southeast region of Florida was more moderate, but was still more than twice the national rate of growth. The population census data for Monroe County are shown below.

Table 5: Changes in the Human Population Size in the Keys, 1980-2004

	1980	1990	1992	2000	2004
Population	63,098	78,024	80,968	79,589	78,284

Source: U.S. Census Bureau, 2005.

Between 1980 and 1990, the population of Monroe County increased by 14,926, or 32.8 percent. Between 1990 and 2000, the population of Monroe County increased by 1,565, only 2 percent,

likely reflecting the effects of ROGO and substantially higher housing costs. The population of Monroe County actually decreased in the eight-year period 1992 to 2000. Big Pine Key, in particular, has experienced little growth since 1997 due to the building moratorium that has been in effect.

In addition to the resident population, the tourist and seasonal populations must be considered for this area. Almost 20 percent of Florida's tourists annually visited South Florida and the Keys in the late 1980's (Phillips and Larson 1990). The Monroe County Comprehensive Plan found that in 1990, seasonal residents accounted for an additional 25,040 people and, on any given day, there were another 29,105 tourists either staying with family or in hotels or rental property. The combination of the peak seasonal and resident populations is called the functional population (NOAA 1995). In 1990, the Key's functional population was estimated as 134,600, with a population density of 1,300 persons per square mile. This combined population is important because of hurricane evacuation times and its impact on resources and the government's ability to manage those resources.

Changes in Land Uses in Monroe County: 1970-2005

In 1992, Monroe County determined how many acres of vacant, developable land were in high value native habitat, and the extent to which development could be directed away from these natural areas to locations more suitable for development. This study concluded that Monroe County had 4,975 acres of natural resource lands remaining. Of this total acreage, 1,137 acres (20 percent) were vegetated, were not Coastal High Hazard Areas, and were not designated by the CBRA. Another 204 acres (4 percent) were vegetated, were not Coastal High Hazard Areas, but were designated by CBRA and therefore not insurable by NFIP.

Residential and Commercial Land Use Trends: As part of ROGO, adopted in July 1992, unincorporated Monroe County was allocated 255 dwelling units per year to be developed through 2010 (Monroe County 1996) and was allocated 239 square-feet of non-residential development for every one dwelling unit permitted. Extrapolation of 239 non-residential square-feet per dwelling unit results yields a total potential for the county to permit 184,840 more square feet (4.24 acres) through 2010. Monroe County also discourages development in areas designated by CBRA. The ROGO allocation was reduced to 197 ROGO units, with a corresponding reduction in the non-residential square-footage, with the incorporation of the City of Marathon (1999) and the Village of Islamorada (1997).

As previously stated, Monroe County allows 239 square feet of commercial development for every ROGO unit allocated. Commercial development is eligible for NFIP insurance. If we multiply the 255 ROGO units allocated each year by Monroe County, the City of Marathon, and the Village of Islamorada by 15 years, the period evaluated in the forthcoming Effects of the Action section, the product is 3,825 ROGO units. If we multiply 3,825 ROGO units by 239 square feet, the amount of commercial land equals 21 acres. We expect the county and municipalities would attempt to steer commercial development away from high quality habitat for threatened and endangered species, and therefore do not analyze commercial development in the Effects of the Action section. If commercial development were proposed in potential suitable habitat, however, the Service would review its impact under the RPA outlined in this document.

As the result of a carrying capacity study completed in 2002, the BOCC adopted the conclusions of the study as Goal 105 and incorporated them into the county's 2010 Comprehensive Plan. One major component of Goal 105 is a 20-year land acquisition program. To implement the program, the county developed and recently adopted a tier system (March 15, 2006) of land development and acquisition in unincorporated Monroe County. All developable lands have been classified into three tiers: I, III, and Special Protection Areas (SPAs). Tier I lands have the highest environmental and natural value. They are areas that are larger than 4 acres of contiguous hammock. Tier I lands are targeted for purchase and only six unincorporated Monroe County ROGO permits, three in the Upper Keys and three in the Lower Keys, are allowed annually in Tier I designations. Tier III lands are generally in subdivisions greater than 50 percent built out, have the least environmental value, and are targeted by the county for development. SPAs have high intrinsic natural value due to habitat, connectivity between existing hammocks, or other unique natural features, but they are less than 4 acres and may be in heavily developed or disturbed areas. Development in all three classes is discouraged or encouraged based on a point system that takes into account natural values, including native habitat and protected species.

On the northernmost portion of the Key Largo is a high-density residential and commercial development. The Ocean Reef Club is an exclusive residential resort facility that consists of about 618 single family homes, 700 condominiums, an airport, golf course medical center, several motels, offices and commercial space and over half-million square feet of lodge/club space.

Environmental protection

Monroe County and the municipalities have environmental measures in their respective codes to protect and conserve the environment. These measures were similar among local governments in the past but recently Monroe County made changes in its requirements.

Monroe County

In 2006, Monroe County made changes in its land development regulations to align them with the Tier system. In the system, evaluation criteria are based on a point system. Points are added or subtracted for a proposed project based on a defined set of criteria, many of which are designed to protect the native environment and listed species. For example, in the previous system, an application that proposed a dwelling unit within a known habitat of a documented threatened/endangered species was given 10 negative points. Negative points are also assigned for construction in various types of native habitat. Positive points are assigned to projects that dedicate to Monroe County 1 vacant, legally platted buildable lot or at least one acre of unplatted buildable land located within a conservation area or areas proposed for acquisition by governmental agencies for the purposes of conservation and resource protection. Permit applications are then ranked by the total of positive points. In general, a total of 20 or more positive points assigned to a proposed project are necessary for it to receive a ROGO permit.

In the new Tier System, Monroe County mapped native habitat into the three categories, Tier I, Special Protection Areas (SPAs), and Tier III, as mentioned above. Negative points are also assigned to projects proposing development in Tier 1 and SPAs. All lands targeted for purchase by the Florida Forever program, Federal refuges, and State parks, as well as quality native habitat are classified as Tier I. Positive points are assigned to proposed development projects in Tier III, which is targeted for development, and for dedication to Monroe County of buildable lots or conservation lands. Monroe County has placed clearing restrictions of native habitat on developable properties to minimize destruction. Clearing of Tier I habitat is limited to 10 percent, clearing of SPA habitat is limited to 40 percent, and clearing of Tier III habitat is limited to 60 percent. Permitted clearing under the Tier system adopted by Monroe County are from Policy 101.4.22 of the “Proposed Amendments to the Comprehensive Plan,” Monroe County.

The analyses presented in this BO are predicated in part upon Monroe County’s Tier System. The Service understands this system has been challenged, and it is unclear what steps, if any, will be taken in the future to address this issue. If changes are made to the system that would result in impacts greater than those calculated in this analysis, reinitiation of consultation would be required.

Monroe County created a Land Authority in 1986. Among the Land Authority’s objectives are the purchase and preservation of environmentally sensitive lands and the preservation of the habitats of rare, threatened or endangered species of plants and animals. Monroe County now requires projects, which entail disturbing native vegetation to have a vegetation plan that lists all native vegetation. Listed vegetation and native trees over 4 inches must be compensated for by making cash contribution into the Monroe County Land Authority’s Restoration Fund. These funds are then used by Monroe County to restore habitat on county lands.

Municipalities

The City of Layton, the City of Key West, and the City of Key Colony are either almost completely built-out or have an insignificant amount of habitat suitable for federally protected species. Therefore, our discussion of environmental protective measures will be limited to the Village of Islamorada and the City of Marathon.

In general, the municipalities require a vegetation survey, or in the case of more environmentally sensitive properties, a habitat evaluation. As in Monroe County, the municipalities have adopted a point system of evaluation for building permit applications. The point systems are based upon criteria similar to Monroe County’s system. Building permit applicants are required to replace listed plants and native vegetation removed from the construction site elsewhere on the property. A conservation easement may then be placed on the remaining native habitat. Both municipalities have numerous policies and regulations in place to minimize negative impacts and enhance native vegetation and wildlife. Both have an acquisition committee to identify and purchase conservation lands. The Village of Islamorada and the City of Marathon have restoration funds and transplantation programs that are used when it is not feasible for property owners to replace vegetation on their property. Restoration funds are also used to clear exotics and restore disturbed native habitat. Clearing is limited to 10 to 30 percent in high quality habitat.

Public Lands and Land Acquisition

The protected lands in the action area are managed by Federal, State, county, and non-governmental agencies. There are about 65,443 acres of non-submerged protected land in the Keys (Shermyen 1993). Five Federal refuge properties encompass 25,574 acres, up from 23,235 acres in 1997). These Federal lands include the NKDR (8,542 acres), the Great White Heron National Wildlife Refuge (7,407.53 acres), Key West National Wildlife Refuge (2,019 acres), and Crocodile Lake National Wildlife Refuge (6,606 acres). The U.S. Naval Air Station owns 6,387 acres, up from 5,700 acres in 1997.

On January 1, 2006, the State of Florida owned 7,851 acres of uplands on nine park sites in the Keys, up from 5,615 acres in 1997. This is an increase of 2,236 acres or 40 percent since 1997. Two of the larger properties are John Pennekamp Coral Reef State Park (3,169 acres of uplands, up from 2,436 acres in 1997), and Key Largo Hammocks State Botanical Site (2,344 acres of uplands, up from 1,700 acres in 1997). Monroe County records show that 20,696 acres are in conservation lands owned by various entities, not including State parks and Federal refuges. The State-run Florida Forever Program plans to purchase 18,104 acres and currently owns 2,768 acres in the Florida Keys as of 2005. The Florida Forever Program (2005) states “The project includes habitat for migratory birds and virtually all remaining Lower Keys rabbits, Key deer, and the State-threatened white-crowned pigeon (habitat).”

Status of species in the action area

As discussed in the Status of the Species section, the entire range of the Key deer, Key Largo cotton mouse, Key Largo woodrat, Key tree-cactus, Lower Keys rabbit, silver rice rat, and Stock Island tree snail is exclusively within the action area and a brief summary of the species information will be provided in this section. For the American crocodile, Garber’s spurge, and Schaus swallowtail butterfly whose ranges extends outside the action area and into the adjacent northern most county, Miami-Dade County, a description of that portion of the population present in the action area will be provided. For the eastern indigo snake, whose range includes suitable habitats throughout Florida and the coastal plains of Georgia, only a description of that portion of the population present in the action area will be provided.

Potential Suitable Habitat Maps

To analyze the effects of the proposed action, we compiled what we believe is the best scientific and commercial information available for the Keys using ArcMap (version 9.1; ESRI 2005). Using this information, we constructed data layers in GIS on:

- (1) the current distribution and range of threatened and endangered species;
- (2) the distribution of potential suitable habitat types based on the 1991 ADID habitat data;
- (3) shoreline, primary and secondary roads;
- (4) FEMA’s FIRMs;

- (5) the Service's CBRA maps;
- (6) FEMA's flood insurance database;
- (7) parcel databases for Monroe County;
- (8) Monroe County and municipalities' lands and permit databases, which include historical data; and
- (9) Monroe County's and municipalities' public and private lands that are managed for conservation.

Using these data layers, we generated maps for species that may likely to be affected by the Federal action. Those maps represent potential suitable (that is, occupied and unoccupied habitat) for each of these species. Some properties within the potential suitable habitat boundaries may not in fact be suitable habitat due to disturbance, clearing, or development. The species maps we generated represent the best information on the historical distribution of these species and our best estimation of the current distribution of the habitats with which these species are associated.

To develop these maps, we first determined, based on our own experience and habitat information from researchers, the preferred native habitat types where the species is usually found (e.g., hardwood hammocks, salt marsh, etc., See Appendix A). We then reviewed information on the historical range of the species in the Keys, the current known range of the species, and determined the range of the species that we would be evaluating in our assessment. Following this determination, we then overlaid the range boundary on the native habitat maps for the Keys. The most current and best information we have on the native habitats in the Keys is the 1991 Advanced Identification System (ADID) habitat maps (US Geological Survey 1991).

This process was used to develop potential suitable habitat maps for the eastern indigo snake, Key Largo cotton mouse, Key Largo woodrat, Key tree-cactus, Schaus swallowtail butterfly, and Stock Island tree snail. However, for the Key deer, Lower keys rabbit, and silver rice rat, we used recent information on habitat suitability. For the Key deer, we used mapping information generated by personal observation from Service staff and Key deer researchers (Frank personal communication, 2003; Lopez 2003). For the silver rice rat, we relied on potential suitable habitat maps also generated by Service staff (Service 2003). For the Lower Keys rabbit potential suitable habitat maps, we relied on the maps developed by Faulhaber (2003).

One of the purposes of this analysis was to determine for each species potential habitat that is not in conservation, not developed, subject to development, and insurable. These calculations yielded for each species acres of vacant at-risk habitat. To this end, these potential suitable habitat maps were then overlaid on property maps provided by Monroe County. The property maps showed whether the property was developed or vacant and whether the property was government owned (State parks, refuge lands, etc.). This information was used to generate the acreage of habitat in vacant lots (where flood insurance is available) and the number of parcels that contained this habitat. We also overlaid this information on CBRA maps (areas where federally backed flood insurance is prohibited) to generate acreage and parcel numbers that are components of our cumulative effects analysis (i.e., those areas where development could occur in vacant parcels containing native habitat but would be ineligible for flood insurance and thus not the subject of a FEMA generated Federal action).

We are aware that one of our primary habitat mapping sources, the 1991 ADID maps, has areas mapped as native habitat that are currently either developed, scarified, or dominated with exotic plant species; and are not considered to be potential suitable species habitat. We are also aware that the maps have areas that are mapped as scarified (no vegetation) that now have native habitat (regrowth) and might be considered potential suitable habitat. Nonetheless, the 1991 ADID maps remain one part of the best available information, which has been updated with other more recent sources, when available, as described above. These maps will be upgraded as better information becomes available.

Our mapping methodology tended to over-estimate potential suitable habitat to err on the side of protection. When we overlaid property boundaries over potential suitable habitat, all of the property was included in the acreage of potential suitable habitat that was generated, even if only one corner was intersected. For example, if a potential suitable habitat boundary crossed one corner of a one-acre parcel, the entire one acre was summed as potential suitable habitat, even though the majority of the property was not potential suitable habitat.

Eastern indigo snake

Eastern indigo snake populations in the Keys are peripheral populations that have adapted to the conditions of more isolated and tropical environments. The indigo snake is suspected to be in very low numbers in the Keys and according to Lazell (1989), the remote, isolated, and possibly distinct Lower Keys populations have been wholly neglected (population surveys). Cox and Kautz (2000) designated extreme north Florida and extreme south Florida (including the Florida Keys) as “peripheral areas within the known range.” The home ranges of individual snakes are large, generally ranging from 80 to 400 acres. Eastern indigo snakes have been collected from Big Pine and Middle Torch Keys, and have been reliably reported in the past from Big Torch, Little Torch, Summerland, Cudjoe, Sugarloaf and Boca Chica Keys (Lazell 1989). Moler (GFC, personal communication, 1996) documented eastern indigo snakes on North Key Largo and feels they are probably restricted to Crocodile Lake National Wildlife Refuge and the protected hammock areas on that key. The Service is aware of three reliable observations of this snake in the Keys in the last 20 years. The most recent sightings, both reliable, but not confirmed were in the Village of Islamorada (Sheahan, personal communication, 2006).

The eastern indigo snake uses a majority of the habitat types available in the Keys, but tends to prefer open, undeveloped areas (Kuntz 1977). Potential suitable eastern indigo snake habitat includes all habitat types in the action area except developed lands, mangroves, saltmarsh, and deep-water areas. Potential suitable habitat for this species is all hardwood hammock, ridge/hammock, and pinelands as identified in the ADID maps. Based on our GIS analyses, 10,024 acres of potential suitable habitat are present in the Keys. The amount of habitat in public ownership (considered protected) is 7,472 acres (74.5 percent of the available habitat), of which 3,515 acres are in Federal ownership, 3,095 acres in State ownership, and 862 acres are in ownership by other government entities.

Our GIS analysis also shows that 1,444 acres of potential suitable habitat are present in vacant parcels, representing 4,568 properties. For assessment purposes, we consider the at-risk acreages to be 1,444 acres. These at-risk lands represent 14 percent of the available habitat for the eastern indigo snake in the Keys ($1,444/10,024 = 0.14$). Figure 3 shows the potential suitable habitat map for the eastern indigo snake.

Key deer

Florida Key deer occupy 20 to 25 islands in the Lower Florida Keys within the boundaries of the NKDR, with about 75 percent (453 to 517 deer in 2001) of the overall population found on Big Pine Key (Lopez et al., 2004b). The NKDR and the Great White Heron National Wildlife Refuge encompass much of this range. These refuges are managed for the Key deer and other wildlife. Key deer use all habitat types including pine rocklands, hardwood hammocks, buttonwood salt marshes, mangrove wetlands, freshwater wetlands, and disturbed/developed areas (Lopez, 2001). Therefore, we define potential suitable Key deer habitat as all habitat types within the range of the Key deer, including residential subdivisions. We have estimated about 24,676 acres, with about 17,646 acres in public ownership (71.5 percent). Vacant lands at-risk in the action area total about 4,959 acres, with about 1,057 acres found on Big Pine and No Name Keys.

The principal factor influencing the distribution and movement of Key deer in the Keys is the location and availability of freshwater. Key deer swim easily between keys and use all islands during the wet season, but suitable water is available on only 13 of the 26 islands during the dry season (Folk, 1991). Key deer use all habitat types including pine rocklands, hardwood hammocks, buttonwood salt marshes, mangrove wetlands, freshwater wetlands, and disturbed/developed areas (Lopez, 2001). Uplands are used more than wetlands (Lopez et al., 2004b). Key deer use these habitats for foraging, cover, shelter, fawning, and bedding.

FDOT recently completed two projects on Big Pine Key (BPK), one of which adversely affected Key deer. One project was completed to improve traffic congestion on U.S. 1, which traverses BPK and is the only route into BPK or to continue south to the Lower Keys. U.S. 1 was a two-lane highway on BPK traveling in an east-west direction and had limited center turn and storage lanes. The intersection of Key Deer Boulevard and U.S. 1 was enhanced by the addition of an eastbound lane on the south side of the U.S. 1. The total paved area increased by 35 percent in that segment of the roadway. A BO issued by the Service (2001a) determined that the project would result in incidental take of four individual Key deer annually for the duration of the project. The BO stated that the level of incidental take was above the baseline average of nine roadkills per year that already existed on the project segment of U.S. 1. The Service determined that this level of take was not likely to result in jeopardy to the Key deer.

FDOT completed a second project in January 2003, which was designed to reduce Key deer vehicular mortality along U.S. 1 on Big Pine Key from mile marker 29.5 to mile marker 33 (Service, 2001b). The project was accomplished through the installation, management, and monitoring of two wildlife underpasses between mile markers 31 and 33. The underpasses included fencing to exclude deer from the highway and direct them toward the underpasses.

Additionally, deer guards were placed on access roads where they intersected U.S. 1, in order to keep Key deer from entering the fenced segment of the highway corridor. Non-structural improvements were added to other segments of the U.S. 1 corridor including the business district, in order to minimize road mortalities in those areas. These non-structural improvements included additional signage, radio advisories, speed control, lighting improvements, and pavement markings. Take was anticipated to remain at base levels prior to the installation of the first wildlife undercrossing. However, the level of take associated with the proposed project is estimated to diminish over time.

The wildlife crossings were predicted to reduce Key deer mortality on the average by 25.7 percent of total annual road mortalities (27 Key deer) within the project area, or 44.4 percent of road mortalities (47 Key deer) recorded annually on U.S. 1. The maximum reduction in road mortalities estimated by the Service is 40.4 percent of all road mortalities (43 Key deer) recorded annually within the project area, or 66.7 percent of those road mortalities (78 Key deer) recorded for U.S. 1 annually. This reduction would be expected to extend for the life of the project. Braden (2005) studied the efficacy of the project and reported that deer-vehicle collisions (DVCs) had been reduced 83 to 93 percent inside the fenced area. However, overall DVCs on U.S. 1 did not change subsequent to the installation of the project.

In 2003, the Service began a Key deer relocation project in an effort to establish viable Key deer populations on islands other than Big Pine and No Name Keys. The project plan calls for equal numbers of deer to be released for 24 deer each at two sites. In 2006, 40 Key deer have been relocated to Cudjoe and Sugarloaf Keys. As part of the project, fresh water holes are being maintained and prescribed fire will be used to improve habitat quality. The relocated animals are reproducing and the project appears to be successful with offspring being produced at both sites. Dr. Roel Lopez (personal communication 2006) believes the potential utility of Key deer translocations into suitable habitat to be an important and necessary management strategy in the deer's restoration and long-term survival. These populations could be important in the event of a natural disaster such as a disease outbreak or a hurricane. They also provide additional animals for the existing population. These separate populations also increase the viability of the existing Key deer population.

In 2004, the Service completed a review of the proposed Big Pine Key Park Marina basin fill located on Big Pine Key, and its effects on the Key deer (Service, 2004). Though vehicular mortality was expected to be low, the Service recommended reducing speed limits and installing speed humps in the area to further reduce risk to the Key deer. This project will include deer-friendly fencing that incorporate setbacks from the edge of the abutting streets rights-of-way. The Big Pine Key Park Marina biological opinion was revised in 2006 to add new information on Key deer (Service, 2006).

Big Pine Key is the largest of the Lower Keys and forms the center of the Key deer's range. Big Pine Key and No Name Key serve as a population center as they provide the freshwater sources and support the majority of the Key deer population (Peterson et al., 2004). Vehicular mortality is the greatest known source of deer mortality within the action area, especially on Big Pine and No Name Keys.

To address vehicle mortality and habitat loss associated with development on Big Pine and No Name Keys, the Service has issued a section 10(a)(1)(B) ITP to Monroe County, FDOT, and DCA under the Act. Issuance of the ITP anticipates take of Key deer, Lower Keys rabbit, and eastern indigo snake on Big Pine and No Name Keys, Monroe County, Florida. The take of these species will be incidental to land clearing for development and recreational improvements.

The applicants have developed a Habitat Conservation Plan (HCP) that establishes guidelines for development activities on Big Pine and No Name Keys to occur progressively over the permit period (20 years) and provides conservation and mitigation strategy to minimize and mitigate for impacts to protected species and their habitat.

The HCP project area encompasses about 7,166 acres, including Big Pine Key (5,975 acres) and No Name Key (1,191 acres). Government owned lands constitute 69 percent of the HCP project area and these lands are already protected under conservation status. The HCP allows for the loss of a maximum of 168 acres of potential Key deer and eastern indigo snake habitat and compensation will be provided by the acquisition at a minimum of three mitigation units for every one-development unit of suitable habitat on Big Pine and No Name Keys. The Service has determined that this level of incidental take would not jeopardize the survival and recovery of the species.

Therefore, for assessment purposes, the Service considers the lands subject to this BO to be potential suitable Key deer habitat present on the remaining islands, other than Big Pine Key and No Name Key. Based on our GIS analyses, the remaining islands provide an additional 17,510 acres, with 12,672 acres in public ownership (72.4 percent). Potential suitable Key deer habitat within at-risk vacant lands on the remaining islands is about 3,902 acres, representing 2,875 parcels. Of this acreage, 1,653 acres, representing 1,345 parcels, are within CBRA zones. Figure 4 shows the potential suitable habitat map for Key deer.

Key Largo cotton mouse

The original range of the cotton mouse probably included all the forested uplands of Key Largo. The amount of habitat undoubtedly fluctuated depending on hurricanes, wildfires, and subsequent vegetation succession, but the primary upland vegetation was usually hardwood hammocks. Key Largo has the highest concentration of platted lots (4,178), comprising 72 percent of all lots in the Upper Keys.

Potential suitable Key Largo cotton mouse habitat is considered all hardwood hammock and ridge/hammock. Current data indicates that known habitat is restricted to North Key Largo, however, we consider all hammocks 12 acres and larger in size (Service 2003) that also remain on South Key Largo, but no longer appear to support the cotton mouse, to be potential suitable habitat and a component of our species analysis. The reasons these lands no longer support the species are not known, but several factors may be responsible. Remaining hammocks on South Key Largo are small, isolated, and disturbed, and contain immature hammock vegetation. The cotton mouse may also be vulnerable to invasion by animals associated with man (dogs, cats, and black rats).

The majority of high quality hammock habitat available on North Key Largo has been protected through acquisition and is being managed for conservation by the Service and State of Florida. Because of these efforts and current land use regulations in place by Monroe County, the threat of occupied habitat loss from development on North Key Largo is low. The status of the cotton mouse appears stable. The population occurs throughout North Key Largo and is apparently viable (Frank et al. 1997).

Within the North Key Largo range, potential suitable cotton mouse habitat is about 2,103 acres, of which 1,862 acres are in public ownership (89 percent). Vacant lands at risk in the range are about 21 acres, representing 62 parcels. However, the Service issued an ITP to Ocean Reef Club for adverse effects from loss of habitat associated with proposed development of 35 acres of potential suitable cotton mouse habitat, which was issued in 1990, amended in 1999, and extended in 2002. The Service determined that this level of take would not jeopardize the survival and recovery of the endangered cotton mouse. These properties have not been developed and are not represented in the 21 acres of lands at risk.

As discussed previously, the Service also considers the hammocks 10 acres and larger remaining on South Key Largo that no longer appear to support the endangered cotton mouse to be potential suitable habitat. These lands represent 1,012 acres of additional cotton mouse habitat, of which 571 acres are in government ownership (56 percent). The acres of vacant at risk land total about 176 acres, representing 804 parcels. Figure 5 shows the potential suitable habitat map for the Key Largo cotton mouse.

We discussed previously the open space requirements of Monroe County, the Village of Islamorada, and the City of Marathon. Clearing is limited to 10 to 30 percent in high quality habitat and 50 to 60 percent in moderate to low quality habitat. Additional regulations require preservation or restoration of habitat to offset vegetation losses that result from development. Fragmentation of habitat will nevertheless occur. However, fragmentation will be offset to an unknown degree by preservation or by restoration, creating more continuity in other fragmented habitat. The Service acknowledges that the benefits are tangible mitigating measures and are already helping to avoid and minimize negative impacts to potential suitable habitat.

Key Largo woodrat

The Key Largo woodrat occurred historically throughout the forested uplands of Key Largo, but it is now restricted to about half of its historic range. It now occurs only north of the U.S. 1 – S.R. 905 intersection. The most important effort to conserve the Key Largo woodrat has been public land acquisition on North Key Largo. Most of the undeveloped land west of S.R. 905 has been acquired by the Federal government and is a part of the Crocodile Lake National Wildlife Refuge. The Florida Department of Environmental Protection, as part of its North Key Largo Hammocks project, has acquired much of the undeveloped land on the east side of the road.

Potential suitable Key Largo woodrat habitat is considered all hardwood hammock and ridge/hammock, as identified in the ADID maps. Current data indicates that known habitat is restricted to North Key Largo. Within the North Key Largo woodrat range, potential suitable

wood rat habitat is about 2,103 acres, of which 1,862 acres are in public ownership (89 percent). Vacant lands at risk in the range are about 21 acres, representing 62 parcels. However, the Service issued an Incidental Take Permit to Ocean Reef Club for adverse effects from loss of habitat associated with proposed development of 35 acres of potential suitable woodrat habitat, which was issued in 1990, amended in 1999, and extended in 2002. The Service determined that this level of take would not jeopardize the survival and recovery of the endangered wood rat. These properties have not been developed and are not represented in the 21 acres of lands at risk and are considered part of the baseline. Figure 6 shows the potential suitable habitat map for the Key Largo woodrat.

We discussed previously the open space requirements of Monroe County, the Village of Islamorada, and the City of Marathon. Clearing is limited to 10 to 30 percent in high quality habitat and 50 to 60 percent in moderate to low quality habitat. Additional regulations require preservation or restoration of habitat to offset vegetation losses that result from development. Fragmentation of habitat will nevertheless occur. However, fragmentation will be offset to an unknown degree by preservation or by restoration, creating more continuity in other fragmented habitat. The Service acknowledges that the benefits are tangible mitigating measures and are already helping to avoid and minimize negative impacts to potential suitable habitat.

Key tree-cactus

The Key tree-cactus is a unique and rare plant species that occurs only in the Florida Keys within the United States. Populations of the Key tree-cactus have always been uncommon and widely scattered (Small 1917, 1921). This species inhabits only lightly shaded upland sites within fragile tropical hardwood hammock habitats. This habitat type is uncommon in the Keys and is transient in nature. As tropical hardwood hammocks mature, or as natural thinning occurs, the suitability for the Key tree-cactus is altered. Populations of this species fluctuate from site-to-site depending upon the availability of potential suitable habitat. Potential suitable habitat for this species is a sub-component of tropical hardwood hammocks. Tropical hardwood hammocks are represented in the Keys by about 8,327 acres, of which 5,976 acres are in public ownership (71.8 percent).

The Key tree-cactus has probably always been rare in Florida. The primary cause for this rarity seems to be the rather restrictive habitat requirements of the species. It grows only on lightly shaded, upland sites. This habitat is not common on the Keys, and, furthermore, is transient in nature. The habitat preferred by Key tree-cactus occurs primarily in naturally disturbed patches of hammock (Avery [no date], Small 1917, 1921). The location of these patches changes with time as disturbed areas re-grow and new sites are disturbed.

Service records (2006b) document seven populations of tree cactus and only three occur on protected public lands: one at the NKDR and two at Long Key State Recreation Area. The other four populations occur on private lands. Of those four on private lands, one is protected from disturbance by a conservation easement and one population may be deceased (Klett, personal communication, 2006). The main threat to the continued existence of the two unprotected populations is habitat loss from private development. However, the “take” of plants on private

property is not a violation of the Act (unless take is also prohibited by State law.) Therefore, authorization to “take” plants on private property is not granted under section 10 (a)(1)(B) or section 7. However, Federal agencies are required under section 7(a)(2) to ensure that their actions do not jeopardize the continued existence of listed plants.

Potential suitable habitat for this species is all hardwood hammock and ridge/hammock as identified in the ADID maps. For our assessment purposes, we consider the acreage of at-risk lands to be the vacant parcels of hardwood hammock in the Keys. Our GIS analysis identified about 1,318 acres of potential suitable habitat on 3,674 vacant residential parcels. Figure 7 shows the potential suitable habitat map for the Key tree-cactus.

Lower Keys rabbit

The Lower Keys rabbit is endemic to the Lower Keys and inhabits tidal, brackish, and transitional upland and freshwater environments. The Lower Keys rabbit’s original range extended from Big Pine Key to Key West, encompassing a linear distance of about 30 miles. Habitat loss and predation by domestic and feral cats have reduced the range of this species. It occurs on some of the larger of the lower Keys from Boca Chica, just north of Key West, to Big Pine Key. The Lower Keys rabbit is habitat specific, depending upon a transition zone of grasses and sedges for feeding, shelter, and nesting. The majority of potential suitable habitat areas lie in transitional zones between marine environments and uplands. Potential suitable habitat for the Lower keys marsh rabbit is about 3,140 acres, of which 2,467 acres are in public ownership (78.6 percent). Habitat on military lands is 333.2 acres. Habitat on NKDR is about 1,833 acres, or 58 percent of the total. The current population estimate is 500 rabbits in the Lower Florida Keys (Perry, personal communication, 2006).

Although habitat loss is responsible for the original decline of the Lower Keys rabbit, high mortality from feral cats has also occurred and may be the greatest current threat. Feral cat control is an ongoing operation on NAS Key West and lands within the NKDR. However, feral cat control activities on Air Force sites are unknown. In June 2006, the Service issued an incidental take permit and HCP for adverse effects from development on Big Pine and No Name Keys. The HCP includes specific development restrictions in Lower Keys rabbit habitat and within a 1,640-foot buffer surrounding this habitat. The distance of 1,640-foot is based on the use of upland areas by this species and the estimated range of domestic cats (Frank, GFC, personal communication, 1996). The HCP provides for incidental take of up to 36 acres of suitable marsh rabbit habitat. This loss represents 37.5 percent of the at-risk marsh rabbit habitat (96 acres) on Big Pine and No Name Keys. However, the HCP on Big Pine and No Name Keys also requires the compensation for the loss of marsh rabbit habitat at a 3 to 1 ratio. The Service has also determined that this level of incidental take would not jeopardize the survival and recovery of the species.

Potential suitable Lower Keys rabbit habitat in the boundaries of the HCP is about 1,045 acres, of which 892 acres are in public ownership (85.3 percent). At-risk lands are about 96 acres, of which 10 acres are within CBRA zones. The Service considers proposed both FEMA and non-

FEMA actions on Big Pine and No Name Keys, which must comply with the terms of the HCP, to be fully addressed by the incidental take exempted for this species by the HCP.

The Service considers the lands subject to this BO to be those lands potentially suitable for Lower Keys rabbit habitat present on the remaining islands other than BPK and No Name Key. For the Lower Keys rabbit potential suitable habitat maps, we relied on the suitable habitat maps developed by Faulhaber (2003). Based on our GIS analyses, the remaining islands provide an additional 2,094 acres, with 1,557 acres in public ownership (72 percent). Potential suitable Lower Keys rabbit habitat within vacant lands on the remaining islands is about 444 acres, representing 369 parcels. Figure 8 shows the potential suitable habitat map for the Lower Keys rabbit.

Schaus swallowtail butterfly

The Schaus swallowtail butterfly is restricted to habitat where its primary food plant, torchwood, grows abundantly (Service 1982c). This habitat is limited to coastal southeast Florida and the Upper Keys, in mature tropical hardwood hammocks. Within the Florida Keys, the current occupied range of this species is restricted to North Key Largo, although potential suitable habitat based on historical records, extends south to Upper Matecumbe Key. However, a 1984 survey from Elliott Key to Key West found no Schaus swallowtail butterflies south of North Key Largo (Emmel 1985a), although a verified sighting occurred on Upper Matecumbe Key in 1986 (Emmel 1986a).

The Schaus swallowtail butterfly is now believed restricted to hardwood hammocks on North Key Largo. The amount of habitat undoubtedly fluctuated depending on hurricanes, wildfires, and subsequent vegetation succession, but the primary upland vegetation was usually hardwood hammocks. Key Largo has the highest concentration of platted lots (4,178), comprising 72 percent of all lots in the Upper Keys.

Hammocks 12 acres in size and larger also remain on South Key Largo and portions of Upper Matecumbe Key, but no longer appear to support the Schaus swallowtail butterfly (Salvato, personal communication, 2006). However, the Service considers these habitats potentially suitable for this species and a component of our species analyses. The reasons these lands no longer support the species are not known, but mosquito spraying may have a significant effect on the population.

The majority of high quality hammock habitat available on North Key Largo has been protected through acquisition and is being managed for conservation by the Service and State of Florida. Because of these efforts and current land use regulations in place by Monroe County, the threat of occupied habitat loss from development on North Key Largo is low. The Service believes the status of the Schaus butterfly appears stable; the population occurs throughout North Key Largo, and is apparently viable. In 2006, the population appears to have increased in the islands of Key Biscayne National Park and may be present at the Deering Estate on the mainland for the first time in many years (Salvato, personal communication, 2006).

Within the North Key Largo range, potential suitable Schaus swallowtail butterfly habitat is about 2,103 acres, of which 1,862 acres are in public ownership (89 percent). Vacant lands at risk in the range are about 21 acres, representing 62 parcels. However, the Service issued an Incidental Take Permit to Ocean Reef Club for adverse effects from loss of habitat associated with proposed development of 27 acres of potential suitable Schaus swallowtail butterfly habitat, which was issued in 1990, amended in 1999, and extended in 2002. The Service determined that this level of take would not jeopardize the survival and recovery of the endangered swallowtail butterfly. These properties have not been developed and are not represented in the 21 acres of lands at risk and are considered part of the baseline. Therefore, for assessment purposes the Service considers the lands subject to this BO to be the 21 acres of at-risk lands in North Key Largo.

As discussed previously, the Service also considers the hammocks greater than 10 acres remaining on South Key Largo and Upper Matecumbe Key that no longer appear to support the endangered Schaus swallowtail butterfly to be potential suitable habitat. These lands represent 1,822 acres of additional Schaus swallowtail butterfly potential suitable habitat, of which 954 acres are in government ownership (52 percent). The acres of vacant at risk land total about 307 acres. Therefore, for assessment purposes the Service considers the lands at risk from the proposed action to be the 307 acres. Figure 9 shows the potential suitable habitat map for the Schaus swallowtail butterfly.

We discussed previously the open space requirements of Monroe County, the Village of Islamorada, and the City of Marathon. Clearing is limited to 10 to 30 percent in high quality habitat and 50 to 60 percent in moderate to low quality habitat. Additional regulations require preservation or restoration of habitat to offset vegetation losses that result from development. Fragmentation of habitat will nevertheless occur. However, fragmentation will be offset to an unknown degree by preservation or by restoration, creating more continuity in other fragmented habitat. The Service acknowledges that the benefits are tangible mitigating measures and are already helping to avoid and minimize negative impacts to potential suitable habitat.

Silver rice rat

The silver rice rat occurs on 11 islands in the Lower Keys, and is restricted to a narrow range of wetland habitat types. Populations are widely distributed and they occur at extremely low densities. The silver rice rat also requires a large home range. Silver rice rats require expanses of high-quality salt marsh habitat. They are extremely limited in habitat occupancy, occurring in salt marsh and transitional buttonwood habitats.

Threats to the silver rice rat include the alteration of wetland habitats from construction activities for residential and commercial developments, predation from feral cats, and niche overlap competition from black rats. Goodyear's (1992) data suggest that black rats may out-compete silver rice rats for food and habitat resources; in areas of potential suitable habitat, the occurrence of black rats may preclude the survival of silver rice rats. Black rats may also prey upon newborn silver rice rats (Forys, personal communication, 1995). Pesticides that are used to control black rats also threaten the silver rice rat (Service 1993b).

In some areas, the natural hydrologic cycles of silver rice rat wetland habitat has been altered by the construction of fill roads, borrow pits, and mosquito ditches. These alterations may encourage invasion by exotic vegetation, which may reduce the ability of the habitat to support rice rats.

For the silver rice rat, we relied on potential suitable habitat maps also generated by Service staff (Service, 2003). However, these maps were historically based on the ADID maps with Service staff species observations and modifications incorporated into the maps. Potential suitable habitat for the silver rice rat is about 14,088 acres of which 10,398 acres are in public ownership (73.8 percent). Of this acreage, 7,416 acres are in Federal ownership; 1,848 acres in State ownership; and 1,135 acres in other government ownerships (county, city, etc). Vacant lands at risk in the range of the silver rice rat are about 3,371 acres, representing 2,111 parcels. However, a portion of these lands are within a CBRA zone and FEMA backed flood insurance is not available. Potential impacts in CBRA areas are considered in the Cumulative Effects section of this BO. Figure 10 shows the potential suitable habitat map for the silver rice rat.

Critical habitat for the silver rice rat

Critical habitat for the silver rice rat includes areas containing contiguous mangrove swamps, salt marsh flats, and buttonwood transition vegetation. These vegetation types, as well as cattail marshes, contain the primary constituent elements in critical habitat types (50 CFR 17.95). The major constituent elements of this critical habitat that require special management considerations or protection are:

- (1) mangrove swamps containing red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), white mangrove (*Laguncularia racemosa*), and buttonwood (*Conocarpus erectus*);
- (2) salt marshes, swales, and adjacent transitional wetlands containing saltwort (*Batis maritima*), perennial glasswort (*Salicornia virginica*), saltgrass (*Distichlis spicata*), sea ox-eye (*Borrichia frutescens*), Key grass (*Monanthochloe littoralis*), and
- (3) coastal dropseed (*Sporobolus virginicus*); and freshwater marshes containing cattails (*Typha domingensis*), sawgrass (*Cladium jamaicense*), and cordgrass (*Spartina* spp.).

Critical habitat for the silver rice rat includes Little Pine Key; Water Keys; Big Torch Key; Middle Torch Key; Summerland Key north of U.S. Highway 1; Johnston Key; Raccoon Key; and Lower Saddlebunch Keys south of U.S. Highway 1, but not including lands in Township 67S, Range 27E, section 8 and the northern 1/5 of section 17. All lands and waters above mean low tide are included in this designation (50 CFR 17.95).

Critical habitat only affects Federal agency actions and does not apply to private, or, local or State government activities that are not subject to Federal authorization or funding. Federal agencies affected by the designation of silver rice rat critical habitat include the Service's National Key Deer Refuge (NKDR), COE, and FEMA. Seven of the nine keys in critical habitat are within the NKDR boundaries. Although the NKDR is managed for Key deer, the habitat requirements and biological needs of the species do not conflict.

Based on GIS mapping of the constituent elements and the habitat types codified in 50 CFR17.95 (a), 8,645 acres encompass the critical habitat for this species, of which 6,712 acres are in government ownership (77.6 percent) and about 1,933 acres are in private ownership (22.4 percent). As of April 2006, GIS analysis shows about 264 acres of rice rat critical habitat have been developed and about 1,526 acres are at risk. However, portions of these lands are within a CBRA zone and NFIP flood insurance is not available.

Stock Island tree snail

The Stock Island tree snail is an arboreal snail inhabiting hardwood hammocks of the Keys. Its historic range includes the islands of Stock Island and Key West. Individuals of the species have since been moved to other hammocks in the Keys and the mainland. Today, populations of snails occur throughout the Keys in hardwood hammocks. The Service has current records of 28 populations, many believed to be populations distributed by collectors.

Extant populations of the Stock Island tree snail are known in at least 28 locations, up from 4 in 1997 and 8 in 2003, and most are outside the historical range. As previously mentioned, snails are continuously being moved by various collectors. Individual snails have been distributed to some residents for placement in the Lower Keys and, perhaps on private lands in Key West. Therefore, it is very difficult to track the current distribution.

Potential suitable habitat for the Stock Island tree snail is considered hardwood hammocks and is estimated at 8,327 acres of which 5,976 acres are in public ownership (71.8 percent). Vacant lands at risk in the range of the Stock Island tree snail are about 1,344 acres, representing 3,674 parcels. However, a portion of these lands are within a CBRA zone and FEMA backed flood insurance is not available. Figure 11 shows the potential suitable habitat map for the Stock Island tree snail.

Integration and Synthesis

The U.S. District Court for the Southern District of Florida concluded on August 25, 1994, that FEMA's implementation of the National Flood Insurance Program constituted a Federal action for the purposes of section 7 of the Act and required FEMA to consult on whether their action was likely to jeopardize the continued existence of the endangered Key deer. On June 16, 1997, the Service issued a BO that concluded that the continued administration of the NFIP was likely to jeopardize the continued existence of Garber's spurge, Key deer, Key Largo cotton mouse, Key Largo woodrat, Key tree-cactus, Lower Keys rabbit, Schaus swallowtail butterfly, silver rice rat, and Stock Island tree snail, and was not likely to jeopardize the continued existence of the eastern indigo snake. The Service also concluded that critical habitat for the silver rice rat was likely to be destroyed or adversely modified.

The 1997 BO provided Reasonable and Prudent Alternatives (RPAs) that FEMA could undertake so that its action would not result in jeopardy to the above listed species or adversely modify the silver rice rat's critical habitat. The RPAs in general required the development of species habitat maps, the development of property maps, and implemented a project review process. The project review allowed the Service the opportunity to provide comments and

recommendations directly to the property owner and to the municipality (county or city) permitting development. Comments during the permit review related to whether a project would affect listed species habitat, what actions could be taken to avoid affecting listed species, and for actions that would adversely affect a listed species, information about applying for an incidental take permit under section 10 of the Act

On April 18, 2003, the Service issued an amended BO for the effects of the NFIP on threatened and endangered species in the Florida Keys. The 1997 BO was amended as a result of new information gained from implementation of the RPAs provided in the 1997 opinion and because a county-wide HCP was not completed within four years of the issuance of the 1997 BO. The new information included improved knowledge of the distribution of listed species and their habitats in the Keys, improved understanding of the manner in which the NFIP may adversely impact listed species, and the addition of two municipal governments, the City of Marathon and the Village of Islamorada, as participating communities in the FEMA NFIP. In addition, the American crocodile had begun to reoccupy portions of the Upper and Lower Keys. Therefore, effects of the action on the crocodile and its critical habitat were included in the amended opinion.

The amended BO concluded that full implementation of the NFIP in Monroe County:

- (1) may affect, but was not likely to adversely affect the Garber's spurge;
- (2) would result in incidental take of habitat of the eastern indigo snake and American crocodile;
- (3) would not result in jeopardy of the eastern indigo snake and American crocodile;
- (4) would result in jeopardy to the Key deer, Key Largo cotton mouse, Key Largo woodrat, Key tree-cactus, Lower Keys rabbit, Schaus swallowtail butterfly, silver rice rat, and Stock Island tree snail; and
- (5) would result in adverse modification of silver rice rat critical habitat.

It was also concluded that the action would also result in loss of critical habitat of the American crocodile but would not result in adverse modification of American crocodile critical habitat.

The amended BO reaffirmed that the implementation of the 1997 RPAs by FEMA would avoid jeopardy to the species listed in the opinion and would avoid adverse modification of critical habitat for the silver rice rat.

The principle RPA that would avoid jeopardy and adverse modification of the species listed in the 1997 BO and reaffirmed in the 2003 amendment was the review of county and municipality building permits for their effects to listed species. To assist in implementation of the RPAs, the Service coordinated closely with FEMA and Monroe County beginning in December 1998 until it was suspended because of the September 9, 2005, Court Order. A 1999 Service memorandum previously lodged with the Court (DE # 158 Exh. 7) detailed the substance of the reviews under the RPA to that date and the conservation recommendations rendered by the Service during the course of these reviews. The Court later determined the 2003 amended BO to be deficient in part because the document did not sufficiently analyze effect of the RPAs from 1997 to 2003. This portion of the opinion, analyzes these effects, as well as the effects of the RPA.

Tables (Table 6, 7, and 8) offer a summary of the informal consultations conducted with individual property owners, the types of actions reviewed, whether a project would affect species habitat, and whether the Service recommended modifications to the proposed project. During the review period, the Service provided technical assistance reviews for 6,590 proposed permit actions.

Table 6: Summary of Technical Assistance, 1998-2005 – Site Description

Year	Actions	Scarified	Exotics or Disturbed	Developed	Native Habitat
1998	530	2	38	412	84
1999	212	68	24	84	54
2000	990	10	40	878	86
2001	904	304	226	362	192
2002	742	232	132	216	212
2003	840	283	216	165	180
2004	1,256	420	418	366	234
2005	1,116	532	324	322	226
Totals	6,590	1,851	1,418	2,805	1,268

As shown in Table 6, 1,268 actions (19.2 percent) were in parcels that contained native habitat, 1,851 (28 percent) were in scarified habitats, and 1,418 (21.5 percent) were in sites that either contained exotics or were disturbed. A significant portion of the reviews (2,805) was for developed properties (42.6 percent) seeking some addition or modification. Developed properties could also contain fringes of native habitat, pockets of exotic species, or areas void of vegetation completely.

Table 7: Summary of Technical Assistance, 1998-2005 – Proposed Action Description

Year	Actions	New Structure	Redevelopment	Addition	Accessory Structures
1998	530	190	54	208	74
1999	212	94	22	48	52
2000	990	313	76	308	330
2001	904	528	78	260	106
2002	742	506	42	98	132
2003	840	571	43	82	159
2004	1,256	786	184	188	208
2005	1,116	760	198	194	112
Totals	6,590	3,748	697	1,386	1,173

As shown in Table 7, our reviews were primarily for new structures (3,748 or 57 percent). Additions and accessory structures accounted for 2,559 reviews (34 percent). Redevelopment

accounted for 697 reviews (10.5 percent). In the 9-year period, 3,748 new structure proposals were reviewed, averaging about 416 per year. This number seems high when considering that only about 255 permits are issued each year in the entire Keys. The explanation is that the Service reviewed properties before permit applications were filed and issued. Many of the proposals the Service reviewed were not filed or permitted. Some owners obtained a technical assistance review in case they wanted to sell their property in the future. In other cases, prospective buyers requested technical assistance on properties they considered buying to determine if there might be environmental problems. In some instances, new owners requested a technical assistance letter in their name.

Table 8: Summary of Technical Assistance, 1998-2005 – Determinations

Year	Actions	Risk to Species	Not Risk to Species	Affects Native Habitat	Does Not Affect Native Habitat	Proposed Conservation Measures	Requested an HCP
1998	530	2	528	50	290	31	14
1999	212	0	212	58	162	2	0
2000	990	28	962	75	906	20	12
2001	904	16	888	22	444	10	12
2002	742	44	698	80	224	64	22
2003	840	57	783	135	513	116	47
2004	1,256	72	1,184	207	1,008	142	36
2005	1,116	56	1,060	203	822	82	38
Totals	6,590	275	6,315	830	4,369	467	181

As shown in Table 8, we determined that 6,315 proposed actions technically reviewed (95.8 percent) did not adversely affect a listed species or a listed species' critical habitat. Our reviews also showed that 4,369 of the proposed actions did not affect native habitat (66 percent). Of the proposals we reviewed that would affect native habitat or otherwise affect listed species, we determined that 275 could have, as designed, an adverse effect on a listed species or a listed species' critical habitat. In these situations, we recommended changes in the project design that could minimize or eliminate an adverse effect, and would recommend measures that could benefit a species. The Service recommended any of several mitigation measures: reduce or re-site the structure, a conservation easement on the undisturbed habitat, a survey to determine possible presence of listed species, transplantation of native vegetation or planting of specific preferred plant species, a contribution into a restoration fund, or replacement of lost habitat.

For the purposes of this BO, the Service reviewed in detail determinations and recommendations for FEMA-related projects in fiscal year (FY) 2004 (October 1 through September 30), the first full fiscal year after the 2003 RPA was implemented. A summary of our findings is presented below in Table 9.

Table 9: Summary of Technical Assistance Actions in FY 2004

Project type	Number of determinations:	Number of determinations: <i>Habitat Conservation Plan (HCP) requested</i>	Number of recommendations: <i>Conservation measures</i>

	<i>Not likely to increase adverse risk</i>		
Single-family residence	146	49	112
Swimming pool	104	0	0
Replacement/ redevelopment	70	0	0
Renovation/shed/commercial/ miscellaneous	59	0	1
Addition/patio/deck	57	0	0
Fence/wall	27	3	0
Garage/carport	7	0	0
Total	470	52	113

In some cases, projects were combined in a single request, for example, a new residence and a fence. Some projects were reviewed, then subsequently canceled by the applicant, and are not included in Table 9. Conservation measures ranged from utilization of standard eastern indigo snake mitigation measures to a Deed of Conservation Easement on the remaining undisturbed parts of the property. Conservation measures imposed by Monroe County or the municipalities were also sometimes referenced.

The Service estimates all these projects represent about 34.4 hectares (85 acres) of property, most of which was scarified and cleared. Proposed projects on about 5.3 hectares (13 acres), representing 102 technical assistance applications, were initially considered to be in tropical hardwood hammock that could support federally listed species. Eighty-nine of the 102 applications were for review of proposed single-family residences and represented about 4.5 hectares (11 acres). Upon in-depth review, the Service determined that many of the projects did not affect potential suitable habitat.

Ultimately, after a review of all the habitat described above, the Service estimated a total impact of about 0.5 to 0.6 hectares (1.2 to 1.5 acres) of suitable habitat could occur and recommended that Habitat Conservation Plans (HCP) completed and/or conservation measures be implemented to avoid and minimize the impact. Twenty-one of 49 requests for new residential development that received an HCP recommendation involved Key deer and were located on Big Pine and No Name Keys. In most cases, anticipated impacts on Big Pine and No Name Keys related to increases in deer-vehicular collisions rather than habitat loss. Three requests that received HCP recommendations were for fences on Big Pine and No Name that did not meet the codified deer-friendly fencing guidelines developed by the Service and Monroe County. The Big Pine/No Name HCP now covers those projects on Big Pine Key and No Name Key. The remaining HCP recommendations were made due to our concerns of the projects' effects to the Stock Island tree snail, the eastern indigo snake, and the Schaus swallowtail butterfly.

We also randomly selected a month out of 2004 to evaluate FEMA technical assistance requests and outcomes in detail. Twenty-six technical requests were evaluated. Sixteen requests occurred on parcels that were identified in the Service's records as potentially containing

suitable habitat (Table 10). Nine of those were determined to have impacts on suitable habitat and mitigation measures were recommended. After a review of aerial photos, maps, and other information, the other seven requests were determined to have no suitable habitat and therefore no mitigation measures were recommended. The ten remaining proposed projects were not located in habitat identified as suitable.

The Service recommended mitigation measures for nine of the proposed projects. Six projects involved Key deer on Big Pine Key and three projects were determined to have footprints possibly occurring in suitable habitat for other federally threatened or endangered species. One proposed single-family residence project with a footprint of 0.10 acre was determined to occur in isolated habitat marginally suitable for the eastern indigo snake. The Service recommended eastern indigo snake protection measures in the event the species was encountered during construction. Two other projects were proposed partially in habitat identified as potential tree cactus suitable habitat. The Service recommended a vegetation survey to identify plants, removal of exotic vegetation, and transplantation of native plants. Five requests were for fences in Key deer habitat on Big Pine Key. The Service worked closely with Monroe County to develop deer-friendly fencing guidelines on Big Pine and No Name keys and recommended adherence to them as a mitigation measure. Service staff visited sites where permits were issued and determined the conservation measures were implemented. One technical assistance request was for a new single-family residence on Big Pine Key. The county issued the permit in compliance with a State Court Order. The Service believes this impact has been addressed in full because the Big Pine/No Name HCP has since been finalized, which considered impacts from traffic and provided adequate compensation.

Table 10: Projects in Potential Suitable Habitat Evaluated in February 2004

Parcel 1	Key	Project	Parcel Size (Acres)	Habitat Type	Species of Potential Suitable Habitat	Project Footprint Size	Acres of Habitat	Mitigation Recommendation	Results
1	Big Pine	Fence	0.34	Scarified	Key deer	350 linear feet	0	Adhere to Monroe County Deer-Friendly Fencing Regulations for Big Pine Key	Permit 96101143. Specific biological conditions (fence) apply. Service letter referenced in permit assessment. Passed biological inspection 5/4/2005
2	Big Pine	Fence	0.34	Scarified	Key deer	350 linear feet	0	Adhere to Monroe County Deer-Friendly Fencing Regulations for Big Pine Key	Permit 04100926. Specific biological conditions (fence) apply. Service letter referenced in permit assessment.
3	Summerland	SFR	0.42	Hammock Fragment	Eastern indigo snake	4,300 square feet	0.10	Eastern Indigo Snake Protection Measures	Permit 04100999. Specific biological conditions apply. Service letter referenced in permit assessment. Passed biological inspection 4/13/2006
4	Big Pine	Screen Enclosure	0.11	Cleared	Key deer	160 square feet	0	None. No native habitat affected.	Permit 04101328. Service letter referenced in permit assessment.
5	Key Largo	Addition	0.22	Existing Footprint Mostly Cleared	Stock Island tree snail	145 square feet	0	None. Project site not within designated suitable habitat on the property.	Permit 94301705. Exotic removal required. Service letter referenced in permit assessment.
6	Big Pine	Flood Proof Existing Building	1.02	Cleared	Key deer	192.5 linear feet	0	None. No native habitat affected.	Permit not yet issued.
7	Big Pine	Fence	0.15	Scarified	Key deer	330 linear feet	0	Adhere to Monroe County Deer-Friendly Fencing Regulations for Big Pine Key	Permit 04100145. Specific biological conditions (fence) apply. Service letter referenced in permit assessment.
8	Ramrod	Pool	0.35	Disturbed/Exotics	Tree cactus	1600 square feet	0	Vegetation Survey, Exotics Removal, and Transplantation of Native Plants.	Permit not yet issued. Service letter referenced in permit assessment.
9	Big Pine	Fence	0.22	Scarified	Key deer	300 linear feet	0	Adhere to Monroe County Deer-Friendly Fencing Regulations for Big Pine Key	Permit not yet issued. Service letter referenced in permit assessment.

Parcel 1	Key	Project	Parcel Size (Acres)	Habitat Type	Species of Potential Suitable Habitat	Project Footprint Size	Acres of Habitat	Mitigation Recommendation	Results
10	Sugarloaf	SFR	0.11	Disturbed/ Exotics	Key deer	1,500 square feet	0	None. Lot vegetated with exotics.	Permit 04100878. Specific biological conditions apply. Service letter referenced in permit assessment. Passed biological inspection 6/12/2006.
11	Big Pine	SFR	0.17	Scarified	Key deer	2,000 square feet	0	HCP Due to Increased Traffic	Permit 04103903. Permit information states Fish and Wildlife, DCA, and DOH exempt. Service HCP letter sent 2004.
12	Big Pine	Fence	0.11	Scarified	Key deer	220 linear feet	0	Adhere to Monroe County Deer-Friendly Fencing Regulations for Big Pine Key	Permit 04100493. Setbacks and height stipulated. Service letter referenced in permit assessment.
13	Big Pine	Addition	5.0	Scarified	Key deer, Eastern indigo snake	2,500 square feet	0	Construction within existing disturbed area. Conservation easement on the four remaining acres.	Permit not yet issued.
14	Cudjoe	SFR	.14	Mixed Exotics/ Natives	Tree cactus	2,200 square feet	0.05	None. Tree cactus not present. Canal lot.	Permit 04100419. Specific biological conditions apply. Service letter referenced in permit assessment. Notice of commencement 6/8/2006
15	Summerland	SFR	0.14	Scarified	Key deer	2,200 square feet	0	None. Cleared, fenced lot.	Permit 04100914. Service letter referenced in permit assessment.
16	Big Pine	Portable Privacy Screens		Scarified/ Developed	Key deer	variable	0	None. Cleared RV park.	Permit not yet issued.

* SFR = Single family residence

Habitat Conservation Plans

To evaluate in detail HCP determinations for proposed projects, the Service selected the first 10 determinations in which HCPs (projects the Service believed might have an adverse effect on listed species) were recommended directly, or as an alternative, in FY 2004. The results of that analysis are shown in Table 11 below.

These 10 projects represent 9.51 acres, possibly affecting 1.12 acres of potentially suitable habitat. Four applicants agreed to sufficient mitigation to minimize the risk of adversely affecting listed species and therefore no HCP was necessary. These projects as originally proposed would have resulted in the removal of 0.62 acres of suitable habitat. Two applicants applied for a building permit and received a building permit number, but were not issued a building permit because of environmental issues identified by the Service. The remaining four applicants have taken no further action over two years later. Because of local building regulations and competition for permits, these properties would only qualify for a building permit through resolution of environmental issues and additional compensation or a beneficial use determination several years later. Proposed projects in this category may score 11 or 12 points in the ROGO system. Currently, 23 points, minimum, are required to qualify for a permit. To move the project into the qualifying range, the applicant would have to purchase 6 lots and donate them to the county.

Review of the Monroe County permit database indicates the county is reliably incorporating the Service's recommendations as stipulations in permits. This supports FEMA's assessment derived from records reviews during community service visits.

Summary of Technical Assistance Review Process, 1997-2005

The Service believes that the RPA helped avoid jeopardy for three reasons:

- (1) as described in the status of the species section many of the species are stable or improving today, including the Key deer, silver rice rat, Schaus swallowtail butterfly, and Stock Island tree snail.
- (2) the coordination between the Service and local governments helped monitor species trends. For example, coordination helped identify many new Stock Island tree snail populations.
- (3) the RPA served as a safeguard against any project that could have caused significant problems for the species.

If the RPA was not in place and a proposed project had no other Federal nexus, the Service may not have known about it and had the chance to engage through section 10. During the period the RPA was in place, the Service requested HCP on all projects with significant impacts in suitable habitat. In the future, a similar review process would continue to provide a safeguard against negative impacts, which would be most important for the species that have appeared to be in a declining condition in recent years, including the Key Largo cotton mouse, Key Largo woodrat, Lower Keys marsh rabbit, and Key tree-cactus.

Table 11: 10 HCP Determinations in FY 2004

HCP	Key	Project	Parcel Size (acres)	Habitat Type on Project	Species of Suitable Habitat	Project Footprint Size	Acres of habitat	Mitigation Recommendation	Results
1	Upper Matecumbe	SFR	0.5	High quality hardwood hammock	Schaus swallowtail butterfly; Stock Island tree snail	5,000 square feet	0.11	Conservation easement on remaining portion, exotic vegetation removal, trans plantation or replanting of specific native species, translocation of any tree snails, implement eastern indigo snake protection measures.	A permit number has not been assigned.
2	Upper Matecumbe	SFR	0.67	High quality hardwood hammock	Schaus swallowtail butterfly; Stock Island tree snail	5,000 square feet	0.11	Conservation easement on remaining portion, exotic vegetation removal, trans plantation or replanting of specific native species, translocation of any tree snails, implement eastern indigo snake protection measures.	A permit number has not been assigned.
3	Upper Matecumbe	SFR	0.41	High quality hardwood hammock	Schaus swallowtail butterfly; Stock Island tree snail	5,000 square feet	0.11	Survey to determine presence or absence, alternatively an HCP.	A permit has not been issued to date
4	Key Largo	SFR	0.15	Low quality hardwood hammock	Schaus swallowtail butterfly; Stock Island tree snail	1,200 square feet	0.06	Survey to determine presence or absence, alternatively an HCP.	A permit number has not been assigned.
5	Key Largo	SFR	0.24	Low quality hardwood hammock	Schaus swallowtail butterfly; Stock Island tree snail	2,500 square feet	0.06	Retain 50 percent of hammock, replace native trees, plant host plants for Schaus butterfly and tree snail.	A permit number has not been assigned.
6	Key Largo	SFR	0.3	Moderate quality hardwood hammock	Schaus swallowtail butterfly	3,825 square feet	0.09	HCP	A permit number has not been assigned.

HCP	Key	Project	Parcel Size (acres)	Habitat Type on Project	Species of Suitable Habitat	Project Footprint Size	Acres of habitat	Mitigation Recommendation	Results
7	Key Largo	SFR	6.58	Moderate quality hardwood hammock	Schaus swallowtail butterfly, Stock Island tree snail	6,300 square feet	0.15	HCP	A permit number has not been assigned.
8	Ramrod	SFR	0.17	Low quality hardwood hammock	Key deer, eastern indigo snake	1,500 square feet	0.34	Conservation easement on remaining portion, mitigation fee determined by and paid to Monroe Co Restoration Fund., no fences, no free-roaming cats or dogs, implement eastern indigo snake protection measures.	Permit 04105722. Permit not issued. Special biological conditions and mitigation apply.
9	Key Largo	SFR	0.37	Moderate quality hardwood hammock	Schaus swallowtail butterfly, Stock Island tree snail	2,000 square feet	0.05	Survey to determine presence or absence, alternatively an HCP.	Permit 05306212. Permit not issued. Special biological conditions and mitigation apply.
10	Key Largo	SFR	0.12	Moderate quality hardwood hammock	Schaus swallowtail butterfly, Stock Island tree snail	1,900 square feet	0.04	HCP	Permit 04300668. Permit not issued. Special biological conditions and mitigation apply. Project incorporated Service recommendations therefore no HCP required. Conservation easement.

* SFR = Single family residence

After reviewing the effectiveness of the technical assistance review process previously in place, the Service believes that, viewed cumulatively in addition to individually, the impacts from projects were not significant on species or their habitats. Many of the properties reviewed did not have much, if any, habitat that was suitable for threatened and endangered species. The properties were mistakenly included in the potential suitable habitat maps because of the mapping tools used at the time. Improvements in mapping technology have helped reduce this error in our latest potential suitable habitat maps, although verification and collection of updated information will continue to be important.

When we believed the proposal would adversely affect listed species, we recommended that an applicant apply for an incidental take permit associated with either another Federal action (COE wetland permit) or a section 10 permit (non-Federal nexus). We recommended incidental take actions and development of an HCP for 181 projects (2.7 percent of the projects reviewed) where we believed adverse effects to a listed species or critical habitat could not be avoided. Forty-nine of the HCPs were related to proposed construction on Big Pine and No Name Keys. The recently adopted HCP for Big Pine and No Name Keys addressed development on these Keys. Of the remaining 132 HCPs requested, no HCP was submitted. In a number of cases, the Service worked with the applicant to reduce habitat loss and to protect on-site habitat values, thus reducing impacts to a point that project effects were not likely to increase adverse risk to listed species. The Service believes many of the HCP requests resulted in the applicants dropping their plans to develop the property.

The Service also recognizes, however, that the RPA could have been designed to address cumulative and indirect effects more clearly. As previously designed, the Service provided technical assistance to individual landowners who, at some point, may seek and obtain a permit to develop. The previous RPA did not allow for a review of permits collectively. This approach would have allowed the Service to review the proposed actions together allowing all the impacts – direct, indirect, interrelated and interdependent, and cumulative – to be considered at the same time. The revised RPA in this BO addresses this point by designing a review process that will allow the Service to consider the cumulative impacts of a series of permit proposals at specific points in time. In addition, the new RPA addresses a key indirect effect – free-roaming cats – more clearly.

Oversight and Compliance: To help oversee the RPA, the Service hired a full-time employee in 1997 and stationed the position in the Keys. This effort was often supplemented by other Service staff, and was completed in partnership with FEMA, Monroe County, and the municipalities. The Service employee handled a variety of duties, including technical assistance requests, site visits, compliance checks, coordination with other officials, and office duties, on a daily basis. In August 2003, the position location was moved to the Ecological Services South Florida Field Office in Vero Beach. Duties in the Vero Beach office remain essentially the same. Compliance visits and technical assistance site visits were generally made over four or five days each month.

The position coordinated with the FEMA specialist who provides technical assistance and compliance reviews in Monroe County. The Service representative accompanied the FEMA specialist in their review of Monroe County and municipality compliance with the 2003 RPA. Reviews involved meeting with designated representative of local government to discuss current actions and issues. The stipulations and conditions imposed by the local government in permits were examined to determine whether they complied with technical assistance letters in which the Service recommend conservation measures.

The Service has learned that a number of building permits in potential habitat were issued without Service review. Due to a building moratorium resulting from level of service concerns on U.S. 1 on Big Pine Key, 21 building permit applications for Big Pine Key were held in abeyance by Monroe County. Some applicants brought suit against the county because of the moratorium. The Special Master who determined the impacts from applicants' building would have a de minimus effect on requirements proposed by Monroe County, subsequently issued the applicants a Beneficial Use determination. On June 11, 2004, Judge Mark Jones of the 16th Judicial Circuit Court for Monroe County approved a settlement agreement between Monroe County and four property owners whose building permit applications had been held by Monroe County (Appendix 2). As the result of a settlement agreement, Monroe County agreed to issue the permits. Neither FEMA nor the Service were a party to this proceeding or had knowledge of it at the time. In addition to these permits issued through the Court-led settlement agreement, the Service now understands that most if not all of the other 21 permits have now been issued. Eleven of the applicants did not apply to the Service for technical assistance and, therefore, did not have their property evaluated by the Service as potential habitat for listed species. As part of the HCP, the county is tracking the impacts of all development, including the 21 projects comprising 4.7 acres. The BO, which accompanied the HCP, exempted take and determined development impacts on Big Pine and No Name Keys would not jeopardize survival and recovery.

Aside from the 21 permits noted above, after regular coordination and review the Service and FEMA have found the technical assistance process has been effective. The modifications to permit requests generally involved a change in the location or a reduction in the footprint of development that avoided adverse impacts. Examples of project modifications have included a landowner with four lots reducing the project footprint to one lot and putting a conservation easement on the remaining three lots; reducing the amount of area proposed to be fenced to leave a travel corridor for Key deer; and shifting the location of a driveway to protect the Keys tree-cactus. Table 12 includes a record of RPA coordination by FEMA, the Service, and Monroe County.

Table 12: RPA Implementation Coordination Record

Date	Action	Outcome
1998-1999	Semi-annual meetings with Service and Monroe County	Compliance with RPA
2000	Exceeded semi-annual consultation	Compliance with RPA
March 29, 2000	Meeting with Service and FEMA	Compliance with RPA

Date	Action	Outcome
March 29, 2000	Review of permits and RPA process, Monroe County	Discovery of two possible violations, upon notice of discovery, county issued stop work on both projects and required HCPs
March 30, 2000	Review of permits and RPA process, Islamorada	No compliance problems discovered, Village appeared to be complying with RPA
March 31, 2000 2001	Review of County permits faxed Exceeded semi-annual consultation	Compliance with RPA
August 6, 2001	Meeting with Service and FEMA	Compliance with RPA
August 6, 2001	Review of permits and RPA process, Islamorada	Village and Service agreed to coordinate follow-up on permitted actions, publish outreach materials, clarification on development definition
August 7, 2001	Review of permits and RPA process, Monroe County	County found to be implementing RPA, County Agreed to publish more outreach materials
August 7, 2001	Review of permits and RPA process, Marathon	City appeared to be implementing RPA
August 9, 2001 2002	Meeting Exceeded semi-annual consultation	Compliance with RPA
September 16-19, 2002	Meeting with Service and FEMA	Compliance with RPA
August 16, 2002	Review of permits and RPA process, Islamorada	Village appeared to be implementing RPA
August 17, 2002	Review of permits and RPA process, Monroe County	County appeared to be implementing RPA
August 17, 2002	Review of permits and RPA process, Marathon	City appeared to be implementing RPA
October 16, 2002	Meeting with Service and FEMA	Agreed that Service would send copies of all correspondence to NFIP communities regarding RPA
2003	Exceeded semi-annual consultation	Compliance with RPA
June 30, 2003	Coordination regarding permits issued by county on Big Pine Key	Service determined these would be covered by proposed HCP
September 25, 2003	Review of county permits and RPA process	County in compliance with RPA
September 25, 2003	Review of City of Marathon permits and RPA process	City was unable to provide copies of all permits
September 26, 2003	Review of Village of Islamorada permits and RPA process	Village appeared to be complying with RPA
December 1, 2003	Letter to county	Request for copy of permits each 6 months

Date	Action	Outcome
December 3, 2003	Letter to Marathon notifying revision of ordinance needed and request for copies of permits every 3 months	Request for proof of stop work at Grassy Key Subdivision, copies of permits provided every 3 months until injunction September 2005
November 19, 2003	Letter to Village of Islamorada	Village appeared to be complying with RPA
2004	Exceeded semi-annual consultation with Service	
January 12, 2004	Visit to Marathon, meeting with FEMA, city, DCA, Service, COE, regarding proper permitting at Grassy Key SD, review of permits	Clarification of RPA, Federal and State permits needed, compliance with 44 CFR 60.3(a)(2)
January 12-13, 2004	Review of permits Monroe	County in compliance with RPA
January 12-13, 2004	Review of Marathon permits	City appeared to be complying with RPA
January 12-13, 2004	Review of Islamorada permits	Village appeared to be complying with RPA
February 4, 2004	Letter to Marathon with notice to comply or jeopardize participation in NFIP	Stop work order, fines, restoration of Grassy Key SD
2005	Exceeded semi-annual consultation	Compliance with RPA
November 1, 2005	Meeting with Service and FEMA	Compliance with RPA
November 1, 2005	Review of permits Monroe County	County appeared to be complying with RPA
November 2, 2005	Review of permits Marathon	City appeared to be complying with RPA
November 2, 2005	Review of permits Islamorada permits	Village appeared to be complying with RPA

EFFECTS OF THE ACTION

In the *Description of the Action* section of this BO, the Service provides an overview of how the NFIP is implemented in the Keys. After that overview, we summarize information on the biology, ecology, and threats facing threatened and endangered species in the Keys. In the *Environmental Baseline* section of this BO, the Service summarized the effects of the NFIP on threatened and endangered species in the Keys. Because the *Environmental Baseline* for this BO covers more than three decades and includes the actions of other Federal, State, and local programs that affect land uses in the Keys, the Service was not able to separate the effects of the NFIP from the effects of these other actions. As a result, the *Environmental Baseline* summarized the actions of other Federal, State, and local agencies and their effects on threatened and endangered species in the Keys from 1970 to 2006.

Factors to be considered

The following factors apply to all species considered in this opinion.

Assessment approach

In this BO, we determine whether continuation of the NFIP in the Florida Keys is likely to adversely affect listed species, and, if so, to what extent. In general, we will make this determination by estimating probable changes in the quantity, distribution, and quality of potential suitable habitat for threatened and endangered species in the Florida Keys resulting from development. Indirect effects in the form of traffic volumes and cat predation are also central. We will also compare species population parameters and range in 2006 to 2003 and 1997.

Methods

To analyze the specific effects of the NFIP in the Keys, we narrowed the action area to those areas in which flood insurance is available. We then determined land ownership and potential suitable habitat susceptible to development. To identify those areas where flood insurance is available, we first generated GIS layers that isolated areas designated by CBRA, as these areas are not available for federally insured flood insurance. The isolated areas not protected were then subtracted from the base maps to generate maps of areas where flood insurance is available.

The analysis of effects that follows is based on activities that we have determined are likely to occur because of the action in the areas where flood insurance is available. However, development activities in potential suitable habitat susceptible to development in the excluded areas are also considered adverse effects to listed species and are evaluated in our cumulative effects section as future non-Federal actions.

Human population in the Keys

Between 1980 and 1990, the population of Monroe County increased by 32.8 percent. Between 1992 and 2020, the population of Monroe County was projected to increase by about 139 percent, as listed in our 1997 BO. By 2000, however, the population actually decreased to 79,589, or by 1.7 percent. By 2004, the population decreased 1.6 percent to 78,284 (U.S. Census 2004) (Table 13). The prediction in Monroe County's Comprehensive Plan that Monroe County population will be 112,300 by 2010 now seems highly unlikely, as the current population is now near the 1990 level. Although the population has declined in the last years, we must assume the population will increase commensurate with a corresponding increase in housing. ROGO allocation in the Florida Keys is 372 ROGO units per year. In the 15-year period, 2006 to 2020, 5,580 ROGO units would be allocated at the current rate. An average of 2.3 persons occupies a household in Monroe County (U.S. Census Bureau 2000). Therefore, the population would increase by 12,834 (5,580 x 2.3) persons (16 percent) by the year 2020 as the result of new development.

Table 13: Changes in the human population size in the Florida Keys, 1980-2004

	1980	1990	1992	2000	2004
Population	63,098	78,024	80,968	79,589	78,284

Source: U.S. Census Bureau

Communities within Monroe County

Monroe County will be assessed according to the six communities that are independently evaluated by FEMA for participation in the NFIP. The local entities are: Unincorporated Monroe County, the Village of Islamorada, the City of Layton, the City of Marathon, the City of Key Colony Beach, and the City of Key West.

Currently, there are about 21,127 acres of vacant land in Monroe County, comprising about 34 percent of the total acreage of the county. These 21,127 acres do not include any of the 14,953 vacant, buildable lots already zoned and platted for residential uses, nor does this acreage include conservation and recreational lands, such as State Parks and Preserves.

Although there are 14,923 vacant, developable, residential lots in Monroe County, this number does not reflect the residential construction potential. The construction potential has proven to be lower because land development regulations manage the county's and municipalities' growth within its carrying capacity. Monroe County developed a land use map that determines future land-use patterns and residential and commercial construction based on the critical measure of carrying capacity. Carrying capacity is based on hurricane evacuation clearance times. Future land-use predictions may be less than what would occur based on a carrying capacity analysis. Actual growth patterns are determined through the Permit Allocation System (i.e., ROGO) and issuance of building permits by the county and municipalities.

For assessment purposes, our evaluation is to the year 2020, a 15-year period representing 5,580 ROGO units, which is based on 372 ROGO units per year (all Monroe County). For future planning purposes the ROGO allocations per year are 197 for unincorporated Monroe County, 92 for the City of Key West, 30 for the City of Marathon, 28 for the City of Islamorada, 22 for the City of Key Colony Beach, and 3 for the City of Layton

Unincorporated Monroe County: Monroe County is allotted 197 ROGO allocations for dwelling units per year. At least 20 percent of these must be allocated for affordable housing. In addition, 239 square feet of non-residential development will be permitted for every one dwelling unit permitted. A total of 610,000 square-feet of non-residential construction could be permitted through 2010 or a total of 61,000 square-feet per year.

City of Islamorada: The City of Islamorada is allocated 28 ROGO allocations for dwelling units per year and has 444 acres of hardwood hammock potential suitable as habitat for federally listed species. Of this acreage, only 134 acres are located within developable properties, representing 337 parcels.

City of Layton: The City of Layton is allocated 3 ROGO allocations for dwelling units per year and has no potential suitable habitat for species considered in this document. Therefore, it will not be considered further.

City of Marathon: The City of Marathon is allocated 30 ROGO allocations for dwelling units per year and has 560 acres of hardwood hammock potentially suitable as habitat for this federally listed species. Of this, 233 acres is located in CBRA zones and 171 acres located on 370 parcels are developable.

City of Key Colony Beach: The City of Key Colony Beach is allocated 22 ROGO allocations for dwelling units per year and has no potential suitable habitat for species considered in this document. Therefore, it will not be considered further.

City of Key West: The City of Key West is allocated 92 ROGO allocations for dwelling units per year and has no potential suitable habitat for species considered in this document. Therefore, it will not be considered further.

Summary

Within the Keys, of the 5,580 ROGO units available for distribution during the 15-year review period, 1,755 are allocated for communities where no potential suitable listed species habitat exists. The remaining 3,825 ROGO units are within unincorporated Monroe County, Village of Islamorada, and the City of Marathon.

Analysis for effects of the action

Beneficial Effects: Beneficial effects are contemporaneous positive effects without any adverse effects to the species. No beneficial effects that might result from the action were identified.

Direct Effects: Direct effects are those that are the immediate effects of the project on the species or its habitat. Direct effects result from the agency action. Future Federal actions that are not a direct effect of the action under consideration (and not included in the environmental baseline or treated as indirect effects) are not considered in this BO. The only direct effect identified because of the action under consultation is the availability of flood insurance that facilitates development. Flood insurance is purchased because lending institutions require it for a government-backed loan or individual property owners purchase on a voluntary basis because they are concerned about their flood risk.

Interrelated and Interdependent Effects: An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent

activity is an activity that has no utility apart from the action under consultation. The Service does not believe that FEMA's proposed NFIP action has any interrelated or independent activities.

Indirect Effects: Indirect effects are those that are caused by or will result from the proposed action and are later in time, but are still reasonably certain to occur. Indirect effects of the action are loss of habitat, habitat fragmentation, and include increased traffic generated from businesses, residences, and community infrastructure that is expected to cause an increase in vehicular mortality. Indirect effects also include, but are not limited to, people moving into a housing unit who bring cats that prey on listed species in the adjacent habitat. Indirect effects may occur outside of the area directly affected by the action.

Each species under consideration will be evaluated as to population, habitat loss, habitat fragmentation, and indirect mortality, such as vehicular mortality, domestic pet predation, chemical hazards, etc.

Eastern indigo snake

Potential suitable native habitat is present for the eastern indigo snake in unincorporated Monroe County, Village of Islamorada, and the City of Marathon. No potential suitable native habitat is present for this species in the City of Layton, the City of Key Colony Beach, and the City of Key West.

Population

Since the Keys are on the extreme southern end of this snake's range and do not contain optimum habitat, the eastern indigo snake population in the Keys is very small. Observations are rare and scattered.

Florida Keys

The Service is aware of three reported but unsubstantiated observations of this snake in the Keys in the last several years.

Unincorporated Monroe County

The Service is aware of three reported but unsubstantiated observations of this snake in the Keys in the few years.

Village of Islamorada

There have been unverified reported sightings of the eastern indigo snake in the Village in the last several years (Sheahan, personal communication, 2006; McNeese 2006)

City of Marathon

Two undocumented sightings of the eastern indigo snake have been made in recent years on Grassy Key.

Habitat loss

Florida Keys

Potential suitable eastern indigo snake habitat includes all habitat types in the action area except developed lands, mangroves, saltmarsh, and deep-water areas. We determined there are 10,024 acres of potential eastern indigo snake habitat in Monroe County. Of these, 7,472 acres are located on conservation lands not subject to development (74.5 percent). Our GIS analysis also shows that 1,444 acres of these lands are at risk from development and are located within 4,568 parcels. These lands represent 14 percent of the total potential suitable habitat in Monroe County ($1,444/10,024 = 0.14$).

Unincorporated Monroe County

We determined there are 9,020 acres of potential eastern indigo snake habitat in unincorporated Monroe County. Of these, 7,472 acres are located on conservation lands and not subject to development (82.8 percent). Our GIS analysis also shows that 1,218 acres of these lands are at risk from development. Within the borders of the HCP for Big Pine and No Name Keys, potential eastern indigo snake habitat is about 2,423 acres, with at risk habitat on vacant parcels of 220 acres. Tier I lands were estimated at 211 acres, SPA lands 6 acres and Tier III lands 1 acre.

Big Pine/No Name HCP

The county plans to conserve habitat on more than 440 lots on Big Pine Key that have been dedicated to the county because of the ROGO competitive process. Much more habitat is scheduled for purchase and protection by various entities in the future. The Big Pine/No Name HCP finalized in June 2006 allows a maximum of 200 lots to be developed on Big Pine Key in the next 20 years. The HCP also accounts for incidental take of the indigo snake on these keys. The HCP exempted incidental take for the loss of 168 acres)of indigo snake habitat. Habitat on the 200 lots proposed for development in the next 20 years must be compensated on a 3:1 basis. Because of the HCP, this BO addresses impacts on potential suitable habitat outside of Big Pine and No Name Keys.

Other Lands

Within the action area, excluding lands within the boundaries of the Big Pine/ No Name HCP, potential suitable eastern indigo habitat at risk in Tier I, SPA, and Tier III designations is about 1,007 acres, consisting of 862 acres of Tier I lands, 94 acres of SPA lands, and 44 acres of Tier III lands. The focus of this analysis is Tier I and SPA lands, which are considered by the Service as more optimal for listed species because of there size and connectivity. Tier III lands, which are generally single isolated parcels within developed subdivision, have far less value, and in many cases, no value. Lands in Tier I and SPA are targeted for purchase by the county and the Florida Forever program. The county also discourages development of these lands by assigning negative ROGO development points for habitat and listed species in their permit review process.

The county's ROGO allotment allows for a maximum of 6 ROGO allotments for Tier I lands, three allocations in the Upper Keys and three allocations in the Lower Keys. There are no ROGO restrictions for SPA lands. There are 1,648 parcels in Tier I, 785 parcels SPA lands and 621 parcels in Tier III lands. Tier 1 lands total 862 acres, SPA lands total 94 acres and Tier III lands total 44 acres, representing 0.36 acres of potential suitable habitat per parcel.

Tier 1 Lands: Based on an allocation of six allotments per year and a 15-year assessment period, we estimate adverse effects to about 32.4 acres of potential suitable eastern indigo snake habitat.

(ROGO allotment X total years X acres per lot = total acres [6*15*0.36=32.4]).

Since we cannot determine whether the six annual ROGO allotments will occur in CBRA zones or within non-CBRA zones, for assessment purposes we will consider that allotments will be equally balanced as a percentage of the lands in and outside the CBRA boundaries. For this analysis, the CBRA zone lands (227 acres) represent 19 percent of the at-risk lands (227/1,218=19). Therefore, we estimate the adverse effect to the eastern indigo snake from the proposed action in unincorporated Monroe County to be the loss of 26 acres of potential suitable habitat over a 15-year period. This habitat loss represents 0.26 percent of the potential suitable eastern indigo snake habitat in the Keys (26/9,020). Based on the current population, we believe this increase will not be significant.

SPA Lands: Since there are no ROGO restrictions on SPA lands, we must consider that development could occur in these lands at the same frequency as in Tier III lands. For this analysis, SPA and Tier III lands represent 1,406 parcels (57 percent SPAs and 43 percent Tier III). With an allotment of 177 ROGO units per year in unincorporated Monroe County (197-10 Tier I and 10 in Big Pine/No Name Key HCP), over a 15-year period, this equates to 2,655 ROGO units, of which 1,513 represent SPA allotments. This allotment exceeds the available SPA parcels. Therefore, we assume that all 94 acres of SPA lands, represented by 801 parcels will be developed, resulting in the loss of all 94 acres of potential suitable eastern indigo snake habitat. As discussed above, the CBRA zone lands represent 19 percent of the at-risk habitat; therefore, we consider the loss of habitat associated with the proposed action to be 76 acres. This loss equates to 0.84 percent of the potential suitable eastern indigo snake habitat in the Keys ($76/9,020 = 0.0084$). Based on the current population, we believe this loss will not be significant.

The habitat loss from ROGO allotments in CBRA zone lands are a component of our cumulative effects assessment. Following the above assessment approach, we calculate the habitat loss to be 6.4 acres of potential suitable habitat over a 15-year period in Tier I lands and 18 acres in SPA lands. This habitat loss represents 0.28 percent of the potential suitable eastern indigo snake habitat in the Keys and will be discussed further in our cumulative effects section ($[6+18]/9,020 = 0.0028$).

Village of Islamorada

We determined there are 444 acres of potential eastern indigo snake habitat within the Village of Islamorada, of which 134 acres are located within undeveloped lots, which represents 337 parcels. Based on our GIS analyses, the proposed action may affect 134 acres of vacant residential and commercial lots subject to development. There are no CBRA lands in the Village of Islamorada.

The Village of Islamorada is allocated 28 ROGO allotments per year. For assessment purposes, we estimate that each of the vacant parcels represents 0.4 acres. We estimate that, based on 28 ROGO units per year, over a 15-year period that 420 units could be developed, which represents 168 acres of habitat. Since there are only 337 parcels in Islamorada, we assumed that all parcels would be developed, resulting in the loss of all 134 acres of potential suitable eastern indigo snake habitat. This loss equates to 1.3 percent of the percent of the potential suitable eastern indigo snake habitat in the Keys ($134/10,024 = 0.013$). Based on the current population, we believe this loss of habitat will not be by itself significant.

City of Marathon

We determined there are 560 acres of potential eastern indigo snake habitat within the City of Marathon. Based on our GIS analyses, the proposed action may affect 92 acres, which are located within 369 parcels. This represents 16 percent of the snake's habitat in the City of Marathon and less than one percent of the eastern indigo snake's habitat in Monroe County.

The City of Marathon is allocated 30 ROGO allotments per year. For assessment purposes, we estimate that each of the vacant parcels represents 0.25 acres. We estimate that, based on 30 ROGO units per year, over a 15-year period that 450 units could be developed, which represents 112.5 acres. Since there are only 369 parcels in the City of Marathon, we assumed that all parcels would be developed, resulting in the loss of all of the 92 acres of potential suitable eastern indigo snake habitat. This loss equates to 0.92 percent of the potential suitable eastern indigo snake habitat in the Keys. Based on the current population, we believe this loss will not be by itself significant. There are no CBRA lands in the City of Marathon.

Habitat fragmentation

Florida Keys

Since indigo snakes have large home ranges (12 to 494 acres), they can be susceptible to construction activities that fragment existing habitat types.

Unincorporated Monroe County

The at-risk lands in unincorporated Monroe County were about 1,218 acres, representing 3,862 parcels. The Tier 1 and SPA lands total about 1,173 acres and are considered by the Service as those lands that could be subject to fragmentation by development. We previously determined the loss of 108 acres would not by itself be significant. We expect this will result in some minor

fragmentation of habitat, although the impacts will be minimal and the precise effect on the species will be difficult to measure.

Village of Islamorada

The at-risk lands in the Village of Islamorada were about 134 acres, representing 337 parcels and include parcels within developed subdivisions and parcels within more rural settings. Since, there are only 337 parcels in Islamorada, we assumed that all parcels would be developed, resulting in the loss of all 134 acres of potential suitable eastern indigo snake habitat within the city. We expect this will result in some minor fragmentation of habitat, although the impacts will be minimal and the precise effect on the species will be difficult to measure.

City of Marathon

The at-risk lands in the City of Marathon were about 92 acres, which are located within 369 parcels and include parcels within developed subdivisions and parcels within more rural settings. Since, there are only 369 parcels in Marathon, we assumed that all parcels would be developed, resulting in the loss of all 92 acres of potential suitable eastern indigo snake habitat within the city. We expect this will result in some minor fragmentation of habitat, although the impacts will be minimal and the precise effect on the species will be difficult to measure.

Indirect effects

The proposed development activities will increase traffic and the number of free roaming pets, increasing the likelihood of vehicular and predator mortalities. However, no deaths due to vehicles have been reported to the Service in the last 10 years. This adverse affect will occur in all of the following areas:

Florida Keys

Unincorporated Monroe County

Village of Islamorada

City of Marathon

Summary – Changes since the 1997 and 2003 BOs

In general, the habitat loss and indirect effects identified in this analysis are more realistic than the build-out scenario assumed in the 1997 and 2003. This BO's methodology benefited from advances in GIS data and a detailed lot-by-lot review guided by the ROGO allocation process. The build-out scenario assumed in the 1997 and 2003 opinions, applied to the current information would identify the acres of at risk from the proposed actions as being 1,444 acres impacting 4,568 parcels. Our analysis incorporates the ROGO development restrictions and identifies the acres of at risk habitat as being 320 acres affecting 1,455 parcels.

The proposed action could result in the loss of 320 acres of habitat, most of which is fragmented and in much smaller patches than 250 acres, considered the average home range for this species. The vast majority of the species' habitat is outside of the Keys. Furthermore, the majority of

the suitable habitat for this species in the Keys (74.5 percent) is protected and county and municipality development regulations discourage development in remaining quality habitat. Based on the above analysis the Service considers the loss of 320 acres of eastern indigo snake habitat, which is about 3.7 percent of the available habitat to be not significant for eastern indigo conservation ($320/10,024 = 0.037$). Based on the current population throughout the range of the species and the insignificance of the Keys to the species as a whole, we believe this increase will not by itself be significant, particularly if the technical assistance process outlined at the end of this document is implemented to help avoid and minimize any potentially negative effects.

Key deer

In the discussions that follow, loss of habitat is evaluated on a “worst case scenario” basis. One assumption is that if a property is developed, all habitats on that unit will be lost. We discussed previously the open space requirements of Monroe County, the Village of Islamorada, and the City of Marathon. Clearing is limited to 10 to 30 percent in high quality habitat and 50 to 70 percent in moderate to low quality habitat. Therefore, a maximum of 70 percent of our affected habitat assessment can actually occur. Generally, only 10 percent of likely occupied (high and moderate quality) habitat (Tier I) can be cleared in Monroe County and a maximum of 30 percent in the municipalities. Additional regulations require preservation or restoration of habitat to offset vegetation losses that result from development. Fragmentation of habitat will nevertheless occur. However, fragmentation will be offset to an unknown degree by preservation or by restoration, creating more continuity in other fragmented habitat. The Service is unable to evaluate the true effects of these beneficial actions, but acknowledges that the benefits are tangible mitigating measures. In essence, the programs are already helping to avoid and minimize negative impacts to potential suitable habitat.

Population

Historically, the maximum population of Key deer was probably between 600-700 individuals occupying about 19,000 acres of habitat in the historical range (Seal et al. 1990). The current population, believed to be about 650 animals, equals the historical maximum estimate. The estimate of 650 animals was derived from Lopez (2004). A mean estimate (485 animals) for Big Pine Key and No Name Key was derived from Lopez’s estimate of 453 to 517 animals and extrapolated from Lopez’s observation that Big Pine Key and No Name Key population comprise about 75 percent of the total population (Lopez 2001).

Florida Keys

Potential suitable Key deer habitat is represented as the entire range of the Key deer, from Ohio Key south to Saddle Hill Key (Service 1985).

Unincorporated Monroe County

All potential suitable Key deer habitat is located within unincorporated Monroe County.

The following municipalities do not include potential suitable Key deer habitat.

Village of Islamorada

City of Layton

City of Marathon

City of Key West

Habitat loss

Habitat data for the Key deer were generated based on the present range of the deer, which includes Bahia Honda Key, west through the Saddlebunch Keys. All native plant communities were considered Key deer habitat, and scarified lots largely devoid of vegetation and lots with existing developments were not considered habitat. However, larger parcels with significant native vegetation remaining were considered Key deer habitat even if some development was present on the parcel.

Florida Keys

The total potential suitable habitat for this species was determined to be 24,676 acres and occurs on 20 to 25 islands. On Big Pine Key and No Name Keys, which is the central population area, there are 7,166 acres of potential suitable habitat, 29 percent of the total. Government entities own 4,974 acres on Big Pine and No Name and 12,672 acres in the rest of Key deer range, which combined represents 71.5 percent of potential suitable habitat. On the remainder of the islands, there are 17,510 acres of potential suitable habitat.

Potential suitable Key deer habitat within at-risk vacant lands is about 4,959 acres, with 1,057 acres on Big Pine and No Name Keys, and 3,902 acres on the other Keys, representing a combined 5,337 parcels (2,462 and 2,875, respectively).

Unincorporated Monroe County

Tier I, SPA, and Tier III Lands: The Service calculated that there are 4,959 acres of at risk habitat in Tier I, SPA, and Tier III designations (4,759 acres in Tier I; 135 acres in SPAs; and 65 acres in Tier III), representing 5,337 parcels. The focus of this analysis is Tier I and SPA lands, which are considered by the Service as more optimal for listed species because of their size and connectivity. Tier III lands, which are generally single isolated parcels within a developed subdivision, have far less value, and in many cases, none whatsoever. Lands in Tier I and SPA are targeted for purchase by the county and the Florida Forever program.

The county also discourages development of these lands by assigning negative ROGO development points for habitat and listed species in their permit review process. The county's ROGO allotment allows for a maximum of 6 ROGO allotments for Tier I lands, 3 allocations in the Upper Keys and 3 allocations in the Lower Keys. There are no ROGO restrictions for SPA lands. There are 4,335 parcels in Tier I, 698 parcels SPA lands and 304 parcels in Tier III lands. Tier 1 lands total 4,759 acres, SPA lands total 135 acres and Tier III lands total 65 acres.

Big Pine/No Name HCP

The county plans to conserve habitat on more than 440 lots on Big Pine Key that have been dedicated to the county because of the ROGO competitive process. Much more habitat is scheduled for purchase and protection by various entities in the future. The Big Pine/No Name HCP finalized in June 2006 allows a maximum of 200 lots to be developed on Big Pine Key in the next 20 years. The HCP also accounts for incidental take of the Key deer on these keys. The HCP exempted incidental take for the loss of 168 acres of Key deer habitat. Habitat on the 200 lots proposed for development in the next 20 years must be compensated on a 3:1 basis. Because of the HCP, this BO addresses impacts on potential suitable habitat outside of Big Pine and No Name Keys.

Other Islands

Potential suitable Key deer habitat present on the remaining islands, based on our GIS analyses, is about 17,510 acres, with 12,672 acres in public ownership (72.4 percent). Potential suitable Key deer habitat within at risk vacant lands on the remaining islands is about 3,902 acres, representing 2,875 parcels. Of this acreage 1,643 acres), representing 1,351 parcels, are within CBRA zones (42 percent [1,643/3,902]).

Tier I, SPA, and Tier III Lands: The Service calculated that there are 3,902 acres of at risk habitat in Tier I, SPA, and Tier III designations 3,837 acres in Tier I; 51 acres in SPAs; and 14 acres in Tier III, representing 2,875 parcels. The focus of this analysis is Tier I and SPA lands, which are considered by the Service as more optimal for listed species because of their size and connectivity. Tier III lands, which are generally single isolated parcels within a developed subdivision, have far less value. However, since Key deer are observed in residential development, we are including Tier III lands in our analysis. Lands in Tier I and SPA are targeted for purchase by the county and the Florida Forever program.

The county also discourages development of these lands by assigning negative ROGO development points for habitat and listed species in their permit review process. The county's ROGO allotment allows for a maximum of 6 ROGO allotments for Tier I lands, 3 allocations in the Upper Keys and 3 allocations in the Lower Keys. There are no ROGO restrictions for SPA lands. There are 2,573 parcels in Tier I, 222 parcels SPA lands and 80 parcels in Tier III lands. Tier 1 lands total 3,837 acres, SPA lands total 51 acres and Tier III lands total 14 acres.

Tier 1 Lands: For assessment purposes the Service considers the lands at risk in Tier 1 from the proposed action to be those lands where flood insurance is available, which is 3,837 acres, representing 2,573 parcels. As stated previously, the county's ROGO allotment allows for a maximum of 6 ROGO allotments for Tier I lands, allocations in the Upper Keys and 3 allocations in the Lower Keys. The Service considers the Key deer habitat to be exclusively in the Lower keys. For assessment purposes, the Service is considering that all Lower keys allotments will be in the "other island" lands, a conservative approach. There are 3,837 acres, representing 2,573 parcels in Tier I lands combined, which equates to an average of 1.5 acres of potential suitable habitat per parcel.

Based on an allocation of 3 allotments per year and a 15-year assessment period, we estimate adverse effects to about 68 acres of potential suitable Key deer habitat

(ROGO allotment X total years X acres per lot = total acres [3*15*1.5=67.5]).

Since we cannot determine whether the 3 annual ROGO allotments will occur in CBRA zones or within non-CBRA zones, for assessment purposes we will consider that allotments will be equally balanced as a percentage of the lands in a CBRA zone. For this analysis, the CBRA zone lands [1,642 acres] represent 42.7 percent of the at-risk lands ($1,642/3,837=42.7$). Therefore, we believe the adverse effect to the Key deer from the proposed action in unincorporated Monroe County to be the loss of 39 acres of potential suitable habitat over a 15-year period. This habitat loss represents 0.22 percent of the potential suitable Key deer habitat in the Keys ($39/24,646 = 0.0022$). Based on the current population, we believe this increase will not by itself hinder the survival and recovery of the species. CBRA zone lands are about 28.8 acres and are consider part of our cumulative effects section.

SPA and Tier III Lands: There are 51 acres of SPA lands and 14 acres of Tier III lands at-risk, representing 300 parcels, which equates to 0.22 acres per parcel. Lands within a CBRA zone are represented by 1 acre within SPA lands and less than one acre within Tier III lands, representing 8 parcels. Since there are no ROGO restrictions on these lands, we must consider that development could occur in these lands proportional to the ROGO allotments allowed for all Lower Keys lands. For assessment purposes, we assumed that the allotments would be split by thirds (Upper keys, Middle keys, and Lower keys). Since we consider the Key deer to be in the Lower keys, we project 66 ROGO units per year as the development potential. Ten of these ROGO units have been allocated for Big Pine and No Name Keys (HCP), leaving 55 ROGO units for the remainder of the Lower Keys. We have determined there are about 8,562 vacant developable parcels in the Lower Keys, of which 2,120 parcels are in SPA and Tier III lands, and 224 are on Big Pine and No Name Keys (HCP). The remaining parcels are within Tier I and development is restricted to 3 ROGO units per year. Therefore, the remaining 52 ROGO units will be distributed evenly across the 1,896 parcels ($2,120-224=1,896$), which represents an allotment of 1 ROGO unit per 36 parcels ($2,069/52=36.4$).

Based on the above assessment, we believe that 8 parcels per year will be allocated to the 300 parcels available in the “other lands” ($300/36=8$). The level of development is about 120 parcels over the 15-year period ($8*15$). Using this level of development we estimate that 26.4 acres of at-risk lands will be developed in SPA and Tier III lands ($120*0.22$). This habitat loss represents 0.11 percent of the potential suitable Key deer habitat in the Keys ($26.4/24,676 = 0.0011$). Based on the current population that is at a historical high, we believe this increase will not by itself hinder the survival and recovery of the species.

The habitat loss from ROGO allotments in CBRA zone lands is a component of our cumulative effects assessment. Following the above assessment approach, we calculate the habitat loss to be 1 acre of Tier I and 1.5 acres of SPA and Tier III lands, for a total of 1.5 acres. This habitat loss represents 0.17 percent of the potential suitable Key deer habitat in the Keys ($30.5/24,676 =$

0.0017). We believe this loss will not by itself hinder the survival and recovery of the species, and will be discussed further in our cumulative effects section.

There is no potential suitable Key deer habitat in the following municipalities:

Village of Islamorada

City of Layton

City of Marathon

City of Key West

Habitat fragmentation

Habitat fragmentation by roads and scattered developments has occurred throughout this species' range in the Florida Keys. In our assessment of the development potential in Key deer habitat subject to the proposed action, we determined that the proposed level of development in these lands, which is about 64 acres, would not by itself be significant. In addition, more than twice the Key deer habitat is available in the "Other Islands" as compared to Big Pine and No Name Keys, although the number of Key deer is far less. As a result, the fragmentation of lands associated with development within the "Other Islands" appears to be minimal.

Fencing on residential lots could result in the exclusion of Key deer from some habitat and potentially restrict movement within the action area. These effects should be minimal, as fencing must meet County and Service-approved "deer-friendly" fencing guidelines. The loss of habitat through land clearing and fencing will directly affect feeding, breeding, and sheltering habitat of the Key deer.

Construction activities will cause temporary and localized direct effects near the construction areas. Given that the majority of the activities proposed will occur in areas of low habitat quality or on already disturbed areas, these effects are expected to be minimal.

Indirect effects

Indirect mortality includes vehicular mortality, death by domestic dogs, and other actions such as fire management and introduction or spread of invasive exotic species.

Florida Keys

Traffic Mortality: Road mortality has always been a concern of the Service regarding the Key deer. The table below shows annual Key deer road mortality from 1996 to 2005 (Service, unpublished data), a time in which the Key deer population increased (Lopez 2004). Stated another way, Key deer road mortality is positively related to population increase (Lopez 2004). The table represents the entire Key deer roadkill on all roads within the Keys deer's range in the respective years. Road mortality accounts for about 60 percent of all Key deer mortality (Lopez 2001). The average number of key deer killed by vehicles in the 10-year period was 80. A particularly large number of deer were killed in 2005, which again may in part be ascribed to the health of the Key deer population (Lopez, personal communication, 2006).

Table 14: Total Key Deer Road Mortality in the Florida Keys, 1996-2005

1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
70	88	88	78	69	71	66	91	82	100

An average of about 40 Key deer is killed each year on Highway U.S. 1 in Big Pine Key (Service, unpublished data, 2006a). This accounts for about 35 percent of all Key deer mortality. Vehicles average about 18,000 trips per day on U.S. 1 (FDOT 2004). Therefore, 1 Key deer is killed roughly every 150,000 trips.

Table 15: Key Deer Road Mortality on U.S. 1 on Big Pine Key, 1996-2005

1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
42	48	47	38	35	26	37	47	38	44

Traffic Assessment: Based on proposed ROGO allotments over a 15-year period, we estimate that an additional 5,580 ROGO units will be available. For assessment purposes we consider the ROGO allotments for the City of Key West (92), one-third the allotments for unincorporated Monroe County (66 [197/3=66]), and one-half of the allotments for Marathon (15 [30]2=15) applicable to our Key deer traffic mortality assessment. Although Marathon is north of Key deer habitat, we considered the close proximity of Marathon to be a factor. This assessment provides for a ROGO allotment of 173 units per year for a 15-year period of 2,595 units. Each housing unit generates an average of 8 trips per day (56 per week) (Schanmugam, pers. comm., 2006). If we consider, for example, that each new household from Marathon to and including Key West generates 10 trips per week (18 percent of the total trips generated by a single household) through Big Pine Key on U.S. 1, each unit would generate an additional traffic increase of 520 trips per year. However, this projection is based on a build-out allotment at the end of the 15-year period. For our assessment, we considered the mid-point of 7.5 years to be the appropriate level of effect for our analysis. For first half of the 15-year period, the effect is lower than anticipated and for second half the 15-year period, the effect is greater than anticipated.

On the average over the 15 year period, one-half of the 2,595 units, 1,298 units, allocated will have an effect since there will be zero units at the beginning of the first year and 1,298 units at the end of year 15. Considering that one deer is killed for every 164,250 trips ([18,000*365]/40=164,250), the 1,298 units would equate to an increase in deer-traffic mortality of about 4 deer per year on U.S. 1 (520*1,298/164,250= 4.11). This level of mortality represents an increase in the baseline from 40 to 44 deer per year, an increase of 10.0 percent above existing levels of deer-traffic mortality. This level of mortality, based on a current population estimate of 650 individuals (Lopez 2004), with a current US 1deer-traffic mortality represented by 6.1 percent (40/650=0.061) of the current population, would increase from 6.1 percent to 6.8 percent (44/650=0.068), a 0.7 percent increase above base levels. The Service believes that an increase in traffic-related base level deer mortality in the 0.7 percent range, based on current population levels, will not adversely affect the survival and recovery of Key Deer.

Fire suppression in pine rocklands, due to the proximity of development, will also result in deterioration of important Key deer habitat. Fire suppression causes ecological succession that

results in increased hardwood cover, decreased herbaceous cover, reduced light penetration, and a general deterioration of habitat quality for Key deer. These represent minor effects to the Key deer. Other indirect effects of more residential development may include harassment or harm by free-roaming pets (dogs) or human activity.

Summary – Changes since 1997 and 2003 BOs

In general, the habitat loss and indirect effects identified in this analysis are more realistic than the build-out scenario assumed in the 1997 and 2003. This BO's methodology benefited from advances in GIS data and a detailed lot-by-lot review guided by the ROGO allocation process. The build-out scenario assumed in the 1997 and 2003 opinions, applied to the current information would identify the acres of at risk from the proposed actions as being 3,902 acres affecting 2,875 parcels. Our analysis incorporates the ROGO development restrictions and identifies the acres of at risk habitat as being 64 acres affecting 164 parcels.

The Key deer population is at or near an all-time high, and recent relocation efforts have returned the species to parts of its historic range. Furthermore, all the impacts to Key deer on Big Pine Key, the core population, were already addressed in the recently finalized HCP and will be offset with habitat protection at a 3:1 ratio. In general, the habitat loss and indirect effects identified in this analysis are more realistic than the build-out scenario assumed in the 1997 and 2003. This BO's methodology benefited from advances in GIS data and a detailed lot-by-lot review guided by the ROGO allocation process. We have estimated that the proposed action will result in adverse effects to about 90 acres of Key deer habitat on "Other Islands," most of which is not occupied today, which represents about 0.4 percent of the 24,676 acres of potential suitable Key deer habitat in the Keys. More than twice the Key deer habitat is available in the "Other Islands" as compared to Big Pine and No Name Keys, although the number of Key deer is far less. As a result, impacts from fragmentation associated with 90 acres of habitat loss appear minimal.

We also believe that the associated increase in traffic on U.S. 1 will result in an increase in deer traffic mortality of 4 deer per year for a total mortality of 60 deer. This increase in base mortality of 4 deer per year represents an increase of 0.7 percent. Because of the historically high population size of Key deer and the recent success of reintroduction efforts, this level of mortality is not significant (Lopes, personal communication, 2006). In summary, we believe the level of habitat loss, traffic-related mortality, and possible fragmentation analyzed in the BO will not adversely affect survival and recovery of the Key deer. We also believe implementation of the technical assistance process outlined at the end of this BO will help minimize any potentially negative effects (e.g., ensuring appropriate fencing).

Key Largo cotton mouse

In the discussions that follow, loss of habitat is evaluated on a "worst case scenario" basis. One assumption is that if a property is developed, all habitat on that unit will be lost. We discussed previously the open space requirements of Monroe County, the Village of Islamorada, and the City of Marathon. Clearing is limited to 10 to 30 percent in high quality habitat and 50 to 70

percent in moderate to low quality habitat. Therefore, a maximum of 70 percent of our affected habitat assessment can actually occur. Generally, only 10 percent of likely occupied (high and moderate quality) habitat (Tier I) can be cleared in Monroe County and a maximum of 30 percent in the municipalities. Additional regulations require preservation or restoration of habitat to offset vegetation losses that result from development. Fragmentation of habitat will nevertheless occur. However, fragmentation will be offset to an unknown degree by preservation or by restoration, creating more continuity in other fragmented habitat. The Service is unable to evaluate the true effects of these beneficial actions, but acknowledges that the benefits are tangible mitigating measures. In essence, the programs are already helping to avoid and minimize negative impacts to potential suitable habitat.

Population

The current population of this species is unknown. However, the most current estimates based on Frank et al., (1997) is an estimate of 6.2 Key Largo cotton mice per acre over an area of 2,147 acres, or 5,456 individuals.

Florida Keys

The current known range of the mouse is from the intersection of U.S. 1 and C.R. 905 north to the Ocean Reef Club.

Unincorporated Monroe County

In addition to North Key Largo, South Key Largo has habitat potential suitable for the cotton mouse, but known occurrences there have not been documented in recent years.

There is no potential suitable Key Largo cotton mouse habitat in the following municipalities:

Village of Islamorada

City of Layton

City of Marathon

City of Key West

Habitat loss

Potential suitable habitat for the cotton mouse is tropical hardwood hammock and includes all of Key Largo north of the U.S. 1 and S.R. 905 intersection (Service 1993c) and tropical hardwood hammocks greater than 12 acres from the intersection of U.S. 1 and C.R. 905 south to, but not including Tavernier on South Key Largo. Hammocks south of North Key Largo were also considered viable Key Largo cotton mouse habitat even though many are isolated from the source population, fragmented, may contain feral and domestic cats, and are generally poor condition in terms of supporting a viable Key Largo cotton mouse population. However, current

data as to the presence or absence of the cotton mice in South Key Largo is lacking; therefore, to be conservative, potential habitat in South Key Largo was included pending further information.

Florida Keys

We determined there is a total of 3,115 acres of potential Key Largo cotton mouse habitat in Monroe County. Of these, 2,433 acres are located on conservation lands not subject to development (78 percent).

North Key Largo: The lands in North Key Largo north of the U.S. 1 and S.R. 905 intersection (the known occupied habitat) are about 2,103 acres of which 1,862 acres are in public ownership (88.5 percent).

South Key Largo: The lands in South Key Largo, which only have historic records of occurrence, are about 1,012 acres of which 571 acres are in public ownership (56 percent).

Unincorporated Monroe County

North Key Largo – Tier I, SPA, and Tier III Lands: The Service calculated that there are 21 acres of at risk habitat in Tier I, SPA, and Tier III designations (Tier I=1.21 acres, SPA=0.0 acres, and Tier III=0.0 acres). The focus of this analysis is Tier I and SPA lands, which are considered by the Service as more optimal for listed species because of their size and connectivity. The focus of this analysis is Tier I and SPA lands, which are considered by the Service as more optimal for listed species because of their size and connectivity. Tier III lands, which are generally single isolated parcels within a developed subdivision, have far less value. The county also discourages development of these lands by assigning negative ROGO development points for habitat and listed species in their permit review process. The county's ROGO allotment allows for a maximum of 6 ROGO allotments for Tier I lands, 3 allocations in the Upper Keys and 3 allocations in the Lower Keys.

North Key Largo – Tier I Lands: The Service calculated that there are 21 acres of Tier I at-risk lands represented by 62 parcels for an average of 0.34 acres per parcel. Since North Key Largo is considered the Upper keys, for assessment purposes we are considering that 3 ROGO units per year will be allotted to this area. Based on an allocation of 3 allotments per year and a 15-year assessment period, we estimate adverse effects to about 15.3 acres of potential suitable Key Largo cotton mouse habitat

(ROGO allotment X total years X acres per lot = total acres [3*15*0.34=15.3]).

Since we cannot determine whether the 3 annual ROGO allotments will occur in CBRA zones or within non-CBRA zones, for assessment purposes we will consider that allotments will be equally balanced as a percentage of the lands inside and outside of the CBRA zone. For this analysis, the CBRA zone lands [19 acres] represent 90 percent of the at-risk lands (19/21=0.9), or 13.77 acres (15.3*0.9=13.77). Therefore, we believe the adverse effect to the Key Largo

cotton mouse from the proposed action in unincorporated Monroe County to be the loss of 1.53 acres of potential suitable habitat over a 15-year period ($15.3 \times 0.1 = 1.53$ acres). This habitat loss represents 0.1 percent of the potential suitable Key Largo cotton mouse habitat in North Key Largo ($1.53 / 2,103 = .001$).

North Key Largo – Tier I Lands: The habitat loss from ROGO allotments in CBRA zone lands is a component of our cumulative effects assessment. Following the above assessment approach, we calculate the habitat loss to be 13.77 acres of potential suitable habitat over a 15-year period ($15.3 \times 0.9 = 13.77$). This habitat loss represents 0.65 percent of the potential suitable Key Largo cotton mouse habitat in North Key Largo and will be discussed further in our cumulative effects section ($13.77 / 2,103 = .0065$).

North Key Largo – SPA Lands: No SPA or Tier III lands are at risk.

South Key Largo – Tier I, SPA, and Tier III Lands: The Service calculated that there are 176 acres of at-risk lands in Tier I, SPA, and Tier III designations (Tier I= 148 acres, SPA=20 acres, and Tier III=8 acres), represented by 505, 154, and 145 parcels, respectively. The focus of this analysis is Tier I and SPA lands, which are considered by the Service as more optimal for listed species because of their size and connectivity. Tier III lands, which are generally isolated parcels within a developed subdivision, have far less value, and in many cases, none whatsoever. Lands in Tier I and SPA are targeted for purchase by the county and the Florida Forever program. The county also discourages development of these lands by assigning negative ROGO development points for habitat and listed species in their permit review process. The county's ROGO allotment allows for a maximum of 6 ROGO allotments for Tier I lands, 3 allocations in the Upper Keys and 3 allocations in the Lower Keys.

South Key Largo – Tier I Lands: There are 505 parcels in Tier I lands, for a total acreage of 148 acres in vacant parcels representing 0.29 acres of potential suitable habitat per parcel. ROGO allotments in Tier I lands in the Upper Keys are restricted to 3 per year. This BO analyzed these 3 units previously in the North Key Largo section above. As a result, no habitat loss is expected in Tier I lands in South Key Largo.

South Key Largo – Tier I CBRA Lands: The habitat loss from ROGO allotments in CBRA zone lands is a component of our cumulative effects assessment. We estimate that 51 percent of the habitat at risk is in CBRA zone lands. Based on the allocation of 3 ROGO units per year over a 15-year period, we calculate the habitat loss to be 6.7 acres of potential suitable habitat over a 15-year period. This habitat loss represents 0.67 percent of the potential suitable Key Largo cotton mouse habitat in South Key Largo ($6.7 / 1,012 = 0.0067$) and will be discussed further in our cumulative effects section.

South Key Largo – SPA Lands: There are 154 parcels in SPA lands, for a total acreage of 20 acres in vacant parcels representing 0.13 acres of potential suitable habitat per parcel. Since there are no ROGO restrictions on SPA lands, we must consider that development could occur in these lands at the same frequency of Tier III lands. For this analysis, SPA and Tier III lands represent 299 parcels (52 percent SPAs and 48 percent Tier III with 154 and 145 parcels,

respectively). With an allotment of 66 ROGO units per year in northern unincorporated Monroe County over a 15-year period, this equates to 990 ROGO units, of which 515 represent SPA allotments

(ROGO allotment X total years X % SPA units = total SPA units [66*15*0.52=515]).

This allotment exceeds the available SPA parcels. Therefore, we assume that all 20 acres of SPA lands, represented by 154 parcels will be developed. This loss equates to 1.97 percent of the potential suitable Key Largo cotton mouse habitat in South Key Largo ($20/1,012 = 0.0197$).

South Key Largo – SPA CBRA Lands: There are no CBRA zone lands present.

Habitat fragmentation

Florida Keys

The range of the Key Largo cotton mouse has declined by more than 50 percent because of habitat loss to land clearing for residential and commercial construction (National Society, et al. 1990, Brown 1978a, Hersh 1981, Barbour and Humphrey 1982b). Most of the remaining habitat is restricted to hammock remnants on the northern portion of Key Largo (Fig. 20). A number of the larger portions in South Key Largo's remaining habitat are fragmented and surrounded by residential housing. Because this species requires relatively large areas of mature hammocks that are free from human disturbance (Brown 1978b, Hersh 1981, Barbour and Humphrey 1982b), we do not believe these cotton mice will use habitat adjacent to human residences and commercial areas.

Unincorporated Monroe County

The at-risk lands in unincorporated Monroe County were about 631 acres, representing 1,388 parcels and include parcels within developed subdivisions and parcels within more rural settings. The Tier 1 and SPA lands total about 189 acres and are considered by the Service as those lands that could be subject to fragmentation by development. In our assessment of the development potential in these lands, we calculated that 23 acres could be developed. To our knowledge, South Key Largo is not occupied, and this may be a function of fragmentation and residential development currently in place. We expect this action will result in some fragmentation of habitat, which could further exacerbate previous fragmentation.

Indirect Effects

Mortality from feral and domestic cats may be the greatest current threat to the persistence of the Key Largo cotton mouse. It is well known that mice and rats are a major component of cats' diets. The number of cats present in the Lower Keys has increased over the past 20 years commensurate with the increase in the human residential population.

To assess the effects that feral cats may have on the extant populations of Key Largo cotton mouse, we used the buffers outlined previously (Frank, personal communication, 1996). Based

on our GIS analysis we have determined that there are about 5,486 acres of buffer lands surrounding potential suitable Key Largo cotton mouse habitat, of which 5,027 acres are in government ownership (91.6 percent). At-risk vacant buffer lands are about 398.5 acres, which is represented by 433 vacant parcels. We have also determined that there are an additional 774 developed residential parcels within the buffer lands, for a combined estimate of 1,207 residential parcels.

Our cat predation analysis is predicated on the estimated number of cats within the buffer lands surrounding the Key Largo cotton mouse habitat. Researchers have shown that 34 percent of the units (residences) have cats (FWC 2003) and that, on average, each household has 2.1 cats. This research also demonstrates that on average 40 percent of the cats are exclusively indoor pets, which relates to 60 percent are occasionally outdoors and occasionally will stalk prey in cotton mouse potential suitable habitat. Following this approach, we estimate that there are currently, based on 774 residences in the buffer lands, an estimated population of 552.6 cats, with 331.6 cats occasionally outdoors

(residences X % of residences with cats X number cats per residence= total cats
[774*0.34*2.1=552.6])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [774*0.34*2.1*0.60=331.6]).

The FWC (2003) study also provides an estimate of feral cats as a component of domestic cats, which is that the feral cat population is about 2/3 of the domestic cats ($0.67*552.6=370.2$). Based on this analysis we estimate the current population of domestic cats and feral cats that could have an adverse effect to the cotton mouse to be 701.8 cats ($331.6+370.2=701.8$).

Although we cannot quantify the amount of take to the species from cat predation, we believe this threat could cause a significant adverse effect and has the potential to adversely affect survival and recovery.

North Key Largo Increase in Cats – Tier I Lands: Our habitat loss analysis provided for a loss of 1.5 acres from the proposed action. Based on an average parcel size of 0.34 acres per parcel, the habitat loss equates to an increase of 4.1 new residences ($1.5/0.34=4.1$). Following our cat population increase analysis, an increase of 4.1 residences equates to an increase of 2.9 cats with 1.7 cats being occasionally outdoors over the 15-year review period

(residences X % of residences with cats X number cats per residence= total cats
[4.1*0.34*2.1=2.9])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [4.1*0.34*2.1*0.60=1.7]).

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the projected outside cat population over the 15-year period is estimated at 3.6 cats ($2.9*0.67+1.7=3.6$).

South Key Largo Increase in Cats: The Service did not complete a cat predation analysis in South Key Largo because we do not believe cotton mice are present at this time. However, we are considering this habitat as an area of interest in our habitat analysis because of its historical occupancy.

North Key Largo Increase in Cats – Tier I Buffer Lands: There are 167 parcels, totaling 382 acres in Tier I buffer lands. ROGO allotments in Tier I lands in this area are restricted to 3 per year. This BO analyzed these 3 units previously in the North Key Largo section above. As a result, no additional habitat loss or cat predation losses are expected in Tier I lands in the buffer lands.

North Key Largo Increase in Cats – SPA Buffer Lands: There are only 10 parcels available in SPA lands in the buffer lands, totaling 1.5 acres, with no lands in CBRA zones. Based on an allotment of 63 ROGO units (66-3 from Tier I) per year in northern unincorporated Monroe County over a 15-year period, this equates to 945 ROGO units, of which 491 represent SPA allotments

(ROGO allotment X total years X % SPA units = total SPA units [63*15*0.52=491]).

This allotment exceeds the available SPA parcels. Therefore for our cat predation assessment, 10 parcels will be developed, which equates to an increase of 7.14 cats with 4.28 cats being occasionally outdoors

(residences X % of residences with cats X number cats per residence=total cats
[10*0.34*2.1=7.14 cats])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [10*0.34*2.1*0.60=4.28]) over the 15-year period.

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the projected outside cat population over the 15-year period is estimated at 9 cats (7.14*.67+4.28=9).

North Key Largo Increase in Cats – Tier III Buffer Lands: There are 99 parcels available in Tier III buffer lands totaling 15 acres, with one parcel totaling 0.5 acres in CBRA zones. Development in Tier III lands is also based on the available ROGO units. An allotment of 63 ROGO units (66-3 from Tier I) per year in northern unincorporated Monroe County over a 15-year period equates to 945 ROGO units. The allotment exceeds the available Tier III parcels in the buffer lands, which is 99 parcels. Therefore, we assume that all 99 parcels will be developed. Development of 99 parcels equates to an increase of 70.7 cats with 42.4 cats being occasionally outdoors

(residences X % of residences with cats X number cats per residence = total cats
[99*0.34*2.1=70.7])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [99*0.34*2.1*0.60=42.4]) over the 15-year period.

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the projected outside cat population over the 15-year period is estimated at 89.9 cats (70.7*0.67+9.4=89.8).

North Key Largo Increase in Cats – CBRA Zone: As discussed above, 90 percent of the Tier I expected development is in the CBRA zone (13.77 acres), with an average parcel size of 0.34 acres. This level of development equates back to 41 units (residences) (13.77/0.34=40.5). Following our cat predation analysis referenced above, the development of 41 additional units represents an increase of 29.3 cats with 18 cats occasionally outdoors

(residences X % of residences with cats X number cats per residence = total cats [40.5*0.34*2.1=29.3])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [40.5*0.34*2.1*0.60=18]).

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the project cat population over the 15-year period is estimated at 37.2 cats (29.3*0.67+18=37.2).

North Key Largo Increase in Cats – CBRA Buffer Zone: Based on our GIS analysis, one parcel is in a CBRA zone, represented by 1.0 acres. This level of development equates back to 1 unit (residences). Following our cat predation analysis referenced above, the development of 1 additional units represents an increase of 0.7 cats with 0.43 cats occasionally outdoors

(residences X % of residences with cats X number cats per residence = total cats [1*0.34*2.1=0.7])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [1*0.34*2.1*0.60=0.43]).

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the projected cat population over the 15-year period is estimated at 0.9 cats (0.7*.67+0.428=0.897).

The build-out scenario assumed in the 1997 and 2003 opinions, applied to the current information would identify the acres of at risk from the proposed actions as being 197 acres impacting 721 parcels. Our analysis incorporates the ROGO development restrictions and identifies the acres of at risk habitat as being 21.5 acres affecting 158 parcels. In general, the habitat loss and indirect effects identified in this analysis are more realistic than the build-out scenario assumed in the 1997 and 2003. This BO's methodology benefited from advances in GIS data and a detailed lot-by-lot review guided by the ROGO allocation process.

North Key Largo: The Key Largo cotton mouse is a rare Upper Keys endemic, existing at extremely low densities where it occurs. Our analysis has identified habitat loss from the proposed action to be 1.5 acres from development and an increase in the free roaming cat population of 51 cats with 2 from development in potential suitable habitat and 49 from development in the buffer lands. This level of habitat loss represents 0.07 percent of potential suitable habitat in North Key Largo ($1.5/2,103 = .0007$).

North Key Largo CBRA Zone: Our analysis has identified habitat loss from the proposed actions in CBRA zones to be the loss of 13.77 acres from development and an increase in the free roaming cat population of 19 cats with 18 from development in potential suitable habitat and 1 from development in the buffer lands. This level of habitat loss represents 0.65 percent of potential suitable habitat in North Key Largo ($13.77/2103 = .0065$). This impact is considered in the Cumulative Effects analysis of this BO.

South Key Largo: Our analysis has identified habitat loss from the proposed action to be the loss of 20 acres from development. This level of habitat loss represents 1.98 percent of potential suitable habitat in South Key Largo ($20/1,012 = .0198$).

South Key Largo CBRA Zone: Our analysis has identified habitat loss from the proposed action to be the loss of 1.44 acres from development. This level of habitat loss 0.14 percent of potential suitable habitat in South Key Largo ($1.44/1,012 = .0014$) and will be further analyzed in our cumulative effects section.

Summary – Changes since 1997 and 2003 opinions

North Key Largo: The Key Largo cotton mouse is a rare Upper Keys endemic, existing at extremely low densities where it occurs. Our analysis has identified habitat loss from the proposed action to be 1.5 acres from development and an increase in the free roaming cat population of 51 cats with 2 from development in potential suitable habitat and 49 from development in the buffer lands. This level of habitat loss represents 0.07 percent of potential suitable habitat in North Key Largo ($1.5/2,103 = .0007$).

North Key Largo CBRA Zone: Our analysis has identified habitat loss from the proposed actions in CBRA zones to be the loss of 13.77 acres from development and an increase in the free roaming cat population of 19 cats with 18 from development in potential suitable habitat and 1 from development in the buffer lands. This level of habitat loss represents 0.65 percent of potential suitable habitat in North Key Largo ($13.77/2103 = .0065$). This impact is considered in the Cumulative Effects analysis of this BO.

South Key Largo: Our analysis has identified habitat loss from the proposed action to be the loss of 20 acres from development. This level of habitat loss represents 1.98 percent of potential suitable habitat in South Key Largo ($20/1,012 = .0198$).

South Key Largo CBRA Zone: Our analysis has identified habitat loss from the proposed action to be the loss of 1.44 acres from development. This level of habitat loss 0.14 percent of potential suitable habitat in South Key Largo ($1.44/1,012 = .0014$) and will be further analyzed in our cumulative effects section.

Since the 1997 and 2003 BOs were completed, no new information has been generated that suggests the Key Largo cotton mouse's endangered condition has changed. In general, the habitat loss and indirect effects identified in this BO have been updated from the build-out scenario assumed in the 1997 and 2003. This BO's methodology benefited from advances in GIS data and a detailed lot-by-lot review guided by the ROGO allocation process. Despite this, however, the loss of habitat and related indirect effects calculated in the BO predict a series of impacts that could exacerbate the endangered status of the Key Largo cotton mouse. Implementing the technical review of individual projects described in the technical assistance process at the end of this document will address this concern.

Key Largo woodrat

In the discussions that follow, loss of habitat is evaluated on a "worst case scenario" basis. One assumption is that if a property is developed, all habitats on that unit will be lost. We discussed previously the open space requirements of Monroe County, the Village of Islamorada, and the City of Marathon. Clearing is limited to 10 to 30 percent in high quality habitat and 50 to 70 percent in moderate to low quality habitat. Therefore, a maximum of 70 percent of our affected habitat assessment can actually occur. Generally, only 10 percent of likely occupied (high and moderate quality) habitat (Tier I) can be cleared in Monroe County and a maximum of 30 percent in the municipalities. Additional regulations require preservation or restoration of habitat to offset vegetation losses that result from development. Fragmentation of habitat will nevertheless occur. However, fragmentation will be offset to an unknown degree by preservation or by restoration, creating more continuity in other fragmented habitat. The Service is unable to evaluate the true effects of these beneficial actions, but acknowledges that the benefits are tangible mitigating measures. In essence, the programs are already helping to avoid and minimize negative impacts to potential suitable habitat.

Population

The current population of this species is unknown. However, the most recent estimate (2005) of the population is believed to be fewer than 200 individuals distributed over an area of about 2,147 acres.

Florida Keys

The current known range of the woodrat is from the intersection of U.S. 1 and C.R. 905 north to the Ocean Reef Club.

Unincorporated Monroe County

In addition to North Key Largo, South Key Largo has habitat potentially suitable for the woodrat, but known occurrences there have not been documented in recent years.

There is no potential suitable Key Largo woodrat habitat in the following municipalities:

Village of Islamorada

City of Layton

City of Marathon

City of Key West

Habitat loss

Potential suitable habitat for the woodrat is tropical hardwood hammock and includes all of Key Largo north of the U.S. 1 and S.R. 905 intersection (Service 1993c) and tropical hardwood hammocks greater than 12 acres from the intersection of U.S. 1 and C.R. 905 south to, but not including Tavernier on South Key Largo. Hammocks south of North Key Largo were also considered viable Key Largo woodrat habitat even though many are isolated from the source population, fragmented, may contain feral and domestic cats, and are generally poor condition in terms of supporting a viable Key Largo woodrat population. However, current data as to the presence or absence of the woodrats in South Key Largo is lacking, therefore South Key Largo habitat is included as a conservative approach, pending further information.

Florida Keys

We determined there is a total of 3,115 acres of potential Key Largo woodrat habitat in Monroe County. Of these, 2,433 acres are located on conservation lands not subject to development (78 percent).

North Key Largo: The lands in North Key Largo north of the U.S. 1 and S.R. 905 intersection (the known occupied habitat) are about 2,103 acres of which 1,862 acres are in public ownership (88.5 percent).

South Key Largo: The lands in South Key Largo, which only have historic records of occurrence, are about 1,012 acres of which 571 acres are in public ownership (56 percent).

Unincorporated Monroe County

North Key Largo – Tier I, SPA, and Tier III lands: The Service calculated that there are 21 acres of at risk habitat in Tier I, SPA, and Tier III designations (Tier I=1. 21 acres, SPA= 0.0 acres, and Tier III=0.0 acres). The focus of this analysis is Tier I and SPA lands, which are considered by the Service as more optimal for listed species because of their size and connectivity. Tier III lands, which are generally isolated parcels within a developed subdivision, have far less value, and in many cases, none whatsoever. Lands in Tier I and SPA are targeted for purchase by the

county and the Florida Forever program. The county also discourages development of these lands by assigning negative ROGO development points for habitat and listed species in their permit review process. The county's ROGO allotment allows for a maximum of 6 ROGO allotments for Tier I lands, 3 allocations in the Upper Keys and 3 allocations in the Lower Keys.

North Key Largo – Tier I Lands: The Service calculated that there are 21 acres of Tier I at-risk lands represented by 62 parcels for an average of 0.34 acres per parcel. Since North Key Largo is considered the Upper keys, for assessment purposes we are considering that 3 ROGO units per year will be allotted to this area. Based on an allocation of 3 allotments per year and a 15-year assessment period, we estimate adverse effects to about 15.3 acres of potential suitable Key Largo woodrat habitat

(ROGO allotment X total years X acres per lot = total acres affected [3*15*0.34=15.3]).

Since we cannot determine whether the 3 annual ROGO allotments will occur in CBRA zones or within non-CBRA zones, for assessment purposes we will consider that allotments will be equally balanced as a percentage of the lands inside and outside of the CBRA zone. For this analysis, the CBRA zone lands [19 acres] represent 90 percent of the at-risk lands ($19/21=0.9$), or 13.77 acres ($15.3*0.9=13.77$). Therefore, we believe the adverse effect to the Key Largo woodrat from the proposed action in unincorporated Monroe County to be the loss of 1.53 acres of potential suitable habitat over a 15-year period ($15.3*0.1= 1.53$ acres). This habitat loss represents 0.1 percent of the potential suitable Key Largo cotton mouse habitat in North Key Largo ($1.53/2,103=.001$).

North Key Largo – Tier I CBRA Lands: The habitat loss from ROGO allotments in CBRA zone lands is a component of our cumulative effects assessment. Following the above assessment approach, we calculate the habitat loss to be 13.77 acres of potential suitable habitat over a 15-year period ($15.3*0.9=13.77$). This habitat loss represents 0.65 percent of the potential suitable Key Largo woodrat habitat in North Key Largo and will be discussed further in our cumulative effects section ($13.77/2,103=.0065$).

North Key Largo – SPA Lands: No SPA or Tier III are at-risk lands.

South Key Largo – Tier I, SPA, and Tier III Lands: The Service calculated that there are 176 acres of at-risk lands habitat in Tier I, SPA, and Tier III designations (Tier I=148 acres, SPA=20 acres, and Tier III=8 acres), represented by 505, 154, and 145 parcels, respectively. The focus of this analysis is Tier I and SPA lands, which are considered by the Service as more optimal for listed species because of their size and connectivity. Tier III lands, which are generally isolated parcels within a developed subdivision, have far less value, and in many cases, none whatsoever. Lands in Tier I and SPA are targeted for purchase by the county and the Florida Forever program. The county also discourages development of these lands by assigning negative ROGO development points for habitat and listed species in their permit review process. The county's ROGO allotment allows for a maximum of 6 ROGO allotments for Tier I lands, 3 allocations in the Upper Keys and 3 allocations in the Lower Keys.

South Key Largo – Tier I Lands: There are 505 parcels in Tier I lands, for a total acreage of 148 acres in vacant parcels representing 0.29 acres of potential suitable habitat per parcel. ROGO allotments are restricted to 3 ROGO units per year in Tier I lands, and our analysis considered them in the North Key Largo section above. No additional habitat loss is expected in Tier I lands in the species range.

South Key Largo – Tier I CBRA Lands: The habitat loss from ROGO allotments in CBRA zone lands is a component of our cumulative effects assessment. We estimate that 51 percent of the habitat at risk is in CBRA zone lands. Based on the allocation of 3 ROGO units per year over a 15-year period, we calculate the habitat loss to be 6.7 acres of potential suitable habitat over a 15-year period. This habitat loss represents 0.67 percent of the potential suitable Key Largo woodrat habitat in South Key Largo ($6.7/1,012 = 0.0067$) and will be discussed further in our cumulative effects section.

South Key Largo – SPA Lands: There are 154 parcels in SPA lands, for a total acreage of 20 acres in vacant parcels representing 0.13 acres of potential suitable habitat per parcel. Since there are no ROGO restrictions on SPA lands, we must consider that development could occur in these lands at the same frequency of Tier III lands. For this analysis, SPA and Tier III lands represent 299 parcels (52 percent SPAs and 48 percent Tier III with 154 and 145 parcels, respectively). With an allotment of 63 ROGO units (66-3 from Tier I) per year in northern unincorporated Monroe County, over a 15-year period, this equates to 945 ROGO units, of which 491 represent SPA allotments

(ROGO allotment X total years X % SPA lots = ROGO units [$63*15*0.52=491$]).

This allotment exceeds the available SPA parcels. Therefore, we assume that all 20 acres of SPA lands, represented by 154 parcels will be developed, resulting in the loss of all 20 acres of potential suitable Key Largo woodrat habitat. There are no CBRA zone lands present. This loss equates to 1.97 percent of the potential suitable Key Largo woodrat habitat in South Key Largo ($20/1,012 = 0.0197$).

South Key Largo – SPA CBRA Lands: There are no CBRA zone lands present.

Habitat fragmentation

Florida Keys

The range of the Key Largo woodrat has declined by more than 50 percent, because of habitat loss to land clearing for residential and commercial construction (National Audubon Society, et al. 1990, Brown 1978a, Hersh 1981, Barbour and Humphrey 1982b). Most of the remaining habitat is restricted to hammock remnants on the northern portion of Key Largo (Fig. 20). A number of the larger portions in South Key Largo of the remaining habitat are fragmented and surrounded by residential housing. Because this species requires relatively large areas of mature hammocks that are free from human disturbance (Brown 1978b, Hersh 1981, Barbour and

Humphrey 1982b), we do not believe these woodrats will not use habitat adjacent to human residences and commercial areas.

Unincorporated Monroe County

The at-risk lands in unincorporated Monroe County are about 631 acres, representing 804 parcels and include parcels within developed subdivisions and parcels within more rural settings. The Tier 1 and SPA lands total about 537 acres and are considered by the Service as those lands that could be subject to fragmentation by development. In our assessment, we determined that the level of development expected in these lands is about 23 acres. To our knowledge, South Key Largo is not occupied, and this may be a function of fragmentation and residential development currently in place. We expect this action will result in some fragmentation of habitat, which could further exacerbate previous fragmentation.

Indirect effects

Mortality from feral and domestic cats may be the greatest current threat to the persistence of the Key Largo woodrat. It is well known that mice and rats are a major component of cats' diets. The number of cats present in the Lower Keys has increased over the past 20 years commensurate with the increase in the human residential population.

To assess the effects that feral cats may have on the extant populations of Key Largo woodrat, we used the 500 meter buffer identified in "Status of the species in the action area" for Lower Keys marsh rabbits (Frank, GFC, personal communication, 1996). Based on our GIS analysis we have determined that there are about 5,486 acres of "buffer lands" surrounding potential suitable Key Largo woodrat habitat, of which 5,027 acres are in government ownership (91.6 percent). At-risk vacant buffer lands are about 398.5 acres, which is about 433 vacant parcels. We have also determined that there are an additional 774 developed residential parcels within the buffer lands, for a combined estimate of 1,207 residential parcels.

Our cat predation analysis is predicated on the estimated number of cats within the buffer lands surrounding the Key Largo woodrat habitat. Researchers have shown that 34 percent of the units (residences) have cats (FWC, 2003) and that on an average each household has 2.1 cats. This research also demonstrates that on average 40 percent of the cats are exclusively indoor pets, which relates to 60 percent are occasionally outdoors and occasionally will stalk prey in woodrat potential suitable habitat. Following this approach, we estimate that there are currently, based on 774 residences in the buffer lands, an estimated population of 552.6 cats, with 331.6 cats occasionally outdoors

(residences X % of residences with cats X number cats per residence=total cats [774*0.34*2.1 = 552.6])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [774*0.34*2.1*0.60=331.6]).

The FWC (2003) study also provides an estimate of feral cats as a component of domestic cats, which is that the feral cat population is about 2/3 of the domestic cats ($0.67 \times 552.6 = 370.2$). Based on this analysis we estimate the current population of domestic cats and feral cats that could have an adverse effect to the woodrat to be 701.8 cats ($331.6 + 370.2 = 701.8$).

Although we cannot quantify the amount of take to the species from cat predation, we believe this threat could cause a significant adverse effect and has the potential adversely affect survival and recovery.

North Key Largo Increase in Cats – Tier I Lands: Our habitat loss analysis provided for a loss of 1.5 acres from the proposed action. Based on an average parcel size of 0.34 acres per parcel, the habitat loss equates to an increase of 4.1 new residences ($1.5 / 0.34 = 4.1$). Following our cat population increase analysis, an increase of 4.1 residences equates to an increase of 2.9 cats with 1.7 cats being occasionally outdoors over the 15-year review period

(residences X % of residences with cats X number cats per residence= total cats
[$4.1 \times 0.34 \times 2.1 = 2.9$])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [$4.1 \times 0.34 \times 2.1 \times 0.60 = 1.7$]).

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the projected outside cat population over the 15-year period is estimated at 3.6 cats ($2.9 \times 0.67 + 1.7 = 3.6$).

North Key Largo Increase in Cats – Tier I Buffer Lands: There are 167 parcels, totaling 382 acres in Tier I buffer lands. Since ROGO allotments are restricted to 3 ROGO units per year in Tier I lands, whether the allotments are in at-risk lands in potential suitable habitat or at-risk lands in the buffer lands, and we have provided our estimated increase in the number of cats as if they were in potential suitable habitat, no additional increase in cats is expected in Tier I buffer lands.

North Key Largo Increase in Cats – SPA Buffer Lands: There are only 10 parcels available in SPA lands in the buffer lands, totaling 1.5 acres, with no lands in CBRA zones. There are only 10 parcels available in SPA lands in the buffer lands. Based on an allotment of 63 ROGO units (66-3 from Tier I) per year in northern unincorporated Monroe County, over a 15-year period, this equates to 945 ROGO units, of which 491 represent SPA allotments

(ROGO allotment X total years X % SPA lots = ROGO units [$63 \times 15 \times 0.52 = 491$]).

This allotment exceeds the available SPA parcels including the 154 parcels in the potential suitable habitat lands. Therefore for our cat predation assessment, 10 parcels will be developed, which equates to an increase of 7.14 cats with 4.28 cats being occasionally outdoors

(residences X % of residences with cats X number cats per residence=total cats
[$10*0.34*2.1=7.14$ cats])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [$10*0.34*2.1*0.60=4.28$]) over the 15-year period.

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the projected outside cat population over the 15-year period is estimated at 9 cats ($7.14*.67+4.28=9$).

North Key Largo Increase in Cats – Tier III Buffer Lands: There are 99 parcels available in Tier III buffer lands, totaling 15 acres, with 1 parcel totaling 0.5 acres in CBRA zones. Development in Tier III lands is also based on the available ROGO units. Based on an allotment of 63 ROGO units (66-3 from Tier I) per year in northern unincorporated Monroe County over a 15-year period, this equates to 945 ROGO units, of which 491 represent SPA allotments

(ROGO allotment X total years X % SPA lots = ROGO units [$63*15*0.52=491$]).

This allotment exceeds the available Tier III parcels in the buffer lands, which is 99 parcels. Therefore, we assume all 99 parcels will be developed. This equates to an increase of 70.7 cats with 42.4 cats being occasionally outdoors

(residences X % of residences with cats X number cats per residence=total cats
[$99*0.34*2.1=70.7$])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [$99*0.34*2.1*0.60=42.4$]) over the 15-year period.

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the projected outside cat population over the 15-year period is estimated at 89.9 cats ($70.7*.67+9.4=89.9$).

North Key Largo Increase in Cats – CBRA Zone Tier I Lands: As discussed above, 90 percent of the Tier I expected development is in the CBRA zone 13.77 acres, with an average parcel size of 0.34 acres. This level of development equates back to 41 units (residences) ($13.77/0.34=40.5$). Following our cat predation analysis referenced above, the development of 41 additional units represents an increase of 29.3 cats with 17.6 cats occasionally outdoors

(residences X % of residences with cats X number cats per residence=total cats [$40.5*0.34*2.1=29.3$])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [$40.5*0.34*2.1*0.60=17.6$]).

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the project cat population over the 15-year period is estimated at 37.2 cats ($29.3*.67+17=37.2$).

North Key Largo Increase in Cats – CBRA Zone Tier I Buffer Lands: Based on our GIS analysis, one parcel is in a CBRA zone, represented by 1.0 acres. This level of development equates back to 1 unit (residence). Following our cat predation analysis referenced above, the development of 1 additional units represents an increase of 0.7 cats with 0.43 cats occasionally outdoors

(residences X % of residences with cats X number cats per residence=total cats [1*0.34*2.1= 0.7])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [1*0.34*2.1*0.60=0.43]).

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the project cat population over the 15-year period is estimated at 0.9 cats ($0.7 \times 0.67 + 0.428 = 0.897$).

The build-out scenario assumed in the 1997 and 2003 opinions, applied to the current information would identify the acres of at risk from the proposed actions as being 197 acres impacting 721 parcels. Our analysis incorporates the ROGO development restrictions and identifies the acres of at risk habitat as being 21.5 acres influencing 158 parcels. In general, the habitat loss and indirect effects identified in this analysis are more realistic than the build-out scenario assumed in the 1997 and 2003. This BO's methodology benefited from advances in GIS data and a detailed lot-by-lot review guided by the ROGO allocation process.

North Key Largo – Tier I: The Key Largo woodrat is a rare Upper Keys endemic, existing at extremely low densities where it is known to occur. Our analysis has identified habitat loss from the proposed action to be 1.5 acres from development and an increase in the free roaming cat population of 51 cats with 2 from development in potential suitable habitat and 49 from development in the buffer lands. This level of habitat loss represents 0.07 percent of potential suitable habitat in North Key Largo ($1.5/2,103 = .0007$).

North Key Largo CBRA Zone: Our analysis has identified habitat loss from the proposed actions in CBRA zones to be the loss of 13.77 acres from development and an increase in the free roaming cat population of 19 cats with 18 from development in potential suitable habitat and 1 from development in the buffer lands. This level of habitat loss represents 0.65 percent of potential suitable habitat in North Key Largo ($13.77/2103 = .0065$). This impact is considered in the Cumulative Effects analysis of this BO.

South Key Largo: Our analysis has identified habitat loss from the proposed action to be the loss of 20 acres from development. This level of habitat loss represents 1.98 percent of potential suitable habitat in South Key Largo ($20/1,012 = .0198$).

South Key Largo CBRA Zone: Our analysis has identified habitat loss from the proposed action to be the loss of 1.44 acres from development. This level of habitat loss 0.14 percent of potential suitable habitat in South Key Largo ($1.44/1,012 = .0014$) and will be further analyzed in our cumulative effects section.

Summary – Changes since 1997 and 2003 BOs

North Key Largo – Tier I: The Key Largo woodrat is a rare Upper Keys endemic, existing at extremely low densities where it is known to occur. Our analysis has identified habitat loss from the proposed action to be 1.5 acres from development and an increase in the free roaming cat population of 51 cats with 2 from development in potential suitable habitat and 49 from development in the buffer lands. This level of habitat loss represents 0.07 percent of potential suitable habitat in North Key Largo ($1.5/2,103 = .0007$).

North Key Largo CBRA Zone: Our analysis has identified habitat loss from the proposed actions in CBRA zones to be the loss of 13.77 acres from development and an increase in the free roaming cat population of 19 cats with 18 from development in potential suitable habitat and 1 from development in the buffer lands. This level of habitat loss represents 0.65 percent of potential suitable habitat in North Key Largo ($13.77/2103 = .0065$). This impact is considered in the Cumulative Effects analysis of this BO.

South Key Largo: Our analysis has identified habitat loss from the proposed action to be the loss of 20 acres from development. This level of habitat loss represents 1.98 percent of potential suitable habitat in South Key Largo ($20/1,012 = .0198$).

South Key Largo CBRA Zone: Our analysis has identified habitat loss from the proposed action to be the loss of 1.44 acres from development. This level of habitat loss 0.14 percent of potential suitable habitat in South Key Largo ($1.44/1,012 = .0014$) and will be further analyzed in our cumulative effects section.

Since the 1997 and 2003 BOs were completed, no new information has been generated that suggests the Key Largo woodrat's endangered condition has improved. In general, the habitat loss and indirect effects identified in this analysis are more realistic than the build-out scenario assumed in the 1997 and 2003. This BO's methodology benefited from advances in GIS data and a detailed lot-by-lot review guided by the ROGO allocation process. Despite this more realistic picture, however, the loss of habitat and related indirect effects calculated in the BO predict a series of direct and indirect impacts that could exacerbate the already precarious condition of the species. Implementing the technical review of individual projects described at the end of this document will address this concern.

Key tree-cactus

Potential suitable native habitat is present for the Key tree-cactus in unincorporated Monroe County, Village of Islamorada, and the City of Marathon. No potential suitable native habitat is present for this species in the City of Layton, the City of Key Colony Beach, or the City of Key West.

Population

Service records (2006b) document seven populations of tree cactus, and three occur on protected public lands: one at the NKDR and two at Long Key State Recreation Area. The other four populations occur on private lands. Of those four on private lands, one is protected from disturbance by a conservation easement and one population may be deceased (Klett, personal communication, 2006). McNeese 2006 referenced eight populations and likely included the possibly deceased population.

Florida Keys

Seven populations of the Key tree cactus are known to currently exist in the Florida Keys.

Unincorporated Monroe County

Four populations of Key tree cactus are located in unincorporated Monroe County.

Village of Islamorada

Three populations of Key tree cactus are located within the boundaries of the Village of Islamorada.

Habitat

The Key tree-cactus grows in a narrow range of plant associations, which include tropical hardwood hammocks and a thorn-scrub association known locally as a “cactus hammock.” The major requirements for successful growth of Key tree-cactus are an open canopy and freedom from frequent floods or frequent fires. Habitat data for the Key tree-cactus were generated based on the present known range of the Key tree-cactus, which includes hardwood hammock habitats on Big Pine Key, Long Key, and Upper and Lower Matecumbe Keys. In addition, based on historical accounts, unoccupied potential suitable habitat consisting of hardwood hammock throughout the Keys was also mapped as potential habitat. Within the hardwood hammock habitat, potential suitable habitats for the Key tree cactus are lightly shaded disturbed areas on the highest parts, associated with other cactus species, which are not often flooded and not common.

Florida Keys

We determined there is a total of 8,327 acres of potential Key tree cactus habitat in Monroe County. Of these, 5,976 acres are located on conservation lands not subject to development (72 percent).

The proposed action may affect 1,318 acres of potential suitable habitat, which are located within 3,674 parcels (lands where flood insurance is available). This represents 16 percent of the Key tree cactus’s habitat in Monroe County ($1,318/8,327 = 0.16$).

Unincorporated Monroe County

Tier I, SPA, and Tier III Lands: The Service calculated that there are 1,092 acres of at-risk habitat in Tier I, SPA, and Tier III designations (Tier I=948 acres, SPA= 99 acres, and Tier III=45 acres). The focus of this analysis is Tier I and SPA lands, which are considered by the Service as more optimal for listed species because of their size and connectivity. Tier III lands, which are generally single parcels within developed subdivision, have far less value, and in many cases, none whatsoever. Lands in Tier I and SPA are targeted for purchase by the county and the Florida Forever program.

The county also discourages development of these lands by assigning negative ROGO development points for habitat and listed species in their permit review process. The county's ROGO allotment allows for a maximum of 6 ROGO allotments for Tier I lands, 3 allocations in the Upper Keys and 3 in the Lower Keys. There are no ROGO restrictions for SPA lands. There are 1,809 parcels in Tier I lands, 704 parcels in SPA lands, and 455 parcels in Tier III lands, for 2,968. Tier I lands total 948 acres, SPA lands total 99 acres, and Tier III lands total 45 acres, representing 0.36 acres of potential suitable habitat per parcel ($1,092/2,968 = 0.0036$).

Tier I Lands: There are 948 acres, representing 1,809 parcels in Tier I lands. Based on an allocation of 6 allotments per year and a 15-year assessment period, we estimate adverse effects to about 32.4 acres of potential suitable Key tree-cactus habitat

(ROGO allotment X total years X acres per lot = total acres [$6*15*0.36=32.4$]).

Since we cannot determine whether the 6 annual ROGO allotments will occur in CBRA zones or within non-CBRA zones, for assessment purposes we will consider that allotments will be equally balanced as a percentage of the lands in and outside of the CBRA areas. For this analysis, the CBRA zone lands (216 acres) represent 19 percent of the at-risk lands ($216/1,092=19$). Therefore, we believe the adverse effect to the Key tree-cactus from the proposed action in unincorporated Monroe County to be the loss of 26 acres of potential suitable habitat over a 15-year period. This habitat loss represents 0.32 percent of the potential suitable Key tree-cactus habitat in the Keys ($26/8,327 = 0.0032$).

SPA Lands: There are 99 acres, representing 704 parcels in SPAs. Since there are no ROGO restrictions on SPA lands, we must consider that development could occur in these lands at the same frequency as Tier III lands. For this analysis, SPA and Tier III lands represent 1,159 parcels (61 percent SPAs and 39 percent Tier III, with 704 and 455 parcels respectively). With an allotment of 187 ROGO units per year in unincorporated Monroe County, over a 15-year period, this equates to 2,805 ROGO units (197-10 Tier I units), of which 1,711 represent SPA allotments. This allotment exceeds the available SPA parcels. Therefore, we assume that all 99 acres of SPA lands will be developed, resulting in the loss of all 99 acres of potential suitable Key tree-cactus habitat. There are no CBRA zone lands present. This loss equates to 1.19 percent of the potential suitable Key tree-cactus habitat in the Keys ($99/8,327 = 0.0119$).

The habitat loss from ROGO allotments in CBRA zone lands are a component of our cumulative effects assessment. Following the above assessment approach, we calculate the habitat loss to be 6.4 acres of potential suitable habitat over a 15-year period in Tier I lands and no habitat loss in SPA lands. This habitat loss represents 0.07 percent of the potential suitable Key tree-cactus

habitat in the Keys and will be discussed further in our cumulative effects section ($6/8,327 = 0.0007$).

Village of Islamorada

We determined there are 1,097 acres of potential Key tree cactus habitat within the Village of Islamorada. Based on our GIS analyses, the proposed action may affect 134 acres, which are located within 337 undeveloped parcels. This represents less than 2 percent of Key tree cactus habitat in Monroe County that is vulnerable to construction activity. There are no CBRA lands in the Village of Islamorada).

The Village of Islamorada is allocated 28 ROGO permits per year. For assessment purposes, we estimate that each of the vacant parcels represents 0.4 acres. We estimate that, based on 28 ROGO units per year over a 15-year period, 420 units could be developed, which represents 168 acres of habitat. Since there are only 338 parcels in Islamorada, we assumed that all parcels would be developed, resulting in the loss of all 134 acres of potential suitable Key tree-cactus habitat. This loss equates to 1.3 percent of the potential suitable Key tree-cactus habitat in the Keys.

City of Marathon

We determined there are 560 acres of potential Key tree-cactus habitat within the City of Marathon. Based on our GIS analyses, the proposed action may affect 92 acres, which are located within 369 parcels. This represents 16 percent of the cactus' habitat in the City of Marathon and less than one percent of the Key tree-cactus's habitat in Monroe County.

The City of Marathon is allocated 30 ROGO allotments per year. For assessment purposes, we estimate that each of the vacant parcels represents 0.25 acres. We estimate that, based on 30 ROGO units per year over a 15-year period, 450 units could be developed, which represents 112.5 acres. Since there are only 369 parcels in the City of Marathon, we assumed that all parcels would be developed, resulting in the loss of all of the 92 acres of potential suitable Key tree-cactus habitat. This loss equates to 0.92 percent of the potential suitable Key tree-cactus habitat in the Keys.

Habitat fragmentation

Unincorporated Monroe County

The at-risk lands in unincorporated Monroe County are about 1,092 acres, representing 2,968 parcels and include parcels within developed subdivisions and parcels within more rural settings.

The Tier 1 and SPA lands total about 1,047 acres and are considered by the Service as those lands that could be subject to fragmentation by development because of their relative high quality. In our assessment of the development potential in these lands, we determined that the proposed level of development in these lands, which is about 125 acres, will not by itself be

significant. Therefore, we also believe that fragmentation of lands associated with the development within these lands will not be by itself significant.

Village of Islamorada

The at-risk lands in the Village of Islamorada are about 134 acres, representing 337 parcels and include parcels within developed subdivisions and parcels within more rural settings. Since, there are only 337 parcels in Islamorada, we assumed that all parcels would be developed, resulting in the loss of all 134 acres of potential suitable Key tree-cactus habitat within the village.

City of Marathon

The at-risk lands in the City of Marathon are about 92 acres, which are located within 369 parcels and include parcels within developed subdivisions and parcels within more rural settings.

Since, there are only 369 parcels in Islamorada, we assumed that all parcels will be developed, resulting in the loss of all 92 acres of potential suitable Key tree-cactus habitat within the city.

Summary – Changes since 1997 and 2003 BOs

In general, the habitat loss and indirect effects identified in this analysis are more realistic than the build-out scenario assumed in the 1997 and 2003. This BO's methodology benefited from advances in GIS data and a detailed lot-by-lot review guided by the ROGO allocation process. The build-out scenario assumed in the 1997 and 2003 opinions, applied to the current information would identify the acres of at risk from the proposed actions as being 1,318 acres affecting 3,674 parcels. Our analysis incorporates the ROGO development restrictions and identifies the acres of at risk habitat as being 351 acres impacting 1,483 parcels. The majority of the potential suitable habitat for this species (72 percent) is protected and county and municipality development regulations discourage development in remaining quality habitat.

Since the 1997 and 2003 BOs were completed, no new information has been generated that suggests the Key tree-cactus' condition has improved. To the contrary, one of the four populations on private lands appears deceased. The species is in decline, possibly from the impacts of hurricanes and salt water. A significant challenge related to analyzing the impacts of the action is the fact that the precise location of future development is not known. Two of the remaining populations have no protection whatsoever and are subject to development pressure. Given that the species occurs in seven locations, the loss of two populations could have significant implications on Key tree-cactus viability. Implementing the technical review of individual projects described at the end of this document will address this concern.

Lower Keys rabbit

Habitat alteration, contaminants, road mortality, domestic animal predation, fire ants, and exotic vegetation threaten the Lower Keys rabbit. These threats have resulted in a decrease in the number of populations, a decline in the size of the populations, the isolation of populations, an

increase in road mortalities, increased feral and domestic cat-caused mortality, and the loss of foraging, shelter, and nesting habitat.

In the discussions that follow, loss of habitat is evaluated on a “worst case scenario” basis. We assume that all new development will occur in potential suitable habitat. We also assume that if a property is developed, all habitats on that unit will be lost. Clearing is limited to 0 to 10 percent in mangrove, buttonwood, saltmarsh, and freshwater wetlands. Therefore, a maximum of 10 percent of our affected habitat assessment can actually occur. Additional regulations require preservation or restoration of habitat to offset vegetation losses that result from development. Some fragmentation of habitat will nevertheless occur. However, fragmentation will be offset to an unknown degree by preservation or by restoration, creating more continuity in other fragmented habitat. The Service is unable to evaluate the true effects of these beneficial actions, but acknowledges that the benefits are tangible mitigation measures. In essence, the programs are already helping to avoid and minimize negative impacts to potential suitable habitat.

Population

The Lower Keys rabbit’s original range extended from Big Pine Key to Key West, encompassing a linear distance of about 30 miles. Habitat loss and predation by domestic and feral cats have reduced the range of this species. The Lower Keys rabbit occurs in many of the larger Lower Keys including Sugarloaf, Saddlebunch, Boca Chica, and Big Pine Keys and some smaller islands near these keys (Forys et al., 1996; Faulhaber, 2003).

Florida Keys

Past population estimates have ranged between 100 and 300 rabbits in the Lower Florida Keys. In 1991, there was a high of 300 individuals, and by 1993, the population decreased to 100 individuals (Forys and Humphrey 1999). The current population in 2006 is about 500 animals (Perry, personal communication, 2006).

Unincorporated Monroe County

All potential suitable Lower Keys rabbit habitat is located within unincorporated Monroe County.

The following municipalities have no potential suitable habitat:

*Village of Islamorada
City of Layton
City of Marathon
City of Key West*

Habitat loss

The Lower Keys rabbit is endemic to the Lower Keys and inhabits tidal, brackish, and transitional upland and freshwater environments. The Lower Keys rabbit is habitat specific, depending upon a transition zone of grasses and sedges for feeding, shelter, and nesting. The majority of potential suitable habitat areas lie in transitional zones between marine environments and uplands. Remaining potential suitable habitat acreage for the Lower keys marsh rabbit is about 3,140 acres, of which 2,467 acres are in public ownership (78.6 percent). Proposed development and related impacts on Big Pine Key and No Name Keys were evaluated in the HCP and BO completed in June 2006, along with related conservation activities, and incidental take was provided that will not jeopardize the survival and recovery of the species. As a result, this BO focuses on other areas of Lower Keys marsh rabbit habitat, known as the “Other Islands.” There are 1,045 acres in the boundaries of the Big Pine and No Name Keys HCP and 2,094 acres in the “Other Islands” lands.

Other Island Lands: The Service calculated that there are 444 acres of at-risk habitat in Tier I, SPA, and Tier III designations (Tier I=444 acres, SPA=0 acres, and Tier III=0 acres). Tier I lands are represented by 367 parcels, SPA lands by 0 parcels, and Tier III by 2 parcels. Tier III lands, which are generally single isolated parcels within developed subdivision, have far less value, and in many cases, none whatsoever. Lands in Tier I and SPA are targeted for purchase by the county and the Florida Forever program. The county also discourages development of these lands by assigning negative ROGO development points for habitat and listed species in their permit review process. The county’s ROGO allotment allows for a maximum of 6 ROGO allotments for Tier I lands, 3 allocations in the Upper Keys and 3 allocations in the Lower Keys.

Tier I Lands: We estimate that there are 444 acres of at-risk lands in Tier I, representing 367 parcels (1.2 acres per parcel). Based on an allocation of 3 allotments per year and a 15-year assessment period, we estimate adverse effects to about 54 acres of potential suitable rabbit habitat

(ROGO allotment X total years X acres per lot = total acres [3*15*1.2=54]).

Since we cannot determine whether the three annual ROGO allotments in the Lower Keys will occur in CBRA zones or within non-CBRA zones, for assessment purposes we will consider that allotments will be balanced as a percentage of the lands in a CBRA zone. For this analysis, the CBRA zone lands (210 acres) represent 46 percent of the at risk lands (205/444=46). Therefore, we believe the adverse effect to the Lower Keys rabbit from the proposed action in unincorporated Monroe County to be the loss of 29.5 acres of potential suitable habitat over a 15-year period. This habitat loss represents 0.93 percent of the potential suitable Lower Keys rabbit habitat in the Keys ($29.5/3,140 = 0.0093$).

Tier I CBRA: The habitat loss from ROGO allotments in CBRA zone lands are a component of our cumulative effects assessment. Following the above assessment approach, we calculate the habitat loss to be 24.8 acres of potential suitable habitat over a 15-year period. This habitat loss represents 0.79 percent ($24.8/3,140 = 0.0079$) of the potential suitable Lower Keys rabbit habitat in the Keys and will be discussed further in our cumulative effects section.

SPA Lands: No SPA or Tier III lands are at-risk.

Big Pine/No Name HCP

The county plans to conserve habitat on more than 440 lots on Big Pine Key that have been dedicated to the county because of the ROGO point allotment process. The Big Pine/No Name HCP allows a maximum of 200 lots to be developed on Big Pine Key in the next 20 years. The HCP implements conservation measures that cover 100 percent of the Lower Keys rabbit's habitat that may be affected by the action on Big Pine and No Name Keys. Habitat on the 200 lots slated for development in the next 20 years must be mitigated on a 3:1 basis.

Habitat fragmentation

Florida Keys

Unincorporated Monroe County

The at-risk lands in the “Other Islands” classification in unincorporated Monroe County were estimated to be 444 acres in Tier I, SPA, and Tier III designations (Tier I=444 acres, SPA=0 acres, and Tier III=0 acres). Tier I lands are represented by 367 parcels, SPA lands by 0 parcels, and Tier III by 2 parcels. The Tier 1 and SPA lands total about 444 acres and are considered by the Service as those lands that could be subject to fragmentation by development. In our assessment of the development potential in these lands, we determined that the proposed level of development in these lands, which is about 29.5 acres, would not by itself be significant. We expect this will result in some minor fragmentation of habitat, although the impacts will be minimal and the precise effect on the species will be difficult to measure.

Indirect effects

Mortality from feral and domestic cats may be the greatest current threat to the persistence of the Lower Keys rabbit (Forys and Humphrey 1999). A detailed study of cat diets in the Keys has not been conducted, but rabbits were a large component of feral cat diets in several studies conducted elsewhere. The number of cats present in the Lower Keys has increased over the past 20 years with the increase in the human residential population. Rabbits appear to be equally susceptible to cat predation, regardless of gender or age. Forys (1995) found that 14 of 19 occupied patches have domestic and feral cats present.

To assess the effects that feral cats may have on the extant populations of Lower Keys marsh rabbit, we used the buffers identified in “Status of the species in the action area” in this BO (Frank, GFC, personal communication, 1996). Based on our GIS analysis we have determined that there are about 13,556 acres of buffer lands surrounding potential suitable Lower Keys rabbit habitat, of which 9,739 acres are in government ownership (72 percent). At-risk vacant buffer lands are about 2,822 acres, which is about 2,119 vacant parcels. We have also determined that there are an additional 4,181 developed residential parcels within the buffer lands, for a combined estimate of 6,300 residential parcels.

Our cat predation analysis is predicated on the estimated number of cats within the buffer lands surrounding the Lower Keys rabbit habitat. Researchers have shown that 34 percent of the units (residences) have cats (FWC, 2003) and that, on an average, each household has 2.1 cats. This research also demonstrates that on the average 40 percent of the cats are exclusively indoor pets, which relates to 60 percent are occasionally outdoors and occasionally will stalk prey in rabbit potential suitable habitat. Following this approach, we estimate there are currently, based on 4,181 residences in the buffer lands, a population of 2,985 cats with 1,791 cats occasionally outdoors

(residences X % of residences with cats X number cats per residence=total cats
[4,181*0.34*2.1=2,985 cats])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [4,181*0.34*2.1*0.60=1,791]).

The FWC (2003) study also provides an estimate of feral cats as a function of domestic cats; the feral cat population is about 2/3 of the domestic cat population ($0.67*2,985=2,000$). Based on this analysis we estimate the current population of domestic cats and feral cats that could have an adverse effect to the Lower Keys rabbit to be 3,791 cats ($1,791+2000=3,791$).

Although we cannot quantify the amount of take to the species from cat predation, we believe this threat could cause a significant adverse effect and has the potential adversely affect survival and recovery.

Other Lands Increase in Cats – Tier I Lands: Our habitat loss analysis provided for a loss of 29.5 acres from the proposed action. Based on an average parcel size of 1.2 acres per parcel, the habitat loss equates to an increase of 24 new residences ($29.5/1.2=24.5$). Following our cat population increase analysis, an increase of 24 residences equates to an increase of 17 cats with 10.3 cats being occasionally outdoors over the 15-year review period

(residences X % of residences with cats X number cats per residence=total cats [$24*0.34*2.1=17$ cats])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [$24*0.34*2.1*0.60=10.3$]).

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the project cat population over the 15-year period is estimated at 21.8 cats ($17*.67+ 10.3=21.8$).

Tier I Lands – CBRA Zone: Our habitat loss analysis provided for a loss of 24.8 acres from the proposed action. Based on an average parcel size of 1.2 acres, the habitat loss equates to an increase of 21 new residences ($24.8/1.2=20.7$). Following our cat population increase analysis, an increase of 21 residences equates to an increase of 15 cats with 9 cats being occasionally outdoors over the 15-year period

(residences X % of residences with cats X number cats per residence=total cats [21*0.34*2.1=15 cats])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [21*0.34*2.1*0.60=9]).

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the project cat population over the 15-year period is estimated at 19 cats ($15*0.67+9=19$). This impact is considered in the Cumulative Effects analysis of this BO.

SPA Lands: No SPA or Tier III lands are at risk.

Buffer Lands Increase in Cats:

Based on our GIS analysis we have determined that there are about 13,556 acres of buffer lands surrounding potential suitable Lower Keys rabbit habitat, of which 9,739 acres are in government ownership (72 percent). Vacant lands at risk in Tier I lands are represented by 2,650 acres, SPA lands by 56 acres, and Tier III lands by 116 acres, encompassing 1,284 parcels, 282 parcels, and 553 parcels respectively. We have determined there are 205 acres, less than 1 acre, and less than 1 acre of CBRA zone lands, represented by 528, 4, and 2 parcels, respectively, for Tier 1, SPA, and Tier III lands. We have also determined that there are about 7,513 vacant developable parcels in the Lower Keys, of which 2,941 are in SPA and Tier III lands (1,022 parcels are in SPAs and 1,919 are in Tier III lands, 35 and 65 percent respectively). For our assessment purposes, we are considering that ROGO allotments will be proportioned according to the

percent of either SPA or Tier III lands present in the buffer area. Therefore, for this assessment, 35 percent and 65 percent of the yearly ROGO allotments will be for SPA or Tier III parcels, respectively.

Monroe County's allotment is 197 ROGO units per year. For assessment purposes, we assumed that the allotments would be split by thirds (Upper keys, Middle keys, and Lower keys). Since we consider the Lower Keys rabbit to be in the Lower Keys, we project 65 ROGO units per year as the development potential. Ten of these ROGO units have been allocated for Big Pine and No Name Keys (HCP), leaving 55 ROGO units for the remainder of the Lower Keys. We have determined that there are about 7,513 vacant developable parcels in the Lower Keys, of which 2,641 parcels are in SPA and Tier III lands, and 224 are on Big Pine and No Name Keys. The remaining parcels are within Tier I where development is restricted to 3 ROGO units per year. Therefore, the remaining 52 ROGO units will be distributed evenly across the 2,417 parcels ($2,641-224=2,417$), which represents an allotment of 1 ROGO unit per 47 parcels ($2,417/52=46.5$), and will be proportioned accordingly between SPA and Tier III parcels.

Tier I Increase in Cats – Buffer Lands: There are 1,284 parcels totaling 2,650 acres in Tier I buffer lands, with 528 parcels totaling 205 acres in CBRA zones. As previously stated, ROGO allotments are restricted to 3 ROGO units per year in Tier I lands, we previously evaluated the increase in cats in Tier I lands. No additional increase in cats is expected in Tier I buffer lands.

SPA Increase in Cats – Buffer Lands: There are 282 parcels available in SPA lands in the buffer, totaling 56 acres, with 0.2 acres in CBRA zones. Considering that only 35 percent of the ROGO units are available for SPA lands, and that 6 ROGO units per year will be allotted ($282/47=6$) we estimate that 90 parcels could be developed over the 15-year period. Therefore, assuming 90 parcels will be developed, there will be an increase of 64.3 cats with 38.6 cats being occasionally outdoors

(residences X % of residences with cats X number cats per residence=total cats
[$90*0.34*2.1=64.3$ cats])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [$90*0.34*2.1*0.60=38.6$]) over the 15-year period.

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the projected outside cat population over the 15-year period is estimated at 81.6 cats ($64.3*0.67+38.6=81.6$).

Tier III Increase in Cats – Buffer Lands: There are 553 parcels available in SPA lands in the buffer, totaling 116 acres, with less than 0.2 acres in CBRA zones. Considering that 65 percent of the ROGO units are available for Tier III lands, and that 12 ROGO unit will be allotted per year, ($553/47=11.9$) we estimate that 176 parcels could be developed over the 15-year period. Therefore we estimate 176 parcels will be developed; this equates to an increase of 125.7 cats with 75 cats being occasionally outdoors

(residences X % of residences with cats X number cats per residence=total cats
[$176*0.34*2.1=125.7$ cats])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [$176*0.34*2.1*0.60=75.4$]) over the 15-year period.

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the projected outside cat population over the 15-year period is estimated at 159.6 cats ($125.7*0.67+75=159$).

SPA and Tier III CBRA Zone Increase in Cats – Buffer Lands: We have estimated that 1.5 acres are within SPA and Tier III CBRA Zones, representing 6 parcels. Following our cat population analysis, an increase of 6 residences equates to an increase of 4.28 cats with 2.57 cats being occasionally outdoors over the 15-year review period

(residences X % of residences with cats X number cats per residence=total cats
[$6*0.34*2.1=4.28$ cats])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [$6*0.34*2.1*0.60=2.57$]).

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the project cat population over the 15-year period is estimated at 5.4 cats ($4.28 \times .67 + 2.57 = 5.4$). This impact is considered in the Cumulative Effects analysis of this BO.

FEMA Actions: Our analysis has identified habitat loss from the proposed action to be the loss of 29.5 acres from development and an increase in the free roaming cat population of 132 cats with 11 from development in potential suitable habitat and 121 from development in the buffer lands. This level of habitat loss represents 0.94 percent of potential suitable habitat ($29.5 / 3,140 = 0.0094$).

CBRA Zone: Our analysis has identified habitat loss from the proposed actions in CBRA zones to be the loss of 24.8 acres from development and an increase in the free roaming cat population of 12 cats with 10 from development in potential suitable habitat and 1 from development in buffer lands. This level of habitat loss represents 0.79 percent of potential suitable habitat ($24.8 / 3,140 = 0.0079$).

Other Indirect Effects

The development that will occur because of the proposed action will increase human population size and road use, which may increase the risk of vehicular mortality.

Habitat that lies in close proximity to developed areas likely will continue to degrade because of vegetative succession caused by suppression of wildfire in the urban interface.

Summary – Changes since 1997 and 2003 Opinions

The build-out scenario assumed in the 1997 and 2003 opinions, applied to the current information would identify the acres of at risk from the proposed actions as being 444 acres impacting 369 parcels. Our analysis incorporates the ROGO development restrictions and identifies the acres of at risk habitat as being 30 acres affecting 24 parcels. In general, the habitat loss and indirect effects identified in this analysis are more realistic than the build-out scenario assumed in the 1997 and 2003. This BO's methodology benefited from advances in GIS data and a detailed lot-by-lot review guided by the ROGO allocation process.

In general, the habitat loss and indirect effects identified in this analysis are more realistic than the build-out scenario assumed in the 1997 and 2003. This BO's methodology benefited from advances in GIS data and a detailed lot-by-lot review guided by the ROGO allocation process. However, impacts from development, notably the potential for increased mortality from domestic and feral cats, are a significant concern. A population viability analysis conducted for the Lower Keys marsh rabbit predicted that this species might become extinct in 20 to 30 years under the current conditions (Forys and Humphrey, 1999).

These data are also consistent with a recent population viability analysis conducted by LaFever and Lopez (2006) of the Lower Keys marsh rabbit metapopulation on Boca Chica Key (Naval Air Station Key West). Results identified the Boca Chica metapopulation the most prone to extirpation. LaFever and Lopez (2006) estimated the probability of persisting for ten years, under the current conditions, was 41.6 percent. Like Fors and Humphrey (1999), these investigators found that control of cat populations on Boca Chica Key would likely have the greatest benefit to marsh rabbit populations than any other management action considered. As a result, further development and the related indirect effects from domestic and feral cats in the “Other Islands” could exacerbate an already precarious condition for this species. Implementing the technical review of individual projects described at the end of this document will address this concern.

Schaus swallowtail butterfly

The Schaus swallowtail butterfly is restricted to a habitat where its primary food plant, torchwood, grows abundantly (Service 1982c). This habitat is limited to coastal southeast Florida and the Upper Keys, in mature tropical hardwood hammocks. Within the Florida Keys, the current occupied range of this species is restricted to North Key Largo, although potential suitable habitat based on historical records, extends south to Upper Matecumbe Key.

In the discussions that follow, loss of habitat is evaluated on a “worst case scenario” basis. One assumption is that if a property is developed, all habitat on that unit will be lost. We discussed previously the open space requirements of Monroe County, the Village of Islamorada, and the City of Marathon. Clearing is limited to 10 to 30 percent in high quality habitat and 50 to 70 percent in moderate to low quality habitat. Therefore, a maximum of 10 percent of our affected habitat assessment in Tier I lands can actually occur. Additional regulations require preservation or restoration of habitat to offset vegetation losses that result from development. Fragmentation of habitat will nevertheless occur. However, fragmentation will be offset to an unknown degree by preservation or by restoration, creating more continuity in other fragmented habitat. The Service is unable to evaluate the true effects of these beneficial actions, but acknowledges that the benefits are tangible mitigation measures. In essence, the programs are already helping to avoid and minimize negative impacts to potential suitable habitat.

Population

Florida Keys

Potential suitable Schaus swallowtail butterfly habitat is about 3,925 acres of which 2,816 acres are in public ownership (72 percent). Vacant lands at risk in the species range area about 546 acres, representing 2,145 parcels. We consider the species range to include those lands in North Key Largo and hammocks greater than 12 acres in size remaining in South Key Largo and Upper Matecumbe Key.

North Key Largo: The lands in North Key Largo North of the U.S. 1 and S.R. 905 intersection (the known occupied habitat) are about 2,103 acres of which 1,862 acres are in public ownership

(88.5 percent).

South Key Largo and Upper Matecumbe Key: The lands in South Key Largo and Upper Matecumbe Key, which only have historic records of occurrence, are about 1,822 acres of additional Schaus swallowtail butterfly habitat, of which 954 acres are in government ownership (52 percent). Lands are included in both unincorporated Monroe County and the Village of Islamorada.

Unincorporated Monroe County

North Key Largo – Tier I, SPA, and Tier III Lands: The Service calculated that there are 21 acres of susceptible habitat in Tier I, SPA, and Tier III designations (Tier I=21 acres, SPA=0.0 acres, and Tier III=0.0 acres). The focus of this analysis is Tier I and SPA lands, which are considered by the Service as more optimal for listed species because of their size and connectivity. Tier III lands, which are generally isolated parcels within a developed subdivision, have far less value, and in many cases, none whatsoever. Native vegetation in Tier III lands, however, could be beneficial for the species. Lands in Tier I and SPAs are targeted for purchase by the county and the Florida Forever program. The county also discourages development of these lands by assigning negative ROGO development points for habitat and listed species in their permit review process. The county's ROGO allotment allows for a maximum of 6 ROGO allotments combined for Tier I and SPA lands, 3 allocations in the Upper Keys and 3 allocations in the Lower Keys.

Since North Key Largo is considered the Upper keys, for assessment purposes, we are considering that 3 ROGO units per year will be allotted to this area. There are 62 parcels in Tier I lands, for a total acreage of 21 acres representing 0.34 acres of potential suitable habitat per parcel.

North Key Largo – Tier I Lands: Based on an allocation of 3 allotments per year and a 15-year assessment period, we estimate adverse effects to about 15.3 acres of potential suitable Schaus swallowtail butterfly habitat

(ROGO allotment X total years X acres per lot = total acres [3*15*0.34=22.1]).

Since we cannot determine whether the three annual ROGO allotments will occur in CBRA zones or within non-CBRA zones, for assessment purposes we will consider that allotments will be equally balanced as a percentage of the lands in a CBRA zone. For this analysis, the CBRA zone lands (19 acres) represent 90 percent of the at-risk lands (19/21=0.9). Therefore, we believe the adverse effect to the Schaus swallowtail butterfly from the proposed action in unincorporated Monroe County to be the loss of 2.1 acres of potential suitable habitat over a 15-year period. This habitat loss represents 0.04 percent of the potential suitable Schaus swallowtail butterfly habitat in North Key Largo ($0.04/2,103 = 0.0004$). Based on the current population, we believe this increase will not be significant by itself.

North Key Largo – Tier I CBRA Lands: The habitat loss from ROGO allotments in CBRA zone

lands are a component of our cumulative effects assessment. Following the above assessment approach, we calculate the habitat loss to be 19 acres of potential suitable habitat over a 15-year period. This habitat loss represents 0.9 percent of the potential suitable Schaus swallowtail butterfly habitat in North Key Largo and will be discussed further in our cumulative effects section ($0.9/2,103 = 0.009$).

North Key Largo – Tier III and SPA Lands: There are no properties at-risk in SPA or Tier III lands.

South Key Largo – Tier I, SPA, and Tier III Lands: The Service calculated that there are 307 acres of at risk habitat in Tier I, SPA, and Tier III designations (Tier I =197 acres, SPA=84 acres, and Tier III=26 acres). The focus of this analysis is Tier I and SPA lands, which are considered by the Service as more optimal for listed species because of their size and connectivity. Tier III lands, which are generally single isolated parcels within developed subdivision, have far less value, and in many cases, none whatsoever. As previously stated, however, native plants in Tier III lands can be beneficial in some cases. Lands in Tier I and SPAs are targeted for purchase by the county and the Florida Forever program. The county also discourages development of these lands by assigning negative ROGO development points for habitat and listed species in their permit review process. The county's ROGO allotment allows for a maximum of 6 ROGO allotments for Tier I lands, 3 allocations in the Upper Keys and three allocations in the Lower Keys. There are no ROGO restrictions for SPA lands.

South Key Largo – Tier I Lands: There are 680 parcels in Tier I lands, for a total acreage of 197 acres representing 0.24 acres of potential suitable habitat per parcel. In this analysis, the 3 ROGO allotments allowed in the Upper Keys were analyzed in North Key Largo. No additional habitat loss is expected in Tier I lands in the species range.

South Key Largo – Tier I CBRA Lands: There are 51 parcels in Tier I lands, for a total acreage of 21 acres. The habitat loss from ROGO Tier I allotments in CBRA zones lands are a component of our cumulative effects assessment. Based on an allocation of 3 allotments per year and a 15-year assessment period, we estimate adverse effects to about 15.3 acres of potential suitable Schaus swallowtail butterfly habitat

(ROGO allotment X total years X acres per lot = total acres [$3*15*0.24=10.8$]).

Following the above assessment approach, we calculate the habitat loss to be 10.8 acres of potential suitable habitat over a 15-year period. This habitat loss represents 0.59 percent of the potential suitable Schaus swallowtail butterfly habitat in South Key Largo and will be discussed further in our cumulative effects section ($10.8/1,822 = 0.0059$).

South Key Largo – SPA Lands: Since there are no ROGO restrictions on SPA lands, we must consider that development could occur in these lands at the same frequency of Tier III lands. For this analysis, SPA and Tier III lands represent 924 parcels (65 percent SPAs and 35 percent Tier III), represented by 110 acres, with an average parcel size of 0.12 acres. Based on an allotment of 63 ROGO units (66-3 from Tier I) per year in northern unincorporated Monroe County over a

15-year period, this equates to 945 ROGO units ($63 \times 15 = 945$), of which 614 represent SPA allotments. Since there are more parcels available than the expected allotments, we are considering the maximum allotment amount of 614 parcels. Considering 614 parcels averaging 0.12 acres per parcel, we estimate the loss of 73.68 acres. This habitat loss represents 4.0 percent of the potential suitable Schaus swallowtail butterfly habitat in South Key Largo ($73.68 / 1,822 = 0.04$) and will be discussed further in our cumulative effects section.

South Key Largo – SPA CBRA Lands: The habitat loss from ROGO SPA allotments in CBRA zone lands are a component of our cumulative effects assessment. Following the above assessment approach, we calculate the habitat loss associated with 6 parcels with an average 0.12 acres per parcel, to be 0.74 acres of potential suitable habitat over a 15-year period. This habitat loss represents 0.04 percent of the potential suitable Schaus swallowtail butterfly habitat in South Key Largo and will be discussed further in our cumulative effects section ($0.74 / 1,822 = 0.0004$).

There is no potential suitable Schaus swallowtail butterfly habitat in the following municipalities:

*City of Layton
City of Marathon
City of Key West*

Village of Islamorada

Our GIS analysis also shows that 134 acres representing 338 parcels are within the Village of Islamorada. There are no CBRA lands within the Village of Islamorada. There are 338 parcels in Village of Islamorada, totaling 134 acres representing 0.4 acres of potential suitable habitat per parcel.

The Village of Islamorada is allocated 28 ROGO allotments per year. For assessment purposes, we estimate that each of the vacant parcels represents 0.4 acres. We estimate that, based on 28 ROGO units per year, over a 15-year period that 420 units could be developed, which represents 168 acres of habitat. Since there are only 337 parcels in Islamorada, we assumed that all parcels would be developed, resulting in the loss of all 134 acres) of potential suitable Schaus swallowtail butterfly habitat. This loss equates to 3.4 percent of the percent of the potential suitable Schaus swallowtail butterfly habitat in the Keys ($134 / 3,925 = 0.034$). Based on the current population, we believe this increase will not be significant by itself.

Habitat fragmentation

Human activities could result in loss and fragmentation of habitat. Most of the species occupied range, however, is protected. In areas within the species historic range but that are now unoccupied, habitat losses could fragment areas that otherwise may be reoccupied if overall conditions improve. County and municipal efforts to avoid loss of native vegetation and offset them when appropriate will help minimize the impacts caused by fragmentation.

Unincorporated Monroe County

The at-risk lands in unincorporated Monroe County are about 328 acres. The Tier 1 and SPA lands total about 302 acres, and are considered by the Service as those lands that could be subject to fragmentation by development. In our assessment of the development potential in these lands, we determined that the proposed level of development, which is about 86.9 acres, would not by itself be significant. Therefore, we also believe that fragmentation of lands associated with the development within these lands will not be significant by itself, especially in light of county efforts to limit the loss of native plants.

Village of Islamorada

The at-risk lands in the Village of Islamorada are about 134 acres, representing 337 parcels and including parcels within developed subdivisions and settings that are more rural. Since there are only 337 parcels in Islamorada, we assumed that all parcels would be developed, resulting in the loss of all 134 acres of potential suitable Schaus swallowtail butterfly habitat within the city. Other protected habitat and the mechanisms in place to minimize loss of native plants and offset losses help provide a potential corridor that could allow the Schaus to use its historical range in the future. Therefore, we believe the potential for fragmentation by development will not be significant by itself, especially in light of municipal efforts to limit the loss of native plants.

Mosquito spraying and road mortality

The use of commercial pesticides has also contributed to the decline of the Schaus swallowtail butterfly. Pesticide used for mosquito control would increase with an increase in residential construction. Monroe County currently operates an active mosquito control program. The pesticides Dibrom, Baytex, and Teknar, used in the Keys for mosquito control, are toxic to the related giant swallowtail (*Heraclides cresphontes*) in the laboratory (Emmel 1986b). Mortality of Schaus swallowtail butterfly could occur from the use of these chemicals directly, and indirectly, by application to food sources and other components of the habitat. Pesticides can also cause behavioral modification and impaired reproduction. The Service (1993a) states that it is very likely that the extensive use of mosquito control pesticides has greatly reduced butterfly populations. An increase in urbanization also results in an increase in the need for roads. Road mortality of Schaus swallowtail butterfly has been documented (Covell 1976) and can be expected to continue into the future.

Summary – Changes since 1997 and 2003 BOs

In general, the habitat loss and indirect effects identified in this analysis are more realistic than the build-out scenario assumed in the 1997 and 2003. This BO's methodology benefited from

advances in GIS data and a detailed lot-by-lot review guided by the ROGO allocation process. The build-out scenario assumed in the 1997 and 2003 opinions, applied to the current information would identify the acres of at risk from the proposed action as being 462 acres influencing 2,003 parcels. Our analysis incorporates the ROGO development restrictions and identifies the acres of at risk habitat as being 221 acres affecting 978 parcels.

The majority of the potential suitable habitat for this species (72 percent) is protected and county and municipality land development regulations discourage development in remaining quality habitat. In addition, county and municipal governments require minimal clearing of native habitats when development does occur, and the planting of native vegetation that benefits Schaus swallowtail butterflies.

In summary, the existing protected lands in the Florida Keys and the habitat review processes stated above at the county and municipal levels could help retain a corridor that the species could use in the future to reclaim other parts of its historic range if the conditions that have reduced it improve. Based on the above analysis, the Service considers the loss of 248.4 acres of Schaus swallowtail butterfly habitat, which is about 6.3 percent of the available habitat, will not be significant for the health of the species ($248.4/3,925 = 0.063$). Furthermore, the technical assistance review process outlined at the end of this document can build upon the county and municipal oversight now in place. Specifically, it can on a case-by-case basis help avoid and minimize negative impacts, and potentially improve habitat conditions. As has occurred through past technical assistance review, project footprints can be modified to minimize impacts to native habitat, and permit applicants can offset losses by planting native vegetation.

Silver rice rat

In the discussions that follow, loss of habitat is evaluated on a “worst case scenario” basis. We assume that all new development will occur in potential suitable habitat. We also assume that if a property is developed, all habitat on that unit will be lost. Clearing is limited to 0 to 10 percent in mangrove, buttonwood, saltmarsh, and freshwater wetlands. Therefore, a maximum of 10 percent of our affected habitat assessment can actually occur. Much of the buffer area may lie on higher ground near potential suitable habitat and may be cleared up to 70 percent in well-developed subdivisions. Additional regulations require preservation or restoration of habitat to offset vegetation losses that result from development. Some fragmentation of habitat will nevertheless occur. However, fragmentation will be offset to an unknown degree by preservation or by restoration, creating more continuity in other fragmented habitat. The Service is unable to evaluate the true effects of these beneficial actions, but acknowledges that the benefits are tangible mitigative measures. In essence, the programs are already helping to avoid and minimize negative impacts to potential suitable habitat.

Population

Rice rat populations are located in the Lower Keys, below the Seven-Mile Bridge. Recently, a silver rice rat was captured on the northern tip of Big Pine Key, documenting this species presence there for the first time in recent history.

N. Perry (personal communication, 2006) found a mean silver rice rat density of 1.2 silver rice rats per acre in his studies. Based on an occupied habitat of about 8,500 acres, he estimated the current population range of the species to be between 5,000 and 20,000. The mean of this range is 10,000 animals, which the Service's basis for our species assessment.

Florida Keys

There is little information available on rice rat populations other than they are small, isolated, and widely distributed populations.

Unincorporated Monroe County

All silver rice rat populations and current known ranges are within unincorporated Monroe County. Potential suitable habitat is about 14,088 acres. Of these lands, 7,416 acres are located on conservation lands and not subject to development (53 percent). Critical habitat has also been designated for this species. Critical habitat is estimated to be 8,645 acres representing 61 percent of all potential suitable silver rice rat habitat. Of these, 6,712 acres are located on conservation lands and not subject to development (78 percent).

Municipalities

There is no potential suitable silver rice rat habitat in the following municipalities:

City of Layton

City of Key West

Village of Islamorada

City of Marathon

Habitat

Habitat maps for the rice rat were generated based on detailed information on the present known range, which includes specific areas of salt marsh, transitional buttonwood, freshwater wetlands, and mangrove habitats in the Lower Keys, from Howe Key through the Saddlebunch Keys. Potentially suitable but unoccupied habitat was also mapped based on vegetation and being adjacent and contiguous to known populations of the rice rat. Small fragments of potentially suitable habitat were not considered viable rice rat habitat due to their isolation from the source population, their fragmented nature, the presence of large numbers of feral and domestic cats, and the generally poor condition in terms of supporting a viable rice rat population.

Florida Keys

All rice rat habitats in the Florida Keys are located within unincorporated Monroe County.

Unincorporated Monroe County

We determined there are 14,088 acres of potential silver rice rat habitat in unincorporated

Monroe County. Of these, 7,416 acres are located on conservation lands and not subject to development (53 percent).

Tier I, SPA, and Tier III Lands: The Service calculated that there are 3,371 acres of at-risk habitat in Tier I, SPA, and Tier III designations (Tier I=3,355 acres, SPA=12 acres, and Tier III=4 acres). Tier I lands are represented by 2,036 parcels, SPA lands by 47 parcels, and Tier III by 28 parcels. Tier III lands, which are generally isolated parcels within developed subdivision, have far less value, and in many cases, none whatsoever. Lands in Tier I and SPA are targeted for purchase by the county and the Florida Forever program. The county also discourages development of these lands by assigning negative ROGO development points for habitat and listed species in their permit review process. The county's ROGO allotment allows for a maximum of 6 ROGO allotments for Tier I lands, 3 allocations in the Upper Keys and 3 allocations in the Lower Keys.

Tier I Lands: We estimate that there are 3,355 acres of at-risk lands in Tier I, representing 2,036 parcels (1.6 acres per parcel). Based on an allocation of 3 allotments per year and a 15-year assessment period, we estimate adverse effects to about 72.1 acres of potential suitable silver rice rat habitat

(ROGO allotment X total years X acres per lot = total acres [3*15*1.6=72.1]).

Since we cannot determine whether the 3 annual ROGO allotments in the Lower Keys will occur in CBRA zones or within non-CBRA zones, for assessment purposes we will consider that allotments will be equally balanced as a percentage of the lands in a CBRA zone. For this analysis, the CBRA zone lands (1,808 acres) represent 54 percent of the at risk lands ($1,808/3,355=54$). Therefore, we believe the adverse effect to the silver rice rat from the proposed action in unincorporated Monroe County to be the loss of 33.1 acres of potential suitable habitat over a 15-year period. This habitat loss represents 0.23 percent of the potential suitable silver rice rat habitat in the Keys ($33/14,088 = 0.0023$). Based on the current population, we believe this increase will not be significant.

The habitat loss from ROGO allotments in CBRA zone lands are a component of our cumulative effects assessment. Following the above assessment approach, we calculate the habitat loss to be 39 acres of potential suitable habitat over a 15-year period. This habitat loss represents 0.03 percent ($39/14,088 = 0.0003$) of the potential suitable silver rice rat habitat in the Keys and will be discussed further in our cumulative effects section.

SPA Lands: There are 12 acres in SPAs representing 47 parcels, which equates to 0.25 acres per parcel. Since there are no ROGO restrictions on SPA lands, we must consider that development could occur in these lands at the same frequency of Tier III lands. For this analysis, SPA and Tier III lands represent 75 parcels (63 percent SPAs and 37 percent Tier III, with 47 and 28 parcels respectively). With an allotment of 66 ROGO units per year in unincorporated Monroe County's Lower Keys over a 15-year period, this equates to 990 ROGO units. This allotment exceeds the available SPA parcels. Therefore, we assume that all 12 acres of SPA lands, represented by 47 parcel will be developed, resulting in the loss of all 12 acres of potential suitable silver rice rat habitat. There are no CBRA zone lands present. This loss equates to 0.09

percent of the potential suitable silver rice rat habitat in the Keys ($12/14,088 = 0.0009$). Based on the current population, we believe this increase will not be significant by itself.

SPA CBRA Lands: There are no CBRA zone lands present.

Habitat fragmentation

Florida Keys

Unincorporated Monroe County

The at-risk lands in the “other island lands” classification in unincorporated Monroe County were estimated to be 3,371 acres in Tier I, SPA, and Tier III designations (Tier I=3,355 acres, SPA=12 acres, and Tier III=4 acres). Tier I lands are represented by 2,036 parcels, SPA lands by 47 parcels, and Tier III by 28 parcels. The Tier 1 and SPA lands total about 3,371 acres and are considered by the Service as those lands that could be subject to fragmentation by development. In our assessment of the development potential in these lands, we determined that the proposed level of development in these lands, which is about 45.1 acres, would not by itself be significant. We expect this will result in some minor fragmentation of habitat, although the impacts will be minimal and the precise effect on the species will be difficult to measure.

Indirect effects

Cat predation

Mortality from feral and domestic cats may be the greatest current threat to the persistence of the silver rice rat. It is well known that rats and mice are a major component of cats’ diets. The number of cats present in the Lower Keys has increased over the past 20 years commensurate with the increase in the human residential population.

To assess the effects that feral cats may have on the extant populations of silver rice rat, we used the buffers identified in “Status of the species in the action area” for Lower Keys marsh rabbits (Frank, personal communication, 1996). Based on our GIS analysis we have determined that there are about 5,958 acres of buffer lands surrounding potential suitable silver rice rat habitat, of which 3,288 acres are in government ownership (55 percent). Tier I lands are represented by 1,208 acres, SPA lands by 50 acres, and Tier III lands by 158 acres, encompassing 558 parcels, 224 parcels, and 771 parcels respectively. We have determined that there are 393 acres, 1 acre and less than 1 acre of CBRA zone lands, represented by 78, 3, and 3 parcels, respectively for Tier 1, SPA, and Tier III lands. We have also determined that there are an additional 2,258 developed residential parcel within the buffer lands, for a combined estimate of 4,468 residential parcels.

Our cat predation analysis is predicated on the estimated number of cats within the buffer lands surrounding the silver rice rat habitat. Researchers have shown that 34 percent of the units (residences) have cats (FWC, 2003) and that on an average each household has 2.1 cats. This

research also demonstrates that on the average 40 percent of the cats are exclusively indoor pets, which relates to 60 percent are occasionally outdoors and occasionally will stalk prey in potential suitable habitat. Following this approach, we estimate that there are currently, based on 2,258 residences in the buffer lands, an estimated population of 1,612 cats with 967 cats occasionally outdoors

(residences X % of residences with cats X number cats per residence=total cats
[2,258*0.34*2.1= 1,612 cats])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [2,258*0.34*2.1*0.60=967]).

The FWC (2003) study also provides an estimate of feral cats as a component of domestic cats, which is that the feral cat population is about 2/3 of the domestic cats ($0.67*1,612=1,080$). Based on this analysis we estimate the current population of domestic cats and feral cats that could have an adverse effect to the silver rice rat to be 1,615 cats ($967+1,080=2,047$).

Other Lands Increase in Cats – Tier I Lands: Our habitat loss analysis provided for a loss of 33.1 acres from the proposed action. Based on an average parcel size of 1.6 acres) per parcel, the habitat loss equates to an increase of 21 new residences ($33/1.6=20.6$). Following our cat population increase analysis, an increase of 21 residences equates to an increase of 15 cats with 8.9 cats being occasionally outdoors over the 15-year review period

(residences X % of residences with cats X number cats per residence=total cats [$21*0.34*2.1=15$ cats])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [$21*0.34*2.1*0.60=8.9$]).

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the project cat population over the 15-year period is estimated at 19 cats ($15*.67+8.9=18.95$).

Tier I Lands Increase in Cats – CBRA Zone: Our habitat loss analysis provided for a loss of 39 acres from the proposed action. Based on an average parcel size of 1.6 acres, the habitat loss equates to an increase of 24 new residences ($39/1.6=24.3$). Following our cat population increase analysis, an increase of 24 residences equates to an increase of 17 cats with 10.3 cats being occasionally outdoors over the 15-year review period

(residences X % of residences with cats X number cats per residence=total cats [$24*0.34*2.1=17$ cats])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [$24*0.34*2.1*0.60=10.3$]).

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the project cat population over the 15-year period is estimated at 21.8 cats ($17 \times .67 + 10.39 = 21.8$).

SPA Lands Increase in Cats: Our habitat loss analysis provided for a loss of 12 acres representing 47 parcels from the proposed action. There are no CBRA zone lands. Based on an average parcel size of 0.25 acres, the habitat loss equates to an increase of 47 new residences. Since ROGO allocations are not restricted in SPA and Tier III lands, which are the preferred areas for development, we considered that all 47 parcels would be developed. Therefore, based on the above, the development of 47 parcels could provide for an increase of 33.6 cats with 20.1 cats being occasionally outdoors over the 15-year review period

(residences X % of residences with cats X number cats per residence = total cats [$47 \times 0.34 \times 2.1 = 33.6$ cats])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [$47 \times 0.34 \times 2.1 \times 0.60 = 20.1$]).

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the project cat population over the 15-year period is estimated at 42.6 cats ($33.6 \times .67 + 20 = 42.6$).

Cat Predation - Buffer Lands: Based on our GIS analysis we have determined that there are about 5,958 acres of buffer lands surrounding potential suitable silver rice rat habitat, of which 3,288 acres are in government ownership (55 percent). Tier I lands are represented by 1,208 acres, SPA lands by 50 acres, and Tier III lands by 158 acres, encompassing 558 parcels, 224 parcels, and 771 parcels respectively. We have determined that there are 393 acres, 1 acre and less than 1 acre of CBRA zone lands, represented by 78, 3, and 3 parcels, respectively for Tier I, SPA, and Tier III lands. We have determined that there are about 7,513 vacant developable parcels in the Lower Keys, of which 2,941 are in SPA and Tier III lands 1,022 parcels are in SPAs and 1,919 are in Tier III lands, 35 and 65 percent respectively. For our assessment purposes, we are considering that ROGO allotments will be proportioned according to the percent of either SPA or Tier III lands present in the buffer area. Therefore, for this assessment, 35 percent and 65 percent of the yearly ROGO allotments will be for SPA or Tier III parcel, respectively.

Monroe County's allotment is 197 ROGO units per year. For assessment purposes, we assumed that the allotments would be split by thirds (Upper keys, Middle keys, and Lower keys). Since we consider the Lower Keys rabbit to be in the Lower keys, we project 66 ROGO units per year as the development potential. Ten of these ROGO units have been allocated for Big Pine and No Name Keys (HCP), leaving 66 ROGO units for the remainder of the Lower Keys. We have determined that there are about 7,513 vacant developable parcels in the Lower Keys, of which 2,641 parcels are in SPA and Tier III lands (224 are on Big Pine and No Name Keys and covered by the HCP). The remaining parcels are within Tier I and development is restricted to 3 ROGO units per year. Therefore, the remaining 53 ROGO units will be distributed evenly across the 2,417 parcels ($2,641 - 224 = 2,417$), which represents an allotment of 1 ROGO unit per 46 parcels ($2,417 / 53 = 45.6$), and will be proportioned accordingly between SPA and Tier III parcels.

Tier I Buffer Lands: There are 558 parcels, totaling 1,208 acres in Tier I buffer lands, with 78 parcels totaling 393 acres in CBRA zones. Since ROGO allotments are restricted to 3 ROGO units per year in Tier I lands, and we have already allocated these units in the above Tier I analysis. No additional cat predations are expected in Tier I buffer lands.

SPA Buffer Lands: There are 224 parcels available in SPA lands in the buffer, totaling 50 acres, with 1 acre in CBRA zones. Considering that only 35 percent of the ROGO units are available for SPA lands, and that 4.8 ROGO units per year will be allotted ($224/47=4.8$) we estimate that 28 parcels could be developed over the 15-year period ($4.8*15*.35=25.2$). Therefore for our cat predation assessment, 28 parcels will be developed, which equates to an increase of 17.9 cats with 10.7 cats being occasionally outdoors

(ROGO allotment X total years X % units in SPA = total units affected [$4.8*15*.35=25.2$]). Therefore for our cat predation assessment, 28 parcels will be developed, which equates to an increase of 17.9 cats with 10.7 cats being occasionally outdoors

(residences X % of residences with cats X number cats per residence = total cats [$25*0.34*2.1=17.9$ cats])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [$25*0.34*2.1*0.60=10.7$]) over the 15-year period.

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the projected outside cat population over the 15-year period is estimated at 22.7 cats ($17.9*.67+10.7=22.7$).

Tier III Buffer Lands: There are 771 parcels available in SPA lands in the buffer, totaling 158 acres, with less than 1 acre in CBRA zones. Considering that 65 percent of the ROGO units are available for Tier III lands, and that 16 ROGO unit will be allotted per year, ($771/47=16.4$) we estimate that 160 parcels could be developed over the 15-year period

(ROGO allotment X total years X % units in SPA = total units affected [$16.4*15*.65=159.9$]).

Therefore for our cat predation assessment, 160 parcels will be developed, which equates to an increase of 114.3 cats with 68.6 cats being occasionally outdoors

(residences X % of residences with cats X number cats per residence = total cats [$160*0.34*2.1=114.3$ cats])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [$160*0.34*2.1*0.60=68.6$]) over the 15-year period.

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the projected outside cat population over the 15-year period is estimated at 145.2 cats ($114.3 \times .67 + 68.6 = 145.2$).

Increase in Cats – Tier I CBRA Zone: Based on our GIS analysis, 39 acres are at risk in CBRA zones. Based on an average parcel size of 1.6 acres, the habitat loss equates to an increase of 24.4 new residences ($39/1.6 = 24.4$). Since ROGO allotments are restricted to 3 ROGO units per year in Tier I lands, and we have already allocated these units in the above Tier I analysis. No additional cat predations are expected in Tier I CBRA buffer lands.

Increase in Cats – SPA and Tier III CBRA Zone: We have estimated that 1.5 acres are within SPA and Tier III CBRA Zones, representing 6 parcels. Following our cat population increase analysis, an increase of 6 residences equates to an increase of 4.28 cats with 2.57 cats being occasionally outdoors over the 15-year review period. This impact is considered in the Cumulative Effects analysis of this BO.

(residences X % of residences with cats X number cats per residence = total cats [$6 \times 0.34 \times 2.1 = 4.28$ cats])

(residences X % of residences with cats X number cats per residence X % of cats outdoors part-time = cats outdoors part-time [$6 \times 0.34 \times 2.1 \times 0.60 = 2.57$]).

The feral cat population will respond proportionally with a 2/3 increase as well, therefore the project cat population over the 15-year period is estimated at 5.4 cats ($4.28 \times .67 + 2.57 = 5.4$).

FEMA Actions: Our analysis has identified habitat loss from the proposed action to be the loss of 45.1 acres from development and an increase in the free roaming cat population of 115 cats, with 31 from development in potential suitable habitat and 84 from development in the buffer lands. This level of habitat loss represents 0.32 percent of potential suitable habitat ($45.1/14,088 = 0.0032$).

CBRA Zone: Our analysis has identified habitat loss from the proposed actions in CBRA zones to be the loss of 39 acres from development and an increase in the free roaming cat population of 13 cats, with 11 from development in potential suitable habitat and 2 from development in buffer lands. This level of habitat loss represents 0.28 percent of potential suitable habitat ($39/14,088 = 0.0028$).

Summary – Changes since 1997 and 2003 BOs

FEMA Actions: Our analysis has identified habitat loss from the proposed action to be the loss of 45.1 acres from development and an increase in the free roaming cat population of 115 cats, with 31 from development in potential suitable habitat and 84 from development in the buffer lands. This level of habitat loss represents 0.32 percent of potential suitable habitat ($45.1/14,088 = 0.0032$).

CBRA Zone: Our analysis has identified habitat loss from the proposed actions in CBRA zones to be the loss of 39 acres from development and an increase in the free roaming cat population of 13 cats, with 11 from development in potential suitable habitat and 2 from development in buffer lands. This level of habitat loss represents 0.28 percent of potential suitable habitat ($39/14,088 = 0.0028$).

In general, the habitat loss and indirect effects identified in this analysis are more realistic than the build-out scenario assumed in the 1997 and 2003. This BO's methodology benefited from advances in GIS data and a detailed lot-by-lot review guided by the ROGO allocation process. Almost all, over 99 percent, of the species' habitat is in Tier I. Because of the ROGO allocation process, development will be extremely controlled in this location (we estimate 72 acres in Tier I over 15 years). In total, we estimate 84 acres of land will be developed in rice rat habitat, or about 0.5 percent of the available potential suitable habitat.

In addition, since the 1997 and 2003 BO was completed, we have updated information on the species population and distribution (Perry et al. 2005). Specifically, the population is now stable at 5,000-20,000 individuals, and the species condition appears good and resistant to modest increases in predation. Rice rats were captured on two new islands, Big Pine and Ramrod Keys, where no silver rice rats had been recorded in previous studies (Perry et al. 2005). Furthermore, the cat predation analysis we completed is likely an overestimate; Perry (personal communication, 2006) rarely saw evidence of cats near rice rat habitat. Cats prefer transitional zones that are partially wet and dry, and not the purely wetland habitat rice rats use. Other predators such as raccoons likely have a larger impact on rice rats.

Based on this analysis, we expect the modest loss of habitat caused by the action and related effects will not be significant for the silver rice rat. Furthermore, we believe the technical assistance review process outlined at the end of this document can help avoid and minimize negative impacts.

Silver rice rat critical habitat

In the discussions that follow, loss of habitat is evaluated on a “worst case scenario” basis. We assume that all new development will occur in potential suitable habitat. We also assume that if a property is developed, all habitats on that unit will be lost. Clearing is limited in mangrove, buttonwood, saltmarsh, and freshwater wetlands. Additional regulations require preservation or restoration of habitat to offset vegetation losses that result from development. Some fragmentation of habitat will nevertheless occur. However, fragmentation will be offset to an unknown degree by preservation or by restoration, creating more continuity in other fragmented habitat. The Service is unable to evaluate the true effects of these beneficial actions, but acknowledges that the benefits are tangible mitigation measures. In essence, the programs are already helping to avoid and minimize negative impacts to potential suitable habitat.

Critical habitat has been designated for the silver rice rat and includes all lands and waters above mean low tide on Little Pine Key, Water Keys, Big Torch Key, Middle Torch Key, Summerland Key north of U.S. 1, Johnston Key, Raccoon Key, and the Saddlebunch Keys south of U.S. 1;

but not including lands in Township 67S, Range 27E, section 8, and the northern 1/5 of section 17 (50 CFR 17.95). The area estimate is 8,645 acres.

Florida Keys

All designated critical rice rat habitat is located in the Lower Keys within the administrative boundaries of unincorporated Monroe County.

Unincorporated Monroe County

We have determined that there are 8,645 acres of critical silver rice rat habitat in unincorporated Monroe County, representing 61 percent of all potential suitable silver rice rat habitat. Of these, 6,712 acres are located on conservation lands and not subject to development (78 percent). Our GIS analysis also shows that 1,527 acres of these lands are at-risk from development and are located within 930 parcels.

Tier I, SPA, and Tier III Lands: The Service calculated that there are 1,527 acres of at-risk critical habitat in Tier I, SPA, and Tier III designations (Tier I =1,519 acres, SPA= 1 acre, and Tier III=6 acres). Tier I and SPA lands are considered by the Service as potential suitable habitat for listed species, whereas, Tier III lands, which are generally isolated parcels within a developed subdivision, are no longer considered by the Service to be potential suitable habitat for listed species. Lands in Tier I and SPA are targeted for purchase by the county and the Florida Forever program. The county also discourages development of these lands by assigning negative ROGO development points for habitat and listed species in their permit review process. The county's ROGO allotment allows for a maximum of 6 ROGO allotments combined for Tier I and SPA lands, 3 allocations in the Upper Keys and 3 allocations in the Lower Keys. There are 900 parcels in Tier I and SPA lands for 1,520 acres of at-risk-habitat.

Tier I Lands: Our GIS analysis identified about 1,519 acres of Tier I lands, represented by 891 parcels, which equates to 1.7 acres per parcel ($1,519/891=1.7$). Based on an allocation of 3 allotments per year (silver rice rat critical habitat is within the Lower keys) and a 15-year assessment period, we estimate adverse effects to about 76.5 acres of critical silver rice rat habitat

(ROGO allotment X total years X acres per lot = total acres [$3*15*1.7=76.5$]).

Since we cannot determine whether the 3 annual ROGO allotments in the Lower Keys will occur in CBRA zones or within non-CBRA zones, for assessment purposes we will consider that allotments will be equally balanced as a percentage of the lands in a CBRA zone. For this analysis, the CBRA zone lands (746 acres) represent 49 percent of the at risk lands ($746/1,519=0.49$). Therefore, we believe the adverse effect to the silver rice rat from the proposed action in unincorporated Monroe County to be the loss of 38.9 acres of potential suitable habitat over a 15-year period. This habitat loss represents 0.45 percent of the critical silver rice rat habitat in the Keys ($38.9/8,645=.0045$). Based on the current population, we believe this loss of habitat will not by itself be significant or adversely modify the critical habitat of this species.

The habitat loss from ROGO allotments in CBRA zone lands are a component of our cumulative effects assessment. Following the above assessment approach, we calculate the habitat loss to be 37.5 acres of potential suitable habitat over a 15-year period. This habitat loss also represents 0.2 percent of the potential suitable silver rice rat habitat in the Keys. We have also determined that development has already occurred in about 264 acres of rice rat critical habitat. This acreage combined with the projected action area loss plus this loss is estimated at 341.4 acres, which represents 3.9 percent ($341.4/8,645=3.5$) of the designated critical habitat and will be discussed further in our cumulative effects section.

SPA and Tier III Lands: Our GIS analysis identified about 7 acres of SPA and Tier III lands (1 and 6 acres, respectively), represented by 39 parcels (9 and 30, respectively), which equates to 0.18 acres per parcel ($7/39=0.18$). As discussed previously, at a rate of one ROGO unit for every 36 parcels, we expect the development of one parcel per year or 15 parcels over the 15-year period. This level of development equates to 2.7 acres ($15*0.18=2.7$) and represents 0.03 percent

of the critical silver rice rat habitat in the Keys ($2.7/8,645=.0003$). Based on the current population, we believe this loss of habitat will not by itself be significant or adversely modify the critical habitat of this species.

Summary – Changes since 1997 and 2003 BOs

In general, the habitat loss and indirect effects identified in this analysis are more realistic than the build-out scenario assumed in the 1997 and 2003. This BO's methodology benefited from advances in GIS data and a detailed lot-by-lot review guided by the ROGO allocation process. The build-out scenario assumed in the 1997 and 2003 opinions, applied to the current information would identify the acres of at risk from the proposed actions as being (1,526 acres) impacting 930 parcels. Our analysis incorporates the ROGO development restrictions and identifies the acres of at risk habitat as being 42 acres affecting 38 parcels.

We have determined based on our GIS analysis that 41.6 acres of silver rice rat critical habitat could be lost from the proposed action. We have also determined that development has already occurred in about 264 acres of rice rat critical habitat. This acreage combined with the projected loss is about 305.6 acres, which represents 3.5 percent of the designated critical habitat ($305.6/8,645=3.5$). In other words, well over 95 percent of the designated critical habitat remains intact, and it is unlikely that a significant amount of primary constituent elements will be lost to development in the future. The vast majority of primary constituent elements fall into the Tier I category, which is capped at a maximum of 3 ROGO permits per year. As a result, the primary constituent elements of silver rice rat critical habitat, including mangrove swamps, salt marsh flats, buttonwood transition vegetation, and cattail marshes will not be significantly impacted by the action. Furthermore, given the sensitivity of these habitat types and existing regulatory mechanisms in place at the Federal, State, and local levels, any impacts would likely be avoided and minimized to the maximum degree possible, and mitigated through some action.

In addition, the approach we employed was protective and assumed all Lower Keys Tier I ROGO permits would be issued in rice rat habitat. This is extremely unlikely, and therefore the above calculations probably over estimate future impacts. In addition, according to the best available science (Perry, personal communication, 2006), the silver rice rat population is stable and may be as high as 20,000 individuals and distributed widely. Because of these facts, we believe the action's impacts will not be significant for the species or its habitat. Furthermore, the technical assistance review process outlined at the end of this document can help avoid and minimize negative impacts that may occur.

Stock Island tree snail

In the discussions that follow, loss of habitat is evaluated on a “worst case scenario” basis. One assumption is that if a property is developed, all habitat on that unit will be lost. Clearing is limited to 10 to 30 percent in high quality habitat and 50 to 70 percent in moderate to low quality habitat. Therefore, a maximum of 70 percent of our affected habitat assessment can actually occur. Generally, only 10 percent of likely occupied (high and moderate quality) habitat can be cleared in Monroe County (Tier I) and a maximum of 30 percent in the municipalities. Additional regulations require preservation or restoration of habitat to offset vegetation losses that result from development. Fragmentation of habitat will nevertheless occur. However, fragmentation will be offset to an unknown degree by preservation or by restoration, creating more continuity in other fragmented habitat. The Service is unable to evaluate the true effects of these beneficial actions, but acknowledges that the benefits are tangible mitigation measures. In essence, the programs are already helping to avoid and minimize negative impacts to potential suitable habitat.

Potential suitable native habitat is present for the Stock Island tree snail in unincorporated Monroe County, Village of Islamorada, and the City of Marathon. No potential suitable native habitat is present for this species in the City of Layton, the City of Key Colony Beach, and the City of Key West.

Population

Exact numbers of Stock Island tree snails are not known. The Stock Island tree snail population is assessed by the numbers of discrete populations that are known. Six known tree snail populations were identified in the Service’s 1997 BO, five of which were outside its historic range. The other site identified is actually in Miami-Dade County. In 2006, the Stock island tree snail is believed to occupy over 28 sites.

Florida Keys

As many as 28 populations Stock island tree snails now exist in the Florida Keys and two populations are known on the Florida mainland in Miami-Dade County. Because of relocations by snail collectors, the Stock Island tree snail presently occupies several areas outside its historic range on Stock Island, near Key West at the extreme southern end of the Florida Keys.

Unincorporated Monroe County

Twenty-one of 28 sites identified to have Stock Island tree snail populations are located in unincorporated Monroe County on Key Largo. Four populations have been identified in the Lower Keys. At least eight sites on public lands on North Key Largo and the Lower keys are not affected by the proposed action.

Village of Islamorada

The Village of Islamorada does not contain any populations of Stock Island tree snails.

City of Marathon

The City of Marathon does not contain any populations of Stock Island tree snails.

Habitat loss

Florida Keys

Potential suitable Stock Island tree snail habitat includes all tropical hardwood hammock habitat types in the action area. We determined there is a total of 8,327 acres of potential Stock Island tree snail habitat in Monroe County. Of these, 5,976 acres are located on conservation lands not subject to development.

Unincorporated Monroe County

We determined there are 7,323 acres of potential Stock Island tree snail habitat in unincorporated Monroe County. Of these, 2,351 acres are located on conservation lands not subject to development (32 percent).

Tier I, SPA, and Tier III Lands: The Service calculated that there are 1,092 acres of susceptible habitat in Tier I, SPA, and Tier III designations (Tier I=948 acres, SPA=99 acres, and Tier III=45 acres). Lands in Tier I and SPA are targeted for purchase by the county and the Florida Forever program. The county also discourages development of these lands by assigning negative ROGO development points for habitat and listed species in their permit review process. The county's ROGO allotment allows for a maximum of 6 ROGO allotments for Tier I lands, three allocations in the Upper Keys and three allocations in the Lower Keys.

Tier I Lands: There are 1,809 parcels in Tier I lands, for a total acreage of 948 acres representing 0.52 acres of potential suitable habitat per parcel. Based on an allocation of six allotments per year and a 15-year assessment period, we estimate adverse effects to about 46.8 acres of potential suitable Stock Island tree snail habitat

(ROGO allotment X total years X acres per lot = total acres [6*15*0.52=46.8]).

Since we cannot determine whether the 6 annual ROGO allotments will occur in CBRA zones or within non-CBRA zones, for assessment purposes we will consider that allotments will be equally balanced as a percentage of the lands in a CBRA zone. For this analysis, the CBRA zone lands (216 acres) represent 23 percent of the at-risk lands (216/948=23). Therefore, we believe the adverse effect to the Stock Island tree snail habitat from the proposed action in unincorporated Monroe County to be the loss of 36 acres of potential suitable habitat over a 15-year period. This habitat loss represents 0.43 percent of the potential suitable Stock Island tree snail habitat in the Keys ($36/8,327 = 0.0043$). We believe this loss of habitat will not be significant.

Tier 1 CBRA Lands: The habitat loss from ROGO allotments in CBRA zone lands are a component of our cumulative effects assessment. Following the above assessment approach, we calculate the habitat loss to be 10.8 acres of potential suitable habitat over a 15-year period in

Tier I lands. This habitat loss represents 0.12 percent of the potential suitable Stock Island tree snail habitat in the Keys and will be discussed further in our cumulative effects section ($10.8/8,327 = 0.0012$).

SPA Lands: There are 99 acres, representing 704 parcels. Since there are no ROGO restrictions on SPA lands, we must consider that development could occur in these lands at the same frequency of Tier III lands. For this analysis, SPA and Tier III lands represent 1,159 parcels (61 percent in SPAs and 39 percent in Tier III with 704 and 455 parcels, respectively). With an allotment of 187 ROGO units (197-10 Tier I units) per year in unincorporated Monroe County, over a 15-year period, this equates to 2,805 ROGO units, of which 1,802 represent SPA allotments. This allotment exceeds the available SPA parcels. Therefore, we assume that all 99 acres of SPA lands represented by 704 parcels will be developed. There are no CBRA zone lands present. This loss equates to 1.19 percent of the potential suitable Stock Island tree snail habitat in the Keys ($99/8,327 = 0.019$).

Village of Islamorada

We determined there are 444 acres of potential Stock Island tree snail habitat within the Village of Islamorada, of which 134 acres are located within undeveloped lots, which represents 337 parcels. Based on our GIS analyses, the proposed action may affect 134 acres of vacant undeveloped lots subject to development. There are no CBRA lands in the Village of Islamorada. The Village of Islamorada is allocated 28 ROGO allotments per year.

For assessment purposes, we estimate that each of the vacant parcels represents 0.4 acres. We estimate, based on 28 ROGO units per year over a 15-year period, in which 420 units could be developed. Since, there are only 337 parcels in Islamorada, we assumed that all parcels would be developed, resulting in the loss of 134 acres of potential suitable Stock Island tree snail habitat. This loss equates to 1.6 percent of the percent of the potential suitable Stock Island tree snail habitat in the Keys ($134/8,327 = 0.016$). Based on the current population, we believe this increase by itself will not be significant.

City of Marathon

We determined there are 560 acres of potential Stock Island tree snail habitat within the City of Marathon, of which 118 acres are located within undeveloped lots, which represent 369 parcels. For assessment purposes, we estimate that each of the vacant parcels represents 0.4 acres. We estimate that, based on 30 ROGO units allocated per year over a 15-year period, 450 units could be developed. Since there are only 369 developable parcels in potential suitable habitat in Marathon, we assumed that all parcels would be developed, resulting in the loss of 118 acres of potential suitable Stock Island tree snail habitat. This loss equates to 1.45 percent of the percent of the potential suitable Stock Island tree snail habitat in the Keys ($118/8,327 = 0.0145$).

Habitat fragmentation

As is the case with other species, unregulated development caused damage to Stock Island tree snail habitat. Stock Island tree snail habitat has been fragmented by development of canal subdivisions and clearing tropical hardwood hammock. Despite these losses, a significant amount of habitat is available for Stock Island tree snails in the Florida Keys. The species is not habitat limited, but the populations on private lands are at risk.

Indirect mortality

Indirect effects associated with the proposed action destroy or remove individual snails from the population and adversely effect behavior and reproduction. The use of pesticides on or near snail habitat can kill snails directly or alter behavior associated with feeding and reproduction. Urbanization within or near snail habitat can promote the establishment of black rats and fire ants that may feed on snails resulting in a reduction in population numbers and reproductive potential. Excessive watering of ornamental plants and lawns can modify snail behavior by bringing snails out of aestivation during the winter months and exposing them to cold temperatures and desiccation. Collecting of snails may increase concurrently with an increasing population.

Summary – Changes since the 1997 and 2003 BOs

In general, the habitat loss and indirect effects identified in this analysis are more realistic than the build-out scenario assumed in the 1997 and 2003. This BO's methodology benefited from advances in GIS data and a detailed lot-by-lot review guided by the ROGO allocation process. The build-out scenario assumed in the 1997 and 2003 opinions, applied to the current information would identify the acres of at risk from the proposed actions as being 1,344 acres influencing 3,674 parcels. Our analysis incorporates the ROGO development restrictions and identifies the acres of at risk habitat as being 387 acres affecting 1,479 parcels.

Based on our analyses, 387 acres of potential suitable Stock Island tree snail habitat could be lost in the next 15 years. This represents 4.6 percent of the total amount of potential suitable habitat

available to this species in Monroe County ($387/8,327 = 0.046$). Currently, 5,976 acres, 73 percent, are in public ownership. In addition, the population has expanded. In 1996, Stock Island tree snails were documented in 5 locations. Since then, many other populations have been identified. In 2006, 28 sites have been recorded, and eight exist on publicly owned land.

The Service believes that incidental take of Stock Island tree snails will occur because of the proposed action. However, based on the current population, we believe this level of take will not be significant to the health of the species. Furthermore, the biological review of individual parcels before development occurs, as outlined in the technical assistance process at the end of this document, can determine whether Stock Island tree snails are on site. This could help identify other sites where the species is found, and allow steps to be implemented to avoid and minimize negative impacts.

Overall Summary – Changes since the 1997 and 2003 BOs

Eastern Indigo Snake: In the Keys, indigo snakes are rare and have not been documented often in recent decades. The primary threat to the eastern indigo snake in the Keys is habitat loss and fragmentation due to development. Low-density residential housing is also a threat because it increases the likelihood of snakes being killed by property owners and domestic pets. There is no change in our understanding of the eastern indigo snakes in the Florida Keys since the 1997 and 2003 BOs were completed. The Florida Keys constitutes a small part of the species' overall range.

Key deer: The Key deer population is at or near an historic high. Furthermore, all the impacts to Key deer on Big Pine Key, the core population, have been separately evaluated and addressed in the Big Pine and No Name Key HCP and related BO finalized in June 2006. This BO focused on the Key deer habitat outside of Big Pine and No Name Keys, and the impact of the action is minimal. We also reviewed potential impacts from traffic, which are minimal.

Key Largo woodrat: Since the 1997 BO and 2003 amendment were completed, no new information has been generated that suggests the Key Largo woodrat's highly endangered condition has improved. The best available science suggests fewer than 200 individuals remain. Despite the more realistic picture of habitat loss, the direct and related indirect effects evaluated in the BO – especially cat predation and habitat fragmentation – could exacerbate the already precarious condition of the species.

Key Largo cotton mouse: This species shares the same habitat as the endangered Key Largo woodrat, and less is known about its condition. Since the 1997 BO and 2003 amendment, no new information has been generated that suggests the Key Largo cotton mouse's highly endangered condition has changed. Despite the more realistic picture of habitat loss, the direct and related indirect effects evaluated in the BO – especially cat predation and habitat fragmentation – could exacerbate the already precarious condition of the species.

Lower Keys rabbit: A population viability analysis conducted for the Lower Keys marsh rabbit predicted this species might become extinct in 20 to 30 years under the current conditions. These data are also consistent with a recent population viability analysis of the Lower Keys marsh rabbit metapopulation on Boca Chica Key. As a result, the level of development estimated in the draft BO and the related indirect effects from domestic and feral cats could exacerbate an already precarious condition for this species.

Key tree-cactus: Since the 1997 BO and 2003 amendment were completed, no new information has been generated that suggests the Key tree-cactus' condition has improved. To the contrary, one of the four populations on private lands appears deceased. The species is in decline, possibly from the impacts of hurricanes and related storm surge over wash. A significant challenge related to analyzing the impacts of the action is the fact that the precise location of future development is not known. Two of the remaining populations have no protection whatsoever and are subject to development pressure. Given that the species occurs in seven locations, the loss of two populations could have significant implications on Key tree-cactus viability.

Schaus swallowtail butterfly: Virtually all the species occupied habitat is protected, and the population is stable and viable. In addition, the Service is now aware of county and municipal requirements to minimize clearing of native habitats when development does occur, and to plant native vegetation to offset impacts. The existing protected lands and habitat review and enhancement process now in place could help retain a corridor the species could use in the future to reclaim its historic range if conditions improve (e.g., new mosquito spraying technologies are developed).

Silver rice rat: Ninety-nine percent of the species' habitat is in an area where development is extremely controlled. In total, we estimate 84 acres of land will be developed in rice rat habitat, or about 0.5 percent of the available potential suitable habitat. In addition, since the 1997 BO and 2003 amendment were completed, we have received updated information on the species population and distribution. Specifically, the population is now stable at 5,000-20,000 individuals, and the species condition appears good and resistant to modest increases in predation. Rice rats were recently captured on two new islands, Big Pine and Ramrod Keys, where none had been recorded in previous studies.

Silver rice rat critical habitat: We have determined a minimal amount of silver rice rat critical habitat could be lost from the proposed action. We have also determined that development has already occurred in about 264 acres of rice rat critical habitat. This acreage combined with the projected loss is about 306 acres, which represents 3.5 percent of the designated critical habitat. In other words, well over 95 percent of the designated critical habitat remains intact, and it is unlikely that a significant amount of primary constituent elements will be affected by development in the future.

Stock Island tree snail: In 1996, Stock Island tree snails were documented in five locations. Since then, many other populations have been identified. In 2006, 28 sites have been recorded, and eight are in public ownership. Based on our analyses, 387 acres of potential suitable Stock Island tree snail habitat could be lost in the next 15 years. This represents 4.6 percent of the total

amount of potential suitable habitat available to this species in Monroe County ($387/8,327 = 0.046$). Currently 73 percent is in public ownership.

The following table provides a summary of the effects the proposed action may have on species potential suitable habitat.

Table 16: Estimated Area of Species Habitat Impacted – Federal Action

Species	Estimated Habitat Affected Village of Islamorada	Habitat Affected City of Marathon	Estimated Habitat Affected City of Layton	Estimated Habitat Affected City of Key West	Estimated Habitat Affected Key Colony	Estimated Habitat Affected Unincorporated Monroe County	Total
Eastern indigo snake	134 ac	92 ac	None	None	None	94 ac	320 ac
Key deer other Islands	None	None	None	None	None	65.4 ac	65.4 ac
Key Largo cotton mouse North	None	None	None	None	None	1.5 ac	1.5 ac
Key Largo cotton mouse South	None	None	None	None	None	20.4 ac	20.4 ac
Key Largo woodrat North	None	None	None	None	None	1.5 ac	1.5 ac
Key Largo woodrat South	None	None	None	None	None	20.4 ac	20.4 ac
Key-tree cactus	134 ac	92 ac	None	None	None	125 ac	351 ac
Lower Keys rabbit other islands	None	None	None	None	None	30 ac	30 ac
Silver rice rat	None	None	None	None	None	45 ac	45 ac
Silver rice rat Critical Habitat	None	None	None	None	None	41.6 ac	41.6 ac
Schaus swallowtail butterfly North Key Largo	None	None	None	None	None	13.26 ac	13.26 ac
Schaus swallowtail butterfly South Key Largo	134 ac	None	None	None	None	73 ac	207 ac
Stock Island tree snail	134 ac	118 ac	None	None	None	135 ac	386.9 ac

In addition to the impacts on habitat loss listed above, the Service identified the following direct effects on species.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the action area considered in this BO. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Actions taken by Monroe County are likely to have the most significant cumulative effects on the threatened and endangered species being considered in this BO. The Monroe County government controls land use practices that affect threatened and endangered species within areas mapped by FEMA as Special Flood Hazards Areas. The Monroe County government also controls land use practices within areas where flood insurance is not available under the NFIP (i.e., within units designated by CBRA). For the cumulative effects analysis, we have focused on the cumulative effects of Monroe County's actions on threatened and endangered species within CBRA areas. The following table identifies the area of potential suitable habitat for threatened and endangered species in the Keys that could be affected by the Monroe County's actions in the future. These methods used to make these calculations were described in the Effects of the Action of this BO.

Table 17: Estimated Area of Species Habitat Impacted – Cumulative Effects

Species	Estimated Habitat Affected Village of Islamorada	Estimated Habitat Affected City of Marathon	Estimated Habitat Affected City of Layton	Estimated Habitat Affected City of Key West	Estimated Habitat Affected Key Colony	Estimated Habitat Affected Unincorporated Monroe County	Total
Eastern indigo snake	None	None	None	None	None	24 ac	24 ac
Key deer other Islands	None	None	None	None	None	31 ac	31 ac
Key Largo cotton mouse North	None	None	None	None	None	14 ac	14 ac
Key Largo cotton mouse South	None	None	None	None	None	1.0 ac	1.0 ac
Key Largo woodrat North	None	None	None	None	None	14 ac	14 ac
Key Largo woodrat South	None	None	None	None	None	1.0 ac	1.0 ac
Key-tree cactus	None	None	None	None	None	6 ac	6 ac
Lower Keys marsh rabbit other islands	None	None	None	None	None	25 ac	25 ac
Silver rice rat	None	None	None	None	None	39 ac	39 ac
Silver rice rat critical habitat	None	None	None	None	None	37.5 ac	37.5 ac
Schaus swallowtail butterfly North Key Largo	None	None	None	None	None	8.8 ac	8.8 ac

Species	Estimated Habitat Affected Village of Islamorada	Estimated Habitat Affected City of Marathon	Estimat ed Habitat Affected City of Layton	Estimated Habitat Affected City of Key West	Estimated Habitat Affected Key Colony	Estimated Habitat Affected Unincorporate d Monroe County	Total
Schaus swallowtail butterfly South Key Largo	None	None	None	None	None	10.3 ac	10.3 ac
Stock Island tree snail	None	None	None	None	None	10.7 ac	10.7 ac

The habitat loss outlined in the table above represents a small proportion of potential suitable habitat for these species and also for silver rice rat critical habitat, and the Service believes the impact of this loss will not be significant in and of itself, particularly in light of the review process outlined in the RPA at the end of this BO.

In addition to the above, cumulative effects analysis in CBRA areas, the Service is aware of an electrical substation being proposed by the Florida Keys Electric Cooperative that would impact the Key Largo woodrat. An HCP is now underdevelopment for this project. The Service is also aware of a proposed school in North Key Largo, which will require review under the Act.

CONCLUSION

After reviewing the status of the nine threatened and endangered species, the environmental baseline, the effects of the action and the cumulative effects, it is the Service's biological opinion that continued issuance of flood insurance policies following the FEMA's NFIP is likely to have the following effects on threatened and endangered species in the Florida Keys:

Eastern indigo snake: We believe the continuing administration of the NFIP in the Keys is likely to result in incidental take but will not jeopardize the continued existence of the threatened eastern indigo snake.

Key deer: We believe the continuing administration of the NFIP in the Keys is likely to result in incidental take but will not jeopardize the continued existence of the endangered Key deer.

Key Largo cotton mouse: We believe the continuing administration of the NFIP in the Keys, along with related habitat loss and indirect effects, will jeopardize the continued existence of the endangered Key Largo cotton mouse.

Key Largo woodrat: We believe the continuing administration of the NFIP in the Keys, along with related habitat loss and indirect effects, will jeopardize the continued existence of the endangered Key Largo woodrat.

Key tree-cactus: We believe the continuing administration of the NFIP in the Keys will jeopardize the continued existence of the endangered Key tree-cactus.

Lower Keys rabbit: We believe the continuing administration of the NFIP in the Keys, along with related habitat loss and indirect effects, will jeopardize the continued existence of the endangered Lower Keys rabbit.

Schaus swallowtail butterfly: We believe the continuing administration of the NFIP in the Keys is likely to result in incidental take but will not jeopardize the continued existence of the endangered Schaus swallowtail butterfly.

Silver rice rat: We believe the continuing administration of the NFIP in the Keys is likely to result in incidental take but will not jeopardize the continued existence of the endangered silver rice rat.

Silver rice rat critical habitat: We believe the continuing administration of the NFIP in the Keys is likely to adversely affect critical habitat, but will not appreciably diminish the value of constituent elements essential to the species' conservation. It will not result in the adverse modification of silver rice rat critical habitat.

Stock Island tree snail: We believe the continuing administration of the NFIP in the Keys is likely to result in incidental take but will not jeopardize the continued existence of the endangered Stock Island tree snail.

Table 18: Conclusions by Species

Species	Jeopardy	Adverse Modification
Eastern indigo snake	NO	NOT APPLICABLE
Key deer	NO	NOT APPLICABLE
Key Largo cotton mouse	YES	NOT APPLICABLE
Key Largo woodrat	YES	NOT APPLICABLE
Key tree-cactus	YES	NOT APPLICABLE
Lower Keys marsh rabbit	YES	NOT APPLICABLE
Schaus swallowtail butterfly	NO	NOT APPLICABLE
Silver rice rat	NO	NO
Stock Island Tree Snail	NO	NOT APPLICABLE

Table 19: Combined Summary of Estimated Area Acreage of Habitat Impacted – Direct, Indirect and Cumulative

Species	Estimated Total Acreage Potential Suitable Habitat	Total Acreage Government	Percent Protected	Estimated Acreage Impacted by Action	Estimated Acreage Impacted Cumulative	Estimated Total Impact	Impact as Percent of Potential Suitable Habitat in Keys	Species Status

Species	Estimated Total Acreage Potential Suitable Habitat	Total Acreage Governmen t	Percent Protected	Estimated Acreage Impacted by Action	Estimated Acreage Impacted Cumulative	Estimated Total Impact	Impact as Percent of Potential Suitable Habitat in Keys	Species Status
Eastern Indigo Snake	10,024	7,472	74.5	320	24	344	3.6	Stable
Key deer	24,676	17,646	71.5	65.4	31	96.4	<1	Stable or Increasing
Key Largo Cotton Mouse	5,046	4,295	85	21.9	15.0	36.9	<1	Unknown
Key Largo Woodrat	5,046	4,295	85	21.9	15.0	36.9	<1	Declining
Key-Tree Cactus	8,327	5,976	71.8	351	6	357	4.3	Declining
Lower Keys Rabbit	3,140	2,467	78.6	29.5	24.8	54.3	1.7	Declining
Silver Rice Rat	14,088	10,398	73.8	45	39	84	<1	Stable but Cyclic
Silver Rice Rat Critical Habitat	8,645	6,712	77.6	41.6	37.5	79.1	<1	---
Schaus Swallowtail butterfly	3,925	2,816	71.7	207	19.1	226.1	5.8	Stable but Cyclic
Stock Island Tree Snail	8,327	5,976	71.8	386.9	10.7	397.6	4.8	Increasing

Table 20: Summary of Indirect Mortality Per Year

Type	Species	Population	FEMA Action	CBRA Area Cumulative	Total	Percent of Population
Traffic	Key Deer	650	4	--	4	<1

In situations where the Service has determined that the action as proposed by the action agency may result in jeopardy to a listed species, the Service can provide an alternate action that if implemented can avoid jeopardy to the listed species. The alternative action needs to meet four specific criteria for implementation by the action agency. For the proposed action, as determined by FEMA, the Service provides the following alternative action.

REASONABLE AND PRUDENT ALTERNATIVE

Regulations (50 CFR §402.02) implementing section 7 of the Act define reasonable and prudent alternatives (RPA) as alternative actions, identified during formal consultation, that:

- (1) can be implemented in a manner consistent with the intended purpose of the action;
- (2) can be implemented consistent with the scope of the action agency's legal authority and jurisdiction;
- (3) are economically and technologically feasible; and
- (4) would, the Service believes, avoid the likelihood of jeopardizing the continued

existence of listed species or resulting in the destruction or adverse modification of critical habitat.

Because this opinion has found jeopardy, FEMA is required to notify the Service of its final decision on the implementation of the reasonable and prudent alternative.

The Court's March 2005 Order criticized the 2003 RPAs for (1) relying on voluntary measures and (2) not protecting against habitat loss and fragmentation or otherwise accounting for the cumulative effects of the permitted projects. These two points have been addressed in the revised RPA below. First, FEMA has more clearly described the steps that will be taken if the RPA is not followed. Second, the revised RPA will result in a review process that will allow the Service to consider the cumulative impacts of a series of permit proposals at clear points in time, rather than on a piecemeal basis.

Our jeopardy determinations were generally based on habitat loss and indirect effects from development expected to occur over a 15-year period of implementation of the NFIP. Therefore, our RPA is also based on habitat loss and indirect effects from development. Habitat loss applies to all species evaluated in this biological opinion. The indirect effects from development apply to free roaming cat predation of Key Largo cotton mice, Key Largo woodrats, and Lower Keys rabbits.

1. The Service will create an updated list of real estate numbers of parcels in threatened and endangered species habitat, and buffer zones as appropriate, in the Florida Keys and provide them to FEMA for distribution to all participating communities in Monroe County. The updated real estate parcel list will be completed within 60 days.
2. In areas mapped as containing unsuitable habitat, participating communities in Monroe County will place a form letter in the permit file that indicates:
 - a. the individual that made the determination,
 - b. the date of the determination; and
 - c. the date of the habitat map used to make the determination and for documentation.
3. After this form letter is finished, participating communities in Monroe County may take action on the proposed building permits without further concerns for threatened and endangered species (or their critical habitat).
4. For the parcels within potential suitable habitat and associated buffer zones, issuance of building permits for certain construction activities will require further consultation with FEMA and the Service. Specifically, in potential suitable habitat for species with a jeopardy conclusion, the Service will review all new development on vacant parcels and development on parcels with a structure that will expand the footprint of the structure into native habitat. The Service will either:
 - a) Determine that a proposed action would not adversely affect threatened or endangered species or designated critical habitat. If the Service determines that

- the action would not adversely affect threatened or endangered species or designated critical habitat, they will notify the participating community by letter of the not likely to adversely affect determination.
- b) Determine that a proposed action may adversely affect threatened or endangered species or designated critical habitat. The Service would notify the participating community by letter of the may affect determination and the possible need for authorization under section 7 or section 10 of the Act. Participating communities would work with the landowner and the Service to ensure compliance with either section 7 or section 10. For the five species in this opinion with a no jeopardy determination and the critical habitat with a no adverse modification determination, the Service would offer technical assistance to avoid and minimize impacts to species and their habitats, as needed. The incidental take that is identified in this process cannot exceed the amount of take anticipated in Table 19 and 20.
5. FEMA will require participating communities to establish written procedures for referring floodplain development/building permit applicants to the Service for review as outlined in RPA 4. For those species with a jeopardy determination, the written procedures will outline a process allowing the impacts of permits to be reviewed in the broader context of development impacts at specified times (e.g. quarterly or at six month intervals). The Service will review the cumulative impacts of permits at that time, along with the impacts of any other projects not included in the review process outlined in RPA 4 that may affect species in the Keys. This will allow: an update of the Environmental Baseline in this BO, tracking of any take that may occur, referral of projects to the section 7 or section 10 processes, if needed, and the development and implementation of additional conservation measures, if appropriate. FEMA and the community will coordinate with the Service to develop procedures in more detail to ensure compliance with the Act.
6. Free-Roaming Cats: FEMA will coordinate with participating communities in Monroe County in their development of a brochure and other materials for addressing predation by domestic and feral cats in areas within endangered and threatened species habitat and buffer zones. Participating communities will be required to hand this brochure to all permit applicants seeking to build a structure. This brochure will describe how to protect threatened and endangered species by keeping pets indoors.
7. FEMA will coordinate with the Service every six months to evaluate the extent of the Act compliance for proposed construction or other development in participating communities in Monroe County. FEMA will visit participating communities in Monroe County every six months. During community visits to participating communities in Monroe County, FEMA will evaluate the administrative records maintained by the participating community on permits issued for proposed construction or other development described in this reasonable and prudent alternative to ensure compliance with the requirement. FEMA will use information provided by the Service or other Federal, State, or local agencies to achieve this purpose. FEMA will treat any violation of this reasonable and prudent alternative as a substantive program deficiency or violation under 44 CFR 60.3.

8. Within 15 days of determining non-compliance with this RPA, FEMA will notify the participating community in writing that substantial progress must be made to correct the program deficiencies or remedy any violation within 60 days. The community must provide FEMA with a written response within 60 days of FEMA's notice of the actions being taken to correct the program deficiencies and any violation. If the community cannot resolve all of the program deficiencies or remedy the violation within 60 days, the community must describe in its response the actions it will take and a schedule for resolving the problems. FEMA will review this schedule.
9. Correcting deficiencies and remedying violations can take a variety of forms depending upon their type and nature. However, the following are examples of possible actions that FEMA would require the community to undertake within 60 days or to include as part of a remediation plan to correct any remaining program deficiencies and violation or violations remaining after 60 days:
 - a. Demonstrate that the community has initiated an enforcement action against the property owner who did not apply for a floodplain development/building permit and provide a description of the enforcement action being taken. If the community has not initiated some type of enforcement action against the property owner, the community should issue a stop work order or take other action to stop further development or construction. If the property owner has not received the necessary section 7 consultation or section 10 permit from the Service, the community will refer the property owner to the Service.
 - b. Submit a declaration of denial of flood insurance following 44 CFR Part 73 (Section 1316 of the National Flood Insurance Act of 1968) to FEMA for construction of an insurable structure that has occurred without receipt of the necessary section 7 consultation or section 10 permit, or without incorporating conservation measures provided by the Service in the technical assistance review process. Upon submission of a valid declaration, FEMA then will deny the flood insurance to that property. If corrective action is not possible, then FEMA will continue to deny the individual flood insurance policy. Insurance availability will be restored to a property only if the community has submitted a valid rescission to FEMA. A valid rescission from the community shall consist of a description of and supporting documentation for the measures taken to bring the structure into compliance with the local floodplain management ordinance and this RPA along with other requirements in accordance with 44 CFR 73.3 (Section 1316).
 - c. Rescind the permit for any building or other floodplain development if the participating community issued a permit in contravention to the Service's technical assistance recommendation.
 - d. Seek civil/criminal penalties or other appropriate legal action against the property owner as provided for in the local ordinance or community code.

10. If FEMA determines the participating community's non-compliance with this reasonable and prudent alternative has caused harm to threatened and endangered species that cannot be corrected or offset, FEMA will initiate procedures outlined in 44 CFR 59.24 (Suspension [also probation] of community eligibility) for probation and suspension of community eligibility for flood insurance. In addition, if the community is not responsive to FEMA's initial notice or it has not made substantial progress within 60 days to correct the program deficiencies and remedy the violation, FEMA will initiate the probation and suspension procedures outlined in 44 CFR 59.24 which allows FEMA to place participating communities on probation or suspend them from the NFIP. If the community fails to adhere to the agreed upon remediation plan and schedule or fails to demonstrate why the schedule for resolving any remaining program deficiencies or violation cannot be adhered to, FEMA will also initiate procedures outlined in 44 CFR 59.24 for probation and suspension.
11. FEMA in conjunction with the Service will conduct training sessions with public officials and local building officials on the requirements of this RPA.
12. FEMA will require participating communities to provide to permit applicants a brochure or similar written material about the permit referral process and post this information on the community's website or otherwise make it generally available. FEMA and the community will coordinate with the Service in developing this communication to the public.
13. FEMA will require the community to maintain either the section 10(a)(1)(B) permit or the completed section 7 consultation in the administrative record for the floodplain development/building permit for future review by FEMA during their community assistance visits.

Without the process implemented by the RPA, the Service would not have the opportunity to review all development projects for potential impacts to listed species. Although some development projects requiring permits from Army Corps of Engineers under section 404 of the Clean Water Act might come to the Service for review, the majority of projects do not require 404 or other Federal permits. Although a permit under section 10 of the Act would be required for private individuals whose proposed development may take listed animal species, in many cases the developers and the Service are not necessarily aware of the exact locations of species within habitat that appears suitable until these site-specific reviews occur. Therefore, many would not necessarily approach the Service for incidental take authorization under the Act absent this process. The RPA results in the Service working directly with each applicant to analyze direct, indirect, and cumulative effects of the development and to provide measures to avoid, minimize, and/or compensate for impacts to listed species.

The implementation of the above RPA by FEMA may still result in incidental take of listed species, including those species where we identified a level of incidental take in the original proposed action. However, we believe that the level of take through implementation of the RPA will not jeopardize the survival and recovery of the nine species evaluated in this biological

opinion where adverse effects from habitat loss and indirect effects from development have been identified.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described in the RPA are non-discretionary, and must be undertaken by FEMA so that they become binding conditions of any grant or permit issued to the participating communities, as appropriate, for the exemption in section 7(o)(2) to apply. FEMA has a continuing duty to regulate the activity covered by this incidental take statement. If FEMA (1) fails to assume and implement the reasonable and prudent alternatives or (2) fails to require the participating communities to adhere to the reasonable and prudent alternatives through enforceable terms that are added by the participating communities to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, FEMA must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(I) (3)]

Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plant species. However, limited protection of listed plants from take is provided to the extent that the Act prohibits the removal and reduction to possession of Federally listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of State law or regulation or in the course of any violation of a State criminal trespass law.

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service has developed the following incidental take statement based on the premise that the reasonable and prudent alternative will be carried out.

The Service anticipates incidental take in the form of harm and harass of the threatened eastern indigo snake, endangered key deer, endangered Schaus swallowtail butterfly, threatened Stock Island tree snail, endangered silver rice rat, endangered Key Largo woodrat, endangered Key

Largo cotton mouse, endangered tree cactus, and endangered lower keys rabbit. However, the actual numbers may be difficult to detect because in general these species have small body sizes, (except the endangered key deer) or are found in habitats that make detection difficult.

However, the level of take of these species can be anticipated by loss of habitat within each species range identified in Table 19 and take will be monitored through a cumulative total of habitat losses from reviewed projects. The Service has also identified incidental take for the Key deer in the form of increased road mortality that may result from an increase in traffic. The Service anticipates an increase in road mortality of an average of 4 deer per year over the 15-year review period and take will be monitored as a component of the annual road mortality totals for this species.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of expected take is not likely to result in jeopardy to the species, or destruction or adverse modification of critical habitat when the reasonable and prudent alternative is carried out.

REASONABLE AND PRUDENT MEASURES

The Service did not identify an additional measure to minimize incidental take other than those in the project description and the reasonable and prudent alternative.

TERMS AND CONDITIONS

Since there are no reasonable and prudent measures, there are no terms and conditions.

Upon locating a dead, injured, or sick individual of an endangered or threatened species, initial notification must be made to the Fish and Wildlife Service Law Enforcement Office in Miami, Florida at (305-526-2610) and the NKDR, 28950 Watson Boulevard, Big Pine Key, Florida 33043; (305-872-2239). Additional notification must be made to the Fish and Wildlife Service Ecological Services Field Office at Big Pine Key (305-872-2753). Secondary notification should be made to the Florida Fish and Wildlife Conservation Commission; South Region, 3900 Drane Field Road, Lakeland, Florida, 33811-1299; (1-800-282-8002). Care should be taken in handling sick or injured individuals and in the preservation of specimens in the best possible state for later analysis of cause of death or injury.

The reasonable and prudent alternatives are designed to eliminate jeopardy and to minimize the impact of incidental take that might otherwise result from the reasonable and prudent alternatives and proposed action. The Service believes that take in the form of habitat loss and Key deer impacts from traffic as described in the above analysis will be incidental. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. FEMA must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the proposed action or the reasonable and prudent alternatives.

CONSERVATION RECOMMENDATIONS

Education and outreach can guide participating communities to implement responsible floodplain management and increase awareness of the NFIP activities regarding protection of listed species and critical habitat. FEMA proposes education and outreach activities to participating communities through the following steps:

1. Participate with local officials from the participating communities in Monroe County and the Service in community meetings to explain to property owners the responsibilities of all parties for complying with the Act while implementing the minimum requirements of the NFIP.
2. Attend and discuss at regional (such as the Florida Floodplain Managers Association) and national floodplain managers conferences (Association of State Floodplain Managers) the responsibilities of all parties for complying with the Act while implementing the minimum requirements of the NFIP.
3. Incorporate materials on the Act in a programmatic way in NFIP-related outreach materials, such as on FEMA's website and Watermark newsletter that goes out to various NFIP constituents.
4. Develop a floodplain management bulletin similar to the NFIP Floodplain Management Bulletins that provide guidance to communities on the requirement of 44 CFR 60.3(a)(2) requiring communities to ensure that applicants have obtained all other Federal and State permits before issuing a floodplain development permit.

Community Rating System

Although FWS recognizes that communities in Monroe county are not currently eligible to receive Community Rating System (CRS) credits associated with the NFIP to benefit communities that have implemented conservation planning under section 10(a)(1)(B) of the Act. FEMA already provides credit in the CRS for protection of areas that provide natural and beneficial functions, such as wetlands, riparian areas, sensitive areas and habitat for rare or endangered species. Since 2002, FEMA has implemented a two tiered system to encourage communities to develop habitat conservation plans which protect rare, threatened, or endangered species. Communities participating in CRS receive credit if they have adopted and implemented a habitat conservation plan, even if the plan has not yet been submitted to or received approval from the Service. Additional credit is awarded to communities which have a Service approved habitat conservation plan under section 10(a)(1)(B) of the Act. The two tiered system encourages communities to develop community-wide, multi-species conservation plans and rewards efforts by providing credit prior to Service approval.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the conservation recommendations carried out.

REINITIATION NOTICE

This concludes formal consultation on the action of the Federal Emergency Management Agency's administration of the NFIP in the Florida Keys. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary FEMA involvement or control over the action has been retained (or is authorized by law) and if:

- (1) the amount or extent of incidental take is exceeded;
- (2) new information reveals effects of the FEMA action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion;
- (3) the FEMA action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion;
- (4) a new species is listed or critical habitat designated that may be affected by the action; or
- (5) Monroe County or municipalities are in non-compliance with this BO and FEMA fails to initiate enforcement actions as described in the reasonable and prudent alternative.

In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation of consultation.

For this biological opinion, the incidental take would be exceeded when the take exceeds that identified in Table 19 and 20 above which is what has been exempted from the prohibitions of section 9 by this opinion. The Service appreciates the cooperation of the FEMA during this consultation. We would like to continue working with you and your staff regarding this implementation of the National Flood Insurance Program in Monroe County, Florida. For further coordination, please contact Paul Souza, acting Field Supervisor, for our South Florida Office at 772-562-3909 extension 285 or Noreen Walsh, Assistant Regional Director for Ecological Services, of this office at 404-679-7085.

Sincerely yours,

(sgd) Sam Hamilton

Sam D. Hamilton
Regional Director

cc: Field Supervisor, FWS, Vero Beach, Florida
Director, FWS

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APPENDIX 1

Habitat in the Florida Keys used by federally listed threatened and endangered species evaluated in this biological opinion

Species Name	Range	Acres of Habitat	Habitat Description
American crocodile (<i>Crocodylus acutus</i>)	Throughout the Florida Keys	782,337 of Critical Habitat	
Eastern indigo snake (<i>Drymarchon corais couperi</i>)	Throughout the Florida Keys	10,024	Hardwood hammock, ridge/hammock, and pinelands as identified in the ADID habitat classification
Garber's spurge (<i>Chamaesyce garberi</i>)	Throughout the Florida Keys		No habitat data available Open, disturbed, or calcareous habitat
Key deer (<i>Odocoileus virginianus clavium</i>)	Occupies 20 to 25 keys from Ohio Key south to Saddle Hill Key	24,676	Pinelands and hardwood hammock, as well as other habitat types
Key Largo cotton mouse (<i>Peromyscus gossypinus allapaticola</i>)	Throughout Key Largo	2,943	Hardwood hammock and ridge/hammock, as identified in the ADID habitat classification
Key Largo woodrat (<i>Neotoma floridana smalli</i>)	Throughout Key Largo.	2,943	Hardwood hammock and ridge/hammock, as identified in the ADID habitat classification
Key tree-cactus (<i>Pilosocereus robinii</i>)	Throughout the Florida Keys	8,327	Hardwood hammock and ridge/hammock, as identified in the ADID habitat classification
Lower Keys (=marsh) rabbit (<i>Sylvilagus palustris hefneri</i>)	Annette, Big Munson, Big Pine, Boca Chica, East Rockland, Geiger, Mayo, No Name, Porpoise, Saddlebunch, Saddlehill, and Sugarloaf	3,140	The transition zone of grasses and sedges from salt marsh to buttonwood transition zones and uplands
Schaus' swallowtail butterfly (<i>Papilio aristodemus ponceanus</i>)	Elliot Key south to, and including, Lower Matecumbe Key	3,925	Hardwood hammock and ridge/hammock, as identified in the ADID habitat classification
Silver rice rat (<i>Oryzomys argentatus</i>)	Little Pine, Big Pine, Howe, Water, Middle Torch, Big Torch, Summerland, Raccoon, Johnston, Cudjoe, Upper Sugarloaf, and Saddlebunch	14,088	Uses salt marsh and transitional buttonwood habitats
Stock Island tree snail (<i>Orthalicus reses reses</i>)	Throughout the Florida Keys	8,327	Hardwood hammock and ridge/hammock, as identified in the ADID habitat classification

Appendix 2

June 11, 2004 Order Approving Settlement Agreement

**IN THE CIRCUIT COURT OF THE 16TH JUDICIAL CIRCUIT
IN AND FOR MONROE COUNTY, FLORIDA**

ROBERT LEE CLAY, JOHN K.
MOYANT and LI CHIUNG MOYANT,
and RICHARD N. MAROT, and CHARLENE MAROT,
and DIETMAR MENCK AND GUDRUN SHULZ-MENCK

Petitioners,

vs.

CASE NO.: 04-CA-05-M

MONROE COUNTY, FLORIDA,
a political subdivision of the
State of Florida,

Respondent.

SETTLEMENT AGREEMENT

COMES NOW the Petitioners, ROBERT LEE CLAY; JOHN K. MOYANT and LI CHIUNG MOYANT; RICHARD N. MAROT and CHARLENE MAROT; DIETMAR MENCK and GUDRUN SHULZ-MENCK; and the Respondent, MONROE COUNTY, a political subdivision of the State of Florida, and file this their Settlement Agreement and state as follows:

WHEREAS each of the Petitioners are owners of a residential lot in Big Pine Key, Florida; and

WHEREAS each of the Petitioners is desirous of building a single family home on their lot; and

WHEREAS each of the Petitioners has applied for and paid for, and received approval for the issuance of a permit for a single family home on their lot in Big Pine Key; and

NOW THEREFORE in consideration of the mutual covenants and conditions contained herein and for other good and valuable consideration the receipt and sufficiency of which are hereby acknowledged, the parties agree to settle the instant proceedings as follows:

1. Each of the Petitioners has applied for, paid for, and received approval for the construction of a single family home on their respective lots in Big Pine Key, Monroe County, Florida, and such approval is currently in effect.
2. The Monroe County Building Department shall issue to Petitioner Robert Lee Clay a building permit to construct a single family home on Lot 39¹ Doctors Arm Subdivision, 3rd Addition, Section C, Big Pine Key, Florida.
3. The Monroe County Building Department shall issue to Petitioners John K. Moyant and Li Chiung Moyant a building permit to construct a single family home on Lot 40 and 41¹ Doctors Arm Subdivision, 3rd Addition, Section C, Big Pine Key, Florida.
4. The Monroe County Building Department shall issue to Petitioners Richard N. Marot and Charlene Marot a building permit to construct a single family home on Lot 9, Block 12, Eden Pines Subdivision, 2nd Addition, Big Pine Key, Florida.
5. The Monroe County Building Department shall issue to Petitioners

¹ Petitioner Moyant, owner of Lot 41, obtained Lot 39 from the County in return for the dedication of a more environmentally sensitive tract of land conveyed to the County by him. Petitioners Clay and Moyant intend to swap Clay's Lot 40 with Moyant's Lot 39. Moyant then will build his single family home on Lots 40 and 41, and Clay will build on Lot 39. This land swap was approved by BOCC Resolution 179-2003 enacted on February 28, 2004

Dietmar Menck and Gudrun Shulz-Menck a building permit to construct a single family home on Lots 4 and 5, Block 24, Eden Pines Subdivision, 3rd Addition, Big Pine Key, Florida.

6. Upon the issuance of the permits to the Petitioners, the Petitioners shall have all the rights, responsibilities and duties that the Monroe County Code and Land Development Regulations grant to builders of single family homes in Monroe County, Florida.
7. Upon the conclusion of the process for the issuance of the above-referenced permits and the expiration of the period for the Department of Community Affairs to review the Petitioners' permits, the Petitioners shall file a notice of voluntary dismissal with prejudice of the above-styled action.
8. By entering into this agreement, the parties agree to waive and release any claims that were raised or could have been raised in this litigation. After approval of this agreement by the Court, all parties shall exchange mutual releases in a format customarily used in this County. All parties acknowledge there is other litigation, presently on appeal between some of these parties and this Agreement is not intended, nor shall it be construed to, waive any rights in any other pending litigation or appeal.
9. Each party shall bear its own attorney's fees and costs in connection with this litigation. In the event it becomes necessary for any party to this litigation to commence legal proceedings to enforce the terms of this agreement, the prevailing party shall be entitled to reasonable attorney's

fees and costs in connection with such action.

10. By entering into this Settlement Agreement, the parties do not acknowledge the merits or lack of merits of these proceedings. Rather, the parties have entered into this agreement for the purpose of avoiding further expense and delay inherent in litigation of this nature.
11. The Court shall retain jurisdiction over the parties to the subject matter of these proceedings, and shall enter any orders or judgments which are just, lawful, and appropriate under the circumstances.

 4/21/04
Robert B. Shillinger, Esq. (Date)
Assistant County Attorney
P.O. Box 1026
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Attorney for the Respondent
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Franklin D. Greenman, Esq. (Date)
GREENMAN & MANZ
5800 Overseas Highway, Suite 40
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Attorney for the Petitioners
FBN: 290815

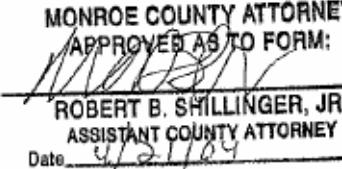
MONROE COUNTY ATTORNEY
APPROVED AS TO FORM:

ROBERT B. SHILLINGER, JR.
ASSISTANT COUNTY ATTORNEY
Date 4/21/04

Figure 1. The action area for the Federal Emergency Management Agency's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2006

FIGURE 1: Florida Keys Action Area

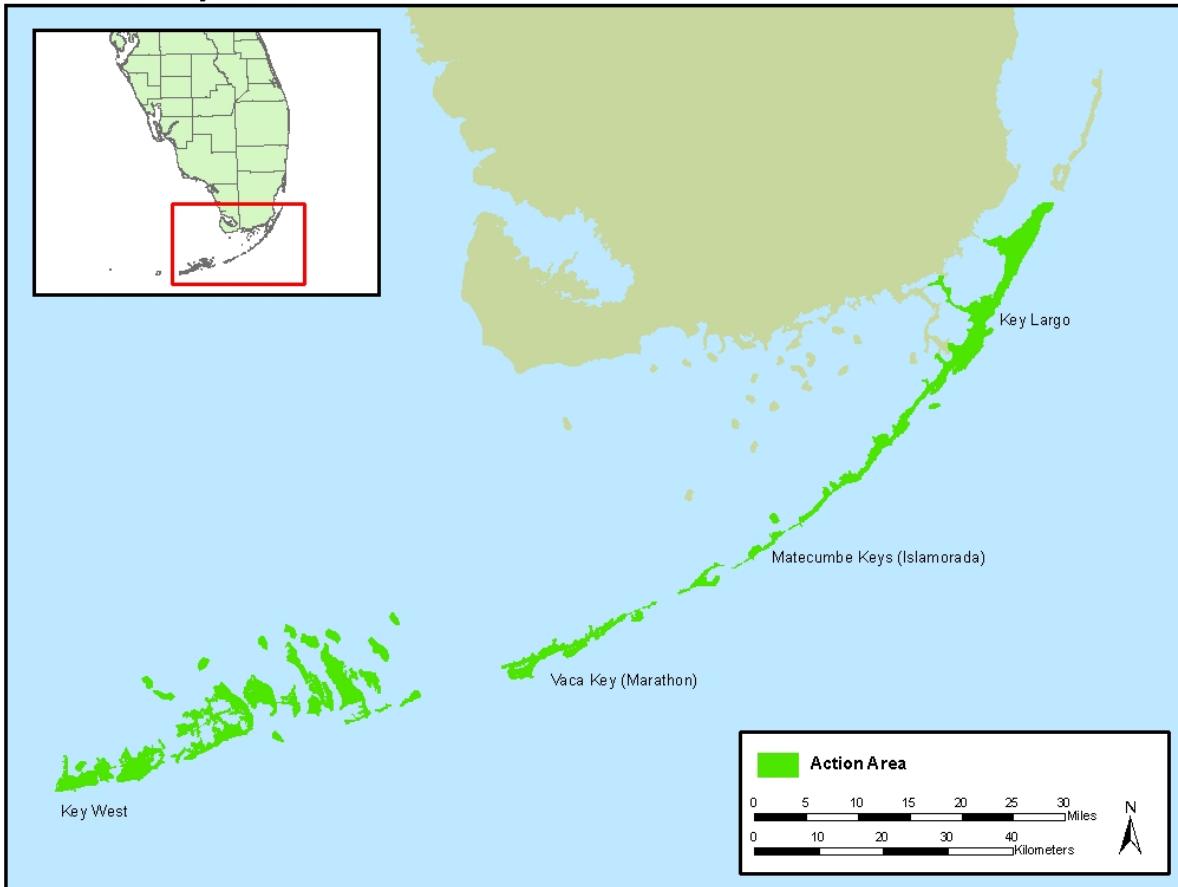


Figure 2. The silver rice rat critical habitat for the Federal Emergency Management Agency's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2006

FIGURE 2: Silver Rice Rat Critical Habitat

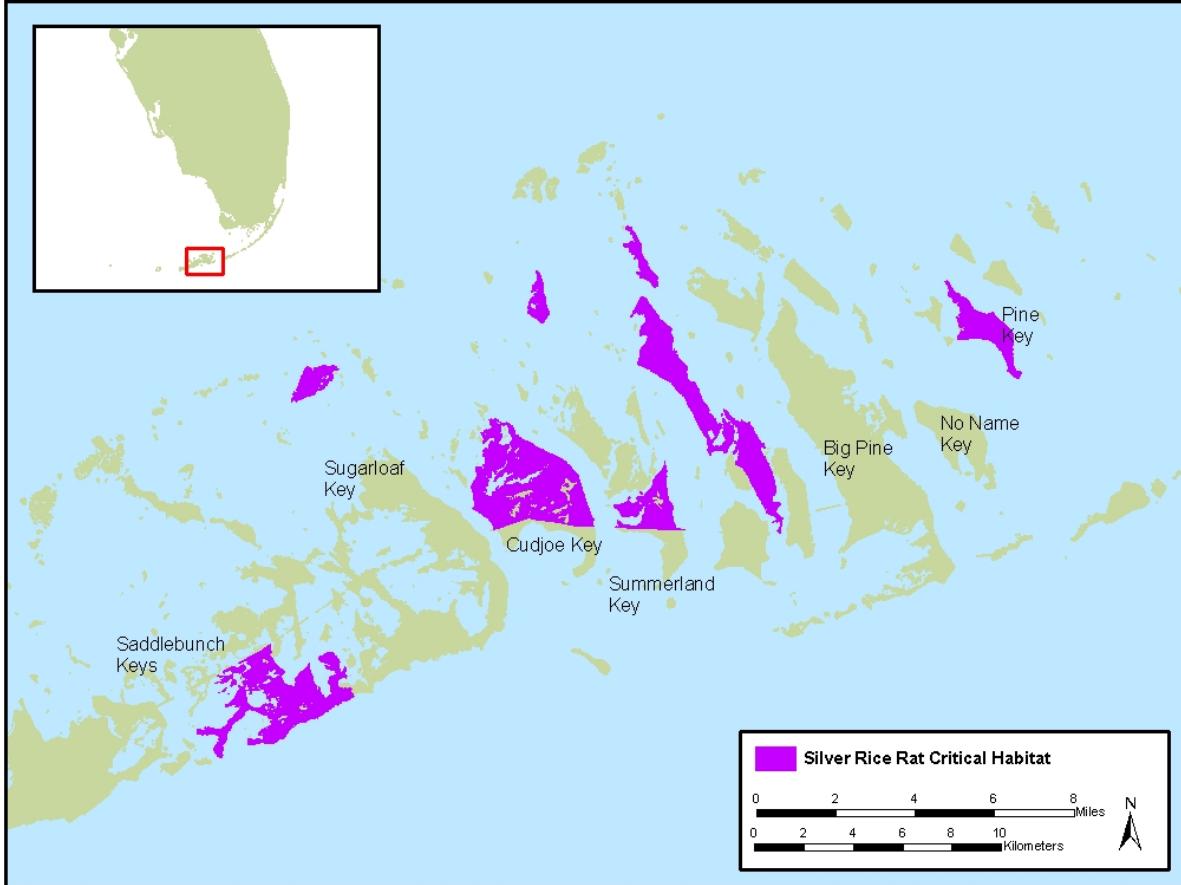


Figure 3. Potential suitable habitat for the eastern indigo snake for the Federal Emergency Management Agency's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2006

FIGURE 3: Suitable Habitat - Eastern Indigo Snake

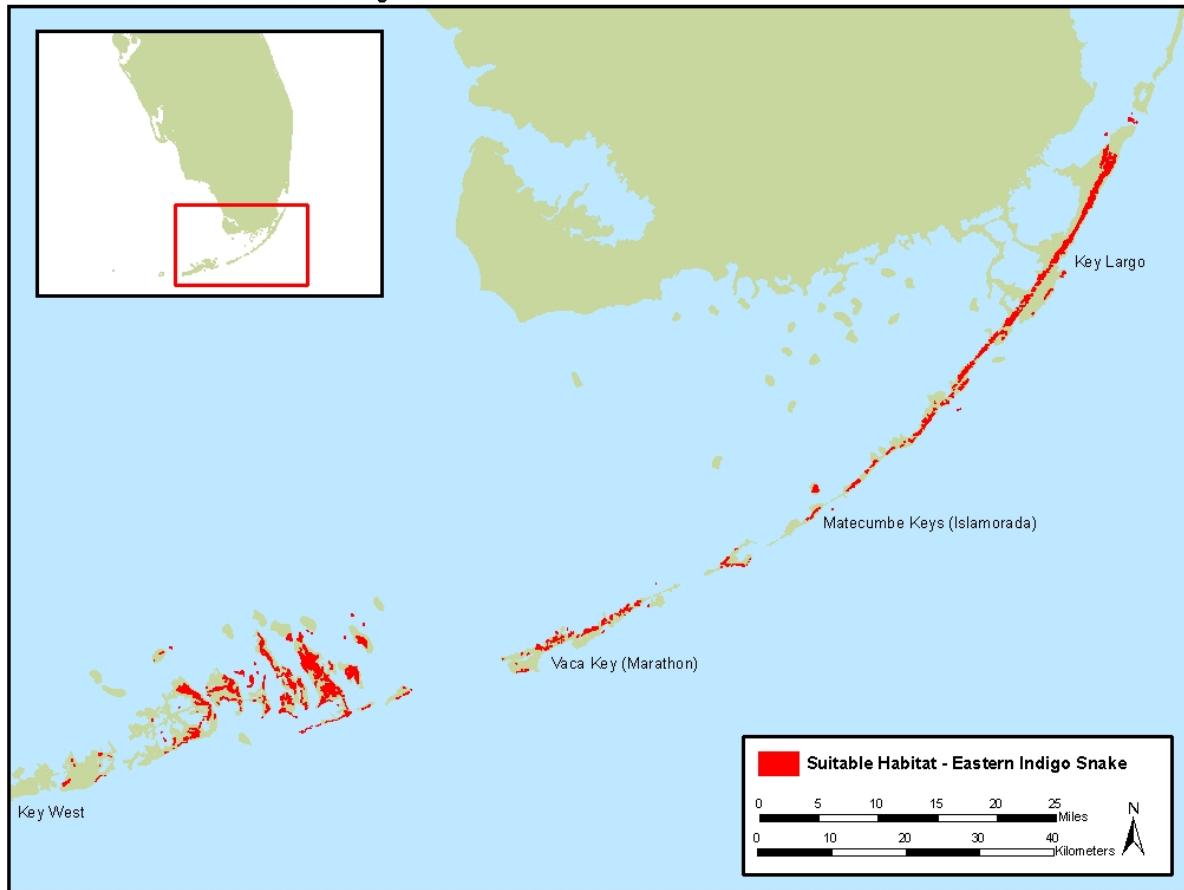


Figure 4. Potential suitable habitat for the key deer for the Federal Emergency Management Agency's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2006

FIGURE 4: Suitable Habitat - Key Deer

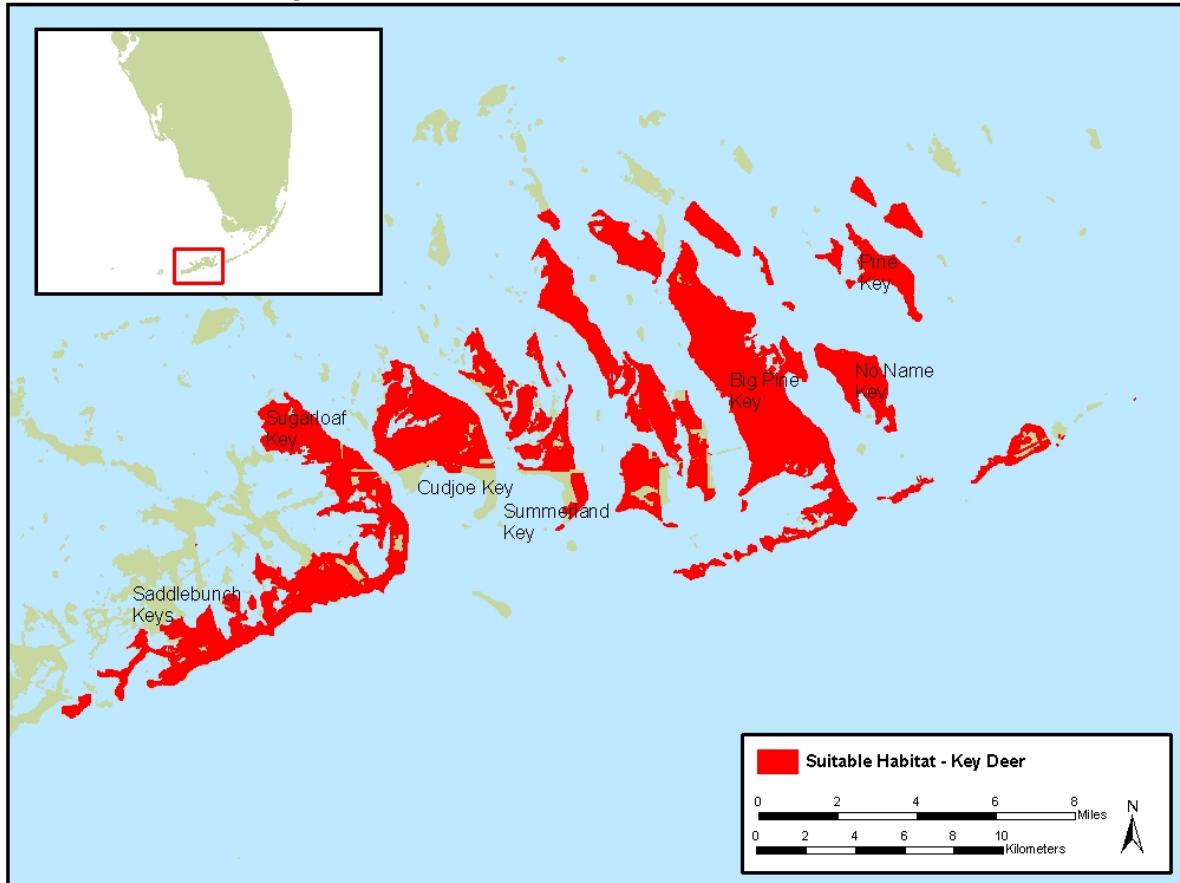


Figure 5. Potential suitable habitat for the Key Largo cotton mouse for the Federal Emergency Management Agency's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2006

FIGURE 5: Suitable Habitat - Key Largo Cotton Mouse

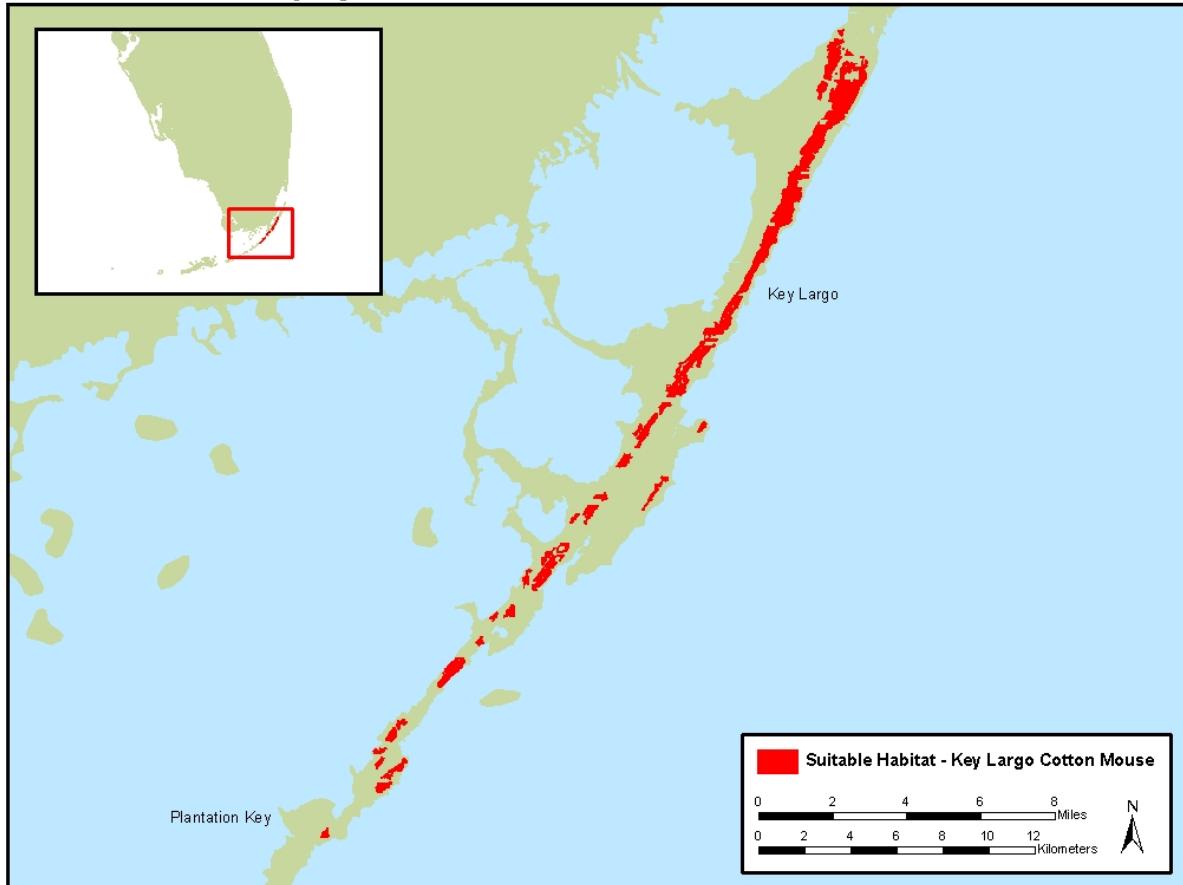


Figure 6. Potential suitable habitat for the Key Largo woodrat for the Federal Emergency Management Agency's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2006

FIGURE 6: Suitable Habitat - Key Largo Woodrat

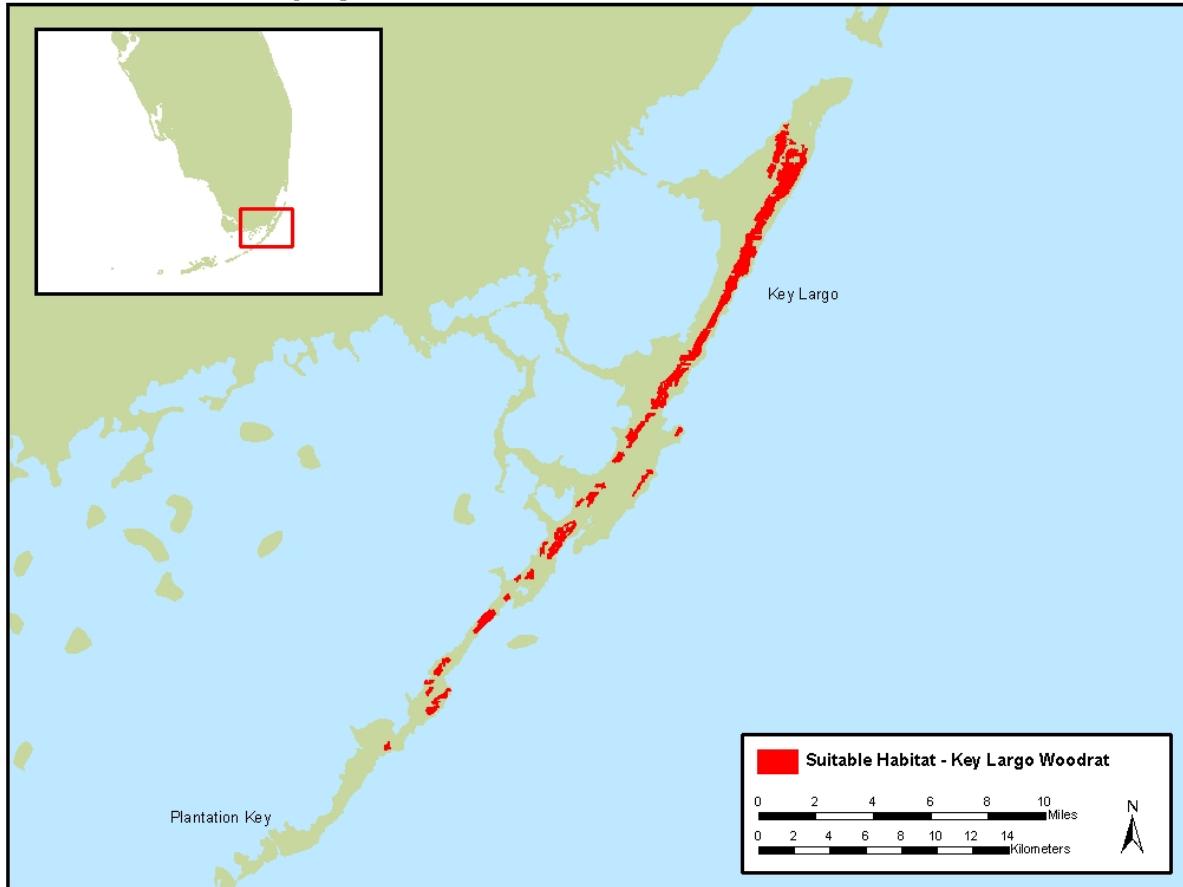


Figure 7. Potential suitable habitat for the key tree cactus for the Federal Emergency Management Agency's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2006

FIGURE 7: Suitable Habitat - Key Tree Cactus

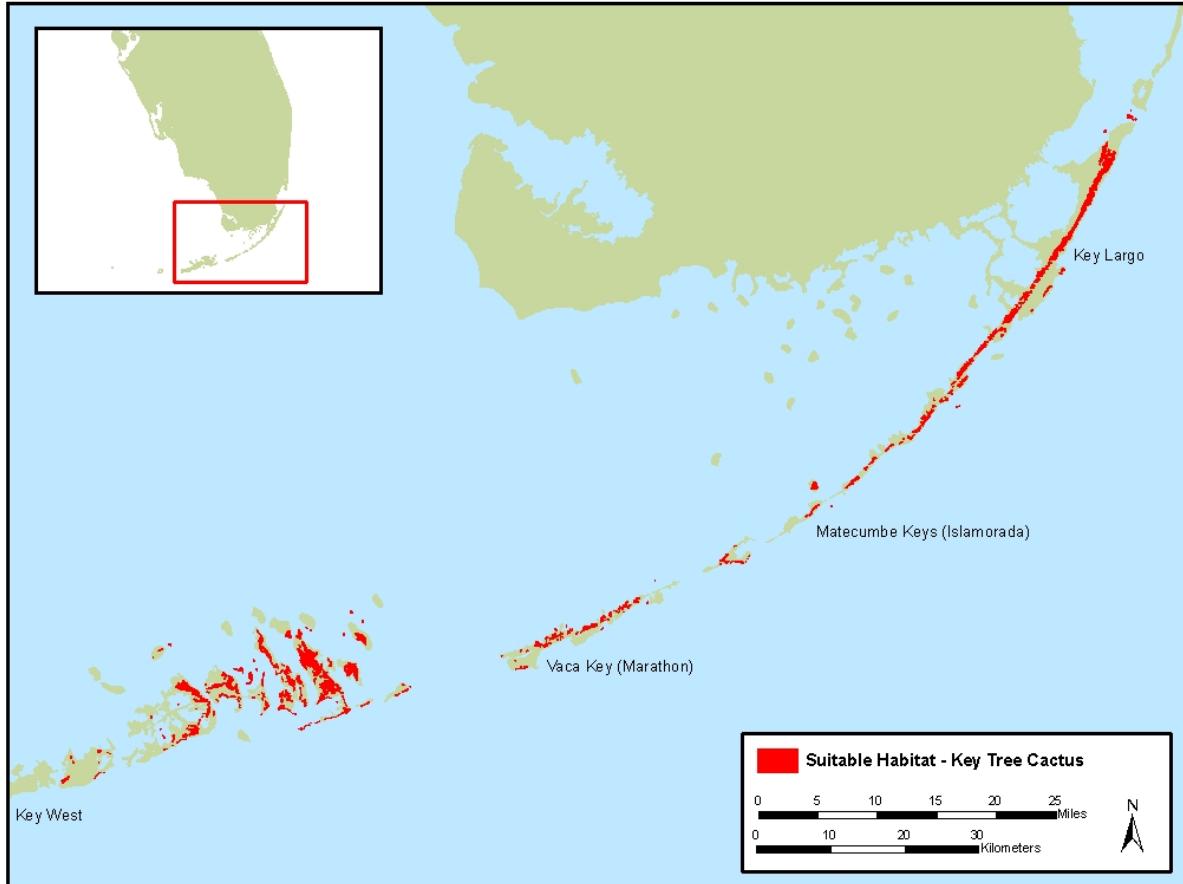


Figure 8. Potential suitable habitat for the Lower Keys marsh rabbit for the Federal Emergency Management Agency's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2006

FIGURE 8: Suitable Habitat - Lower Keys Marsh Rabbit

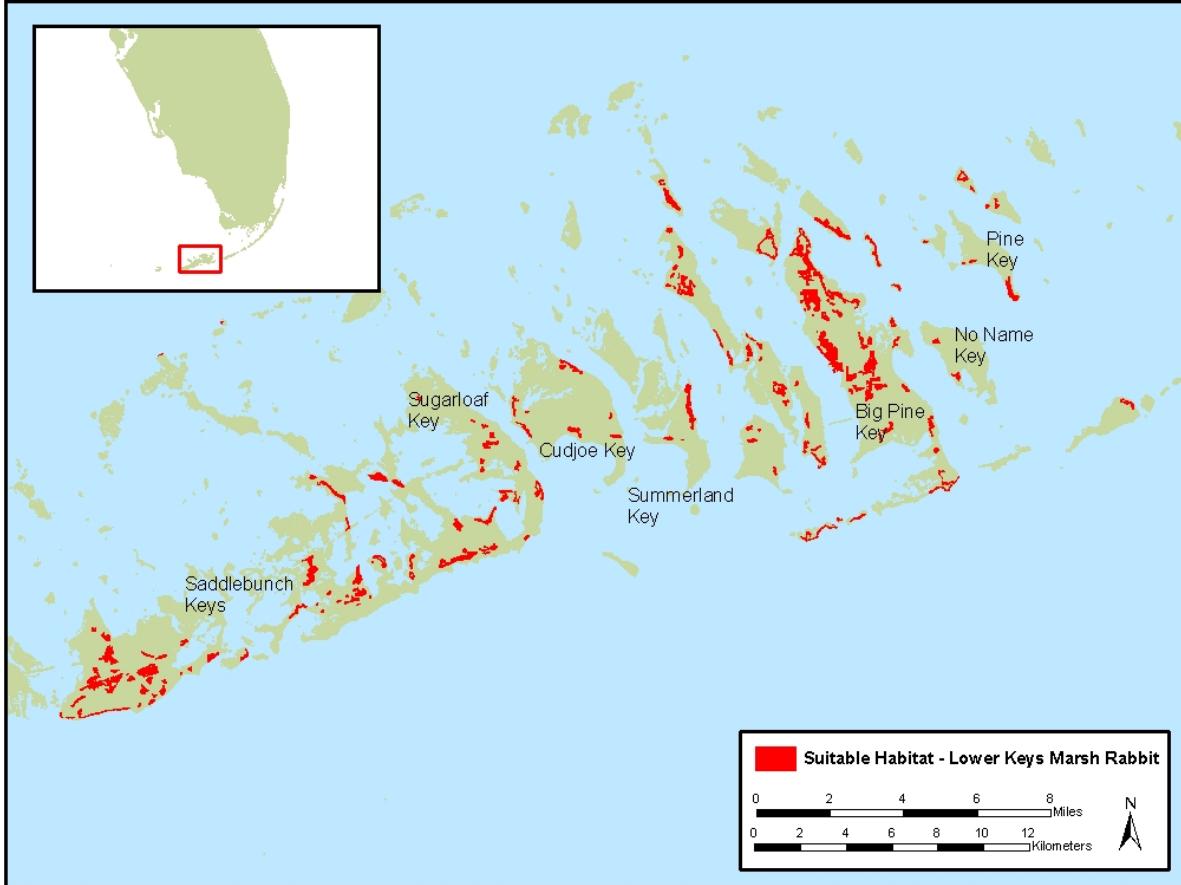


Figure 9. Potential suitable habitat for the Schaus swallowtail butterfly for the Federal Emergency Management Agency's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2006

FIGURE 9: Suitable Habitat - Schaus Swallowtail Butterfly

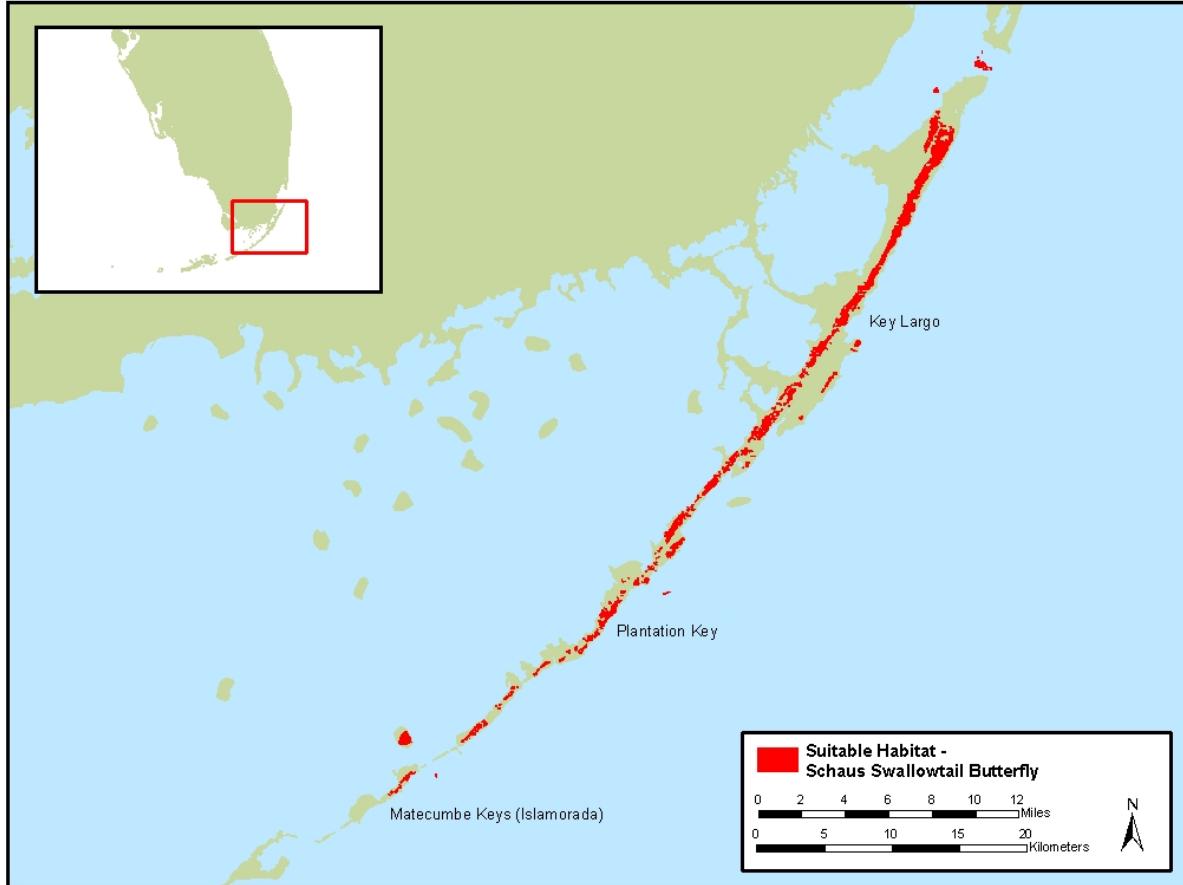


Figure 10. Potential suitable habitat for the silver rice rat for the Federal Emergency Management Agency's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2006

FIGURE 10: Suitable Habitat - Silver Rice Rat

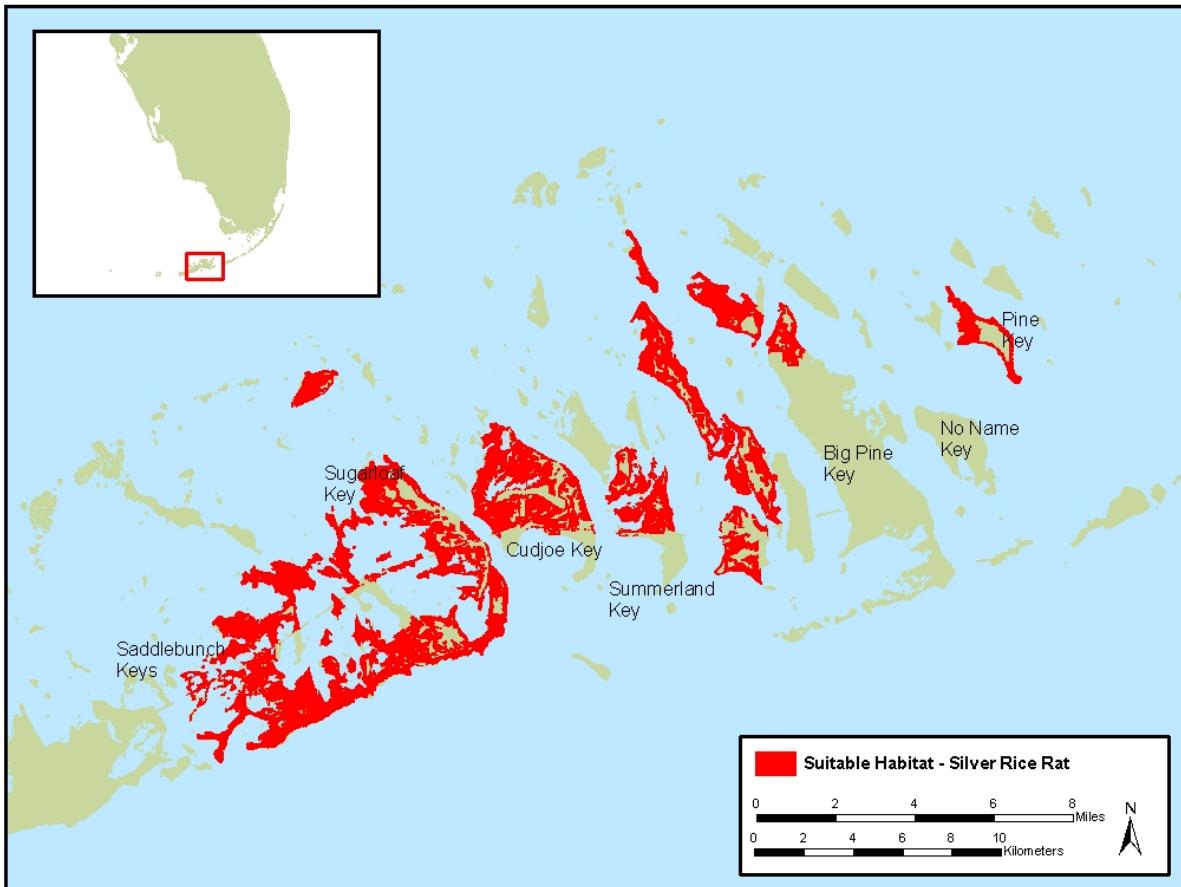


Figure 11. Potential suitable habitat for the Stock Island tree snail for the Federal Emergency Management Agency's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2006

FIGURE 11: Suitable Habitat - Stock Island Tree Snail

