United States Department of the Interior

FISH AND WILDLIFE SERVICE
1875 Century Boulevard
Atlanta, Georgia 30345

In Reply Refer To:
FWS/R4/ES

April 30, 2010

Mr. W. Craig Fugate, Administrator
Federal Emergency Management Agency
500 C Street, SW
Washington, D.C. 20472

Dear Mr. Fugate:

This is the U. S. Fish and Wildlife Service's (Service) Biological Opinion (BO) for the Department of Homeland Security's Federal Emergency Management Agency's (FEMA) administration of the National Flood Insurance Program (NFIP) in participating communities in Monroe County, Florida. The NFIP, created in 1968, is a Federal program enabling property owners in participating communities to purchase flood insurance in exchange for the community's adoption of 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. For assessment purposes, our evaluation is to the year 2023, which is a 13-year period (2010 through 2023).

The 13-year period coincides with the expiration of the Big Pine/No Name Key Habitat Conservation Plan (HCP) incidental take permit (Service 2006). The Big Pine/No Name Key HCP addresses development related effects to three of the nine species addressed in this BO. In order to maintain consistency between the two reviews, as there is overlap of species habitat and development related effects, the Service is matching the FEMA NFIP period of review to the period of time and expiration date of the Big Pine/No Name Key HCP.

In 1990, the National Wildlife Federation, Florida Wildlife Federation, and the Defenders of Wildlife filed suit against FEMA pursuant to the Endangered Species Act of 1973 as amended (Act) (87 Stat. 884; 16 United States Code [U.S.C.] 1531 *et seq.*) on behalf of the endangered Key deer (*Odocoileus virginianus clavium*) in the Florida Keys (Keys) claiming FEMA was not consulting with the U.S. Fish and Wildlife Service (Service) pursuant to the Act. As a result, in 1997 the Service completed a Biological Opinion (BO) as directed by section 7 of the Act for the effects of the NFIP, administered by FEMA, on federally protected species in the Keys. The 1997 BO found the NFIP jeopardized nine species in the Keys (Monroe County, Florida). In 2003, the Service and FEMA re-initiated consultation in accordance with a re-initiation clause in the 1997 BO. The resulting amendment to the 1997 BO in 2003 concluded that the effect of the NFIP would result in jeopardy on eight of 10 species evaluated in the BO. In a second amended

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complaint in 2003, the plaintiffs filed suit against FEMA and the Service pursuant to the Act and the Administrative Procedure Act (APA) (79 Stat. 404; 5 U.S.C. 500 *et seq*.).

The plaintiffs won a Summary Judgment on all three counts of their complaint. On March 29, 2005, the United States District Court, Southern District of Florida (Court) issued an Order ruling the Service and FEMA violated the Act and the APA. Specifically, the Court found:

(1) the Service and FEMA violated the Act's 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 granted the plaintiffs' motion for an injunction against FEMA issuing flood insurance on any new residential or commercial developments in suitable habitats of federally listed species in the Keys. The injunction applied to properties on a list of potential suitable habitat submitted to the Court by the Service. Plaintiffs have stipulated to the removal of some properties on the suitable habitat list based on Plaintiffs' determination that the properties were not located in suitable habitat, thereby enabling some owners to obtain flood insurance. The Court also ordered the Service to submit a new BO by August 9, 2006. The Service issued a new BO on August 8, 2006.

On April 1, 2008, FEMA and the Service filed an appeal with the United States Court of Appeals for the Eleventh Circuit arguing that section 7(a)(2) of the Act did not apply to FEMA's provision of flood insurance and that FEMA had fully complied with the Court's March 29, 2005, ruling.

On April 1, 2009, the United States Court of Appeals for the Eleventh Circuit affirmed the judgment of the District Court.

On February 26, 2009, the Court ordered the Service to submit a new BO by March 31, 2010. On March 28, 2010, the Court granted a 30 day extension of this deadline. In compliance with the Court's order, this document transmits the Service's BO on FEMA's implementation of the NFIP in the Keys and its effects on 18 federally threatened or endangered species. This revised BO also addresses the Court's March 2005, criticism of the 2003 RPA. The Court criticized the 2003 RPA 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. In this BO, we more clearly describe the steps that will be taken if the RPA is not followed, which includes new mechanisms for enforcement by FEMA, consistent with its regulations. 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.

This revised BO also provides a complete review of the baseline conditions of having the 2003 RPA in effect and includes new habitat maps reflecting the best available scientific information. The new maps were developed in cooperation with Monroe County and include Plaintiffs' comments on habitat mapping parameters.

The listed species in the Keys include:

American crocodile (*Crocodylus acutus*), threatened, designated critical habitat;
Eastern indigo snake (*Drymarchon corais couperi*), threatened;
Garber's spurge (*Chamaesyce garberi*), threatened;
Key deer (*Odocoileus virginianus clavium*), endangered;
Key Largo cotton mouse (*Peromyscus gossypinus allapaticola),* endangered;
Key Largo woodrat (*Neotoma floridana smalli*), endangered;
Key tree-cactus (*Pilosocereus robinii*), endangered;
Lower Keys marsh rabbit (*Sylvilagus palustris hefneri*), endangered;
Piping plover (*Charadrius melodus*), threatened, designated critical habitat;
Roseate tern (*Sterna dougallii*), threatened;
Schaus swallowtail butterfly (*Papilio aristodemus ponceanus*), endangered;
Silver rice rat (*Oryzomys argentatus*), endangered, designated critical habitat;
Stock Island tree snail (*Orthalicus reses reses*), threatened;
Green sea turtle (*Chelonia mydas*), endangered, designated critical habitat;
Hawksbill sea turtle (*Eretmochelys imbricata*), endangered, designated critical habitat;
Kemp's ridley sea turtle (*Lepidochelys kempii*), endangered;
Leatherback sea turtle (*Dermochelys coriacea*), endangered, designated critical habitat;
Loggerhead sea turtle (*Caretta caretta*), threatened.

Of the above, only the American crocodile, silver rice rat, and piping plover have designated critical habitat in the Keys. Critical habitats for the green sea turtle, hawksbill sea turtle, and leatherback sea turtle is not present in the Florida Keys and will not be affected by this action.

In some cases, the action will not affect listed species because their habitat occurs on protected lands or lands where development will not likely occur. For example, 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.

Nesting sea turtles generally are not directly affected by development. The greatest threats to sea turtles on land are disturbance of females attempting to nest, destruction of nesting areas, nest disturbance, 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 (usually 100 feet) from sea turtle nesting habitat. McNeese (2006) suggests that disturbances such as lighting, pets, noise or blocking of nesting areas could adversely affect sea turtles. Local governments have established ordinances to impose lighting restrictions to avoid and minimize the potential for disorientation of nesting sea turtles and their hatchlings. Moreover, the U.S. Army Corps of Engineers (Corps), in consultation with the Service, must issue permits for proposed projects in waters of the United States that may directly develop or block turtle nesting areas. The Corps works with the Service to avoid and minimize these types of impacts.

Piping plovers are not common in the Keys, primarily because there are so few sandy beaches.

As mentioned previously, setback requirements (usually 100 feet) regulated by Monroe County and municipalities protect beaches and the Service consults with the Corps on development actions affecting them. Virtually all (99.95 percent) of the piping plover critical wintering habitat (also sandy beaches) in Monroe County is protected.

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 the American crocodile occurs primarily on sites under public ownership and managed for conservation, such as the Service's Crocodile Lake National Wildlife Refuge (NWR). Because these habitats are not subject to residential or commercial development, the NFIP does not have any impacts in these areas. Moreover, the Corps, in consultation with the Service, must issue permits for proposed projects that might directly affect potential crocodile habitat. A similar situation exists for designated crocodile critical habitat. About 3.6 percent of crocodile critical habitat is within the Florida Keys. Of this, about 1.6 percent is on North Key Largo where the large majority is protected. About 2 percent is in South Key Largo down to Long Key. The Corps, in consultation with the Service, issues permits for proposed projects that may directly affect crocodile critical habitat.

Information gained from 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 managed for conservation under public ownership, such as the Service's National Key Deer Refuge (NKDR). Florida Natural Areas Inventory (FNAI) (2008) indicates 27 of 31 extant occurrences are on managed areas. The plant also occurs on road right-of-ways, which are not subject to residential or commercial development.

As referenced above, during the implementation of the technical assistance review outlined in the 1997 and 2003 Reasonable and Prudent Alternative (RPA) for this Federal action, over 6,500 development projects were reviewed in Monroe County. During this effort, it became evident that the NFIP action would have an insignificant impact on several federally listed species including the roseate tern, loggerhead sea turtle, green sea turtle, leatherback sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, piping plover, American crocodile, and Garber's spurge in Monroe County. In view of this, and for the aforementioned reasons, the Service, on behalf of FEMA, has determined these species are not likely to be adversely affected by the action. In addition, critical habitats for the piping plover and American crocodile are not likely to be adversely affected by the action. Consequently, these species and their critical habitats will not be considered further in this consultation.

Therefore, the species evaluated in this BO include the: eastern indigo snake, Key deer, Key Largo woodrat, Key Largo cotton mouse, Schaus swallowtail butterfly, Key tree-cactus, Stock Island tree snail, Lower Keys marsh rabbit, and silver rice rat. Critical habitat for the silver rice rat will also be evaluated. Appendix 1 includes a listing of land cover classifications where these species may occur (based on Monroe County's 2009 Land Cover Classifications).

Candidate Species

Candidate species are considered for possible addition to the List of Endangered and Threatened Species. The Service has on file sufficient information on biological vulnerability and threat(s) to support a proposal to list, but issuance of a proposed rule is precluded by higher priority listing actions. [61 FR 7596-7613 (February 28, 1996)] We include them here in an effort to: 1) clarify the candidate species that may be in the action area, and 2) explore ways to modify the action to reduce or remove adverse effects to the species. While the Act does not protect candidate species, the Service is notifying FEMA that candidate species may occur in the action area. As such, we will not conduct a jeopardy analysis of these candidate species, but we will provide conservation recommendations to reduce adverse effects and/or request studies as appropriate. These candidate species may later be proposed for listing, requiring future consultation if proposed actions are likely to jeopardize the continued existence of such species. We encourage FEMA to address candidate species in their Federal programs. Addressing candidate species at this stage of consultation provides a focus on the overall health of the local ecosystem and may avert the likelihood that they will require the protection of the Act in the future. Appendix 2 provides a more detailed assessment of the candidate species and includes a listing of current land cover classifications where these species may occur. Current candidate species in the Florida Keys are:

Bartram's hairstreak butterfly (*Strymon acis bartrami*);
Big Pine partridge pea (*Chamaecrista lineata keyensis*);
Blodgett's silverbush (*Argythamnia blodgettii*);
Cape Sable thoroughwort (*Chromolaena frustrate*);
Everglades bully (*Sideroxylon reclinatum austrofloridense*);
Florida leafwing butterfly (*Anaea troglodyta floridalis*);
Florida prairie clover (*Dalea carthagenensis floridana*);
Florida semaphore cactus (*Consolea corallicola*);
Miami blue butterfly (*Cyclargus* (=*Hemiargus*) *thomasi bethunebakeri*);
Red knot (*Calidris canutus rufa*);
Sand flax (*Linum arenicola*); and
Wedge spurge (*Chamaesyce deltoidea serpyllum*)

This BO incorporates information from the June 16, 1997, BO, April 18, 2003, amendment, and the August 8, 2006, BO, which was not implemented. It also incorporates documentation provided by FEMA, the State of Florida Department of Community Affairs (FDCA), 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 Ecological Services Office in Vero Beach, Florida.

Consultation History

On August 25, 1994, the Court filed a memorandum opinion and final declaratory judgment for *Florida Key Deer v. Stickney* (Case No. 90-10037-CIV-MOORE). The Court directed 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 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, 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. FEMA representatives confirmed that they still needed to provide the information the Service requested in its September 7, 1995, letter. They explained that a large number of severe weather emergencies along the Gulf Coast States during the fall of 1995 caused the delay.

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. Experts on threatened and endangered species in the Florida Keys and managers of public and private lands important to those species attended the meeting. The Service used 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 19 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 RPA, 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 set.

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 BO 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 an appropriate Reasonable and Prudent Alternative (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 produce a 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, *i.e.*, those caused by natural disaster or calamity or that did not take place in native habitat, not requiring coordination with the Service.

On September 24, 2002, the Service and FEMA met to discuss and evaluate compliance with the 1997 BO. The agencies met with representatives from local governments 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 Keys. In that BO, the Service concluded that full implementation of the NFIP in Monroe County would jeopardize the continued existence of several species without a site-specific assessment for proposed developments affecting suitable habitat where flood insurance is available. The Service added the American crocodile to the species evaluated in the BO.

In a February 22, 2005, letter from the Service to Monroe County, the Service identified exempted actions that would not require coordination with the Service, e.g., those caused by natural disaster, or that did not take place in native habitat.

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 and its RPAs. The Court determined:

(1) that the Service's preparation of the 2003 BO amendment was arbitrary, capricious or otherwise not in accordance with the law;

(2) that the 2003 RPA failed to protect against jeopardy;

(3) that FEMA's failure to engage in any independent analysis of the sufficiency of the 2003 BO amendment and the 2003 RPA was arbitrary, capricious or otherwise not in accordance with the law; and

(4) that FEMA was in violation of section 7(a)(1) of the Act for failing to develop and implement a conservation program for the Listed Species.

In an August 18, 2005, letter from the Service to Monroe County, the Service identified other exempted actions that would not require coordination with the Service, e.g., those caused by natural disaster; fences in accordance with Monroe County deer-friendly fence guidelines, or that did not take place in native habitat.

On September 9, 2005, Judge Moore granted the plaintiffs' 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 2

months. The Court also retained jurisdiction until the defendants complied with the March 29, 2005, Order. As discussed below, FEMA and the Service appealed portions of the March 29, 2005, and September 9, 2005, ruling (Appeal filed in February 2006).
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(c) was invalid. RPA(c) 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 writing a new BO evaluating the effects of the flood insurance program on listed species in the Florida Keys.

On January 31, 2006, the Service received email correspondence from Mr. Morgenstern, plaintiffs' attorney, concerning Tier and habitat maps provided to the Service from Monroe County.

On February 1, 2006, the Service received email correspondence from Mr. Morgenstern, plaintiffs' attorney, concerning habitat map designations for revisions to FWS suitable habitat maps.

On February 10, 2006, FEMA and the Service filed an appeal with the United States Court of Appeals for the Eleventh Circuit arguing that:

(1) Section 7(a)(2) of the ESA does not apply to FEMA's administration of the NFIP;

(2) Section 7(a)(2) of the ESA does not require FEMA to perform an independent analysis of the Service's proposed "RPAs" before adopting them;

(3) Section 7(a)(1) of the ESA does not require agencies to develop species- and location-specific programs for the conservation of listed species; and

(4) The District Court exceeded its authority by issuing an injunction that is allegedly inconsistent with the ESA and the National Flood Insurance Act (NFIA) of 1968 (42 U.S.C. 4001, et al).

On February 14, 2006, the Service notified Monroe County that due to the March 29, 2005, Summary Judgment and the September 9, 2005, injunction and direction by the Court for the Service to submit a new BO within 9 months, Monroe County was no longer required to consult with the Service under RPA(c) of the 2003 BO.

On February 16, 2006, the Service received email correspondence from FEMA concerning status of additional data request to FEMA and County's responses.

On February 17, 2006, the Service received additional data on Monroe County's cat control program.

On February 17, 2006, the Service received additional information from FEMA and from Monroe County and municipalities.

On March 2, 2006, the Service sent an email request to Monroe County and FEMA requesting update on data specific to outstanding FEMA BO questions.

On March 22, 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.

On March 24, 2006, the Service received email correspondence from FEMA documenting action items needing FEMA's response.

On March 31, 2006, the Service received email correspondence from Monroe County documenting additional data needs on parcel list.

On April 4, 2006, the Service requested via email clarification of the ROGO (Rate of Growth Ordinance) allotments for Monroe County and individual municipalities.

On June 20, 2006, the Service received, via email, the Village of Islamorada's threatened and endangered species analysis.

On June 25, 2006, the Service received via email the 2006 Monroe County Cat Control Ordinance.

On August 8, 2006, the Service issued a new BO, which found the NFIP would likely jeopardize five Florida Keys species (four animals and one plant).

On August 8, 2006, the Service received FEMA's letter of acceptance of the RPA referenced in the Service's August 8, 2006, jeopardy BO.

On August 8, 2006, the Service and FEMA had a conference call to discuss implementation of the RPAs referenced in the BO, feral cats, and settlement options.

On August 17, 2006, the Service and FEMA had a conference call to discuss implementation of the RPAs referenced in the BO, feral cats, and a settlement proposal.

On September 13, 2006, the Service and FEMA met to discuss next steps to implement the RPAs referenced in the BO and actions necessary to comply with the Court's order.

On October 6, 2006, the Service provided to FEMA and the Court, the list of properties within potentially suitable habitat of affected species referenced in the August 8, 2006, BO.

On October 11, 2006, the Service received a confirmation email from FEMA of the transmittal of the list of properties in potential suitable habitat to Monroe County and municipalities.

On October 31, 2006, the Service received an email from plaintiffs concerning list and mapping discrepancies in the Service's August 8, 2006, BO.

On November 1, 2006, the Service received an email from FEMA addressing other county and state agency responsibilities for compliance with NFIP policies.

On November 3, 2006, the Service received via email, the plaintiffs' October 20, 2006, review of list and mapping discrepancies.

On March 21, 2007, the Service received correspondence from FEMA referencing receipt of correspondence from the State of Florida Department of Education to the State of Florida Education Facility Planners in reference to construction permits affecting listed species.

On April 1, 2008, the United States Court of Appeals for the Eleventh Circuit affirmed the judgment of the District Court and concluded that:

(1) Section 7(a)(2) of the Act does apply to FEMA's administration of the NFIP.

(2) FEMA need not conduct any independent analysis of the proposed alternatives. However, where new information arises between the proposal and the adoption, an acting agency would be required to consider that information prior to acting. The decision to adopt is particularly susceptible to challenge absent consideration of the new evidence.

(3) Section 7(a)(1) of the Act does require agencies to develop species- and location-specific programs for the conservation of listed species; and

(4) The District Court did not err in issuing an injunction.

On May 2 and 5, 2008, the Service and DOJ conducted a conference call with plaintiffs' to discuss outstanding issues concerning the Service's 2006 BO.

On May 7, 2008, the Service received via email, additional comments from plaintiffs on 2006 BO mapping issues, and cat buffers.

On May 9, 2008, the Service received via email, additional comments from plaintiffs on 2006 BO mapping issues, and marsh rabbit habitat.

On May 14, 2008, the Service received via email, additional comments from plaintiffs on 2006 BO mapping issues, and tropical hardwood hammock.

On July 28, 2008, the Service, FEMA, and DOJ met with NWF to discuss outstanding issues with the revisions of the 2006 BO, outstanding mapping questions, and enforceability of the RPA by FEMA.

On August 2, 2008, the Service and FEMA participated in an open forum meeting hosted by Representative Ros-Lehtinen in Marathon, Florida to receive and respond to questions concerning ongoing FEMA flood insurance in the Florida Keys.

On August 7, 2008, the Service, FEMA, and DOJ met with NWF to discuss outstanding issues with the revisions of the 2006 BO related to mapping and enforceability of the RPA by FEMA.

On August 25, 2008, the Service received correspondence from Everglades Law Center in reference to the Service's 2006 BO.

On September 14, 2008, the Court ordered the parties to notify the Court by December 3, 2008, of the status of the settlement regarding the 2006 BO.

On October 24, 2008, the Service received the proposed Geospatial Land Cover mapping schedule for Monroe County.

On December 3, 2008, the Service and FEMA, through coordination with DOJ and the plaintiffs filed a joint motion to withdraw the 2006 BO and to file a new BO.

On February 26, 2009, the Court ordered the Service to submit a new BO by March 31, 2010.

Between February 2009 and January 2010, the Service coordinated with FEMA, FDCA, the Florida Department of Environmental Protection (FDEP), Monroe County, and local municipalities, and the plaintiffs on additional information regarding land acquisition, mapping and permits.

On October 5, 2009, the Service sent FEMA a letter requesting additional information to assist the Service in writing a new BO evaluating the effects of the flood insurance program on listed species in the Florida Keys.

On January 8, 2010, the Service received comments from Mr. Kruer, biologist for plaintiffs, on 2009 draft potential suitable habitat maps.

On March 28, 2010, a 30-day extension of the filing deadline for the BO was granted by the Court.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The action addressed in this BO is the administration of the NFIP in participating communities in Monroe County, Florida, by the Department of Homeland Security's FEMA. The NFIP, created in 1968, is a Federal program enabling property owners in participating communities (as defined by 44 CFR Section 59.1) 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 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 within the Special Flood Hazard Areas (SFHAs) of non-participating communities (42 U.S.C. 4106). This prohibition would, for example, prevent issuance of mortgage loans in non-participating communities that are 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 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).

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.

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 development plans to ensure they are consistent with base flood elevations.

(4) Communities must review proposed development to insure that applicants obtain all necessary permits required by Federal or State law.

(5) Once the community has issued a permit, the development 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 BOs. We used Geographic Information System (GIS) analyses of the spatial distribution of threatened and endangered species in the Keys, vegetative land cover, and areas in the Coastal Barrier Resources System (CBRS) and Otherwise Protected Areas (OPA) designated by the Coastal Barrier Resources Act (16 U.S.C. 3501 *et seq*.) (CBRA). We used GIS analyses to identify those areas which: 1) are cleared for residential, commercial, or other purposes; (2) may support threatened and endangered species or include designated critical habitat; or (3) could qualify for the NFIP in Monroe County. We excluded areas included in CBRS from the action area because FEMA does not issue flood insurance in those locations. We also exclude lands owned by the state of Florida because NFIP Regulations list Florida under Part 75 as self-insured. We excluded non-Federal properties covered by Incidental Take Permits (ITP) authorizing incidental take in accordance with Section 10 of the Act, since incidental take for adverse species effects has already been addressed by the Service. We also excluded Federal

lands since consultation with the Service under section 7of the Act is required and is a separate action.

The action area is composed of six political entities each with their own government and land use regulations: 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. 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 our original 1997 FEMA BO 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 habitats used by the nine listed species addressed in this BO, see Appendix 1.

The Upper Keys consist of long narrow islands 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 almost block 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 connect the Gulf and Florida Bay. These passageways allow for greater water exchange between the two water bodies than occurs in the Upper Keys.

Most of the land area in the Keys lies between 2.0 to 3.0 feet above high tide. Two locations 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 parallels 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 contingent upon 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 21,000 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. A FEMA Flood Insurance Rate Map (FIRM) identifies the SFHA in each community. The limits of the SFHA depend on the area inundated during the Base Flood (a flood having a 1 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. They use them for calculating flood insurance premiums and for determining whether the law requires property owners to obtain flood insurance as a condition of obtaining 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 river and 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
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 percent 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 0.2 percent 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. It should 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 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, suspension from the program is mandated.

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 Flood Insurance Study (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 prohibits alteration of natural features, such as frontal sand dunes and mangrove stands, which act to reduce flooding. 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 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, it will avoid probation. If the community does not address the issues, formal probation begins (at a minimum probation lasts for 1 year and extended in 1-year increments).

During the time a community is on probation, new policies are allowed to 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 are 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 National Flood Insurance Reform Act of 1994 codified the CRS. 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 CRS, 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 U.S. Congress created the NFIP, it 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. Property owners in NFIP communities can buy flood insurance in two ways: 1) through State-licensed property and casualty insurance agents and brokers who deal directly

with FEMA; or 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. The NFIP provides most of the flood insurance coverage, however. In early 2006, there were about 4.8 million flood insurance policies in force nationwide. In December 2009, there were about 5.5 million policies, an increase of about 14 percent.

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 (CBRA), as amended (16 U.S.C. 3501 *et seq*.) 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 (not preserved) coastal barriers 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. Otherwise Protected Areas are lands already protected by public agencies or conservation organizations. Structures are eligible for flood insurance in CBRS if built to support recreation or conservation, but residences built on private in holdings are not.

The Department of Interior identifies CBRA designations and recommends them to Congress. The Service implements the law. Federal assistance prohibitions are in effect on the date Congress approves additional CBRA designations. 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-CBRS areas.

STATUS OF THE SPECIES/CRITICAL HABITAT

Climate Change

In recent years, researchers armed with new data have increasingly recognized climate change as a major factor affecting sea levels, coastlines, and islands. The Service also recognizes climate change as a significant influence, especially on low-relief islands such as the Florida Keys.

Climate change is evident from observations of increases in average global air and ocean temperatures, widespread melting of snow and ice, and rising sea level, according to the Intergovernmental Panel on Climate Change Report (IPCC 2007, Bates et al 2008). The 2007 and 2008 IPCC Reports describe changes in natural ecosystems with potential widespread effects on many organisms, including marine mammals and migratory birds. The potential for rapid climate change poses a significant challenge for fish and wildlife conservation. Species' abundance and distribution are dynamic, relative to a variety of factors, including climate. As climate changes, the abundance and distribution of fish and wildlife will also change. Highly specialized or endemic species are likely to be most susceptible to the stresses of changing climate.

Climate change at the global level drives changes in weather at the regional level. Season and local effects (e.g., elevation, topography, latitude, proximity to the ocean) also strongly affect weather regionally. Scientists predict temperatures will rise from 2°C to 5°C for North America by the end of this century (IPCC 2007). Other processes to be affected by this projected warming include rainfall (amount, seasonal timing, and distribution), storms (frequency and intensity), and sea level rise. However, the exact magnitude, direction, and distribution of these changes at the regional level are not well understood or easy to predict. Seasonal change and local geography make prediction of the effects of climate change at any location variable. Current predictive models offer a wide range of predicted changes.

The 2007 IPCC Report estimates a 90 percent probability that sea level will rise 7 to 23 inches by 2100 (18 to 58 cm). Wanless et al. (1997) found that, over the past 2,500 years, south Florida experienced an average rate of sea level rise of about 1.5 inches per century (3.8 cm). Wanless (2008) also observed that south Florida experienced about a 9-inch rise (23 cm) in sea level since 1932. This is about six times (9/1.5=6) the average rate over the past 2,500 years. Much of this accelerated rise is the result of warming and expansion of water in the western North Atlantic Ocean.

Prior to the 2007 IPCC Report, Titus and Narayanan (1995) modeled the probability of sea level rise based on global warming. They estimated that the increase in global temperatures could likely raise sea level 6 inches (15 cm) by 2050 and 13 inches (33 cm) by 2100. While these estimates are lower than the estimates described in the 2007 IPCC Report, Titus and Narayanan's (1995) modeling efforts developed probability-based projections that when added to local tide-gauge trends, estimate future sea level at specific locations.

It should be noted that Titus and Narayanan's (1995) worst-case scenario was premised on a 1 percent chance that global warming would raise sea level that high; however, most climate change researchers agree with the findings in the 2007 IPCC Report. Scientific evidence has emerged since the publication of the 2007 IPCC Report indicating an increase in the speed and scale of the changes affecting the global climate. Previously, scientists may have underestimated important aspects of climate change and the resulting impacts are likely to occur sooner than originally anticipated. For example, early signs of change suggest that the less than 1°C (1.8°F) of global warming the world has experienced to date may have already triggered the first tipping point of the Earth's climate system – the disappearance of summer Arctic sea ice. This process could lead to rapid and abrupt climate change, rather than the forecasted gradual changes.

Ecosystems of coastal islands, like the Florida Keys, face threats from sea level rise that are distinct from those threatening ecosystems of continental margins (Mimura et al. 2007). Global warming will be a particular challenge for endangered, threatened, and other "at-risk" species in the Florida Keys. The progressive disappearance of suitable upland habitat caused by sea level rise will lengthen or destroy migration routes to similar environments on the mainland or islands with higher elevations. Deyle et al. (2007) summarized in their report that the most obvious impact of sea level rise is simple inundation of previously dry land. As sea level rises, the elevation of the mean high-tide line will move landward at a rate determined by the gradient of the local topography. The value of this recession factor varies substantially from one location to another with estimates that Florida beaches are likely to recede from 500 to 1,000 feet (152 to 304 m) for every 1-foot (0.3 m) rise in sea level. Titus et al. (2001) reported that the recession factor for Florida ranges between 100 and 1,000 feet (30 to 304 m). As referenced in Deyle et al. (2007), Tasker (2007) quotes Wanless as saying that the gradient in the Florida Keys may be as low as 1:2000 feet (0.3:610 m).

This low gradient elevation correlates to an even greater impact to upland acreage in the Florida Keys. Tropical hardwood hammocks in the upper keys are expected to convert to mangrove communities and freshwater wetlands. Tropical hardwood hammocks and pine rocklands in the middle and lower keys are also expected to convert to saline tolerant habitats (Ross et al. 2009, LaFevar 2007, Ish-Shalom et al. 1992, Sternberg et al. 2007, Su Yean Teh et al. 2008).

Florida Keys Species

It is difficult to estimate, with any degree of precision, how climate change will affect Florida Keys species, although recent assessments by Bergh (2009), Ross et al. (2009), Su Yen Teh et al. (2008), and LaFevar (2007) provide projections for several species and habitats endemic to the

Florida Keys. Bergh (2009), based on model scenarios referenced in IPCC (2007), estimated that by the year 2100, at-risk lands subject to habitat succession in the Florida Keys ranged from 58,800 (a 18 cm rise – IPCC optimistic scenario) to 115,000 acres (a 59 cm rise – IPCC worst case scenario). Corresponding ranges for 18 cm and 59 cm sea level rises, are 11,000 and 54,400 acres, 4,430 and 11,200 acres, and 43,300 and 49,600 acres for the lower, middle, and upper keys, respectively.

Based on Bergh's (2009) projection, sea level changes by year 2100 may place habitats at-risk for succession from between 38 to 75 percent of the available habitats. The greatest habitat threat is in the lower keys where at-risk land succession ranges from 18 percent for the IPCC optimistic projection to 90 percent for the IPCC worst-case projection. Risk changes for the middle and upper keys are 25 and 60 percent for optimistic, and 64 and 65 percent for the worst-case scenario, respectively.

Although IPCC projections provide optimistic and worst-case scenarios, Wanless (2008) observed that south Florida has experienced about a 9-inch rise (23 cm) in sea level since 1932, which implies that the worst case IPCC scenario is current in the Florida Keys. This concern has also been expressed by Ross et al. (2009) and Bergh (2009) in their evaluations of sea level rise in the Florida Keys. They suggest that since the IPCC projections excluded the potential for "future rapid dynamical changes in ice flow" or the potential for "Antarctica and Greenland's ice sheets to melt relatively quickly," the IPCC projections are underestimates. Thus, the estimates provided by Rahmstorf (2007) and Mitrovica et al. (2009) that incorporate these parameters should also be considered in evaluating sea level rise in the Florida Keys.

Bergh (2009) included sea level rise estimates referenced by Rahmstorf (2007) and Mitrovica et al. (2009) in model predictions. Bergh's (2009) model predicts that Rahmstorf's (2007) worst case projection (140 cm (55 in)) will result in 92 percent (142,000 acres) of lands in the Florida Keys becoming at-risk of habitat succession with the greatest at-risk observed in the middle keys (99 percent) and lower keys (96 percent) by year 2100. Rahmstorf's (2007) worst case estimate is an increase of 81 cm (32 in) over IPCC's worst-case projection with a comparable increase of 27,000 acres with 17,500 acres in the upper keys, although the greatest change by percent (35 percent) of available land is in the middle keys.

Most models predict that by the year 2100, significant acreages of upland and transitional habitats will be at-risk of habitat succession. The general succession trend as suggested in Ross et al. (2009), Bergh (2009), and LaFevar (2007) for the lower keys is the loss of the pine rocklands and freshwater wetlands to mangrove wetland communities. Ish-Shalom et al. (1992) also suggest that remaining tropical hardwood hammocks in the lower keys will also succeed to mangrove communities. The succession trend as suggested by Sternberg et.al. (2007) and Su Yean Teh et.al (2008) for the middle and upper keys is replacement of the tropical hardwood hammocks by mangroves.

Lower Keys Species

Ross et al.'s (2009) evaluation provided a basic assessment of the physical and biological parameters present in the Florida Keys that may be directly or indirectly influenced by climate

change. In the upper and middle keys, the underlying porous coralline limestone in the higher elevation is only covered by a thin organic layer and the salinity gradient is more uniform. In the lower keys (from Big Pine Key to Key West), the surface limestone is an oolite material (a composite of spherical, sand-sized carbonate particles formed in shallow marine waters). This oolite material is subject to cementation of the ooids, which causes this layer to be less permeable to water movement than the coralline limestone. This layer allows retention of the seasonal rains as a fresh groundwater lens that "floats" on the underlying saltwater. This lens supports freshwater wetlands and salt-intolerant slash pine (*Pinus elliotti* var *densa*) forest (pine rocklands) that are absent from the upper keys.

The projected sea level rise not only influences the underlying gradient between saline groundwater and the overlying freshwater lenses present in the lower keys, but also influences the impact of hurricane storm surges on these systems and the frequency of fire. LaFever's (2007) assessment of the lower keys marsh rabbit (*Sylvilagus palustris hefneri*), only evaluated sea level rise. However, Ross et al.'s (2009) evaluation of lower keys communities includes both the influence of sea level rise and the interactions with disturbance associated with hurricanes and fire. Their assessment notes that fires inhibit the transition of pine to hammock forest and herbaceous freshwater marsh to woody swamp, whereas, storm surge accelerates the transition from freshwater-dependent ecosystems to more saline communities. The increased salinity causes selective mortality of salt-sensitive vegetation (pines and herbaceous freshwater marsh species).

Ross et al.'s (2009) concluding assessment of these conditions in the lower Florida Keys states that the synergetic effects of fire suppression and hurricane surge coupled with sea level rise provide little choice in management for protected species in the lower Florida Keys. The management choice is to follow a strategy of adaptation, in which core sites within landscapes that retain some of their historic connectivity are identified, fortified, and defended, all the while planning for the day when species threatened with extinction due to submerging islands must be translocated to suitable recipient sites elsewhere or, ultimately, maintained in captivity.

LaFever et al.'s (2007) conclusions for the Lower Keys marsh rabbit notes that, for all sea level rise scenarios evaluated, there is a general trend of decreasing total potential Lower Keys marsh rabbit habitat with increasing sea level rise and that endangered species conservation and ecosystem managers need to rethink static approaches to conservation or else stand by and watch ecosystems degrade and species go extinct. LaFever et al. (2007) also noted that other endemic and insular species of the Florida Keys will be impacted by rising sea levels. Global climate change may inhibit recovery efforts of endangered species such as the Florida key deer (*Odocoileus virginianus clavium*) and the endangered silver rice rat (*Oryzomys palustris natator*) as well as cause the disappearance of endemic species such as the key ringneck snake (*Diadophis punctatus acricus*) and striped mud turtle (*Kinosternon baurii*) before much is known about these species (LaFever et al. (2007)

Middle and Upper Keys Species

The dynamics of sea level rise coupled with hurricane surge were also evaluated by Sternberg et al. (2007) and Su Yean Teh et al. (2008) for the middle and upper keys. Their assessments conclude that, depending on area specific parameters, the tropical hardwood hammocks characteristic of the middle and upper Florida Keys will ultimately be replaced by mangrove communities. Ish-Shalom et al. (1992) provided a similar assessment of the remaining hardwood hammocks in the lower key resulting in the same conclusion.

Although the synergic effects of fire and the presence of a fresh groundwater lens are important parameters in habitat succession in the lower keys, the presence and depth of the vadose zone is of greater importance in succession in the middle and upper keys. The vadose zone is the unsaturated zone between the soil surface and the top of the water table (Su Yean Teh et al. 2008). In the middle and upper keys, the vadose zone is underlain by porous coralline limestone and the underlying groundwater varies in salinity from less than 7 (fresh) to greater than 30 (salt) ppt. The underlying porous coralline limestone in the higher elevation is only covered by a thin organic layer and the salinity gradient is more uniform.

In the Florida Keys and in coastal communities in south Florida, the depth of this organic layer and the salinity of the vadose zone influence the vegetative community present and species dominance (Su Yean Teh et al. 2008, Sternberg et al. 2007). Sharp boundaries typically separate the salinity tolerant mangroves community from the salinity intolerant hardwood hammock community although both can occupy similar geographical areas. Research studies and field observations (Su Yean Teh et al. 2008, Sternberg et al. 2007) have shown that mangroves are able to tolerate a wider range of salinities and can also grow well in low salinity environments. Su Yean Teh et al. (2008) note that hardwood hammock species appear to be competitively superior in low salinity areas (less than 7 ppt), whereas mangrove have a competitive advantage in higher salinity areas (greater than 15 ppt). The boundary of competition between the two communities is along the intermediate salinity gradient (roughly 7 to 15 ppt).

The projected sea level rise from climate change will increase the rate of salinization of the vadose zone and favor succession from hardwood hammocks to mangroves. Bergh's (2009) model data representing IPCC 59 cm (23 in) worst case scenario provides the best representation of projected sea level rise minus hurricane and storm surge events. By year 2100, acres at-risk of succession in the middle and upper keys are estimated at 11,200 and 49,600 acres, respectively, and represent a change of 64 and 65 percent of baseline acreages (2008 baseline - Bergh 2009).

Climate change is also forecast to increase the frequency of hurricanes and intensity of storm surges as well as to increase the amount and intensity of the saline over-wash of adjacent tropical hardwood hammocks (Su Yean Teh et al. 2008, Sternberg et al. 2007). This increased saline over-wash increases the salinization of the vadose zone and favors succession to the mangrove community (Su Yean Teh et al. 2008, Sternberg et al. 2007). Bergh's (2009) model data representing Rahmstorf (2007) worst case [140 cm (55 in) sea level rise] scenario provides the best representation of projected sea level rise including hurricane and storm surge events. By year 2100, acres at-risk of succession in the middle and upper keys are estimated at 17,500 and 67,100 acres, respectively, and represent a change of 99 and 88 percent of baseline acreages (2008 baseline - Bergh 2009).

Federally protected species in the upper and middle keys at greatest risk from sea level rise are those endemic to tropical hardwood hammock (i.e., the Key Largo woodrat and Key Largo cotton mouse in the upper keys). Both species formerly inhabited all of the hardwood hammock forests from Key Largo south through Tavernier, although the current range is 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). The current range is about 2,498 acres (1,011 hectares), of which 2,174 acres (880 hectares) are in public ownership (87 percent). Both species are considered at-risk of extinction, although factors other than habitat loss appear to be a major cause of concern for these species.

Species Included in this Biological Opinion

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

Table 2: Species Included in this Biological Opinion

Common Name	Scientific Name	Listed As
Eastern indigo snake	*Drymarchon corais couperi*	Threatened
Key deer	*Odocoileus virginianus clavium*	Endangered
Key Largo cotton mouse	*Peromyscus gossypinus allapaticola*	Endangered
Key Largo woodrat	*Neotoma floridana smalli*	Endangered
Key tree-cactus	*Pilosocereus robinii*	Endangered
Lower Keys marsh rabbit	*Sylvilagus palustris hefneri*	Endangered
Silver rice rat	*Oryzomys palustris natator*	Endangered/Critical Habitat
Schaus swallowtail butterfly	*Heraclides aristodemus ponceanus*	Endangered
Stock Island tree snail	*Orthalicus reses (not incl. nesodryas)*	Threatened

The historical ranges of the following species are exclusively within the action area: Key deer, Key Largo cotton mouse, Key Largo woodrat, Key tree-cactus, Lower Keys marsh rabbit, silver rice rat, and Stock Island tree snail. 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. There is designated critical silver rice rat habitat in the action area.

This BO does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR. 402.2. Instead, we relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat. Our analysis follows the guidance provided in Service Memorandum FWS/AES/DCHRS/019634, dated December 9, 2004 (Service 2004).

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. It does not include lands in Township 67S, Range 27E, section 8 and the northern 1/5 of section 17. All lands and waters above mean low tide in the designated area are included (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 that is relevant to the analyses in the Effects of the Action section that follows.

Eastern indigo snake

Species/critical habitat description

The eastern indigo snake was listed as threatened 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). There is no designated eastern indigo snake critical habitat (Service 2008a).

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. erebennus*) (Conant 1975; Moler 1985a). At one time, the eastern indigo snake occurred in the coastal plain of the southeastern United States, from Georgia to Florida and west to Mississippi.

The eastern indigo snake is the largest non-venomous snake in North America, up to 104 inches in length (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

<u>Distribution and habitat:</u> Historically the eastern indigo snake occurred throughout Florida and in the coastal plains of Georgia, Alabama and Mississippi. It may have occurred in southern South Carolina, but there is no confirmation of its occurrence there.

Georgia and Florida currently support the remaining, endemic populations of the eastern indigo snake (Lawler 1977). Stevenson (2006) determined that populations of eastern indigo snakes still remain widespread in southeastern and south-central Georgia. As of 1982, only a few populations remained in the Florida panhandle. According to information provided in 2007 (Gunzberger and Aresco 2007), eastern indigo snakes continue to persist in low numbers in the panhandle. Throughout its range, the species is considered rare. Nevertheless, based on museum

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

On the central Atlantic coast, eastern indigo snakes occur in citrus 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. 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 NWR 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. They frequently used stumps, ground litter, and saw palmetto debris as refugia. Adult indigo snakes often used gopher tortoise burrows (*Gopherus polyphemus*), while juveniles chose smaller root and rodent holes. They used gopher tortoise burrows as oviposition sites in high pineland areas, while they chose stumps in flatwoods and pond edge habitats.

On peninsular Florida, eastern indigo snakes need a mosaic of habitats to complete their annual cycle. Interspersion of tortoise-inhabited sand hills and wetlands improves habitat quality for the indigo snakes (Landers and Speake 1980, Auffenberg, Franz 1982). Wherever the eastern indigo snake occurs in xeric habitats in Georgia and north Florida, 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). In laboratory experiments, they appear to be especially susceptible to desiccation (Bogert and Cowles 1947). On the sandy central ridge of south Florida, eastern indigos use gopher tortoise burrows more (62 percent) than other underground refugia (Layne and Steiner 1996). However, 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 sand hill 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 that 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).

According to a study conducted in Georgia, the average range of the eastern indigo snake is 11.9 acres during the winter (December-April), 106.0 acres during late spring and 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; Moler (1985b) noted ranges in the summer varying between 553 acres and 390 acres. By contrast, a gravid female may use from 3.4 acres to 106 acres (Smith 1987).

In the Keys, eastern indigo snakes have been collected from Big Pine and Middle Torch Keys, and were 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, and the FDEP (FDEP submitted road kill data for Key Largo, which documented the presence of eastern indigo snakes from 1995 through 1998). A report by Brian Sheahan, a planner from the Village of Islamorada, on sightings on Lower Matecumbe Key in 2005 are unverified. A Service biologist also reported an observation of a juvenile eastern indigo at one of the same sites at about the same time. The most recent observation of an eastern indigo snake occurred on Little Knockemdown Key in 2009. A photo verification of the individual was provided to the National Key Deer Refuge (NKDR) via email in 2010 (Service 2010). Because there are no comprehensive eastern indigo snake surveys for the Keys, one cannot rule out that the snake occurs on other keys as well.

Using a variety of survey techniques, Schmidt et al. (2008) conducted a herpetological inventory of Big Pine Key and No Name Key in 2006 and 2007. Although documenting 27 species, the researchers did not observe the eastern indigo snake and suggest their research supports the presumption that it has been extirpated from those keys.

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, 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). In 2003, Smith and Dyer conducted a study to test the efficiency and applicability of three commonly used herpetological survey techniques (drift fence arrays, road cruising, and burrow camera surveys). None of these methods proved effective or reliable for

surveying eastern indigo snakes. 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 are no available data on range wide or local trends. The indigo snake apparently occurs in very low numbers in the Keys. Cox and Kautz (2000) designated extreme north Florida and extreme south Florida (including the Florida Keys) as "peripheral areas within the known range." Populations in the Keys have adapted to the conditions of more isolated and tropical environments. Anecdotal sightings are rare, but there are few substantiated sightings.

Threats: At the time of listing, the main factor in the decline of the eastern indigo snake was exploitation for the pet trade. However, because of effective law enforcement, the pressure from the collectors has declined, but remains a concern (Moler 1992). Remaining threats to the eastern indigo snake in the Florida Keys are habitat loss, fragmentation of habitat, and climate change.

Habitat Loss and fragmentation: Loss of habitat resulting from development is the most significant and obvious threat. As residential development continues, additional human population growth will increase the risk of direct mortality of the eastern indigo snake from property owners, domestic animals, and highway mortality.

Climate Change: The dynamics of sea level rise coupled with hurricane surge were also evaluated by Sternberg et al. (2007) and Su Yean Teh et Al. (2008) for the middle and upper keys. Their assessments conclude that, depending on area specific parameters, the tropical hardwood hammocks characteristic of the middle and upper Florida Keys will ultimately be replaced by mangrove communities. The eastern indigo snake, although occasionally present in all native habitats in the Florida Keys prefers hammock communities. Under the worst-case scenario, models predict inundation of a majority of the uplands important to eastern indigo snake by 2100 (Bergh 2009) and eventually result in the conversion of existing coastal hammock and forest habitat to transitional habitat then to tidal areas dominated by mangroves.

Summary analysis– *Changes since the 1997, 2003, and 2006 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 prior 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 established in 1957 to protect the Key deer. The Key deer was officially listed as federally endangered on March 11, 1967, in accordance with section 1(c) of the Endangered Species Preservation Act of October 15, 1966, (80 Stat. 926; 16 U.S.C. 668aa(c)) (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 pounds (lbs), adult females 63 lbs, and fawns weigh about 32 lbs at birth. Height at the shoulder averages 27 inches for adult bucks and 25 inches 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 they produce forked antlers. They usually attain 8 points 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.

Key deer live in a complex of native upland and wetland habitats interspersed in a mix 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

<u>Distribution</u>: 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 of the overall population found on Big Pine Key (Lopez et al., 2004a). The NKDR and the Great White Heron NWR encompass much of this range.

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 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 non-breeding 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 from 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. Key deer home ranges have become smaller and tolerance for other deer has increased because of development and feeding (Lopez et al. 2005).

Urbanization: Key deer have 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. Peterson documented deer aggregations around homes that provided food and water, and the deer exhibited increased levels of tameness.

Past research has shown that the Key deer on Big Pine Key habituate to human noises, lights, and vehicular traffic (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, or 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 habituate to noise and lights. Bashore and Bellis (1982) found that deer quickly became accustomed to noise and lights on Pennsylvania airfields. It has been suggested that less than 10 percent of Key deer on Big Pine Key exhibit "wild," or natural, characteristics (Frank 2005, personal communication). A study conducted by Harveson et al. (2007) concluded that Key deer have adapted to an urban environment.

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 (Harveson et al. 2005). 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). More recent data note an increase in population, 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 on Big Pine and No Name Key (Lopez 2001; Nettles et al. 2002; Lopez et al. 2004a). Harveson et al. (2005) provided estimates of deer abundance in 2000 and 2001 (646 deer) and determined that subpopulations outside of Big Pine and No Name Key remain well below the carrying capacity of the habitat available to them. The total Key deer population was estimated at about 650 in 2006, perhaps at or near historic highs (Lopez, personal communication, 2006). No significant changes were noted in the population levels in succeeding years and the status of the species is considered stable (Service 2010c).

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 favors

males at birth, 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: Habitat loss to development; high, human-related mortality; and dangerously declining low numbers resulted in the 1967 Key deer listing as an endangered species (Service 1967).

Range wide trends: 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 (from Big Pine Key to Sugarloaf Key) during the wet season, but fresh water is available on only 13 of the 26 islands during the dry season (Folk 1991). Key deer are wide ranging and use virtually all available habitats, including developed areas (Lopez 2001). The Key deer population is growing because of protection from hunting, habitat protection, and the positive response of the population to decreased levels of urban development in Big Pine and No Name Keys (Lopez et al. 2004a).

The protection afforded the Key deer through prohibitions on hunting, habitat management, and habitat protection through acquisition has resulted in an 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 has 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 (Lopez et al. 2004). Recent relocation efforts, however, and the overall population increase have helped address this concern. The population now is at or near historical highs (Service 2007).

As part of its recovery strategy, the Service relocated 39 Key deer to two islands within their existing range from 2003 to 2005. 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 and the relocations appear to be a success due to high survival, low dispersal, and evidence of reproduction (lactation, fawn present, etc.) in translocated females (Parker et al. 2008).

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 more

than doubled from 1980 to 2000. An estimated 116 acres per year of Key deer habitat was cleared on Big Pine Key in the early 1970s. A building moratorium, new County ROGO requirements and Habitat Conservation Plan (HCP) for Big Pine and No Name Keys reduced development in recent years, but habitat loss from development is still a threat.

Fencing - Fencing associated with development may cause direct Key deer habitat loss by preventing access to areas used for breeding, feeding, and sheltering. 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 reduces 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 death that occurs when deer become entangled when attempting to jump 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).

Exotics - Exotic vegetation is believed to restrict Key deer and concentrate their movements along established trails. This results in more Key deer crossing roads at fewer access routes or walking along roads, increasing their vulnerability to traffic. 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.

Disease - As the population density nears carrying capacity, density dependent disease becomes an increasing problem (Lopez 2001). Service biologists necropsy mortalities and test for infectious diseases. Several diseases are documented, 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). Scientists first documented the presence of paratuberculosis or Johne's disease in Key deer in 1996 (Nettles et al. 2002, Quist et al. 2002). Corn et al. (2006) monitored the disease and found that it had remained localized within the Big Pine Key and Newfound Harbor subpopulations. The level of this threat to Key deer is unknown, but could potentially be significant, depending on how infectious the disease is among Key deer and sympatric animals (Quist et al. 2002). However, in the 13 years since its discovery, paratuberculosis in the population has not been significant. Nonetheless, density dependent disease is an issue that warrants continued scrutiny.

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. Telemetry data suggests that the majority of deer mortality attributed to road

kills occurs on U.S. 1 (Lopez 2001). Although lower speed limits are an attempt to reduce traffic mortality, speeding motorists (Lopez 2001; Frank, personal communication, 2005) may continue to cause deaths in some areas.

The Service has kept records on Key deer mortality since the 1960s and more than 73 percent of the cases are due to vehicular mortality (Silvy 1975; Lopez et al. 2003; Service unpublished data, 2009a). From 1996 to 2009, 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, the Service and biologists from the Florida Department of Transportation (FDOT) have attempted to address this mortality issue on U.S. 1 by installing and monitoring underpasses for deer. Braden et al. (2005) summary report to FDOT noted that the Key deer collisions were reduced by 83 to 92 percent inside the fenced segment and that the US 1 highway improvements have not restricted Key deer movements.

Climate change - The projected sea level rise may affect Key deer through changes in the underlying gradient between saline groundwater and the overlying freshwater lenses present in the lower keys. Sea level rise may also affect Key deer through changes in frequency and duration of hurricane storm surges, fire, and the availability of freshwater. On Big Pine Key, slash pine forest (rocklands) hold freshwater year round and are especially important to Key deer survival. Hurricane Georges made landfall at Big Pine Key in October 1998, and caused severe damage to the Keys vegetation and salinization of the freshwater wetlands. Ross et al. (2009) noted significant stress to the salt-intolerant slash pine forest (pine rocklands). Under the worst-case scenario, models predict inundation of a majority of the uplands important to Key deer by 2100 (Bergh 2009) and eventual conversion of existing coastal hammock and forest habitat to transitional habitat then to tidal areas dominated by mangroves.

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, in accordance with the Act, issued a Section 10(a)(1)(B) ITP to Monroe County, FDOT, and FDCA in June 2006. The ITP authorizes take of Key deer (4 per year), Key deer habitat (168 acres), Lower Keys marsh rabbit buffer habitat (40 acres), and eastern indigo snake habitat (168 acres) on Big Pine and No Name Keys, Monroe County, Florida. The take will be incidental to land clearing for development and recreational improvements. The applicants developed an 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 a 168-acre maximum loss of potential Key deer habitat (maximum loss of 7 acres of native habitat) and compensation by acquiring a minimum of three mitigation units for each development unit of suitable habitat on Big Pine and No Name Keys. The Service determined that this level of incidental take would not jeopardize the survival and recovery of the species.

Summary analysis– *Changes since the 1997, 2003, and 2006 BOs*

The Key deer herd has increased substantially over the past 40 years, due principally to a ban on hunting and protection and management of habitat within NKDR. The population is at or near historical highs. It has remained stable since 2003. Recent relocation efforts have returned the species to parts of its historic range. Hurricanes, disease, vehicle mortality, development, increasing tameness, habitat loss, fragmentation, and degradation, continue to threaten the Key deer population, but the overall health of the species appears stable.

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. Schwartz (1952a) was first described the Key Largo cotton mouse as a medium-sized mouse with large ears and protuberant eyes. Its back is reddish to dusky brown and its underside is white. Its body length ranges from 6.6 to 7.4 inches, tail length ranges from 2.8 to 3.4 inches, and hind-foot length ranges from 0.82 to 0.90 of an inch.

Life history

Distribution: The Key Largo cotton mouse formerly inhabited all of the hardwood hammock forests from Key Largo south through Tavernier. It is now 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). Although the species occurred in the past at the south end of Key Largo, at Plantation Key, attempts to collect this species in southern Key Largo have been unsuccessful (Service 1999; Frank et al. 1997). The Service introduced the Key Largo cotton mouse to Lignumvitae Key in 1970. The last recorded sighting was in 1977, when a park ranger observed one individual. A trapping study conducted on Lignumvitae Key in 2007 yielded no captures (Greene 2007) suggesting the population is extirpated there.

Habitat: The Key Largo cotton mouse builds leaf-lined nests in logs, tree hollows, and rock crevices. The entrances measure 1.2 to 3.5 in. in diameter. The cotton mouse often partially covers entrances with 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 (Goodyear 1985).

Behavior: Key Largo cotton mice feed on leaves, buds, seeds, and fruits. The Key Largo cotton mouse breeds throughout the year. They produce two to three litters 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 (Service 2009b).

Population dynamics

In 1997, the population occurred throughout North Key Largo and was apparently viable (Frank et al. 1997). Population studies conducted in 2007 estimated about 17,000 individuals and an increasing trend in the population from April to December (Castleberry et al. 2008).

Status and distribution

Reason for Listing: The Key Largo cotton mouse 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 1984a), and was listed as endangered on August 31, 1984 (Service 1984b). The proposed critical habitat was withdrawn on February 18, 1986 (Service 1986; Service 1999).

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. At present, within this range (North Key Largo), suitable cotton mouse habitat is about 2,498 acres, of which about 2,188 acres are in public ownership (88 percent).

Threats: Factors other than habitat loss are cause for concern for the cotton mouse. Although much of the land currently occupied by the cotton mouse is protected, the secondary impacts from development, perhaps most notably free roaming domestic and feral cats, remains a significant 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 (*Solenopsis invicta*) were also in some of the trapped areas 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 likely 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 NWR and Key Largo Hammocks State Botanical Site. 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 by cotton mice following abandonment of the proposed development 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 Service contracted the U.S. Department of Agriculture's Wildlife Services in 2005 to remove the cats from the area. Although they removed the colony, free-roaming domestic cats and the abandonment of new cats into the area are a continuing problem. Feral cats are secretive, and unless they are actively tracked and or trapped, their presence may go unnoticed.

Other non-native predators, such as fire ants and exotic snakes, also pose a threat to the Key Largo cotton mouse (Service 2009b). The role of fire ants in the ecology of the North Key Largo hammocks is unknown. However, fire ants have substantially affected wildlife populations in other areas (Killion and Grant 1993). Because the cotton mouse is a ground nester 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. Both adult and young cotton mice are vulnerable to predation by Burmese pythons (*Python molurus bivittatus*) and other exotic species of constrictors now found in the Keys. Seven non-native Burmese pythons have been captured in Key Largo since April 2007, and predation of Key Largo woodrats by Burmese pythons was documented in 2007 (Snow 2008).

In addition to threats posed by introduced predators, Brown (1978b) and Hersh (1981) attributed the apparent extirpation of this species from Key Largo south of the U.S. 1-S.R. 905 intersection to land clearing followed by residential and commercial development. 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).

Climate change is also considered an important threat to the Key Largo cotton mouse. Sternberg et al. (2007) and Su Yean Teh et al. (2008) in their assessment of the middle and upper keys susceptibility to sea level rise conclude that tropical hardwood hammocks characteristic of the upper Florida Keys will ultimately be replaced by mangrove communities. Worst-case models by Bergh (2009) forecast a change (loss) in hammock vegetation of 88 percent by 2100. For a species endemic to tropical hardwood hammock (*i.e.*, both the Key Largo woodrat and Key Largo cotton mouse), the long term projection is that these species will need resource management intervention for survival in the Florida Keys or translocation to suitable recipient sites elsewhere.

Summary analysis– *Changes since the 1997, 2003, and 2006 BOs*

The Key Largo cotton mouse occurred historically 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. Because of land acquisition efforts for conservation and current county land use regulations, the threat of occupied habitat loss from development on North Key Largo is low. The status of the cotton mouse may be stable, but we do not have sufficient data available to determine long-term trends. Some threats, such as domestic and feral cats, remain a significant concern. Other threats include predation by exotic fire ants and exotic constrictors, and stochastic environmental events such as fires and hurricanes.

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 to 9.0 inches, tail length ranges from 5.1to 7.4 inches, and hind foot length ranges from 1.3 to 1.5 inches.

Life history

Distribution and Habitat: The Key Largo woodrat is endemic to the tropical hardwood hammocks of Key Largo (Service 2008). 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 woodrat habitat is about 3,755 acres, of which about 2,730 acres are protected (72 percent).

Key Largo woodrats have several distinct traits. They 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,* has a 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 to 7 feet 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).

Efforts to manage the hammocks on North Key Largo have focused primarily the maintaining an intact ecosystem. Crocodile Lake NWR has enhanced woodrat habitat through demolition of

concrete buildings at the old NIKE missile site in 2004 and construction of rubble piles to provide cover and nesting sites. The Crocodile Lake NWR also installed large rock piles to provide additional structure as the site 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. Potts (2008a) reported over 150 supplemental nest structures within Crocodile Lake NWR, with about 33 percent in use. Crocodile Lake NWR reported (Klett, personal communication, 2010) in January 2010 that over 300 structures are now in place.

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 averages less than 1 year in the wild.

Population dynamics

Population Size: A sporadic effort to monitor the status of the Key Largo woodrat population began in the 1970s (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 available information 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 are prominent indicators of the species' presence in an area. One survey of stick nests found 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 and 1986.

Hersh (1978) conducted a study of the woodrat in 1976 and 1977 and found densities of 0.9 woodrat 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 hammocks 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 and 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. She believed older hammocks with increased structural complexity were 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 previously 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. Since 1997, Key Largo woodrats have been absent on Lignumvitae Key as evidenced by both trapping and lack of sign (Greene 2007).

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. It 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 2000-2001 survey had 15 transects and four 4.4-acre grids. The total trap nights were 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) documented low numbers of Key Largo woodrats and a high mortality rate of radio-collared individuals. McCleery (2003) trapped 60 randomly-placed plots on North Key Largo, and found Key Largo woodrats on 10 (17 percent). Winchester (2007) captured Key Largo woodrats on 7 of 40 randomly placed grids (18 percent). These data suggest a consistent reduction in the distribution of Key Largo woodrats on North Key Largo.

While population trends are difficult to interpret from the various study designs and estimation techniques (Barbour and Humphrey 1982; Humphrey 1988; McCleery 2003; Potts et al. 2007), surveys in the last 20 to 25 years suggest a declining population, currently at very low densities (Florida Fish and Wildlife Conservation Commission [FWC] 2005; McCleery et al. 2006b; Winchester 2007). Available population estimates do not reliably assess the decline and population modeling yielded a high risk of extinction for the Key Largo woodrat (McCleery et al. 2005; McCleery et al. 2006b).

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 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 a construction project that would result in habitat loss. The Key Largo woodrat was proposed for listing as an endangered species with critical habitat on February 9, 1984 (Service 1984a) and was officially listed as endangered under the Act on August 31, 1984 (Service 1984b). The proposed critical habitat designation was withdrawn on February 18, 1986 (Service 1986).

Range wide Trends: The status of the Key Largo woodrat is precarious with a declining population affected by multiple threats. Populations have declined to the point where extinction is a possibility. 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. The captive propagation project is a short-term solution to prevent the extinction of the Key Largo woodrat. In February 2010, 14 captive-bred woodrats were released into their native habitat at Crocodile Lake NWR. The woodrats, fitted with radio collars, were tracked for 60 days. Follow-up monitoring of the released woodrats recorded predation of five of the woodrats. Feral cats were documented as predators of the woodrats and follow-up trapping removed 12 cats from the release site. Continual monitoring of the released woodrats has also verified reproduction (Service 2010b).

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, exotic constrictor snakes, fire ants, and invasive exotic vegetation. These non-native species adversely affect the woodrat through predation, competition, and habitat alteration.

While the specific mechanisms responsible for the decline of the Key Largo woodrat are speculative, several hypotheses regarding the problem have emerged:

1. *Natural habitat changes*: Successional changes towards more mature habitat may have degraded Key Largo woodrat habitat. Recent observations of Key Largo woodrats inhabiting refuse piles support this idea. In addition, natural predators may be more abundant or forage more efficiently in mature hammock (e.g., owls), 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 reduced the extent of available habitat and degraded the condition of remaining habitat, however since the 1990's, habitat loss and degradation has diminished with the establishment of the ROGO system in the County and land purchases for conservation by State and Federal entities.

3. *Exotic predators*: Fire ants, feral and domestic cats, exotic constrictors (such as the Burmese python) and black rats (*Rattus rattus*) 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 a parasite 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.

Climate change is also considered an important threat to the Key Largo woodrat. Sternberg et al. (2007) and Su Yean Teh et al. (2008) in their assessment of the middle and upper keys susceptibility to sea level rise conclude that tropical hardwood hammocks characteristic of the upper Florida Keys will ultimately be replaced by mangrove communities. Worst-case models by Bergh (2009) forecast a change (loss) in hammock vegetation of 88 percent by 2100. For a species endemic to tropical hardwood hammock (i.e., both the Key Largo woodrat and Key Largo cotton mouse), the long term projection is that these species will need resource management intervention for survival of this species in the Florida Keys or translocation to suitable recipient sites elsewhere.

Summary analysis– *Changes since the 1997, 2003, and 2006 BO*

The Key Largo woodrat formerly occupied all of Key Largo, but is now restricted to North Key Largo. The majority of occupied habitat on North Key Largo is under public ownership and managed for conservation by the Service, the State, and the County. 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 Burmese pythons and other exotic species of constrictor snakes, predation by exotic fire ants, and stochastic environmental events such as fires and hurricanes (Service 2008). Because of Federal, State, and county acquisition of woodrat 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. In February 2010, 14 captive-bred woodrats were released into their native habitat at Crocodile Lake NWR. The woodrats, fitted with radio collars, were tracked for 60 days. Follow-up monitoring of the released woodrats recorded predation of 5 of the woodrats. Feral cats were documented as predators of the woodrats and follow-up trapping removed 12 cats from the release site. Continual monitoring of the released woodrats has also verified reproduction (Service 2010b).

Key tree-cactus

Species/critical habitat description

The Key tree-cactus is a large, tree-like cactus with erect columnar stems, reaching 33 ft in height. 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 inch long and 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 has been substantially diminished (Avery 1982, Britton and Rose 1937; Small 1917, 1921), with populations on Key West, Boca Chica, Key Largo, and Windley Keys having become extirpated. 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 that 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 canopy story typically contains small dominant species and the following plants: *Amyris elemifera, Ateramnus lucidus, Bumelia celastrina, Capparis flexuosa, Eugenia foetida, Guapira discolor, Pithecellobium guadelupense, Randia aculeata*, and *Zanthoxylum fagara* (Austin 1980, Weiner [no date]). Hardwood hammocks are upland communities, which are rarely flooded (only 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.

Mineral soil is, if present at all, a very thin (less than 0.4 inch) layer of rock rubble, calcareous sands or calcareous marl (Austin 1980). A layer of leaf litter 0.4 inch to 0.8 inch thick is typically present (Austin 1980). Deeper accumulations of soil occur in pockets and crevices in the rock. These soils are Histosols (Soil Conservation Service 1975). They are 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, grow on oolitic limestone. Soil conditions at these sites are unknown, 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 several square meters (Austin 1980, Small 1917). When many plants occur in a clump, most, if not all, of the separate stems likely represent vegetative (asexual) offshoots of one or a few founders. Vegetative (asexual) reproduction is common because of old stems being knocked to the ground.

<u>Reproduction</u>: 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 (asexual). 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 to 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: As of 2009, the known distribution of this species is restricted to seven populations on four islands of the Florida Keys (Big Pine Key, Long Key, Lower Matecumbe Key, and Upper Matecumbe Key) (Adams and Lima 1994, Service 1999, Maschinski 2009a, Florida Natural Areas Inventory 2009). Six of seven populations are on lands protected through acquisition or agreements (Maschinski et al. 2009). One is located on private, developable property currently used for aquaculture.

The Key tree-cactus has probably always been rare in the Keys. 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 on a limerock substrate. 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 a population on Long Key (Service 2010a). Morbid trees showed a lack of living tissue (only woody pith) at the base. This pattern extended upwards, as an advancing edge of necrotic tissue, towards the branch tips. By November 2004, the Service recognized the problem as a widespread decline phenomenon afflicting most other subpopulations (Service 2010a).

Status and distribution

Reason for Listing: The Key tree-cactus was listed as endangered on July 19, 1984 (Service 1984c) 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 Key Largo, Windley Key and Lower Matecumbe Key (Small 1917) were presumed to have been destroyed (Avery 1982); however, the population on Lower Matecumbe Key was rediscovered (Adams and Lima 1994).

Adams and Lima (1994) conducted the first quantitative survey of all Key tree-cactus sites, which serves as the baseline for analyzing population trends. Fairchild Tropical Garden began regular annual monitoring of populations in 2007. Data for 2007 through 2009 show that four populations continued to decline in number of stems and that two appear stable (Maschinski et al. 2009). A seventh population, located on Long Key, was last surveyed in 2006, when it consisted of six small plants (Klett, personal communication 2006). As of July 2009, there were approximately 260 plants spread across seven populations (Maschinski et al 2009). The species has experienced a decline of about 80 percent of all plants and 88 percent of all stems from 1994 to 2009 (Maschinski et al 2009). Continued annual monitoring will be important in determining if the decline trend is continuing or if the populations are becoming stable. The recent decline phenomenon has left most populations with only a fraction of the individuals they had just 10 years ago, and this very likely has greatly diminished the overall viability of these populations.

Ex situ conservation measures that have been implemented for Key tree-cactus include long term seed storage at the National Center for Genetic Resource Preservation in Fort Collins, Colorado, representing multiple maternal lines. Cuttings from a large number of plants, and from all populations, are being grown at Fairchild Tropical Gardens in Miami, Florida and the Desert Botanical Garden in Phoenix, Arizona.

Threats: Development remains a threat to the long-term conservation of this species. The last remaining population of Key tree-cactus on private land is susceptible to development. Overall, loss of hardwood hammock habitats to development continues in the Keys, reducing the area of suitable habitat that Key tree-cactus could expand into or migrate through as habitats shift in response to sea level rise**.**

Hurricanes also have the potential to affect tree-cactus populations both directly due to wind damage and indirectly due to increased salinity from storm surges. Hurricane Georges made landfall at Big Pine Key in October 1998 and caused severe damage to the tree-cactus population on the NKDR. Storm surges modify habitat by increasing soil salinity. Maschinski et al. (2009) suspect high soil salinity is the primary cause of the recent die-off phenomenon.

Storm events are likely to increase in severity due to rising ocean surface temperatures (IPCC 2007). When coupled with sea level rise, more intense hurricanes will likely produce stronger storm surges that inundate larger areas for longer periods. Scientists predict the threat posed by storm surges will increase in the future due to increased storm intensity and sea level rise.

Sea-level rise is the largest climate-driven challenge in the sub-tropical ecoregion of southern Florida (U.S. Climate Change Science Program [CCSP] 2008). According to CCSP (2008), much of low-lying, coastal south Florida "will be underwater or inundated with salt water in the coming century." Scientists predict sea level rise will exacerbate inundation, storm surge, erosion and other coastal hazards. In scenarios modeled by Bergh (2009), partial inundation of habitat may occur by 2100. Under the worst-case scenario, models predict inundation of a majority of the Key tree-cactus habitat by 2100. It is likely that under any scenario, that soil salinity will continue to increase in coastal Florida, either by pulses as with successive storm surges, or incrementally due to saltwater intrusion. We anticipate these processes will act separately or synergistically to cause ongoing mortality pulses of Key tree-cactus and eventually result in the conversion of their existing coastal hammock to transitional habitats and then tidal areas dominated by mangroves.

Summary analysis– *Changes since the 1997, 2003, and 2006 BOs*

The Key tree-cactus occurs at seven known locations in the Keys, six of which are on conservation lands or protected by conservation easement (Service 2010a). One population, on Long Pine Key, is in private ownership and the lands are subject to development (Service 2010a). Propagation of Key tree-cactus is ongoing at two locations. The main threat to the continued existence of the unprotected population is development. In addition, the remaining population is in decline, due to the effects of recent hurricanes and storm surges. 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. Lazell (1984) recognized the Lower Keys marsh rabbit as a distinct subspecies. They have short, brown fur and a grayish-white belly. Their feet are small and their tails are dark brown and inconspicuous. Males and females 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. The Lower Keys marsh rabbit was listed as an endangered species on June 21, 1990 (Service 1990). There is no critical habitat designated for the Lower Keys marsh rabbit (Service 2007).

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 present on 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. Investigations between 2003 and the present have shown that Annette and Howe Keys were extirpated by 2005 (Service 2007).

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 to or greater than the death rates. This subspecies may be less fecund than others, making it more susceptible to demographic and stochastic events (Forys, 1995). Breeding occurs year round and urbanization has affected the Lower Keys marsh rabbit reproductive potential through loss of habitat. In addition to natural threats, residential and commercial construction in the Keys has caused direct mortality to the marsh rabbit and disrupted their dispersal.

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 (Faulhaber et al. 2007). Lower Keys marsh rabbit habitats often include areas of mangrove (red mangrove [*Rhizophora mangle*], black mangrove [*Avicennia germinans*], and white mangrove [*Laguncularia racemosa*]) woodlands within their home ranges, and the animals regularly pass through mangrove when traveling between their other habitats (Faulhaber et al. 2007). 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 1,322 acres of occupied habitat, and 689 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 NWR, 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 in a mixture of grasses, sedges, and forbs is a dominant feature within home ranges. Such ground cover provides runs, dens, nesting habitat and food. 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, tides rarely inundate many sites. In 1996, the total area of all suitable occupied habitat was about 625 acres (Forys et al. 1996).

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

oxeye (*Borrichia* 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 the winter dry season. 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 correlated with 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. Lower Keys marsh rabbits avoided areas with mature buttonwoods and high canopy cover. Forys (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. Forys (1995) concluded that rabbits 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, which average about 0.8 acre. Adult rabbits have permanent home ranges and females in particular exhibit small dispersal distances. 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 and, typically, male subadults tend to disperse.

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 (Forys 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 are 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, compared to 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. 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: Various researchers monitored patch occupancy between 1988 and 1995 by noting the presence of fecal pellets and other means. In 1995, the Lower Keys marsh rabbit population was estimated at 275 individuals (Forys et al. 1996). In 2006, based on patch occupancy, Perry estimated the population at about 500 rabbits (Perry, personal communication 2006). Overall, investigators identified and assessed occupancy in 142 patches during the period 1988 to 1995.

An index of abundance that estimates population numbers more accurately for the Lower Keys marsh rabbit is patch occupancy, *i.e.*, 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 of population decline or growth. 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 occupancy from 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). By 2005, only 52 of the original 71 patches remained occupied (Faulhaber et al. 2007), indicating a 27 percent decrease since the 1988 to 1995 period. However an additional 45 patches were documented that previously were unknown (Faulhaber et al. 2007).

Based on the information available, the Lower Keys marsh rabbit currently occupies 112 patches, with a median size of 5.1 acres (Faulhaber et al. 2007). The average home range of a marsh rabbit is about 0.8 acre (Service 1999). However, the 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, Schmidt 2009).

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 (Big Pine Key area) and western portions (Boca Chica area) 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 about 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 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 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 recolonized patches 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. Fewer occupied patches and lower potential for interchange between subpopulations reduce the probability of persistence.

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 should be considered.

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; Faulhaber et al. 2007). Results from rangewide monitoring efforts are available for four periods: 1988 to 1995 (various investigators; records on file), 2001 to 2003 (Faulhaber, 2003), winter 2003 to 2004, and winter 2004 to 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. Faulhaber et al. (2007) found patch

occupancy relatively stable on Big Pine, Sugarloaf and Boca Chica keys between 2001 and 2005, but recorded a large net reduction on the Saddlebunch Keys.

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 to 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 to 2003 period (Faulhaber 2003), and one patch colonized as of the winter of 2004 to 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 generated by the Forys and Humphrey (1999a) population viability analysis. A study of habitat patch occupancy (Service 2007a), based on the presence or absence of fecal pellets, show patches are being extirpated more than they are being recolonized. Accordingly, the dynamics of remaining occupied patches is driving the population trajectory.

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 in comparison to other management action considered.

The Service and collaborators have initiated a reintroduction program for the Lower Keys marsh rabbit (Service 1999). In 2002, 13 rabbits were translocated to Little Pine Key, which resulted in successful establishment (Faulhaber et al. 2003). In 2004, seven rabbits were translocated to Water Key (Perry, 2005a). In both cases, evidence of reproduction was documented on the newly colonized islands (Perry, 2005a). The colonization of Little Pine persisted after Wilma in 2005, but that of Water Key did not (Service 2007). These efforts have served, to a degree, to offset some of the trends discussed above, and ameliorate threats.

Threats: The Lower Keys marsh rabbit is vulnerable to predation by free-roaming cats, habitat loss and degradation, fire suppression, vehicular traffic, hurricanes, sea level rise, fire ants, and exotic constrictor snakes. The greatest threats to the continued existence of the Lower Keys marsh rabbit are predation by cats, habitat loss and degradation, and hurricanes (Service 2007). 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.

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). To our knowledge, a detailed study of free roaming cat diets in the Keys has not been conducted; however, 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, 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 – The 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. 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. Habitat fragmentation is an important factor in Lower Key marsh rabbit demographics (Forys and Humphrey, 1999a). Urbanization has fragmented the sites occupied by this species and eliminated many of the corridors that allowed 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 other predators, 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. 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.

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. 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, such as hurricanes, is enhanced due to the characteristics of small, poorly dispersed populations. 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). At that time, however, a search also yielded signs (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 to 2005) and re-assessed in the post-Wilma period, patch occupancy declined 33.3 percent between periods, a net loss of 11 occupied patches.

Hurricanes are a significant threat to the Lower Keys marsh rabbit and reduce the capacity to resist adverse impacts associated with other threats. It is possible that hurricane impacts to

Lower Keys marsh rabbit habitat would be less extensive if the habitat contained more topographic and vegetative diversity than that present on Boca Chica Key. More topographic relief would provide more opportunities for refuge above rising water. 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.

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. 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.

Sea level rise - Sea-level rise has been shown to result in degradation and elimination of pine rockland in the Keys due to increased salinity of water available to plant roots (Ross et al. 1994). Impacts on other communities have not been estimated. On Big Pine Key, freshwater wetlands comprise a significant component of Lower Keys marsh rabbit habitat, and thus profoundly affect the distribution of suitable habitat. Loss of freshwater wetlands could have widespread, long-term, detrimental impacts to the Lower Keys marsh rabbit, particularly on Big Pine Key. LaFever (2006) modeled potential impacts of sea level rise on three Lower Keys marsh rabbit metapopulation areas and concluded that abandonment of human dominated areas (i.e., development and roads), as opposed to protecting them from ongoing sea level rise, may significantly ameliorate habitat impacts because it could allow for upslope migration of habitat.

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. Burmese pythons and other exotic species of constrictors recently found in the Keys pose a predation threat to the Lower Keys marsh rabbit.

<u>Big Pine Key HCP</u>: Lower Keys marsh rabbit 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 FDCA pursuant to the Act (Service 2006). Issuance of the ITP exempted take of Lower Keys marsh rabbit buffer habitat and indirect effects from cat predation. However, no direct take of marsh rabbits or marsh rabbit habitat was exempted. The take will be incidental to land clearing for development and recreational improvements. The applicants have developed an 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. Compensation will be provided by the acquisition at a minimum of three mitigation units for every one-development

unit of affected 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 marsh rabbit.

Summary analysis– *Changes since the 1997, 2003, and 2006 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, increased mortality due to cats, and increased threats due to exotic pythons and sea level rise. The potential for recovery 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

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. 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, personal communication, 1985).

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 and Krizek 1984).

No critical habitat has been designated for the Schaus swallowtail butterfly.

Life history

<u>Distribution</u>: 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 (BNP) in the northeast to northern Key Largo to the

southwest (Service 1982b, Emmel 1985a, Emmel and Daniels 2005; Service 2008). The last known mainland specimen collected from the south Miami area was collected at Coconut Grove, Dade County, in May 1924 (Service 1982b). A single Schaus swallowtail was photographed at the Charles Deering Estate on May 31, 2006 (Salvato, personal communication 2006). The individual likely represented a vagrant from BNP. 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 BNP since 1972 (Brown 1973; Covell and Rawson 1973). Individuals have also been seen in and adjacent to the Crocodile Lakes NWR. Captive bred butterflies have been released on six sites in North Key Largo, one site on Lower Matecumbe Key and one site in mainland Miami-Dade County.

The majority of the Schaus swallowtail butterfly population occurs on Adams, Elliott, Old Rhodes, Swan, and Totten Keys within 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 1995b). Emmel and Daniels (2005) estimated that 1,200 to 1,400 Schaus swallowtail butterflies occurred range wide, but those estimates included released individuals (captive-raised Schaus swallowtail butterflies associated with reintroduction efforts). As in preceding and subsequent years, most Schaus swallowtail butterflies occurred in BNP.

Although, 30 different wild plant species may be exploited (Emmel 1988, 1995a) as a nectaring food source, torchwood (*Amyris elemifera*) and wild lime (*Zanthoxylum fagara*) are the primary food sources for caterpillars. In the major Keys of BNP (Elliott, Old Rhodes, Totten, and Adams Keys) and on northern Key Largo, the two caterpillar food plants, torchwood and wild lime, seem adequate to support a healthy population. High numbers of individuals sighted in 1985 (Emmel, personal communication, 1985b) 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. 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 to 1000 individuals; in the same year, there were an estimated 50 to 80 individuals (adult and immature) 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 (*Psychotria nervosa*), 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).

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 (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.

Behavior: 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). 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 two female Schaus swallowtail butterflies on different days visiting cheese shrub blossoms just before 9:00 am, his earliest observation, and another female hovering over cheese shrub at 5:00 pm comprised his last observation. 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 one-generation of Schaus swallowtail butterflies 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 from July to 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 (*Zanthoxylum fagara*) 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 (Rutkowski 1971, Service 1982b). 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: No detailed status surveys have been conducted for the Schaus swallowtail since 2003. However, survey data collected during annual North American Butterfly Association (NABA) counts are available from 2003 through 2008 for Elliott Key (BNP) and Key Largo, and they provide some information on the status of the Schaus swallowtail. On Elliott Key, the number of adult Schaus swallowtails encountered on these annual one-day surveys ranged from 2 to 28 (Salvato, personal communication, 2009). On Key Largo, the number of adult Schaus swallowtails encountered ranged from 0 to 8 (Salvato, personal communication, 2009). Emergence of adults is highly dependent on rain, and timing is often of major significance in survey results. The poor survey results during some years are likely the result of dry conditions (Salvato, personal communication, 2009), and likely do not represent a general decline of the species.

Population Variability:

No documentation of variability among populations of this species is available.

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 as an endangered species on August 31, 1984, because its numbers and range had declined dramatically since listing (Service 1984d).

Rangewide Trends: Previous attempts to establish Schaus butterfly populations outside their current range have failed (Emmel and Daniels, 2005). The most recent investigations of Schaus swallowtail butterfly populations provided estimates that include Elliot Key in BNP and other areas (Emmel and Daniels, 2004). The range-wide population in 2003 was about 360 to 400 adults, including 255 on Elliott Key. Elliot Key contains the largest of all extant Schaus populations. Abundance estimates for Elliott Key from 1999 to 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 BNP 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 status of the Schaus swallowtail within Key Biscayne National Park remains variable based on annual NABA counts conducted from 2006 to 2008 (Salvato, personal communication, 2009).

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. The population is distributed throughout North Key Largo and is apparently viable based annual NABA counts conducted from 2006 to 2008 (Salvato, personal communication, 2009).

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 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 to 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, personal communication, 2006).

Cheeca Lodge, University of Florida, and the Service finalized a Safe Harbor Agreement, and the Service issued an Enhancement of Survival Permit, in 2001 (expiring 2011). Cheeca Lodge is a golf course and resort on Upper Matecumbe Key. Wild lime and torchwood, as well as a variety of nectar-producing trees, were planted on the golf course. These efforts sought to establish dispersal corridors for the Schaus swallowtail, which might serve to facilitate recolonization of other habitat in the southern portions of the historical range. Monitoring has been sporadic. We are not aware of Schaus swallowtail use of the site to date (Salvato, personal communication, 2009).

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. 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 control 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 efforts 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 to1974; but again the lasting effects cannot be gauged (Covell 1976). Commercial exploitation has existed, but its extent cannot be assessed.

Earlier studies found evidence of substantial predation on Schaus swallowtail butterfly life stages by insectivorous birds and other predators (Emmel 1995b, 1997). 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). 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).

Emmel (1995b, 1997) observed various ants to be the major predators of Schaus swallowtail butterfly larvae. First discovered in Florida in the 1960s, the Mexican twig ant, an exotic insect, may be responsible for additive mortality, and may have a differential impact on larvae depending upon their host plant.

Periodic climatic factors such as hurricanes, freezes, and droughts pose additional threats to the Schaus swallowtail butterfly. 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.

Sea-level rise in the 20th century has been shown to affect conversions of upland communities (i.e., hardwood hammock, pine rockland) with low soil and moisture salinities to communities comprised of more salt tolerant plant species and higher soil and groundwater salinities in the Florida Keys (Ross et al. 1994). This phenomenon may result in loss of suitable Schaus swallowtail butterfly habitat. Over time, the ultimate effect of sea-level rise may be total inundation in some areas. The general effects of sea-level rise within the range of the Schaus swallowtail butterfly will depend upon the rate of rise and landform topography. However, the specific effects across the landscape will be affected by complex interactions between

geomorphology, tides, and fluctuations in energy and matter. These effects have yet to be simulated and projected for the range of the Schaus swallowtail butterfly.

Summary analysis– *Changes since the 1997, 2003, and 2006 BOs*

No detailed status surveys have been conducted for the Schaus swallowtail butterfly since 2003. However, survey data collected during annual NABA counts are available from 2003 through 2008 for Elliott Key (BNP) and Key Largo does provide some information on status of the Schaus swallowtail butterfly. On Elliott Key the number of adult Schaus swallowtail butterflies encountered on these annual one-day surveys ranged from 2 to 28 (Salvato, personal communication, 2009). On Key Largo the number of adult Schaus swallowtails encountered ranged from 0 to 8 (Salvato, personal communication, 2009). Emergence of adults is highly dependent on rain and timing is often of major significance in survey results. The poor survey results during some year are likely the result of dry conditions (Salvato, personal communication, 2009), and likely 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 on North Key Largo is protected through acquisition and is 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, predation by exotic insects).

Silver rice rat

Species/critical habitat description

Spitzer and Lazell (1978) originally described the silver rice rat as a full species 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 ranges between 2.1 and 5.3 ounces; male rice rats are generally heavier than females (Spitzer 1983). External measurements of the adult female holotype specimen for this species (United States National Museum 514995) are: total body length 10 inches, tail 4.8 inches, hind foot 1.25 inches, and ear 0.7 inch (Spitzer and Lazell 1978).

Life history

Distribution: The silver rice rat occurs on thirteen islands in the Lower Keys: Big Pine, Little Pine, Howe, Water, Middle Torch, Big Torch, Summerland, Raccoon, Johnston, Ramrod, Cudjoe, Upper Sugarloaf, and Saddlebunch Keys (Vessey et al. 1976, Goodyear 1984, Wolfe 1987, Forys et al. 1996, Perry 2006, Service 2008). 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 such as Little Torch. Rangewide surveys confirmed that rice rat populations are not established on Boca Chica, Geiger, East Rockland or Big Coppit Keys (the islands that encompass the Naval Air Station Key West) (Perry 2006).

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-acre home range for a male silver rice rat on Summerland Key. Forys et al. (1996) observed movements of 1,066 feet in 1 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 trapped on the northern tip of Big Pine Key (Perry 2006). 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 rice rats could colonize Boca Chica and Big Pine Keys from existing populations on adjacent islands. Because black rats compete for food resources and raccoons are predators, these animals could be factors in the absence or rarity of silver rice rats from Boca Chica and Big Pine Keys (Goodyear 1984).

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, considered to be in the lower keys, were in a freshwater marsh, vegetated mainly with sawgrass and cattails (Spitzer and Lazell 1978) and Mitchell (1996) also reported trapping them occasionally in freshwater marshes. Radio telemetry and trapping data from Goodyear (1987) revealed the use of three topographic zones: low intertidal areas, low salt marsh, and buttonwood transitional salt marsh. 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). Mitchell (1996) conducted additional work on silver rice rats and found that reproductive activity is occurring in freshwater habitat and that animals regularly use freshwater marsh on Big Torch Key.

Behavior: Silver rice rats are nocturnal and range extensively (Spitzer 1983, Mitchell 2000). 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 mile in a single night. There is no estimate on the average dispersal distance for silver rice rats; however, their home range size is much larger than is known for other rice rats (5 to 10 times as large). Studies done by Perry et al. (2005) and Mitchell (1996) support the observation of far ranging movement 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, mangroves, *Borrichia*, coconut palm (*Cocos nucifera*), and invertebrates including isopods (Spitzer 1983; Goodyear 1992). However, they probably eat a greater variety of foods.

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 estimate of species population size is 5,000 to 20,000 individuals (Perry et al. 2005).

Population Variability: A variety of ecological factors likely influence reproduction in silver rice rats throughout the year (Wolfe 1982). The reproduction peak occurs after the wet season, from October to November. The gestation period for silver rice rats is 21 to 28 days, with litter sizes 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 that are 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 *Oryzomys. 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, Forys 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. It 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 led the Service to conclude the illicit takings arising from publication of critical habitat were not 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.

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 habitat 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). In addition, raptors are documented predators (Wolfe 1982); however, because they are predominantly nocturnal, their vulnerability to diurnal raptor predation may be low.

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).

Other non-native predators, such as fire ants and exotic snakes, 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. Both adult and young rice rats are vulnerable to predation by Burmese pythons and other exotic species of constrictors that have been recently found in the Keys.

In some areas, wetland habitat used by silver rice rats 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.

Some small, isolated, and widely distributed populations of silver rice rats may be 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.
Climate change forecast for the lower Florida Keys predicts a worst-case sea level rise of 23 inches (IPCC 2007). This rise in sea level is predicted by Ross et al. (2009), Bergh (2009), and LaFevar (2007) to result in the loss of pine rocklands and freshwater wetlands to mangrove wetland communities. The long range projection for the silver rice rat and silver rice rat critical

habitat is unclear at this time as this species not only uses the upland habitats that are in recession, but also is found and prefers expanses of high-quality salt marsh habitat, which based on sea level rise projections may become more abundant in the Florida 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 9,362 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 silver rice rat habitat. Based on GIS mapping (Table EA-15) of the constituent elements and the habitat types codified in the 50 CFR §17.95(a), 8,532 acres encompass the critical habitat for this species, of which 6,750 acres (79.1 percent) are in government ownership and about 1,782 acres (20.9 percent) occur in private ownership. About 315 acres of rice rat critical habitat no longer contain constituent elements and 515 acres are open water. Total acreage in the mapping unit is 9,362 acres. Federal, State, and local regulations largely prohibit development in wetland habitats where the species is found.

Impacts to critical habitat are only evaluated when there is a Federal nexus (e.g., Federal authorization or funding). Federal agencies affected by the designation of silver rice rat critical habitat include the Service's NKDR, Corps, and FEMA (Service1993b). Seven of the nine keys in critical habitat are within the NKDR boundaries. Although the NKDR manages for Key deer,

the habitat requirements and biological needs of the two species do not conflict. The silver rice rat's critical habitat designation affects both the Corps' permitting program and the administration of flood insurance by FEMA. The Corps is required to ensure 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 the 1997, 2003, and 2006 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. Construction activities, although limited in rice rat habitat, have increased the number of predators and competitors, such as dogs, cats, raccoons, birds of prey, exotic constrictor snakes, and black rats.

The silver rice rat population has apparently remained stable throughout its range in the last 10 years. The best available population estimate ranges between 5,000 to 20,000 individuals (Perry et al. 2005). In addition, Perry (2006) captured rice rats on two new islands, Big Pine and Ramrod Keys, where no silver rice rats had been recorded in previous studies. 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 two species do not conflict. Of the 9,362 acres of critical habitat within the boundaries of the designated area, 8,532 acres contain critical elements, 515 acres are mapped as open water, and 315 acres are mapped as no longer containing constituent elements. Of the 8,532 acres with critical element parameters, 6,750 acres are in public ownership (79.1 percent).

Stock Island tree snail

Species/critical habitat description

Say first described the Stock Island tree snail in 1830 based on a snail likely collected from Key West (Say 1830). 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. Although populations of snails now occur throughout the Keys in hardwood hammocks, the majority of suitable habitat remains unoccupied. As of 2006, a tabulation of all well-known and poorly documented sites indicated that Stock Island tree snails occupied approximately 27 sites, 25 sites in the Florida Keys (Monroe County) and two sites on the mainland (Miami-Dade County) (Service 2006a). However, for many of those sites, confirmation as to whether Stock Island tree snails persist in recent years is lacking. Populations in the northern Keys are believed to have been 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 to 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 contain 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 27 populations, 25 in the Florida Keys and 2 in mainland Miami-Dade County.

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 to 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).

Rangewide Trends: McNeese (1997) concluded that the Stock Island tree snail was extinct on Stock Island. However, snails were observed there 2 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 27 populations, which 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. The snails are also faced with predation by invertebrate predators, such as fire ants. Forys et al. (2001a) used Florida tree snails (*Liguus fasciatus*) as a surrogate for Stock Island tree snails to assess vulnerability to fire ant predation. In laboratory trials, 19 out of 22 tree snails were killed by the fire ants within 3 days, some while foraging and others while aestivating. Opossums

(*Didelphis virginiana*) and raccoons (*Procyon lotor*) are known to prey upon both *Orthalicus* and *Liguus* snails (Voss 1976, Deisler 1987). Iguanas have also been documented to feed upon tree snails (Townsend et al. 2005).

The dynamics of sea level rise coupled with hurricane surge are a significant threat to the Stock Island tree snail. Ish-Shalom et al. (1992) suggest that remaining tropical hardwood hammocks in the lower keys will succeed to mangrove communities. This succession trend is also suggested by Sternberg et.al. (2007) and Su Yean Teh et al. (2008) for the middle and upper keys. LaFever et al. (2007) and Ross et al. (2009) in their analysis of endemic species in the lower Florida Keys, conclude that as sea level rises and habitats critical to the survival of the species is lost, management actions must include translocation to suitable recipient sites elsewhere.

Summary analysis– *Changes since the 1997, 2003, and 2006 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 2 years ago in the Key West Botanical Garden (Hughes, personal communication, 2006).

The Service has reports of several new populations, including Key Largo. At least three populations now exist in South Key Largo. Viable populations are apparently successful in North Key Largo. There are now 27 known or reported Stock Island tree snail locations, 25 in the Florida Keys and two in mainland Miami-Dade County.

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.

Other Federal, State, and local agency actions, unrelated to the NFIP, can result in habitat loss and fragmentation. Some of these actions may be subject to the NFIP floodplain management requirements and may also be subject to the Mandatory Purchase Requirement, if the property is located in the Special Flood Hazard Area. For example, a home built in jurisdictional wetlands would be subject to review under the Clean Water Act (CWA). If a 404 wetland permit is issued to the property owner for construction of a building and it is located in a Special Flood Hazard Area, the building must be constructed to the minimum requirements of the NFIP. If the property owner obtains a Federal loan, the owner will be subject to the Mandatory Purchase Requirement. The owner may voluntarily purchase flood insurance if the owner pays cash for

the construction of the building. Further details on impacts from other agency actions, as well as how we evaluate them in our analyses, are provided below.

In the Environmental Baseline, the Service will:

(1) provide an overview of action agencies, in addition to FEMA, and their regulatory 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 sub-section 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 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 the program. 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.

FEMA provided the Service with information on the issuance of flood insurance policies from 1997 through 2009 (Van Dyke, personal communication, 2009). By 1997, FEMA issued 30,702 policies on individual buildings through direct and "Write-your-own" companies. Of these, 23,724 policies were for residential and commercial units in "unincorporated" Monroe County and 6,978 were for residential and commercial units in incorporated municipalities in the county.

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.

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.

(1) Monroe County's flood damage prevention 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 damage prevention ordinances are found in Village of Islamorada Code Article III, Chapter 6, section 81;

(3) the City of Layton's flood damage prevention ordinances are found in City of Layton Land Development Regulations, section 30;

(4) the City of Key Colony Beach's flood damage prevention 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 damage prevention 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 damage prevention ordinances are found in City of Key West Code Chapter 34, Article 2.

These ordinances also identify standards for issuing development permits in special flood hazard areas and include requirements for residential construction, nonresidential construction, accessory structures, manufactured homes in A Zones and coastal 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 and mangrove stands in V Zones 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 area below the lowest floor of an elevated structure for parking, access and limited storage. Any enclosed area in A Zones must have openings in the foundation wall to minimize hydrostatic pressure. In V Zones, the area below the elevated structure must be either free of obstruction or if the area is enclosed it must be built with insect screening, open lattice work, or breakaway walls.

The following table (Table 3) provides the number of insurance policies by year from 1997 through 2009 in the Keys for each of the referenced NFIP participants. Specifically, these are the number of policies on individual buildings by year and by community and include both new and renewal policies. The total number of flood insurance policies has decreased annually 8 of the last 10 years with an average decrease over the 10-year period of 2 percent per year.

Table 3: Total NFIP Policies in the Florida Keys, 1997 to 2009

Year	Total Policies						
	Islamorada	**Key Colony Beach**	**Key West**	**Layton**	**Marathon**	**Unincorporated 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
2006	2,349	911	7,648	104	2,779	17,876	31,667
2007	2,366	893	7,826	100	2,785	17,234	31,204
2008	2,237	873	6,622	96	2,463	15,862	28,153
2009*	2,207	866	6,426	96	2,453	15,225	27,274

*as of August 8, 2009.

Table 4, below, shows the number of new policies on individual buildings built by year and by community between January 1, 1997, and August 8, 2009. These new policies, if associated with a new residence, are in response to the annual Rate of Growth Ordinance (ROGO) permit allotment. The ROGO program is explained in more detail in the "Monroe County Government and Municipalities" section that follows. However, new policies also result from the replacement of manufactured homes and travel trailers with new modular or constructed homes, 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 larger new home, or substantially improving an existing home). The total number of flood insurance policies has decreased annually in 8 of the last 13 years with a decrease over the 13-year period of 11 percent.

Table 4: New NFIP Policies in the Florida Keys, 1997 to 2009

Year	**New Policies**						
	Islamorada	**Key Colony Beach**	**Key West**	**Layton**	**Marathon**	**Unincorporated Monroe County**	**Total**

Year	New Policies						
	Islamorada	Key Colony Beach	Key West	Layton	Marathon	Unincorporated Monroe County	Total
1997		10	132	2		244	388
1998		13	88	1		299	401
1999	31	21	143	1		259	455
2000	30	20	107	1		212	370
2001	24	31	51	0	13	175	294
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
2006	16	11	30	1	92	183	333
2007	37	8	112	1	66	198	422
2008	39	0	49	1	24	108	221
2009	7	0	7	1	17	65	97
Total	300	176	975	15	445	2,483	4,394

*as of August 8, 2009.

Other agency programs and actions in the Florida Keys

As 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, and environmental pollution in ways that adversely affect threatened and endangered species. Below, are summaries of these programs and their interaction with the direct and indirect effects of the NFIP and related effects to threatened and endangered species in the Florida Keys.

Since 1986, the Service has formally consulted on 64 actions affecting listed species in the Florida Keys. Forty consultations were specific to actions affecting the West Indian manatee. The remaining 24 actions were associated with species addressed in this document. Of these, 13 were associated with section 7 consultations, 9 were associated with section 10(a)(1)(A) permits (recovery and research), and 3 were associated with section 10(a)(1)(B) permits (HCPs). Table 5 provides a summary of these consultations. As referenced in the table, three of the consultations were specific to the NFIP as administered by FEMA. The Service determined jeopardy for several of the listed species evaluated and provided FEMA with an RPA, that if implemented would preclude jeopardy for the affected species. An analysis of the RPA is discussed in detail in a later section of this BO. For the remaining consultations, the Service determined that for the affected species, the proposed actions individually and cumulatively would not result in jeopardy. The Service also provided separate evaluations of the project that affected silver rice rat critical habitat and determined that the proposed actions individually and cumulatively would not result in adverse modification of critical habitat.

Over this same consultation period, the Service also provided informal consultation with Federal agencies for an additional 336 actions. Three hundred reviews were associated with actions

affecting the West Indian manatee. The remaining actions (36) addressed species referenced in this BO. In each of these evaluations, the Service concurred with the Federal action agencies' determinations that the proposed actions may affect, but were not likely to adversely affect, the threatened or endangered species at issue.

Table 5: Formal consultations in the FEMA action area

Year	Project	Eastern indigo snake		Stock Island tree snail		Keys tree cactus		Key Largo woodrat		Key Largo cotton mouse		Schaus swallowtail butterfly		Key deer		Silver rice rat		Lower Keys marsh rabbit	
		Acres	Ind.	Acres	Ind.	Acres	Ind.	Acres	Ind.	Acres	Ind.	Acres	Ind.	Acres	Ind.	Acres	Ind.	Acres	Ind.
1986	Nichols HCP	1						1	5	1	15	1							
1990	Dressler Harbor Course HCP							42	5	42	70	42							
1997	FEMA NFIP*	2,738		1,102**		3,195**		1,013**		1,013**		1,416**		5,531**		4,690**		462**	
1997	Charles River Laboratories															19.8	69		
1998	Dressler Harbor Course HCP							19.6	3	19.6	40	19.6							
1999	FDOT Wildlife Crossing*													1.9	28			1.9	3
2001	FDOT north turning lane														4				
2001	FDOT Wildlife Crossing*													1.9				1.9	
2003	Service Captive Breeding								20		1								
2003	NKDF Burn	466	10											446	4				
2003	FEMA NFIP*	2,738		1,095**		373**		54**		54**		1,408**		7,275**		1,841**		600**	
2004	Lopez Research																9		1
2004	Big Pine Key Marina*													10	1				
2004	Mengak Research								1		2								
2006	Schmidt Research		5																
2006	McGuire Research												No Take						

2006	Big Pine Key HCP	168												168	4				
2006	Big Pine Key Marina*													1.92					
2006	FEMA NFIP*	244		397.6		357**		36.9**		36.9**		226.1		96.4	4	84		54.3**	
2006	FDOT Survey								1		1								
2007	Spencer Survey				1				1		1								
2007	Indorf Research																1		
2007	Navy Key West Airfield															135	6	135	1
2008	FDOT Fill in State Park							5.7	1	5.7	1	5.7							
2008	Hoffman Research																1		1
	Total	879	15	397.6	1	357	0	63.2	32	63.2	61	252.4	0	714.22	44	238.8	86	191.2	6

Ind. = Individuals

* If a project was reviewed more than once, only the latest values were totaled.

** The Service determined jeopardy for these species.

Federal Refuges in the Florida Keys

The Service manages four National Wildlife Refuges in the action area encompassing 25,574 acres, up from 23,235 acres in 1997. These Federal lands include the NKDR (8,542 acres), the Great White Heron NWR (7,407 acres), Key West NWR (2,019 acres), and Crocodile Lake NWR (about 6,606 acres). The refuge system has increased by over 646.7 acres, primarily the NKDR (391 acres) and Great White Heron NWR (241 acres), from 2000 to 2010.

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 0.1 acre. 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. In addition to protecting Key Deer habitat, the NKDR protects about 58 percent of the remaining habitat for the endangered Lower Keys marsh rabbit.

Crocodile Lake NWR was established in 1980 to protect critical habitats, including prime feeding and nesting areas, of the American crocodile. The Crocodile Lake NWR 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: 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 acreage of State-owned park lands in Monroe County as of January 2006 (FDEP 2006) is about 80,329 acres, an increase of 7,724 acres over the 72,605 State-owned park acres in 1997 (Smith, personal communication, 2006). State acquisitions since 2006 have added an additional 164 acres of park lands (FDEP 2009). These acreages include submerged and aquatic environment lands (72,074 acres), as well as uplands (8,420 acres).

Florida Department of Community Affairs: The FDCA 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 FDCA also administers the Florida Land Management Act, which provides the statewide framework for comprehensive plans developed by counties.

The FDCA administers the Florida Coastal Management Program, which is a network of State agencies that improves the effectiveness and efficiency of implementing existing laws and programs in the coastal zone. The FDCA also administers the Areas of Critical State Concern (ACSC) program, 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 jurisdiction of the program ends about 250 feet below mean high water. The ACSC designation places limits on upland development and capital improvements and requires higher water quality standards. ACSC are critical when there is a need to protect public resources from unregulated or inadequately regulated development. The governor and cabinet designated Monroe County and the City of Key West as ACSCs in April 1975.

Florida Department of Agriculture and Consumer Services: Within the Keys, the Florida 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.

Monroe County Mosquito Control District (MCMCD): The 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, the Florida Keys Aqueduct Authority (FKAA) supplies almost all potable water via a pipeline. FKAA's water system uses well fields and treatment facilities in Miami-Dade County for its entire water supply. 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. 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 conform to specific Florida statutes and administrative codes. Comprehensive plans updates 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 Monroe County Board of County Commissioners and/or city councils implement the comprehensive plans.

In 1992, Monroe County and the municipalities, in accordance with FDCA regulations, established 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. At that time, 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 from 1992 to 2002, this equaled 3,720 potential new residential units.

The ROGO program originally allocated 255 units per year to unincorporated Monroe County. However, when Village of Islamorada incorporated in 1998, 28 of these units were reallocated to Islamorada. Another 30 units were taken from unincorporated Monroe County's allocation in 1999 when the City of Marathon incorporated. The current 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 a total annual allocation of 372 ROGO units.

The original 10-year allotments were issued all at one time for the City of Key West, Layton, and Key Colony Beach. However, not all ROGO allocations are used each year. For example the City of Key West, although allocated 92 ROGO units per year, has not used any in the last 8

years. Unincorporated Monroe County, whose allocation is 197 has issued an average of only 155 ROGO unit building permits per year for the past several years.

For assessment purposes, our evaluation is to the year 2023, which is a 13-year period (2010 through 2023). This coincides with the expiration of the Big Pine/No Name Key HCP. The Big Pine/No Name Key HCP addresses development related effects to three of the nine species in this BO. In order to maintain consistency between the two reviews, as there is overlap of species habitat and development related effects, the Service is matching the FEMA NFIP period of review to the period of time and expiration date of the Big Pine/No Name Key HCP. Countywide, 4,836 total ROGO units are available through 2023 (372 per year). It is important to state that one ROGO unit equals one residential unit. For example, a single family home on 1 acre equates to one ROGO unit. Similarly, a five-unit condominium equals 5 ROGO units, even if the condominium occurs on 1 acre. In both examples, if potential suitable habitat is lost, the listed species effect is the loss of that 1 acre of 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, an increase of 8.8 percent over the year 2000. About half of these people lived in the southernmost counties of Florida. The 2008 population estimate for Florida is 18,328,340, reflecting an increase of 14.7 percent since the 2000 census (U.S. Census Bureau 2010)(http://quickfacts.census.gov/qfd/states/12000.html).

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 2008. 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.

Between 1980 and 1990, the population of Monroe County increased by 14,926, or 32.8 percent. From 1990 to 2000, the population of Monroe County increased by 1,565, only 2 percent, likely reflecting the effects of ROGO and substantially higher housing costs. However, the population of Monroe County decreased by 9 percent in the 8 year period 1992 to 2008. In 2010, the 2008 population estimate for Monroe County was 72,243, a decrease of 9.2 percent from July 1, 2000. Big Pine Key, in particular, has experienced little growth since 1997 due to the building moratorium that has been in effect. Based on the annual ROGO allotment of 372 dwellings with an average of 2.3 people per dwelling (U.S. Census Bureau 2010), the annual project increase in population is about 856 people or 1.18 percent. Below are the population census data for Monroe County and the 2023 projected population estimate, which is the BO assessment period. (U.S. Census Bureau 2010)(http://quickfacts.census.gov/qfd/states/12/12087.html).

Table 6: Changes in the Human Population Size in Monroe County, Florida, 1980 to 2008

Year	Population	% change
1980	63,188	-
1990	78,024	23.5%
1992	80,968	3.8%
2000	79,589	-1.7%
2004 (est.)	78,284	-1.6%
2006 (est.)	74,737	-4.5%
2008 (est.)	72,243	-3.3%
2023 (est.)*	83,366	15.4%

*Project increase based on ROGO
Source: U.S. Census Bureau , 2010
(**http://www.census.gov/popest/counties/files/CO-EST2008-ALLDATA.csv**)

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 at 134,600, with a population density of 1,300 persons per square mile. This combined population is important because of hurricane evacuation times for residents and the residents' impact on resources, and the government's ability to manage those resources.

Changes in Land Uses in Monroe County: 1970-2009

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 high value native habitat remaining.

Residential and Commercial Land Use Trends**:** Under ROGO (adopted in July 1992), unincorporated Monroe County was allocated 255 dwelling units per year to be developed through 2010 (Monroe County 1996). In addition, 239 square-feet of non-residential development was allocated for every one dwelling unit permitted. Extrapolation of 239 non-residential square-feet per dwelling unit yields a total potential for the county to permit 60,945 more square feet per year, based on 255 ROGO units. 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 372 dwelling units allocated each year by 13 years, the period evaluated in the Effects of the Action section, the product is 4,836 ROGO units. If we multiply 4,836 ROGO

units by 239 square feet, the amount of commercial land equals 26.5 acres and is the amount evaluated in our assessment.

Although not subject to ROGO allotments, commercial developments are evaluated in individual communities and Monroe County under a similar point system, with positive and negative points assessed according to project specific criteria (Monroe County Ordinance 032-2001).

Public Service Land Use Trends: These land uses include education, institutional, public buildings, public facilities, and recreation. As with commercial developments, these facilities are eligible for NFIP insurance and are not subject to Tier development restrictions and ROGO allotments. To estimate future public facility needs, Monroe County, as part of the 1992 Comprehensive Plan, projected facility needs as a percent of the change in residential densities multiplied by the amount of existing lands to project future land needs. During the period of review (1992 to 2002), the percent change was 10.6 percent for education, public building, and public facilities. They projected 0.95 and a 12.8 percent increases for recreation and institutional demand, respectively. They forecast a 10-year increase of 3,720 ROGO units that would require 106.8 acres, or an average of 1,251 square-feet per dwelling unit.

Following this approach, based on the allotment of 372 ROGO units per year over the 13-year assessment period, the projected increase is 4,836 ROGO units by 2023. With an average of 2.3 residents per unit, we estimate a 15.4 percent increase for education, public building, and public facilities. The Monroe County Comprehensive Plan (1997) estimated 1.38 percent and 19.8 percent respectively, for recreation and institutional demands. Using an average parcel size (2009 Monroe County property list), we estimate 121 acres will be required for these units or an average of 1,093 square-feet per dwelling unit (Table 7). In our assessment of the distribution of at-risk lands, we found the average ROGO distribution was 15 percent non-NFIP and 85 percent NFIP. Therefore, we consider all land use improvement to be an additive component of our evaluation.

Table 7: Future public service land use estimates

2008 land use	2008 acres	2008 square feet	Percent increase by 2023	Additional sq. ft. in 2023	Additional sq. ft. per Residential Unit	Additional acres per Residential Unit
Education	565	24,611,400	15.4%	3,789,262	81	0.002
Public building	4,290	186,872,400	15.4%	28,771,567	612	0.014
Public Facilities	220	9,583,200	15.4%	1,475,465	31	0.001
Recreational	573	24,959,880	1.4%	344,446	7	0.000
Institutional	668	29,098,080	19.8%	5,761,420	123	0.003
Commercial *				0	239	0.005
Total	6,316	275,124,960		40,142,161	1,093	0.025
Total 2008 residential units	42,173					
New ROGO units by 2023	4,836					
Estimated 2023 residential units	47,009					

* Commerical square foot per ROGO and the increase in Recreational and Institutional uses are established in the Comprehensive Plan

Tier System: The Monroe County Board of County Commissioners adopted the 20-year future growth plan (1990 to 2010) in April 1993. The plan is referred to as the 2010 Comprehensive Plan. In 1995, based on legal challenges questioning the plan's compliance with state law, a Florida State Hearing Officer, provided a Final Order and Recommendations determining that the Plan was not in compliance and specified remediation actions. The Order stated, among other things, that the near shore waters, shoreline sea grasses, and Key deer habitat had reached or exceeded carrying capacity. Because of the Order, the State of Florida, in cooperation with Monroe County, developed a 5-year work program (Work Program) that would carry out the Final Order and Recommendations. The Work Program included the development of a carrying capacity study and a 20-year land acquisition program. The Carrying Capacity Study was completed in 2002 and required revisions to the 2010 Comprehensive Plan. The revisions affected Goal 105, which was modified to provide the framework to implement the Carrying Capacity Study recommendations and the 20-year land acquisition program. To implement Carrying Capacity Study and the 20-year land acquisition program, the County developed a tier system of land development and acquisition in unincorporated Monroe County, which was adopted on March 15, 2006. The County classified all developable lands into three Tiers: I, III, and Special Protection Areas (SPAs) – formerly Tier II.

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 designated areas.

Tier III lands are generally in subdivisions greater than 50 percent developed. Tier III lands 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 either discouraged or encouraged based on a point system that takes into account natural values, including native habitat and protected species.

In our evaluation of Monroe County's Tier designations, we also noted lands designated as Tier 0, Tier 4, and undesignated Tier lands.

Tier 0 lands generally include submerged lands and right-of-ways. In our evaluation of at-risk lands, potential development of right-of-ways are a component of our public service land use and submerged lands are a component of our state-owned lands evaluation.

Tier 4 lands by definition in Monroe County's Tier system, are considered military lands and actions on these lands would be considered a future Federal action and not subject to the NFIP.

We also noted a land development code titled undesignated Tier lands. Monroe County has placed lands in this designation that were either determined by either Court order and/or land owner petition to be incorrectly classified. Monroe County's Work Program with the State of Florida, requires that these Tier-less parcels be re-evaluated and processed into Tier categories, based upon recommendations made by a Tier Designation Review Committee. The Board of County Commissioners will ultimately be asked to adopt amendments to the Tier Maps. Since these lands will ultimately be placed in one of the three Tiers evaluated in this BO, they would be subject to the Tier analysis conducted in this BO and any potential development impacts addressed as a component of that particular Tier evaluation.

On the northernmost portion of the Key Largo is a high-density residential and commercial development known as the Ocean Reef Club. This community 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 or club space. The Ocean Reef Club has been exempted from ROGO and is not a part of the county's Tier system due to its proximity to Card Sound Road and ability to evacuate in case of a hurricane (Monroe County 2005). Because the estimated rate of growth over the 13-year review period for unincorporated Monroe County and local municipalities is estimated at 15.4 percent, we are applying this same level of growth to at-risk lands in the Ocean Reef Club.

Our analysis also identified a number of suitable habitat acres that fall outside of parcel boundaries, which we called "other" lands. At-risk lands in the "other" lands category include those lands outside Monroe County's parcel layer not subject to the ROGO program and include a composite of state- and federally-owned lands. Development on these lands is unlikely and would probably consist of recreational uses (*i.e.*, trailheads, canoe launches, etc.). Since recreational development in Monroe County is typically 1.38 percent of the total lands, we estimated that 1.38 percent of the "other" lands may be developed. Development on these lands is considered in our cumulative effects analysis.

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 historically, 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. Negative points are assigned for construction in native habitats and positive points are assigned to projects for various other criteria. 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. One criterion resulting in positive points is the dedication of lands to Monroe County for conservation purposes. For example, preservation of a vacant, legally platted, buildable lot or at least 1 acre of unplatted buildable land located within an existing or proposed conservation area would result in positive points. The County ranks permit applications by total points and 20 or more positive points assigned to a proposed project are necessary for it to receive a ROGO permit.

The County mapped native habitat into the Tier I, SPA and Tier III categories, 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 high quality native habitat are classified as Tier I. Positive points may be added to proposed development projects for various conservation measures, for example installing a sewage treatment apparatus. The most positive points are gained by dedicating buildable lots or conservation lands to the County. The County has placed restrictions on clearing 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 criteria under the Tier system adopted by the County are described in Policy 101.4.22 of the "Proposed Amendments to the Comprehensive Plan," Monroe County. The analyses presented in this BO rely in part on the County's Tier System.

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 that entail disturbing native vegetation to have a vegetation plan that lists all native vegetation. Impacts to listed vegetation and native trees over 4 inches dbh (diameter at breast height) must be compensated for by making cash contribution into the Monroe County Land Authority's Restoration Fund. These funds are used by Monroe County to restore habitat on county lands.

Municipalities

The City of Layton and the City of Key Colony Beach are either almost completely built-out or

have little remaining habitat suitable for federally protected species. Therefore, our discussion of environmental protective measures will be limited to the Village of Islamorada, the City of Marathon and the City of Key West.

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. Their point system has 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 is granted on the remaining native habitat with the municipality as grantee. Each municipality has numerous policies and regulations in place to minimize negative impacts and enhance native vegetation and wildlife. They also have acquisition committees to identify and purchase conservation lands. The Village of Islamorada, the City of Marathon, and the City of Key West have restoration funds and transplantation programs they use when it is not feasible for property owners to replace vegetation on their property. Restoration funds are also used to clear exotic vegetation and restore disturbed native habitat. Clearing is limited to 10 to 30 percent in high quality habitat.

Public Lands and Land Acquisition

Protected lands in the action area are managed by Federal, State, County, and non-governmental agencies (NGO). For our assessment of NFIP effects, we are using the Monroe County Land Authority Public Conservation Lands data layer (2009) and the Monroe County Land Authority NGO data layer (2009) to determine the acres protected on conservation lands. Prior to 1999, there was a total 40,752 acres of conservation lands in the Keys (Table 8). Conservation lands accrue at an average rate of 547 acres per year. Federally protected lands include the NKDR (8,542 acres), the Great White Heron NWR (7,407.53 acres), Key West NWR (2,019 acres), and Crocodile Lake NWR (6,606 acres). The U.S. Naval Air Station owns 6,387 acres, up from 5,700 acres in 1997.

Table 8: Protected conservation land acreage in the Keys through 2008 and the acres added per year (Monroe County Conservation Lands 2009 data layer).

Acres of Additional Protection	Public Conservation Lands	Conservation Lands NGO	Total New	Running Total	Percent added
Pre-1999 Protected Acres				**40,752**	
1999	1,522	0	1,522	42,274	3.7%
2000	839	0	839	43,113	2.0%
2001	500	0	500	43,613	1.2%
2002	529	0	529	44,142	1.2%
2003	174	568	742	44,884	1.7%
2004	113	0	113	44,997	0.3%
2005	330	27	357	45,354	0.8%
2006	469	0	469	45,823	1.0%
2007	280	0	280	46,103	0.6%
2008	116	0	116	46,219	0.3%
Total			**5,467**	**46,219**	**13.4%**
Average added per year			**547**		**2.5%**
Expected new lands to be added through 2023			**7,107**	**53,326**	**15.4%**

As of January 1, 2006, the State of Florida owned 80,329 acres, an increase of 7,724 acres over the 72,605 state-owned park acres in 1997. The 2006 acreage includes 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 (40 percent) since 1997. State acquisitions since 2006 have added an additional 164 acres of park lands (FDEP 2009). These acreages include submerged and aquatic environment lands (72,074 acres), as well as uplands (8,420 acres).

Two of the larger State conservation 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). The State-run Florida Forever Program plans to purchase 18,104 acres and owned 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 marsh rabbits, Key deer, and the State-threatened white-crowned pigeon (habitat)."

To date, Monroe County and the State have spent or committed in contracts nearly $200 million on property acquisition (Monroe County has spent $32 million and the State over $168 million). Information provided by Monroe County indicates that about 82 percent of the vacant property acreage in unincorporated Monroe County (excluding Tier III properties, which are about 36 percent of the total) has been acquired. The Work Program directs the County and State to acquire lands within the Coupon Bight/Key Deer, Florida Keys Ecosystem and North Key Largo Hammocks. Progress as of February 29, 2008, is reported in the tables below:

Table 9: Florida Forever Projects

Florida Forever Project Acres, as of February 2008				
	Coupon Bight/Key Deer	Florida Keys Ecosystem	North Key Largo Hammocks	Total
Project Acres	2,830	11,863	4,621	19,314
Acquired Acres	1,768	5,461	3,964	11,193
Remaining Acres	1,062	6,402	657	8,121
Percent Acquired	62%	46%	86%	58%

In 2004 and 2005, two Florida Forever boundary amendments were approved adding about 7,700 acres of environmentally sensitive lands to the three existing Keys project. Since late 2003, the State has spent or committed in contracts to spend approximately $98 million to acquire Florida Forever project lands in the Keys (FDCA 2008).

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 marsh 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 Schaus swallowtail butterfly whose range 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.

Focus Area 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), a computer based Geographic Information System (GIS). Using this information, we constructed data layers on:

(1) the current distribution and range of threatened and endangered species;

(2) the distribution of potential suitable habitat types based on Monroe County's 2009 habitat maps;

(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 within the action area. The maps represent potential suitable (*i.e.*, occupied and unoccupied) habitat for each of these species. However, some properties may not in fact be suitable habitat due to microclimate, substrate, vegetation, disturbance, clearing, or development. The maps we generated represent our best estimation of the current habitat distribution of these species.

To develop these maps, we first identified the native habitat types where the species is usually found (*e.g.*, hardwood hammocks, salt marsh, etc., See Appendix 1). We then identified the historical range for each species as well as the current known range. From this, we established the geographic area for our species assessments and overlaid this layer onto Monroe County's 2009 habitat maps for the Florida Keys (Monroe County 2009). Monroe County's habitat maps are the most current available and were created using state-of-the-art aerial photography.

We used this method to develop focus area maps for the species considered in this BO including 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 marsh rabbit, and Silver rice rat, we added new information as follows. For the Key deer, we incorporated occurrence data from Service staff and Key deer researchers (Frank, personal communication, 2003; Lopez et al. 2003). For the silver rice rat, we added habitat maps generated by Service staff (Service 2003). For the Lower Keys marsh rabbit, we added habitat maps developed by Faulhaber (2003), and historical data (Service 2003).

Eastern indigo snake

The indigo snake is suspected to occur in very low numbers in the Keys and, according to Lazell (1989), the remote, isolated, and possibly distinct Lower Keys populations have not been systematically surveyed. 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. Researchers have collected eastern indigo snakes from Big Pine and Middle Torch Keys; this species has also been historically reported on Big Torch, Little Torch, Summerland, Cudjoe, Sugarloaf and Boca Chica Keys (Lazell 1989). Moler (FWC, personal communication, 1996) documented eastern indigo snakes on North Key Largo and believes they are probably restricted to Crocodile Lakes NWR and the protected hammock areas on that key. The Service is aware of three indigo snake observations in the Keys in the last 12 years. One verified roadkill occurred on North Key Largo in 1998 (Duquesnel 1998). The most recent unverified sightings were in the Village of Islamorada in 2005 (Sheahan, personal communication, 2006). Schmidt et al. (2008) conducted

a herpetological inventory of Big Pine Key and No Name Key in 2006 and 2007 and did not observe the eastern indigo snake.

The eastern indigo snake uses a majority of the habitat types available in the Keys, but tends to prefer open, undeveloped areas (Kuntz 1977). For the purpose of our analysis, potential suitable eastern indigo snake habitat includes all habitat types in the action area except developed lands, impervious surfaces, and open water areas (Appendix 1). Based on our GIS analyses (Table EA-3), 65,552 acres occur in the action area (R3). The amount of habitat in public ownership (considered protected) is 42,012 acres (64.1 percent) (R4).

Our GIS analysis also shows that 23,541 acres (R5) of potential suitable habitat are present in both developed and undeveloped parcels, representing 14,413 properties (R7). For assessment purposes, we consider this 23,541 acres (36 percent) of lands to be at-risk of development. Figure 3 shows the focus area map for the eastern indigo snake. Two HCPs in the Keys, the Big Pine and No Name Key HCP and the Nichols-Hendrix HCP, have already addressed impacts to the eastern indigo snake within their boundaries. Within the boundaries of the aforementioned HCPs, there are 6,110 acres of total suitable habitat (Σ B3:D3); 4,956 acres are protected (Σ B4:D4). The remaining 1,154 acres (Σ B5:D5) of at-risk habitat are not considered in our effects analysis since they have been previously evaluated through the HCP process.

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 NWR 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). For the purpose of our analysis, we define potential suitable Key deer habitat to include all habitat types within the range of the Key deer, including residential subdivisions. Based upon our GIS analysis (Table EA-4), this is about 30,482 acres (J3). Of this, about 20,226 acres (J4) (66.4 percent) are in public ownership. Focus area lands at-risk total about 10,256 acres (J5), with about 2,115 acres (B5) 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 fresh water is available on only 13 of the 26 islands during the dry season (Folk, 1991). Although they use all habitat types, 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, one of which adversely affected Key deer. One project was completed to improve traffic congestion on U.S. 1, which traverses Big Pine Key and is the only route into the key or to continue south to the Lower Keys. U.S. 1 was a two-lane highway on Big Pine Key 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 improved 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 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 and diminish over time.

The wildlife crossings were predicted to reduce Key deer mortality by 25.7 percent (27 Key deer), or 44.4 percent (47 Key deer) of annual road mortalities on U.S. 1. The maximum reduction in road mortalities estimated by the Service is 40.4 percent (43 Key deer) of all road mortalities in the project area, or 66.7 percent (78 Key deer) of annual road mortalities recorded for U.S. 1. 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 by 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 the release of 24 deer at each of two sites. As of 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 (Parker et al. 2008). Dr. Roel Lopez (personal communication 2006) believes Key deer translocation 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). Although 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 included deer-friendly fencing and setbacks from the edge of the abutting streets rights-of-way.

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 FDCA under the Act. Issuance of the ITP anticipates take of Key deer, Lower Keys marsh rabbit, and eastern indigo snake on Big Pine and No Name Keys. The applicants have developed an HCP that establishes guidelines for development activities over the permit period (20 years).

The HCP project area encompasses about 7,203 acres (Table EA-4), including Big Pine Key (6,012 acres) and No Name Key (1,191 acres). Government owned lands constitute 71 percent (5,114 acres) 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.

In consideration of the Big Pine and No Name Key HCP and ITP, the Service considers the lands subject to this BO as those that are potential suitable Key deer habitat on islands other than Big Pine Key and No Name Key (7,203 acres of suitable habitat on Big Pine and No Name Keys). Based on our GIS analyses, the remaining islands provide an additional 23,279 acres (J3-B3), with 15,138 acres in public ownership (65 percent) (J4-B4). Potential suitable Key deer habitat within at-risk lands on the remaining islands is about 8,141 acres (J5-B5), representing 3,280 parcels (J7-B7). Of this acreage, 3,709 acres fall outside the jurisdiction of the NFIP (J6-B6). Figure 4 shows the focus area 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 probably hardwood hammocks. Key Largo has the highest concentration (4,178 or 72 percent) of platted lots of all lots in the Upper Keys.

Potential suitable Key Largo cotton mouse habitat is considered to be all hammock, undeveloped lands, and beach berm as identified in the Monroe County's 2009 habitat maps (Monroe County 2009) (Table EA-7). Known habitat is restricted to North Key Largo, however, we consider all hammocks (Service 2003) on South Key Largo to be potential suitable habitat and a component of our analysis. The reasons these lands no longer support the Key Largo cotton mouse 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 predation or competition from 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. Frank et al. (1997) noted that the cotton mouse occurs throughout North Key Largo and seems viable. This finding is supported by the Service's 5-year review for this species (Service 2009b).

On North Key Largo, potential suitable cotton mouse habitat is about 2,489 acres (Σ B3:I3), of which 2,240 acres (90 percent) are in public ownership (Σ B4:I4). At-risk lands comprise about 251 acres (Σ B5:I5), representing 413 parcels (Σ B7:I7). In 1986, the Service issued an ITP to Nichols-Hendrix, and in 1990 to Ocean Reef Club for adverse effects from loss of habitat associated with proposed developments in 35 acres of potential suitable cotton mouse habitat. The Ocean Reef Club ITP was amended in 1999 and extended in 2002. The Service determined that the impacts associated with the issued HCPs would not jeopardize the survival and recovery of the endangered cotton mouse. These properties are not represented in our analysis of lands at risk.

As discussed previously, the Service is also considering the hammocks on South Key Largo that no longer appear to support the endangered cotton mouse to be potential suitable habitat in this BO. These lands represent 1,414 acres (Σ J3:N3) of additional cotton mouse habitat, of which 688 acres (49 percent) are in government ownership (Σ J4:N4). The acres of at-risk land total about 726 acres (Σ J5:N5) and represent 2,848 parcels (Σ J3:N3). Figure 5 shows the focus area map for the Key Largo cotton mouse.

We discussed previously the open space requirements of Monroe County, the Village of Islamorada, the City of Marathon, and the City of Key West. 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. Nevertheless, some fragmentation of habitat will likely occur.

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 part of the Crocodile Lake NWR. The FDEP, 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 to be all hammock, undeveloped lands, and beach berm as identified in the Monroe County's 2009 habitat maps (Monroe County 2009) (Table EA-7). Current data indicates that known habitat is restricted to North Key Largo. Within the North Key Largo woodrat range, potential suitable woodrat habitat is about 2,490 acres (Σ B3:I3), of which 2,240 acres (90 percent)(Σ B4:I4) are in public ownership. At-risk lands comprise about 251 acres (Σ B5:I5), representing 413 parcels (Σ B7:I7).

In 1986, the Service issued an ITP to Nichols-Hendrix, and in 1990 to Ocean Reef Club for adverse effects from loss of habitat associated with proposed developments affecting 35 acres of potential suitable woodrat habitat. The Ocean Reef Club ITP was amended in 1999 and extended in 2002. The Service determined that the impacts associated with the issued HCPs would not jeopardize the survival and recovery of the endangered wood rat. These properties are not represented in our analysis of lands at risk and are considered part of the baseline. Figure 6 shows the focus area map for the Key Largo woodrat.

As discussed previously, the Service is also considering the hammocks on South Key Largo that no longer appear to support the endangered Key Largo woodrat to be potential suitable habitat in this BO. These lands represent 1,414 acres (Σ J3:N3) of additional woodrat habitat, of which 688 acres (49 percent)(Σ J4:N4) are in government ownership. The at risk lands total about 726 acres (Σ J5:N5), representing 2,848 parcels (Σ J3:N3). Figure 5 shows the focus area map for the Key Largo woodrat.

We discussed previously the open space requirements of Monroe County, the Village of Islamorada, the City of Marathon, and the City of Key West. 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. Nevertheless, some fragmentation of habitat will likely occur.

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.

The Key tree-cactus has probably always been rare because of the restrictive habitat requirements of the species. It grows only on lightly shaded, upland sites 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. The Key tree-cactus occurs at seven known locations in the Keys, six of which are on conservation lands or protected by conservation easement. The main threat to the continued existence of the last remaining unprotected population 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 hammock and beach berm as identified in the Monroe County's 2009 habitat maps (Monroe County 2009). Our GIS analysis identified about 9,207 acres of potential suitable habitat with 2,758 acres at-risk on 5,607 parcels (Table EA-9). Figure 7 shows the potential suitable habitat map for the Key tree-cactus.

Lower Keys marsh rabbit

The Lower Keys marsh rabbit is endemic to the Lower Keys and inhabits tidal, brackish, and transitional upland and freshwater environments. The Lower Keys marsh 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 keys from Boca Chica, just north of Key West, to Big Pine Key. The Lower Keys marsh 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 19,472 acres (Table EA-10) (J3), of which 13,714 acres (70.4 percent) (J4) are protected on conservation lands. Of the 5,758 acres (J5) of at-risk lands, 3,098 of them (J6) lie in areas not subject to the NFIP. Figure 8 shows the focus area map for the Lower Keys marsh rabbit.

The current population estimate is about 500 rabbits in the Lower Florida Keys (Perry, personal communication, 2006). Although habitat loss is responsible for the original decline of the Lower Keys marsh rabbit, high mortality from feral cats has also occurred and may be the greatest current threat. Feral cat control is an ongoing operation on Naval Air Station Key West and lands within the NKDR. However, feral cat control activities outside Air Force lands and the NKDR are unknown.

In June 2006, the Service approved an HCP and issued an ITP for adverse effects from development on Big Pine and No Name Keys. There are 4,298 acres (B3) of marsh rabbit habitat on Big Pine and No Name Keys, 3,626 acres (B4) of which are protected. The HCP includes specific development restrictions in Lower Keys marsh rabbit habitat and within a 1,640-foot (500 meter) buffer surrounding this habitat. The distance of 1,640-feet is based on the use of upland areas by this species and the estimated distance domestic cats will travel from their homes (Frank, personal communication, 1996). The ITP does not authorize incidental take of suitable marsh rabbit habitat, but does authorize incidental take of up to 40 acres of buffer lands surrounding suitable marsh rabbit habitat. The HCP also requires the compensation for these losses at a 3 to 1 ratio (Service 2006). Based on the remaining 5 ROGO allotments allowed by the HCP for Big Pine and No Name Key, an additional 2.6 acres (B12) of at-risk lands may be developed, of which 0.8 acre (B13) are not subject to NFIP. The remaining acres (1.8 acres) (B16) are subject to NFIP. Since at-risk marsh rabbit habitat was not exempted in the Big Pine and No Name HCP, the direct and cumulative effects of NFIP actions on at-risk marsh rabbit are addressed in this BO. The Service's HCP did address indirect effects (cat predation) and determined that this level of incidental take would not jeopardize the survival and recovery of the Lower Keys marsh 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. 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 suitable habitat undoubtedly fluctuates depending on hurricanes, wildfires, and subsequent vegetation succession, but the primary upland habitat is hardwood hammocks. Contiguous tracts of hammock 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. The reasons these lands no longer support the species are not known, but mosquito spraying is suspected (Salvato, personal communication, 2006).

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 habitat loss from development on North Key Largo is low. The Service believes the status of the Schaus butterfly is stable (Service 2008c). In 2006, the population may have increased in the islands of Key Biscayne National Park; in addition, a single Schaus swallowtail butterfly was observed 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 2,486 acres (Table EA-12) (Σ B3:I3), of which 2,240 acres (90 percent) (Σ B4:I4) are in public ownership. Lands at-risk in this area comprise about 247 acres (Σ B5:I5) and include 411 parcels (Σ B7:I7). In 1986, the Service issued an ITP to Nichols-Hendrix, and in 1990 to Ocean Reef Club for adverse effects from the loss of 35 acres of potential suitable Schaus swallowtail butterfly habitat associated with proposed developments. The Service determined that the impacts associated with the issued HCPs would not jeopardize the survival and recovery of the Schaus swallowtail butterfly. These properties are not represented in our analysis of lands at risk and are considered part of the baseline. For our assessment of the effects of the proposed action on the Schaus swallowtail butterfly, the Service considers the lands in North Key Largo subject to this BO to total 217 acres (Σ D54:I5) of at-risk lands consisting of 336 parcels(Σ D7:I7).

As discussed previously, the Service also considers hammocks on South Key Largo, Upper and Lower Matecumbe Key, and Lignumvitae Key that no longer appear to support the endangered Schaus swallowtail butterfly as potential suitable habitat. These lands represent 2,316 acres (46 percent) (Σ J3:P3) of additional Schaus swallowtail butterfly potential suitable habitat, of which 1,000 acres (Σ J4:P4) are in protected status. The total number of acres of Schaus swallowtail

butterfly potential suitable habitat at-risk is about 1,733 acres (Σ D5:P5). Figure 9 shows the focus area map for the Schaus swallowtail butterfly.

We discussed previously the open space requirements of Monroe County, the Village of Islamorada, the City of Marathon, and the City of Key West. 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. Nevertheless, some fragmentation of habitat will likely occur.

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).

For the silver rice rat, we relied on potential suitable habitat maps generated from Monroe County's 2009 habitat maps (Monroe County 2009). Potential suitable habitat for the silver rice rat is about 21,748 acres (Table EA-13)(J3) of which 14,256 acres (65.6 percent)(J4) are in public ownership. Lands at-risk in the range of the silver rice rat are about 7,492 acres (J5), representing 3,985 parcels (J7). 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 focus area potential suitable habitat map for the silver rice rat.

Critical habitat for the silver rice rat includes areas containing mangrove swamps, salt marsh flats, and buttonwood transition vegetation. The major constituent elements of this critical habitat that require special management considerations or protection are:

(1) mangrove swamps containing red mangrove, black mangrove, white mangrove, and buttonwood;

(2) salt marshes, swales, and adjacent transitional wetlands containing saltwort, perennial glasswort saltgrass, sea ox-eye), Key grass and

(3) coastal dropseed and freshwater marshes containing cattails sawgrass and cordgrass.

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 that may be affected by the designation of silver rice rat critical habitat include the Service (NKDR), Corps, FEMA, U.S. Navy, and the Federal Highway Administration. 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 two species do not conflict.

Based on GIS mapping of the constituent elements and the habitat types codified in 50 CFR17.95 (a), 8,532 acres (J3) encompass the critical habitat for this species (Table EA-15), of which 6,750 acres (79 percent) (J4) are in government ownership and about 1,782 acres (21 percent) (J5) are in private ownership. As of 2010, GIS analysis shows about 315 acres of rice rat critical habitat no longer contain constituent elements and about 1,782 acres (J5) are at risk.

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 records of 27 populations 25 in the Keys and 2 in mainland Miami-Dade County. Many of these populations are believed to have been established by collectors.

Extant populations of the Stock Island tree snail are known in at least 27 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 beach berms (Table EA-9) and is estimated at 9,207 acres (R3) of which 6,449 acres (70 percent) (R4) are in public ownership. Lands at-risk in the range of the Stock Island tree snail are about 2,758 acres (R5), representing 5,607 parcels (R7). Figure 11 shows the focus area map for the Stock Island tree snail.

Integration and Synthesis

On August 25, 1994, the U.S. District Court for the Southern District of Florida concluded that FEMA's implementation of the National Flood Insurance Program constituted a Federal action for the purposes of section 7 of the Act. The Court required FEMA to consult with the Service

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 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 marsh 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 a RPA that FEMA could undertake so that its action would not result in jeopardy to the above listed species or result in adverse modification of silver rice rat's critical habitat. The RPA required the development of species habitat maps, property maps, and implementation of a project review process. The project review process 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 RPA provided in the 1997 BO and because a county-wide HCP was not completed within 4 years of the issuance of the 1997 BO. The new information 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 included the addition of two municipal governments, the City of Marathon and the Village of Islamorada, as participating communities in the 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 would:

(1) result in jeopardy to the Key deer, Key Largo cotton mouse, Key Largo woodrat, Key tree-cactus, Lower Keys marsh rabbit, Schaus swallowtail butterfly, silver rice rat, and Stock Island tree snail;

(2) result in incidental take of habitat of the eastern indigo snake and American crocodile;

(3) result in adverse modification of silver rice rat critical habitat;

(4) not result in jeopardy of the eastern indigo snake and American crocodile; and

(5) affect, but was not likely to adversely affect the Garber's spurge;

The Service also concluded 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 and critical habitat listed in the 1997 BO and reaffirmed in the 2003 amendment was the review of county and municipal building permits for their effects to listed species. To assist in implementation of the RPA, the Service coordinated closely with FEMA, Monroe County, and the affected municipalities beginning in December 1998. This coordination continued until it was suspended because of the September 9, 2005, Court Order**.** A 1999 Service memorandum previously lodged with the Court (DE # 158 Exhibit 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 RPA from 1997 to 2003. This portion of the opinion, analyzes these effects, as well as the effects of the RPA through September 2005.

Tables 10, 11, and 12 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 10: Summary of Fish and Wildlife Technical Assistance in Monroe County, Florida 1998 to 2005 by Site Condition

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 10, 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 (2,805 or 42.6 percent) of the reviews involved an addition or modification of a developed property. Developed properties may contain native habitat, exotic species, or completely barren areas.

Table 11: Summary of Fish and Wildlife Technical Assistance in Monroe County, Florida, 1998 to 2005 by Action Type

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 11, 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. However, 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 12: Summary of Service Technical Assistance in Monroe County, Florida, 1998 to 2005 by Determination

Year	Actions	Risk to Species	No 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 12, we determined that 6,315 (95.8 percent) of the proposed actions that were technically reviewed did not adversely affect a listed species. In addition, 4,369 (66 percent) of the proposed actions did not affect native habitat. 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. In these situations, we recommended changes in

the project design that could minimize or eliminate an adverse effect, as well as measures that could benefit a species. Depending on the site-specific conditions, the types of measures that might be recommended included: reduce or re-site the structure; place a conservation easement on the undisturbed habitat; conduct a survey to determine possible presence of listed species; transplant native vegetation or specific preferred plant species; contribute to a restoration fund; or replace lost habitat.

For the purposes of this BO, the Service carefully reviewed 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**.** The purpose of this review was to qualify and quantify the types of projects that were referred for technical assistance and the specific types of advice rendered or actions taken by the Service in response. A summary of our findings is presented below in Table 13.

Table 13: Summary of Service Technical Assistance Actions in Monroe County, Florida, FY 2004

Project type	Number of determinations: *Not likely to increase adverse risk*	Number of determinations: *Habitat Conservation Plan (HCP) requested*	Number of recommendations: *Conservation measures*
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 13. 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.

For FY2004, the Service reviewed 522 proposals in Monroe County that were submitted to the South Florida Ecological Services office in Vero Beach for Technical Assistance. These projects had the potential to affect about 85 acres of property, most of which was scarified and cleared. Proposed projects on about 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 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 the habitats described above, the Service estimated a total impact of about 1.2 to 1.5 acres of suitable habitat could occur and recommended that Habitat Conservation Plans (HCP) be 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 1 month in 2004 to evaluate FEMA technical assistance requests and outcomes in detail. Twenty-six technical assistance requests were evaluated. Sixteen requests occurred on parcels that were identified in the Service's records as potentially containing suitable habitat (Table 14). 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.

Our review also included an analysis of our recommended mitigation measures for nine of the proposed projects randomly selected for the 1 month period in 2004. 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.

Table 14: Projects in Consultation Area Evaluated in February 2004

Parcel	Key	Project	Parcel Size (Acres)	Habitat Type	Species of Consultation	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	Key	Project	Parcel Size (Acres)	Habitat Type	Species of Consultation	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, FDCA, 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

For the purposes of this BO, we evaluated our recommendations for landowners to implement HCPs in Monroe County in 2004. We selected the first 10 determinations in which we recommended HCPs directly, or as an alternative. The results are provided in Table 15 below.

The 10 projects we reviewed cover 9.51 acres of proposed development, possibly affecting 1.12 acres of potentially suitable habitat. Four applicants agreed to Service recommended project-specific mitigation to minimize the risk of adversely affecting listed species; therefore, no HCP was necessary. These projects as originally proposed would have resulted in the removal of 0.62 acre 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 had taken no further action. 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.

A 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 to 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 Key Largo cotton mouse. The status of the Stock Island tree snail and Key tree-cactus are uncertain.

(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 the project and had the chance to engage the applicant in the Section 10 review process. During the period the RPA was in place, the Service requested HCPs on all projects with 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 eastern indigo snake, Key Largo woodrat, and Lower Keys marsh rabbit.

Table 15: Section 10 HCP Evaluations in FY 2004

HCP	Key	Project	Parcel Size (acres)	Habitat Type on Project	Consultation Species	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, transplantation 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.
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.

HCP	Key	Project	Parcel Size (acres)	Habitat Type on Project	Consultation Species	Project Footprint Size	Acres of habitat	Mitigation Recommendation	Results
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 County 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 and 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. Most of the properties were mistakenly included in the consultation maps because of the mapping tools used at the time. Improvements in mapping technology have helped reduce this error in our latest focus maps, although verification and collection of updated information will continue to be important.

During our project reviews, when we believed a proposal would adversely affect listed species, we recommended that an applicant seek an ITP under Section 10 or identify a Federal nexus (e.g., Corps wetland permit) in accordance with section 7. We recommended development of an HCP for 181 projects (2.7 percent of projects reviewed) where we believed adverse effects to a listed species or critical habitat could not be avoided.

Forty-nine of our requests for an applicant to pursue an HCP were related to proposed construction on Big Pine and No Name Keys where the HCP for Big Pine and No Name Keys was in effect. 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 insignificant or discountable. The Service also recognizes, however, that the 1996 and 2003 RPAs 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 1996 and 2003 RPA did not allow for a review of permits collectively, however, the 2006 RPA did. This approach 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 also 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 1996 RPA, the Service stationed an employee in the Keys. The employee received assistance from other Service staff, and worked collaboratively 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 was relocated to the South Florida Ecological Services Office in Vero Beach. The duties for this position remained the same. Compliance visits and technical assistance site visits continued to be made over 4 or 5 days each month over the period of time the RPA was in effect.

Service staff accompanied FEMA staff in their review of Monroe County and municipality compliance with the 2003 RPA. 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 (Table 16). The results (31 inspections) note compliance with RPA in 28 of 31 inspections. Two non-compliance were noted for the City of Marathon and one for unincorporated Monroe County. Corrective actions were implemented.

Over the last several years, a building moratorium related to level of service concerns on U.S. 1 on Big Pine Key, resulted in 21 building permit applications on Big Pine Key being held in abeyance by Monroe County. Some applicants brought lawsuits against the county because of the moratorium. The Special Master assigned by the Court determined the impacts from applicants' building would have a de minimus effect on requirements proposed by Monroe County. Consequently, several property owners were issued a Beneficial Use determination meaning Monroe County could issue building permits for them to develop their property.

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 3). 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.

In accordance with the Big Pine and No Name Key HCP, the county is now tracking the impacts of all development, including the 21 building permits (impacting 4.7 acres) that were issued. Since issuance of the HCP, five additional permits have been issued.

Aside from the 21 permits noted above, after regular coordination and review, the Service and FEMA have found that the technical assistance process has been effective. Table 16 includes a record of RPA coordination by FEMA, the Service, and Monroe County.

Table 16: 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
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	Review of County permits faxed	Compliance with RPA
2001	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

Date	Action	Outcome
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	Meeting	Compliance with RPA
2002	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
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, FDCA, Service, Corps, 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

Date	Action	Outcome
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

Factors to be considered

In this BO, we determine whether continued implementation of the NFIP in the Florida Keys is likely to adversely affect listed species, and, if so, to what extent. In general, for direct effects, we 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. We also consider indirect effects, such as traffic volumes and cat predation, in our evaluation. For cumulative effects, *i.e.*, those actions not subject to NFIP, we incorporated the same approach and considered the same parameters.

Methods

Suitable habitat for listed species in the Keys includes all habitat classes referenced in Monroe County's 2009 habitat maps used by federally listed threatened and endangered species. These lands include protected areas (e.g., NWRs, Pennekamp State Park, etc.) as well as areas where the NFIP is generally not applicable (e.g., CBRA lands and state and Federal lands). We further categorized the suitable habitat to allow for accurate assessment of direct and cumulative impacts from the NFIP. Baseline data and calculations for the effects analyses are in spreadsheets that are included as tables in this document (Tables EA-1 through EA-18) (Appendix 4).

Standard parameters applied to all of the calculations are shown in Table EA-1. We subtracted those lands that are not at risk of development from our overall acreage of suitable habitat (row 3) to determine which parcels are at risk of development. This "lands in conservation" acreage, as shown in the analysis tables (row 4), was generated using GIS layers provided by the Monroe County Land Authority that identified parcels as Public Conservation Lands and NGO Conservation Lands. The difference (row 5) is the potential suitable habitat susceptible to development.

In order to determine the direct effects from the NFIP, we used GIS parcel data for land ownership and the CBRA flood maps to identify acres of suitable habitat that are susceptible to development, but would not be eligible for flood insurance under the NFIP. Parcels not eligible for NFIP flood insurance include all lands falling in the boundaries of the CBRA zones, lands owned by the Federal government and lands owned by the State of Florida.

Although there are privately-owned parcels in CBRA zones, and any new or substantially improved building in a CBRA zone must meet the minimum requirements of the NFIP, FEMA

does not issue flood insurance for properties that fall within the boundaries of the CBRA zones. In addition, neither the Federal government nor the State of Florida is required to obtain FEMA flood insurance on structures as both entities are self-insured. In our analysis, at-risk lands in CBRA zones are included in row 6 of the analysis tables (Tables EA 3,4,7,9,10,12,13, and 15 (Appendix 4)). We consider potential development on these lands (row 13) in our evaluation of cumulative effects.

In some areas, additional habitat may be subject to development associated with the new residences. As discussed previously, about 85 percent of this additional development is likely to occur in at-risk lands in areas where NFIP insurance is available, with the remaining 15 percent occurring in areas where NFIP insurance is not available. However, we are considering all of these lands (row 15) as indirect effects and part of FEMA's proposed action. We reduced the maximum impacted acres (row 12) by the relative percentage of at-risk lands in areas where NFIP insurance is not available (row 13) to determine the direct effects anticipated to occur in suitable habitat due to the NFIP (row 16). We consider this the direct effects of the action based on activities that are likely to occur in areas where flood insurance is available.

Throughout the remainder of the BO, when we refer to at-risk lands due to the NFIP and non-NFIP, we are referring to at-risk lands in areas that are eligible for flood insurance under the NFIP and at-risk lands in areas that are not eligible for flood insurance (non-NFIP).

Human population and development in the Keys

As shown in Table 6, the population of Monroe County increased by 23.5 percent between 1980 and 1990. It continued to increase in the early 1990's. Based on those trends, in 1997 we projected the population of Monroe County would increase by about 139 percent by 2020. By 2000, however, the population actually decreased to 79,589. This decreasing trend continued through 2008, with the population currently 7.4 percent less than that in 1990. The prediction in Monroe County's Comprehensive Plan that Monroe County population will be 112,300 by 2010 now seems unlikely, as the current population is now below the 1990 level. Although the population has declined in the last years, we assume the population will increase commensurate with a corresponding increase in housing. ROGO allocation in the Florida Keys is 372 ROGO units per year. The current ROGO program allocates 372 new units per year in the Keys; in the 13-year period from 2010 through 2023, 4,836 new ROGO units are possible. Based on an average of 2.3 persons per household in Monroe County (U.S. Census Bureau 2000), the population would increase by 11,123 persons (15.4 percent) by the year 2023 as the result of new development.

Currently, there are about 20,644 acres of vacant land in Monroe County, which represents about 32 percent of the total acreage of the county. These 20,644 acres do not include 11,104 vacant, buildable lots already zoned and platted for residential uses, nor does this acreage include conservation and recreational lands ("protected" lands), such as State parks.

Although there are 11,104 vacant, developable, residential lots in Monroe County, this number does not reflect the residential construction potential. The actual potential for new construction is lower due to growth management regulations in the county and municipalities. Monroe

County developed a land use map that determines future land uses and residential and commercial construction limits based on carrying capacity as a function of hurricane evacuation times. Future land-use predictions may be less than what would occur based on a carrying capacity analysis because of the building permit system. Actual growth patterns are determined through the Permit Allocation System (*i.e.*, ROGO), issuance of building permits, and open space requirements by the county and municipalities (Monroe County 1996).

For assessment purposes, we are evaluating a 13-year period from 2010 through 2023. This represents 4,836 ROGO units throughout the entire county (372 ROGO units per year). We consider these ROGO units in our analyses to project future development and estimate the acreage of impacts associated with residential development. The ROGO allocation in Monroe County is divided into six communities for future planning purposes as follows: unincorporated Monroe County (197 units), the Village of Islamorada (28 units), the City of Layton (3 units), the City of Marathon (30 units), the City of Key Colony Beach (22 units), and the City of Key West (92 units). FEMA independently evaluates each of the six communities for participation in the NFIP. Details on each community are below and in Table EA-2a.

Unincorporated Monroe County: Monroe County provides 197 ROGO allocations for dwelling units per year. At least 20 percent of these must be used for affordable housing with the remaining (157 ROGO units) proportioned equally among the upper, middle, and lower keys, which is about 52 ROGO units per region. Annual ROGO allotments for affordable housing can be allocated in any of the three regions. However, for our assessment we are considering equal allotments of the affordable housing units per region, which provides on average, 66 ROGO allotments per region. In addition, 239 square feet of commercial development will be permitted for every one dwelling unit permitted. A total of 612,079 square feet (14.1 acres) of commercial construction could be permitted through 2023 or a total of 1.08 acres per year.

There are 63,411 acres of suitable habitat for listed species in unincorporated Monroe County, of these, 40,976 acres are protected conservation lands and 15,571 acres fall outside the purview of the NFIP. The 22,435 acres of habitat at risk are divides amongst 14,521 parcels.

Village of Islamorada: The Village of Islamorada has 28 ROGO allocations for dwelling units per year. Based on allotted ROGO units, an additional 2 acres of commercial development could be permitted. There are 2,077 acres of habitat suitable for listed species in the Village of Islamorada; of these, 671 acres are protected conservation lands and 1,350 acres fall outside of the purview of the NFIP. The 1,405 acres of habitat at risk are divided amongst 1,433 parcels.

City of Marathon: The City of Marathon has 30 ROGO allocations for dwelling units per year. Based on allotted ROGO units, an additional 2.1 acres of commercial development could be permitted. There are 2,871 acres of habitat suitable for listed species in the City of Marathon; of these, 961 acres are protected conservation lands and 1,074 acres fall outside of the purview of the NFIP. The 1,910 acres of habitat at risk are divided amongst 1,718 parcels.

City of Key Colony Beach: The City of Key Colony Beach has 22 ROGO allocations for dwelling units per year. Based on allotted ROGO units, an additional 1.6 acres of commercial development could be permitted. There are 20 acres of habitat suitable for listed species in the

City of Key Colony Beach, none of which are protected and all of which fall outside of the purview of the NFIP.

City of Key West: The City of Key West has 92 ROGO allocations for dwelling units per year. Based on allotted ROGO units, an additional 6.6 acres of commercial development could be permitted. There are 869 acres of habitat suitable for listed species in the City of Key West; of these, 165 acres are protected conservation lands and 376 acres fall outside of the purview of the NFIP. The 703 acres of habitat at risk are divided amongst 434 parcels.

City of Layton: The City of Layton has 3 ROGO allocations per year for dwelling units. Based on allotted ROGO units, an additional 0.2 acre of commercial development could be permitted. Less than an acre of habitat (0.1 acre) for listed species falls in the boundaries of the City of Layton. These lands also fall within the boundaries of the NFIP.

Analysis for effects of the action

Beneficial Effects: Beneficial effects are contemporaneous positive effects without any adverse effects to the species. The Service did not identify any beneficial effects that might result from the action.

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 are not included in the environmental baseline or treated as indirect effects. We do not consider effects from these future Federal actions in this BO because they will require consultation at the time of the action**.** The only direct effect identified from the proposed action is the issuance of flood insurance that facilitates development. Property owners purchase flood insurance because lending institutions require it for a government-backed loan or because they are concerned about their flood risk.

Interrelated and Interdependent Action: An interrelated action 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 still reasonably certain to occur. Indirect effects may occur outside of the area directly affected by the action. The indirect effects of the proposed action include, but are not limited to, loss of habitat, habitat fragmentation, increased traffic that could cause an increase in vehicular mortality, and increased outdoor cat populations that prey on listed species.

We have independently evaluated each species under consideration as to population, habitat loss, habitat fragmentation, indirect mortality (such as vehicular mortality), domestic pet predation, chemical hazards, etc. The details of our analyses are in the individual species sections that follow.

In the analyses that follows for each species, we evaluate loss of habitat on a "worst case scenario" basis. We assume that all ROGO units will result in new development; however, we are aware that some units will be used to redevelop properties that are already developed. Also, we assume that if a property is developed, all suitable habitat present on that unit will be lost. In Monroe County, the Village of Islamorada, the City of Marathon, and the City of Key West, 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 of likely occupied habitat can be cleared in the municipalities. Additional regulations require preservation, restoration, or compensation to offset vegetation losses that result from development. 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 existing programs administered by the county and municipalities are already helping to avoid and minimize negative impacts to potential suitable habitat.

We created spreadsheets for each of the species below to calculate the amount of estimated impacts from the NFIP, as well as the cumulative impacts. Tables EA 3,4,7,9,10,12,13, and 15 (Appendix 4) show the formulas in each of the row headings. Slight rounding errors may occur within the tables, but these are so small they have no significant effect on our final effect conclusions. The calculations account for the average size of a parcel containing habitat (row 8), the number of ROGO allocations over the life of the review (row 10), and the impact acres in areas not subject to the NFIP (row 13). We consider the acres of NFIP impacts to be the direct effects (row 16) and the acres of impacts on non-Federal lands outside NFIP (row 13) to be cumulative effects. We considerer additional development associated with public use improvements (row 15), although only 85 percent is NFIP, to also be an indirect effect of FEMA's NFIP action.

Our analysis identified a number of suitable habitat acres that fall outside of Tier parcel boundaries, which we called "other" lands. At-risk lands in the "other" lands category include those lands outside Monroe County's mapped parcel boundaries not subject to the ROGO program and a composite of state- and federally-owned lands. Development on these lands is unlikely and would probably consist of recreational use areas (*i.e.*, trailheads, canoe launches, etc.). Since recreational development in Monroe County is typically 1.38 percent of the total lands, we estimated that 1.38 percent of the "other" lands may be developed. Development on these lands is considered in our cumulative effects analysis.

Eastern indigo snake

Potential suitable habitat is present throughout all of the Keys. 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. In the last several years, they have included four reported, but unsubstantiated observations of this snake in Monroe County, two undocumented sightings on Grassy Key (City of Marathon), and two unverified reported sightings in the Village of Islamorada (Sheahan, personal

communication, 2006; McNeese 2006). The most recent observation of an eastern indigo snake occurred on Little Knockemdown Key in 2009. A photo verification of the individual was provided to the NKDR via email in 2010 (Service 2010).

Direct effects - Habitat loss

Potential suitable eastern indigo snake habitat includes all habitat types in the action area, as described in the status of the species above. We determined there are 65,552 acres (R3) of potential eastern indigo snake habitat in Monroe County (Table EA-3). Of these, 42,012 acres (64.1 percent) (R4) are located on conservation lands not subject to development. Our GIS analysis shows that 14,413 parcels (R7) containing 23,541 acres (R5) of suitable habitat are at risk from development. Table EA-3 provides a detailed breakdown of the acreages of eastern indigo snake habitat within the five Keys jurisdictions where it may be present.

The majority of indigo snake habitat in the Keys is in unincorporated Monroe County (51,136 acres) (Σ B3:K3), of which 6,074 acres (B3) fall inside the boundaries of the Big Pine and No Name HCP (Service 2006). The HCP allows for the development of a maximum of 200 lots on Big Pine Key in the next 20 years and provides incidental take for 168 acres of indigo snake habitat on Big Pine and No Name Keys. The HCP requires mitigation of habitat lost due to development at a 3:1 ratio. In addition, the County continues to conserve habitat on Big Pine Key from lots that have been dedicated to the county through the ROGO process. Because the HCP has already addressed impacts and exempted take within its boundaries, this BO addresses impacts on potential suitable habitat outside of Big Pine and No Name Keys. The HCP allowed for 10 Tier 1 and 190 Tier 2 and Tier 3 ROGO units through 2023. The County has issued 5 Tier 1 permits, which leaves 5 remaining for the life of the HCP. These 5 Tier 1 ROGO units in the HCP count towards the overall Tier 1 ROGO units in unincorporated Monroe County for the life of the permit. As such, we factored them out of the available Tier 1 ROGO units because the HCP is not included in our analysis (Row 10, B10 and G 10). We also excluded from our analysis the at-risk lands associated with the Nichols-Hendrix and Ocean Reef HCPs, because the HCPs already addressed impacts and exempted take for the indigo snake.

Unincorporated Monroe County

There are about 51,136 acres (Σ B3:K3) of indigo snake habitat in unincorporated Monroe County. About 6,074 acres (B3) of these fall inside the boundaries of the Big Pine and No Name HCP and 40,214 acres (Σ B4:K4) occur on conservation lands. This leaves 9,802 acres (Σ B5:K5) of habitat at risk, of which 5,069 acres (Σ B6:K6) fall on lands outside the purview of the NFIP. Based on the data in Table EA-3, the ROGO permit allocations allow for the development of 770.6 acres (Σ B12:K12) of habitat in unincorporated Monroe County, 686.5 acres (Σ B16:K16) of which are considered direct effects of the NFIP. We consider impacts to 72.8 acres (Σ B14:K14) of habitat on non-Federal lands outside the NFIP to be cumulative effects. We consider impacts to 63.8 acres (Σ B15:K15) of habitat through associated non-residential development to also be an indirect effect of FEMA's NFIP action.

We have also identified about 8,580 acres (Q3) of at-risk land in the "other" category. At-risk lands in the "other" lands category include those lands outside Monroe County's parcel layer not

subject to the ROGO program and include a composite of state- and federally-owned lands. Development on these lands is unlikely and would probably consist of recreational use areas (*i.e.*, trailheads, canoe launches, etc.). Since recreational development in Monroe County is typically 1.38 percent of the total lands, we estimated that about 118 acres (0.0138*8,500=118.4) of the "other" lands may be developed. Development on these lands is considered in our cumulative effects analysis (Table EA-17).

Village of Islamorada

There are 2,077 acres (L3) of indigo snake habitat in the Village of Islamorada, of which 671 acres (L4) are on conservation lands. There are 50 acres that are outside the purview of the NFIP (L6). The 1,406 acres of at-risk habitat (L5) are located on 1,433 parcels (L7). The ROGO program allocates 28 units per year to the Village of Islamorada (L9) and the average suitable habitat on a parcel is 1 acre (L8). Based on the data in Table EA-3, the ROGO permit allocations allow for the development of 357.1 acres (L12) of habitat in Islamorada, 344.4 acres (L16) of which are considered direct effects of the NFIP. We consider impacts to 10.4 acres (L14) of habitat on non-Federal lands outside the NFIP to be cumulative effects. We consider impacts to 9.1 acres (L15) of habitat through associated non-residential development to be an indirect effect of FEMA's NFIP action.

City of Marathon

There are 2,871 acres of indigo snake habitat in the City of Marathon (P3), of which 961 acres are on conservation lands (P4). The remaining 1,910 acres (P5), located on 1,718 parcels (P7), are at risk of development. There are 781 acres (P6) that fall in areas not subject to the NFIP. The ROGO program allocates 30 units per year to the City of Marathon (P9) and the average suitable habitat on a parcel is 1.1 acres (P8). Based on the data in Table EA-3, the ROGO permit allocations allow for the development of 433.6 acres (P12) of habitat in Marathon, 256.3 (P16) of which are considered direct effects of the NFIP. We consider impacts to 144.8 acres (P14) of habitat on non-Federal lands outside the NFIP to be cumulative effects. We consider impacts to 9.8 acres (P15) of habitat through associated non-residential development to be an indirect effect of FEMA's NFIP action.

City of Key Colony Beach

There are 20 acres (M3) of indigo snake habitat in the City of Key Colony Beach, none of which are on conservation lands (M4) and all of which fall under the jurisdiction of the NFIP (M16). These 20 acres, located on 112 parcels (M7), are at risk of development. The ROGO program allocates 22 units (M9) per year to Key Colony Beach and the average suitable habitat on a parcel is 0.2 acre (M8). Based on the data in Table EA-3, the ROGO permit allocations allow for the development of all 20 acres (M16) of habitat in Key Colony Beach, all of which are considered direct effects of the NFIP. We have also identified 0.55 acre of impact associated with non-residential development (M10*0.025=0.55). Since there is no remaining at-risk habitat (M15), this development will have no additional habitat impacts on the affected species.

City of Key West

There are 869 acres of indigo snake habitat in the City of Key West (N3), of which 165 acres are on conservation lands (N4). The remaining 703 acres (N5), located on 433 parcels (N7), are at risk of development. There are 327 acres that fall in areas not subject to the NFIP (N6). The ROGO program allocates 92 units per year to the Key West (N9) and the average suitable habitat on a parcel is 1.6 acres (N8). Based on the data in Table EA-3, the ROGO permit allocations allow for the development of all 703 acres of habitat in Key West (N12), 376.1 of which are considered direct effects of the NFIP (N16). We consider impacts to 267.3 acres of habitat on non-Federal lands outside the NFIP in our cumulative effects analysis (N14). We have also identified 29.9 acres of impact associated with non-residential development (N10*0.025=29.9). Since there is no remaining at-risk habitat (N15), this development will have no additional habitat impacts on the affected species.

City of Layton

There is less than an acre (0.1 acre) of indigo snake habitat in the City of Layton (O3). This small area falls on one lot, which is unprotected and subject to the NFIP (O16). The ROGO program allocates 3 units per year to Layton (O9) and the average suitable habitat on a parcel is 0.1 acre (O8). Based on the data in Table EA-3, the ROGO permit allocations allow for the development of all suitable habitat in Layton, which is considered a direct effect of the NFIP (O16).

Summary Habitat Loss – Eastern Indigo Snake

Throughout the range of potential eastern indigo snake habitat in the Keys, we anticipate the development of no more than 2,433 acres (R12+R15) from 2010 through 2023, considering the current building permit ROGO program. Of this, 1,789 acres (R15+R16) would be subject to the NFIP. Therefore, FEMA's implementation of the NFIP would result in the loss of no more than 2.7 percent (1,789/65,552=0.027) of the total indigo snake habitat in the Keys. We believe this loss of habitat is not significant.

Direct effects - Habitat fragmentation

Since indigo snakes have large home ranges (12 to 494 acres), they can be susceptible to construction activities that fragment existing habitat types. The majority of the suitable habitat in the Keys is protected, and we previously determined that the loss of 2.7 percent of the suitable habitat would not result in a significant effect to the snake. These development activities may also result in some minor fragmentation of habitat, however, much of the at-risk habitat is already fragmented. Therefore, we expect the impacts due to fragmentation to be minimal.

Indirect effects – Vehicular and predatory mortality

The proposed development activities may increase traffic and the number of free roaming pets, thereby increasing the possibility of vehicular and predator mortalities. We reasonably expect that these indirect effects would occur within the same areas where suitable habitat for the snake is present. The Service has not received a report of an indigo snake death due to vehicles since 1998 and we have no records of indigo snakes killed by cats. In addition, as stated in the status

of the species section, sightings and documentation of indigo snakes in the Keys is rare. As such, the Service believes that indirect effects from implementation of the NFIP are unlikely to result in significant affects to the indigo snake.

Summary *– Changes since the previous BOs*

The habitat loss and indirect effects identified in this analysis more accurately reflect the potential 13-year development scenario than estimated in previous BOs. Our current methodology benefited from advances in GIS data, including updated parcel and habitat maps, a spreadsheet-based calculation system, and a detailed lot-by-lot review guided by the ROGO allocation process. The development scenario assumed in previous BOs identified the acres at risk from the proposed action as 320 acres over 1,455 parcels (Service 2006c). Our current analysis incorporates the ROGO development restrictions as well as the updated parcel data and identifies the acres of habitat at risk from the proposed action as about 1,789 acres (R15+R16) over about 3,387 parcels (R18). We believe this is a more accurate estimate based on current data; however, it is still a worst-case scenario estimate because our analysis is unable to account for ROGO units used to redevelop existing residences or increased land conservation that continues to occur in the Keys.

The proposed action could directly result in the estimated loss of a maximum of 1,789 acres of habitat, most of which is already fragmented, with the average habitat per parcel being less than 2 acres (250 acres is considered the average home range for this species (Service 2008). The vast majority of the species' habitat is outside of the Keys. The habitat in the Keys is relatively unimportant considering the current population throughout the species' range. Furthermore, the majority of the suitable habitat for this species (64.2 percent) is protected and county and municipal development regulations discourage development in remaining high quality habitat. Based on the above analysis, the Service considers the loss of 1,789 acres (about 3 percent of total available habitat) to be minor for the eastern indigo snake. We believe this increase in development will not be significant, particularly if FEMA implements the technical assistance process outlined in the RPA to help avoid and minimize any potentially negative effects.

Key deer

Potential suitable habitat for the Key deer is only present in unincorporated Monroe County, specifically from Ohio Key south to Saddle Hill Key (Service 1985). This is the entire known range of the Key deer.

Habitat loss

We consider Key deer habitat to primarily be native plant communities throughout the present range of the deer, which extends from Bahia Honda west through the Saddlebunch Keys. Scarified and developed lots devoid of native vegetation are not considered quality habitat; however, these lots and developed lots are occasionally used by Key deer and are included in our mapping focus area. We determined there are 30,482 acres (J3) of potential Key deer habitat in Monroe County. Of these, 20,226 acres (J4) are located on conservation lands (66.4 percent) not subject to development. Our GIS analysis shows that 8,205 parcels (J7) containing 10,256 acres

(J5) of suitable habitat are at risk from development. Table EA-4 provides a detailed breakdown of the acreages of Key deer habitat within the Keys communities where it is present.

Of the habitat in unincorporated Monroe County (30,482 acres (J3)), 7,202 acres (B3) fall inside the boundaries of the Big Pine and No Name HCP (Service 2006). The HCP allows for the development of a maximum of 200 lots on Big Pine Key during the life of the ITP and provides incidental take for 168 acres of Key deer habitat on Big Pine and No Name Keys. The HCP requires mitigation of habitat lost due to development at a 3:1 ratio. In addition, the County continues to conserve habitat on Big Pine Key lots that have been dedicated to the County through the ROGO process. Because the HCP has already addressed impacts and exempted take within its boundaries, this BO addresses impacts on potential suitable habitat outside of Big Pine and No Name Keys. The HCP allowed for 10 Tier 1 and 190 Tier 2 and Tier 3 ROGO units through 2023. The County has issued 5 Tier 1 permit, which leaves 5 remaining for the life of the HCP. These 5 Tier 1 ROGO units in the HCP count towards the overall Tier 1 ROGO units in unincorporated Monroe County for the life of the permit. As such, we factored them out of the available Tier 1 ROGO units because the HCP is not included in our analysis.

Unincorporated Monroe County

There are 30,482 acres (J3) of Key deer habitat in unincorporated Monroe County, of which 7,203 acres (B3) fall inside the boundaries of the Big Pine and No Name HCP. About 15,138 acres (J4-B4) of the remaining lands (20,279 acres (J3-B3) fall on conservation lands outside of the HCP. This leaves 8,141 acres (J5-B5) of habitat at risk, of which 3,709 acres (J6-B6) fall on lands outside the purview of the NFIP. The majority of the at-risk habitat (4,164 acres) (D5) is on Tier 1 lands, where development is the most restricted. As a worst-case estimate, our analysis assumes that all 3 of the lower Keys Tier 1 ROGO allocations will be built within Key deer habitat. When evaluating impacts to SPA and Tier 3 lands, we considered that a third of the available ROGO allocations for all of unincorporated Monroe County would be used in the lower third of the Keys.

Based on the data in Table EA-4, the ROGO permit allocations allow for the development of 66.3 acres (D12) of Tier 1 habitat and all of the suitable habitat in SPA and Tier 3 lands (254 acres combined (Σ E12 and F12)), resulting in a maximum development acreage of 320.6 acres (Σ D 12:F12) from 2010 through 2023. A subset of the impact acres (30.9 acres (Σ D 14:F14)) is not subject to the NFIP, but we will consider it in our cumulative effects analysis. Therefore, we can reasonably anticipate that the NFIP will directly affect no more than 289.6 acres (J16) of habitat in unincorporated Monroe County suitable for the Key deer. FEMA's implementation of the NFIP would result in the loss of no more than 0.9 percent (289.6/30,482=0.0094) of the total Key deer habitat in the Keys. We believe this loss of habitat is not significant by itself and will not hinder the survival or recovery of the species.

We have also identified about 3,510 acres (I3) of at-risk land in the "other" category. At-risk lands in the "other" lands category include those lands outside Monroe County's parcel layer not subject to the ROGO program and include a composite of state- and federally-owned lands. Development on these lands is unlikely and would probably consist of recreational use areas (*i.e.*, trailheads, canoe launches, etc.). Since recreational development in Monroe County is

typically 1.38 percent of the total lands, we estimated that about 63 acres (0.0138*3,510=63) of the "other" lands may be developed. Development on these lands is considered in our cumulative effects analysis (Table EA-17).

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 loss of 0.9 percent (289.6/30,482=0.0094) of the suitable habitat would not result in a significant effect to the Key deer. In addition, the majority of the Key deer population occurs on Big Pine and No Name Keys, which are outside of the scope of the proposed action because of the existing HCP for these keys. The development activities, including fencing on residential lots, may result in fragmentation of habitat and restrict deer movement; however, the County requires "deer friendly" fencing, as well as preservation and restoration of habitat through the ROGO process. These programs can reduce impacts due to fragmentation. Therefore, we expect the impacts due to fragmentation to be minimal and we believe the potential for fragmentation by development will not be significant by itself.

Indirect effects

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

Traffic Mortality: Road mortality has always been a concern of the Service regarding the Key deer. Table EA-5 shows annual Key deer road mortality from 1996 through 2008 (Service, unpublished data), both over their entire range as well as specifically on U.S. 1. Road mortality accounts for about 60 percent of all Key deer mortality (Lopez 2001) and vehicle strikes on US 1 account for half of the total road mortality. The average number of Key deer killed by vehicles in the 13-year period was 84 per year, with 42 per year killed on U.S. 1 (Table EA-5). The number of Key deer killed by vehicles was notably high in 2005 and 2006, immediately following an increase in the population of Key deer (Lopez 2004). Data trends (Figure EA-1) show an overall positive correlation between Key deer road mortality and Key deer populations. Vehicles average about 18,000 trips per day on U.S. 1 in the Keys (FDOT 2004), and traffic counts for U.S. 1 on Big Pine Key average 16,344 trips per day for that area (Table EA-5).

In an attempt to determine the traffic effect the NFIP may have on the Key deer, we considered the available ROGO system units in areas where traffic could affect the Key deer. As a conservative estimate, we assume that half of the possible Marathon units, Key West units, unincorporated Tier 1 units and the lower third of the unincorporated SPA/Tier 3 units (Table EA-6) are likely to travel regularly in the range of the Key deer. Therefore, 128 new units per year would result in 1,664 units over the 13-year timeframe (that could generate traffic in Key deer areas. Each housing unit generates an average of 8 trips per day (Schanmugam, personal communication, 2006), which would result in 13,312 new trips per day at build-out. Not all of these trips will travel roads in the Key deer range, as many of them will be local; traffic studies have shown that the majority of trips are within 0.25 mile of the residence (Schanmugam,

personal communication, 2006). Based on this, we assume that 25 percent (3,328 trips per day) of the trips could travel through the Key deer range (Table EA-6).

We based our projection of an additional 3,328 trips per day on a 13-year review period. For our assessment, we consider the mid-point of 6.5 years to be the appropriate level of effect for our analysis. This is because the effect is lower than anticipated for the first half and greater than anticipated for the second half. Therefore, an average additional 1,664 trips per day (607,360 trips per year) could have an effect on Key deer. Based on the average trips per day and the number of deer killed on U.S. 1, one deer is killed for approximately every 142,000 trips. Therefore, the additional 1,664 units would equate to an increase in deer-traffic mortality of about 4 deer per year on U.S. 1 at the mid-point assessment period. Based on these assumptions, each new unit will generate 1 trip per day that could affect the Key deer.

Currently the U.S. 1 traffic mortality accounts for the death of about 6.5 percent of all Key deer, based on a population estimate of 650 individuals (Lopez 2004). The additional 4 deer killed per year at the mid-point assessment period as a result of the action increases this to about 7.08 percent (46/650=0.0708) (year 2015), a 0.58 percent increase (7.08-6.5=0.58) above the existing level (year 2010).

The Service believes that our estimated increase in traffic-related mortality of about 0.58 percent above existing conditions, based on a population of 650 deer is a minor effect to the species. We note, however, that assessing the indirect effects of traffic from future development is difficult because traffic affecting the Key deer is evenly distributed amongst residences and does not account for the high percentage of tourist trips that contribute to vehicle mortality in Key deer.

Fire suppression in pine rocklands, due to the proximity of development, could also result in deterioration of important Key deer habitat through ecological succession that results in increased hardwood cover, decreased herbaceous cover, reduced light penetration, and a general deterioration of habitat quality. However, the KDNR has a current prescribed fire management plan that should serve to offset the effects of fire suppression. Other indirect effects of more residential development may include harassment or harm by free-roaming pets (dogs) or human activity.

***Summary** – Changes since the previous BOs*

In general, the habitat loss and indirect effects identified in this analysis more accurately reflect the potential 13-year development scenario than estimated in previous BOs (Service 2006c). Our current methodology benefited from advances in GIS data, including updated parcel and habitat maps, a spreadsheet-based calculation system, and a detailed lot-by-lot review guided by the ROGO allocation process. The development scenario assumed in previous BOs identified the acres at risk from the proposed action as 64 acres over 164 parcels (Service 2006c). Our current analysis incorporates the ROGO development restrictions as well as the updated parcel data and identifies the acres of habitat at risk from the proposed action as 289.6 acres (J16) over about 773 parcels (J18). Most of these impacts will occur on Tier 3 lands (145 acres; 672 parcels), which are already highly fragmented and offer lower habitat value to the species. We believe this is a

more accurate estimate based on current data; however, it is still a worst-case scenario estimate because we cannot adequately account for continuing land conservation in the Keys.

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. In addition, the Service previously addressed all impacts to the core Key deer population on Big Pine Key in the 2006 HCP; the HCP requires habitat protection to offset impacts at a 3:1 ratio.

We have estimated that the proposed action will directly result in adverse effects to about 289.6 acres of Key deer habitat (0.93 percent of all available habitat), all of which will occur on islands other than Big Pine and No Name Keys. Key deer do not currently inhabit most of these other islands as the majority of Key deer live on Big Pine and No Name Keys (in the boundary of the HCP). About 145 acres of impacts will occur on already fragmented Tier 3 lands. Consequently, impacts from fragmentation associated with habitat loss appear minimal.

As discussed above, Key deer traffic mortality associated with new development from the proposed action is projected to increase an average of about 4 deer per year. Because of the historically high population size of Key deer and the recent success of reintroduction efforts, this level of mortality is not significant to the population (Lopez, 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. In addition, negative effects can be avoided and minimized if FEMA implements the technical assistance process outlined at the end of this document.

Key Largo cotton mouse and Key Largo woodrat

The Key Largo cotton mouse and Key Largo woodrat occupy the same area of the Keys and have nearly identical habitat requirements. Potential suitable native habitat for the Key Largo cotton mouse and the Key Largo woodrat is only present in unincorporated Monroe County, specifically on Key Largo. The current known range of these species is on north Key Largo from the intersection of U.S. 1 and C.R. 905 north to the Ocean Reef Club. Although suitable habitat exists in south Key Largo, there have been no documented occurrences of either cotton mice or woodrats on south Key Largo in recent years. Because the habitat mapped for these species is identical and they are subject to the same threats, the analysis below applied to both the Key Largo cotton mouse and the Key Largo woodrat.

Direct effects - Habitat loss

Potential suitable habitat for the cotton mouse and woodrat is tropical hardwood hammock in Key Largo north of the U.S. 1 and S.R. 905 intersection and tropical hardwood hammock south of the intersection of U.S. 1 and C.R. 905 south to, but not including, Tavernier on South Key Largo. Although many of the hammocks in south Key Largo are isolated from the source population, fragmented, and may contain feral and domestic cats, we consider them potential suitable habitat for the cotton mouse and woodrat in our conservative analysis.

We determined there are 4,191 acres (P3) of potential cotton mouse/woodrat habitat in Monroe County (Table EA-7). Of these, 2,928 acres (P4) are located on conservation lands not subject to development (69.9 percent). Our GIS analysis shows that 3,261 parcels (P7) containing 1,263 acres (P5) of suitable habitat are at risk from development. Table EA-7 provides a detailed breakdown of the acreages of cotton mouse/woodrat habitat within the Keys communities where it is present.

Of the habitat in unincorporated Monroe County (4,191 acres), 2 acres (B3) fall inside the boundaries of the Nichols HCP (Service 1986) and 30 acres (C3) fall inside the boundaries of the Dressler Ocean Reef HCP (Service 1998). Because these HCPs have already addressed impacts to both the cotton mouse and the woodrat, and have exempted take within their boundaries, this BO addresses impacts on potential suitable habitat outside of the HCPs.

Unincorporated Monroe County

North Key Largo: The lands in north Key Largo (the known occupied habitat) total about 2,490 acres (Σ B3:I3), of which 2,240 acres (Σ B4:I4) (90 percent) are on conservation lands. This leaves 250 acres (2,490-2,240= 250) of habitat at risk, of which 30 acres fall within the existing HCPs and 127 acres (Σ D6:F6) fall on lands outside the purview of the NFIP. All suitable habitat on north Key Largo falls either within the Tier 1 ROGO designation boundaries or in the boundaries of Ocean Reef Club (which is exempt from ROGO review). As a worst-case estimate, our analysis assumes that all three of the upper Keys Tier 1 ROGO allocations will be built within the known occupied habitat in north Key Largo. Based on the data in Table EA-7, the ROGO allocations would allow for development of 17.6 acres (F12) of suitable cotton mouse/woodrat habitat in north Key Largo, 2.7 acres (F15) of which would be the direct result of the NFIP. We consider impacts to 14.9 acres (F13) of habitat on non-Federal lands outside the NFIP to be cumulative impacts. We consider the impacts to 1 acre of habitat through associated non-residential development to be an indirect effect of FEMA's NFIP action.

We have identified an additional 19.2 acres (D12) of additional development in at-risk habitat (125 acres (D5)) in North Key Largo that are not subject to ROGO restrictions (portions of Ocean Reef Club). Of the 19.2 acres, 5.7 acres (D13) are outside NFIP and 13.5 acres (D15) are considered direct effects of FEMA's NFIP action. We have also identified an additional 0.65 acre (26 parcels times 0.025=0.65) of non-residential development to be an indirect effect of FEMA's NFIP action.

South Key Largo: The unoccupied suitable habitat in south Key Largo encompasses about 1,701 acres (Σ J3:O3) of which 688 acres (Σ J4:O4) (40.5 percent) are protected. This leaves 1,013 acres (1,701-688=1,013) of habitat at risk, of which 289 acres (Σ K6:N6+O5) fall on lands outside the purview of the NFIP. The habitat on south Key Largo is present on lands designated as Tier 0, Tier 1, SPA, and Tier 3, as well as some areas where a Tier has not been designated. Because we assumed that all of the Tier 1 allocations would occur in occupied habitat in North Key Largo, there would be no remaining Tier 1 allocations for use in south Key Largo. Therefore, all impacts would occur in SPA and Tier 3 lands. We considered that a third of the available ROGO allocations for all of unincorporated Monroe County would be used in the upper third of the Keys (including Key Largo). Based on the data in Table EA-7, the ROGO

allocations would allow for development of 189.7 acres (Σ L12:M12) of suitable cotton mouse/woodrat habitat in SPA and Tier 3 areas on south Key Largo, 179.8 acres (Σ L15:M15) of which would be the direct result of the NFIP. We consider impacts to 9.9 acres (Σ L13:M13) of habitat on non-Federal lands outside the NFIP to be cumulative effects. We consider impacts to 20.8 acres (Σ L14:M14) of habitat through associated non-residential development to be an indirect effect of FEMA's NFIP action.

Summary Key Largo

Based on the data in Table EA-7, the ROGO permit allocations allow for the development of 17.6 acres (F12) of Tier 1 habitat in north Key Largo and 189.7 acres (Σ L12:M12) of suitable habitat in SPA and Tier 3 lands in south Key Largo, resulting in an estimated maximum development acreage of 207.3 acres (P11) from 2010 through 2023. A subset of the impact acres (21.8 acres) (P14) is not subject to the NFIP, but we will consider it in our cumulative effects analysis.

We identified and additional 19.2 acres (D12) of development associated with lands in north Key Largo not subject to ROGO restrictions (Ocean Reef Club). About 13.5 acres (D15) are subject to NFIP and 5.7 acres (D13) considered non-NFIP lands.

We have also identified about 287 acres (O3) of at-risk land in the "other" category. At-risk lands in the "other" lands category include those lands outside Monroe County's parcel layer not subject to the ROGO program and include a composite of state- and federally-owned lands. Development on these lands is unlikely and would probably consist of recreational use areas (*i.e.*, trailheads, canoe launches, etc.). Since recreational development in Monroe County is typically 1.38 percent of the total lands, we estimated that about 3.94 acres (0.0138*287=3.96) of the "other" lands may be developed. Development on these lands is considered in our cumulative effects analysis (Table EA-17).

Therefore, we can reasonably anticipate that the NFIP will directly affect no more than 196.0 acres (P15) of habitat in unincorporated Monroe County suitable for the Key Largo cotton mouse and Key Largo woodrat. FEMA's implementation of the NFIP would result in the loss of no more than 4.7 percent (P16) of the total cotton mouse/woodrat habitat in the Keys. As the majority of suitable habitat (70 percent) (2,928/4,191=0.699) is protected on conservation lands, we believe this loss (4.7 percent) of habitat is minor.

Habitat fragmentation

The ranges of the Key Largo cotton mouse and Key Largo woodrat have declined by more than 50 percent because of habitat loss due to land clearing for residential and commercial construction (National Society et al. 1990, Brown 1978a, Hersh 1981, Barbour and Humphrey 1982b). However, the majority (70 percent) of habitat for these species in the Keys is now protected and we previously determined that the loss of 4.7 percent of the suitable habitat due to development would not result in a significant effect to either the cotton mouse or the woodrat. The proposed action may result in fragmentation of habitat; however, much of the at-risk habitat is already fragmented, especially in south Key Largo. The County's ROGO process requires

preservation and restoration of habitat concurrent with new development, which could help reduce impacts due to fragmentation. Therefore, we expect the impacts due to fragmentation to be minimal and we believe the potential for fragmentation by development will not be significant by itself.

Indirect Effects

Mortality from feral and domestic cats may be the greatest current threat to the persistence of the Key Largo cotton mouse and Key Largo woodrat. Cats consume mice and rats as a major component of their diets. The number of cats present in the 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 cotton mice and woodrats, we used the 500-meter buffer surrounding all identified suitable habitat as outlined previously. The 500-meter buffer is based on the estimated distance domestic cats will travel from their homes (Frank, personal communication, 1996). For the cotton mouse and woodrat, we drew the buffer around only the known occupied habitat in north Key Largo (Table EA-8a). Based on our GIS analysis, we determined that there are about 5,988 acres (R4) of buffer lands surrounding cotton mouse/woodrat habitat, of which 4.322 acres (R5) (72.1 percent) are on conservation lands protected from future development. There are 327 undeveloped parcels (R7) at risk from development in the buffer area. The remaining 1,190 residential parcels (R8) within the buffer lands are already developed. Table EA-8a shows the detailed breakdown of these at-risk lands and parcels.

We base our cat predation analysis on the estimated number of cats within the buffer lands surrounding the cotton mouse/woodrat habitat. Research shows that 34 percent of residences have cats and that, on average, each of these has 2.1 cats (FWC 2003). This research also demonstrates that, about 40 percent of these cats are exclusively indoor pets and 60 percent occasionally go outdoors and stalk prey. Based on these numbers, the 1,190 existing residences in the buffer lands have about 510 cats (C16), which are occasionally outdoors.

The FWC (2003) study also estimates that the feral cat population is about 66 percent of the population of domestic cats. Based on the number of domestic cats, there is an estimated feral cat population of 566 cats (D16) in north Key Largo buffer lands. Therefore, the combined number of outdoor cats (domestic and feral) living in buffer lands that could affect cotton mice and woodrats is about 1,076 cats (E16).

Although we cannot quantify the amount of take resulting from cat predation, we believe this threat could cause a significant adverse effect and has the potential to adversely affect survival and recovery of the Key Largo woodrat and Key Largo cotton mouse. Hence, we analyzed the potential increase in outdoor cats resulting from the proposed action as a surrogate. We show calculations in Tables EA-8a and EA-8b and provide discussion below. Because cotton mice and woodrats do not inhabit south Key Largo, we considered only the increase in cats in north Key Largo habitat and buffer lands.

North Key Largo (suitable habitat): As determined in the previous habitat analysis, we anticipate an additional 6 residences (F17, EA-7) in Tier 1 suitable habitat on north Key Largo and 26 new residences (D17, EA-7) in Ocean Reef Club to result from the NFIP. This may result in 14 additional (C17) outdoor domestic cats and 15 additional (D17) feral cats. Therefore the projected outside cat population over the 13-year period is estimated to increase by 29 cats (E17).

As discussed above, the majority of the Tier I habitat on north Key Largo is on lands outside the purview of the NFIP. Therefore, we assume the remaining 33 ROGO allotments (F10-F17, EA-7) in Tier 1 habitat will occur on lands that are not subject to the NFIP. We have also identified an additional 11 new residences (L17, EA-8b) in non-NFIP lands in Ocean Reef Club. The 44 additional residences (L21) will result in 19 new outdoor cats (C20) and 21 new feral cats (D20). The projected outside cat population over the 13-year period is estimated to increase by 40 cats (E20). We consider this increase in our cumulative effects section since this development is not subject to the NFIP.

North Key Largo (buffer lands): Details on the lands subject to development in the buffer area details are shown in Table EA-8a. Because we assumed the Tier 1 ROGO allocations would occur within the suitable habitat, they would no longer be available for use in the buffer; therefore, we anticipate no additional Tier 1 development in the buffer in our calculations.

Monroe County's ROGO system allots 191 units per year to unincorporated SPA and Tier 3 areas. As shown in Table EA-7, we assume the use of 64 units per year in the upper Keys, 832 units (Σ L10 and M10, EA-7) from 2010 through 2023. Because none of these were used within the suitable habitat area in north Key Largo, all of them remain and could be used in the buffer area surrounding north Key Largo at-risk habitat. However, in our assessment of at risk lands in south Key Large, as shown on Table EA-7, we also show the use of all 832 units in Tier 2 and Tier 3 lands in south Key Largo.

However, for our 'worst" case assessment of cat predation, we are considering that all 832 ROGO units will be available for use in the buffer lands surrounding at-risk habitat in north Key Largo. The number of vacant SPA and Tier 3 parcels (77) (R10, EA-8a) in the buffer is less than the available ROGO allotment. Therefore, we assume that all of the parcels (77) will be developed by 2023. All but one (P7) of these parcels is within the jurisdiction of the NFIP.

These additional 76 residences (B18, EA-8b) built through the NFIP could result in 33 new outdoor domestic cats (C18) and 36 new feral cats (D18), for an estimated increase in the free-roaming cat population of 69 cats (E18), a 6.4 percent increase over the existing cat population. The one parcel developed in the CBRA area would result in one new free-roaming cat, which is considered in our cumulative effects section since this development is not subject to the NFIP.

***Summary** – Changes since the previous BOs*

In general, the habitat loss and indirect effects identified in this analysis more accurately reflect the potential 13-year development scenario than estimated in previous BOs. Our current methodology benefited from advances in GIS data, including updated parcel and habitat maps, a

spreadsheet-based calculation system, and a detailed lot-by-lot review guided by the ROGO allocation process. Our current analysis incorporates the ROGO development restrictions as well as the updated parcel data and identifies the acres of habitat at risk from the proposed action as 196 acres (P15, EA-7) over about 838 parcels (P17, EA-7) throughout Key Largo. We believe our impact estimate is more accurate than in previous BOs; however, it is still a worst-case scenario estimate because we cannot adequately account for increased land conservation that continues to occur in the Keys.

North Key Largo: The Key Largo cotton mouse and Key Largo woodrat are rare Upper Keys endemics, existing only in a limited area and at extremely low densities where they occur. Our current analysis incorporates the ROGO development restrictions as well as the updated parcel data and identifies the acres of habitat at risk from the proposed action as 2.7 acres (F15, EA-7) over about 6 parcels (F17, EA-7). We also note that an additional 26 parcels (D17) not subject to ROGO although subject to NFIP may be developed in Ocean Reef Club and may affect 13.5 acres (D15). The combined impact in at-risk lands is 16.2 acres over 32 parcels (B17, EA-8b) with an associated increase in the free roaming cat population of 29 additional cats (E17, EA-8b). This habitat loss represents less than 0.1 percent (16.5/4,191=0.0039) of the total suitable habitat and a 2.7 percent increase (F17, EA-8b) in the outdoor cat population.

We estimate an additional 14.9 acres (F13, EA-7) of impacts on 33 parcels (F10-F17, EA-7) will occur in north Key Largo within areas not subject to NFIP. We also estimate an additional 5.7 acres of impacts on 11 parcels, not subject to ROGO in Ocean Reef Club that may also be developed. These 44 new residences could generate an additional 40 outdoor cats (E20, EA-8b). This non-NFIP habitat loss represents 0.5 percent (20.6/4,191=0.00491) of the total suitable habitat and a 3.7 percent (F20, EA-8b) increase in the outdoor cat population; we consider these impacts in our cumulative effects section.

South Key Largo: Although there are no known populations of the cotton mouse or woodrat on south Key Largo, habitat exists that would be suitable to support expansion, should these species expand their range. Our current analysis incorporates the ROGO development restrictions as well as the updated parcel data and identifies the acres of habitat at risk from the proposed action as 179.8 acres (Σ J15:N15, EA-7) over about 807 parcels (Σ J17:N17). This loss represents 4.3 percent of the total suitable habitat (179.8/4,191=0.043). We estimate an additional 9.9 acres (Σ J13:N13) of impacts that will occur in south Key Largo within areas not subject to the NFIP to be cumulative effects. We consider impacts to 20.8 acres (Σ L14:M14) of habitat through associated non-residential development to be an indirect effect of FEMA's NFIP action. Because there are currently no known cotton mice or woodrats in south Key Largo, we do not anticipate that an increase in cats in south Key Largo would have an effect on these species other than limiting the potential for expansion of woodrats or cotton mice into this area.

The proposed action could directly result in the loss of a maximum of 216.8 acres (196+20.8=216.8) of potential suitable cotton mouse/woodrat habitat, some of which is already fragmented. This represents 5.2 percent (216.8/4,191=0.052) of the total amount of potential suitable habitat available to this species in Monroe County. The majority of the suitable habitat for this species throughout Key Largo (69.9 percent (2,928/4,191=0.699)) and 90 percent (2,240/2,489=0.899) of the habitat within the known species' range on north Key Largo is

protected. Therefore, the Service believes that this loss of habitat will not be significant to the species. County and municipal development regulations discourage development in remaining quality habitat and require minimal clearing of native habitats, furthermore, the technical assistance review process outlined at the end of this document can build upon the county and municipal oversight now in place and help FEMA avoid and minimize negative effects.

Key tree-cactus

Potential suitable native habitat is present throughout all the municipalities in the Keys. There are seven known populations of tree cactus, four of these occur in unincorporated Monroe County and three in the Village of Islamorada. Six of these are on protected lands. Although suitable habitat exists in other areas, there are no known populations in Marathon, Layton, Key West, or Key Colony Beach at this time.

Habitat loss

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 an absence of floods or fires. We generated habitat data based on the present known range of the Key tree-cactus, which includes hardwood hammock and beach berm habitats on Big Pine Key, Long Key, and Upper and Lower Matecumbe Keys. In addition, we also mapped unoccupied potential suitable habitat based on historical accounts and beach berm and hardwood hammock areas throughout the Keys (Table EA-9).

We determined there are 9,207 acres (R3) of potential Key tree-cactus habitat in Monroe County. Of these, 6,449 acres (R4)(70 percent [6,449/9,207=0.070) are located on conservation lands not subject to development. Our GIS analysis shows that 5,607 parcels (R7) containing 2,758 acres (R5) of suitable habitat are at risk from development. Table EA-9 provides a detailed breakdown of the acreages of Key tree-cactus habitat within the Keys communities where it is present. None of the three HCPs in the Keys provide take for the Key tree cactus, therefore, these areas are considered in our direct effects analysis.

Unincorporated Monroe County

There are 7,684 acres (Σ B3:K3) of Key tree-cactus habitat in unincorporated Monroe County, of which 5,959 acres (Σ B4:K4) are protected on conservation lands. Of the 1,725 acres of at-risk habitat (7,684-5,959=1,725), 500 acres (Σ B6:K6) fall on lands outside the purview of the NFIP. Most of the at-risk acres (1,014 acres) (G5) of Key tree-cactus habitat occur on Tier 1 lands; however, development in Tier 1 lands is the most restricted. Based on the data in Table EA-9, the ROGO permit allocations allow for the development of 58.3 acres (G13) of Tier 1 habitat, 1.6 acres (B12) of habitat within Big Pine and No Name Keys, and all of the suitable habitat in SPA and Tier 3 lands (204 acres combined [Σ H12 and I12), for a total ROGO regulated development of 264.9 acres (Σ B12+ Σ G12:I12). An additional 4.6 acres (D12) of development not subject to ROGO restriction in Ocean Reef Club may also be developed for a total impact of 269.5 acres (Σ B12:I12). A subset of the total impact acres, 35.4 acres [Σ B13:I13]) is not

subject to the NFIP and is included in our cumulative effects. We also estimate an additional 2.71 acres (Σ B15:K15) of associated non-residential development to be an indirect effect of FEMA's NFIP action. Therefore, we can reasonably anticipate that the NFIP will affect 272.2 acres (269.5+2.71=272.2) of Key tree-cactus habitat in unincorporated Monroe County; this accounts for only 2.96 percent (272.2/9,207=0.0296) of the total suitable habitat in the county.

We have also identified about 436 acres (Q3) of at-risk land in the "other" category. At-risk lands in the "other" lands category include those lands outside Monroe County's parcel layer not subject to the ROGO program and include a composite of state- and federally-owned lands. Development on these lands is unlikely and would probably consist of recreational use areas (*i.e.*, trailheads, canoe launches, etc.). Since recreational development in Monroe County is typically 1.38 percent of the total lands, we estimated that about 6 acres (0.0138*436=6.01) of the "other" lands may be developed. Development on these lands is considered in our cumulative effects analysis (Table EA-17).

Village of Islamorada

There are 445 acres (L3) of Key tree-cactus habitat in the Village of Islamorada, of which 145 acres (L4) are on conservation lands. The remaining 300 acres (L5), located on 779 parcels (L7), are at risk of development; there is 1 acre (L6) not subject to the NFIP. The ROGO program allocates 28 units (L9) per year to the Village of Islamorada and the average suitable habitat on a parcel is 0.4 acre (L8). Based on the calculations in Table EA-9, the ROGO program would allow for the development of 140.1 acres (L12) of habitat, 0.6 acre (L13) of which not be subject to the NFIP. We estimate 0.5 acre (L14) of non-federal impacts outside of the NFIP to be cumulative effects. We also estimate 9.1 acres (L15) of additional non-residential development to be an indirect effect of FEMA's NFIP action. Therefore, we can reasonably anticipate that the NFIP will directly affect 145 acres (139.5+9.1=145) of Key tree-cactus habitat in the Village of Islamorada; this accounts for only 1.57 percent (145/9,207=0.0157) of the total suitable habitat in the county.

City of Marathon

There are 588 acres (P3) of potential Key tree-cactus habitat in the City of Marathon, of which 340 acres (P4) are on conservation lands. The remaining 249 acres (P5), located on 579 parcels (P7), are at risk of development. Twenty-eight (28) acres (P6) fall in areas not subject to the NFIP. The ROGO program allocates 30 units (P9) per year to the City of Marathon and the average suitable habitat on a parcel is 0.4 acre (P8). Based on the calculations in Table EA-9, the ROGO program would allow for the development of 167.4 acres (P12) of habitat, 18.8 acres (P13) of which not be subject to the NFIP. We estimate 16.8 acres (P14) of non-federal impacts outside of the NFIP to be cumulative effects. We also estimate 9.8 acres (P15) of additional non-residential development to be an indirect effect of FEMA's NFIP action. Therefore, we can reasonably anticipate that the NFIP will affect 158.4 acres (148.6+9.8=158.4) of Key tree-cactus habitat in the City of Marathon; this accounts for only 1.7 percent (158.4/9,207=0.017) of the total suitable habitat in the county.

City of Key West

There are 48 acres (N3) of potential Key tree-cactus habitat in the City of Key West, of which 5 acres (N4) are on conservation lands. The remaining 43 acres (N5), located on 102 parcels (N7), are at risk of development. Seventeen (17) acres (N6) fall in areas not subject to the NFIP. The ROGO program allocates 92 units (N9) per year to Key West and the average suitable habitat on a parcel is 0.4 acre (N8). Based on the calculations in Table EA-9, the ROGO program would allow for the development of all 43 acres (N12) of at-risk habitat, 17.3 acres (N13) of which not be subject to the NFIP. We estimate that 25.5 acres (N16) will be subject to NFIP. We estimate 15.5 acres (N14) of non-federal impacts outside of the NFIP that will be considered in our cumulative effects analysis. We have also identified 29.9 acres (1,196 parcels*0.025=29.9) of impact associated with non-residential development. Since there is no remaining at-risk habitat, this development will have no additional habitat impacts on the affected species. Therefore, we can reasonably anticipate that the NFIP will directly affect 25.5 acres (N16) of Key tree-cactus habitat in Key West; this accounts for only 0.3 percent (25.5/9,207=0.0027) of the total suitable habitat in the county.

City of Key Colony Beach

There are 5.5 acres (M3) of potential Key tree-cactus habitat in the City of Key Colony Beach, all of which are at-risk and subject to the NFIP (M16). The ROGO program allocates 22 units (M9) per year to Key Colony Beach and the average suitable habitat on a parcel is 0.1 acre (M8). Based on the calculations in Table EA-9, the ROGO program would allow for the development of all 5.5 acres (M12) of at-risk habitat. We have also identified 7.15 acres (286 parcels * 0.025=7.15) of impact associated with non-residential development. Since there is no remaining at-risk habitat, this development will have no additional habitat impacts on the affected species. Therefore, we can reasonably anticipate that the NFIP will directly affect 5.5 acres (M16) of Key tree-cactus habitat in Key Colony Beach; this accounts for only 0.06 percent (5.5/9,207=0.0006 of the total suitable habitat in the county.

City of Layton

There is less than an acre (0.1 acre) (O3) of Key tree cactus habitat in the City of Layton. This small area falls on one lot (O7) which is unprotected and subject to the NFIP. The ROGO program allocates 3 units (O9) per year to Layton and the average suitable habitat on a parcel is 0.1 acre (O8). Based on the data in Table EA-9, the ROGO permit allocations allow for the development of all of the suitable habitat in Layton, which is considered a direct effect of the NFIP. We have also identified 0.97 acre (39 parcels *0.025=0.097) of impact associated with non-residential development (O15). Since there is no remaining at-risk habitat, this development will have no additional habitat impacts on the affected species.

<u>Key tree-cactus summary – habitat loss</u>

Throughout the range of potential Key tree-cactus habitat in the Keys, we anticipate the development of no more than 638.7 acres (R12) from 2010 through 2023, considering the current building permit ROGO program. Of this, 587.4 acres (R16+R15) would be subject to the NFIP. Therefore, FEMA's implementation of the NFIP would result in the loss of no more than 6.4

percent (587.4/9,207=0.064) of the total Key tree-cactus habitat in the Keys. We believe this loss of habitat is not significant.

Habitat fragmentation

Over half of the potential suitable Key tree-cactus habitat in the Keys is protected, and we previously determined that the loss of 6 percent of the suitable habitat due to development would not result in a significant effect to the Key tree-cactus. These development activities may also result in some minor fragmentation of habitat; however, much of the at-risk habitat is already fragmented, as it is located in areas that have existing development. In addition, preservation and restoration of habitat will occur through the County's ROGO process that can reduce fragmentation. Therefore, we expect the impacts due to fragmentation to be minimal.

Indirect effects

The Service does not anticipate any indirect effects to the Key tree-cactus or its habitat to result from the proposed action.

Summary *– Changes since the previous BOs*

In general, the habitat loss and indirect effects identified in this analysis more accurately reflect the potential 13-year development scenario than estimated in previous BOs. Our current methodology benefited from advances in GIS data, including updated parcel and habitat maps, a spreadsheet-based calculation system, and a detailed lot-by-lot review guided by the ROGO allocation process. The development scenario assumed in previous BOs identified the acres at risk from the proposed action as 351 acres over 1,483 parcels (Service 2006c). Our current analysis incorporates the ROGO development restrictions as well as the updated parcel data and identifies the acres of habitat at risk from the proposed action as 587.4 acres (R16+R15) over about 1,994 parcels (R18). We believe this is a more accurate estimate based on current data; however, it is still a worst-case scenario estimate because we cannot adequately account for increased land conservation that continues to occur in the Keys.

Our habitat analysis showed the action would result in the loss of about 587.4 acres (R16+R15) of Key tree-cactus habitat, which is about 6.4 percent (587.4/9,207=0.064) of the total available habitat. Since the previous BOs, two additional known populations of Key tree-cactus have been protected because of lands being brought into public ownership or encumbered with a conservation easement. At this time, only one known population remains on private lands subject to development. Direct impact to the known population, as well as a reduction of potential habitat where the Key tree-cactus can expand remains a concern. However, the Service believes that FEMA can address this concern by implementing the technical assistance process outlined at the end of this document.

Lower Keys marsh rabbit

Potential suitable native habitat for the Lower Keys marsh rabbit is only present in unincorporated Monroe County, specifically in the lower Keys. The Lower Keys marsh rabbit

occurs on 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). Its original range extended from Big Pine Key to Key West, encompassing a linear distance of about 30 miles; however, that range has been reduced by habitat alteration, contaminants, road mortality, and predation. The Status of the Species section provides additional details on threats to the Lower Keys marsh rabbit. The most recent population data (Perry, personal communication, 2006) suggests there are about 500 animals present in 52 clusters.

Habitat loss

The Lower Keys marsh rabbit is endemic to the lower Keys and inhabits tidal, brackish, and transitional upland and freshwater environments. It is habitat specific and depends on a transition zone of grasses and sedges for feeding, shelter, and nesting. Potential suitable marsh rabbit habitat is predominantly in transitional zones between marine environments and uplands. We determined there are 19,472 acres (J3) of potential marsh rabbit habitat in Monroe County. Of these, 13,714 acres (J4) (70.4 percent) are located on conservation lands not subject to development. Our GIS analysis shows that 3,710 parcels (J7) containing 5,758 acres (J5) of suitable habitat are at risk from development. Table EA-10 provides a detailed breakdown of the acreages of marsh rabbit habitat within the Keys communities where it is present. Because the potential loss of marsh rabbit habitat was not evaluated in the Big Pine and No Name HCP, we consider effects on Big Pine and No Name Key in our analysis.

Unincorporated Monroe County

There are 19,472 acres (J3) of marsh rabbit habitat in unincorporated Monroe County, of which 13,714 acres (J4) are on conservation lands. This leaves 5,758 acres (J5) of habitat at risk, of which 3,098 acres (J6) fall on lands outside the purview of the NFIP. The majority of the at-risk habitat (2,644 acres)(D5) is on Tier 1 lands, where development is the most restricted. As a worst-case estimate, our analysis assumes that all 3 of the lower Keys Tier 1 ROGO allocations will be built within marsh rabbit habitat. When evaluating impacts to SPA and Tier 3 lands, we considered that a third of the available ROGO allocations for all of unincorporated Monroe County would be used in the lower third of the Keys.

Based on the data in Table EA-10, the ROGO permit allocations allow for the development of 48.1 acres (D12) of Tier 1 habitat, 55.6 acres (Σ E12,F12) of suitable habitat in SPA and Tier 3 lands, and 2.6 acres of habitat (B12) on Big Pine and No Name Keys, resulting in a maximum development acreage of 106.3 acres (J12) from 2010 through 2023. A subset of the impact acres (23.7 acres)(J13) is not subject to the NFIP. We estimate 17.1 acres (J14) of non-federal impacts outside of the NFIP to be cumulative effects. We also estimate 1 acre (J15) of additional non-residential development to be an indirect effect of FEMA's NFIP action. Therefore, we can reasonably anticipate that the NFIP will affect no more than 83.61 acres (J15+J16) of habitat in unincorporated Monroe County suitable for the Lower Keys marsh rabbit. FEMA's implementation of the NFIP would result in the loss of no more than 0.43 percent (83.6/19,472=0.0043) of the total marsh rabbit habitat in the Keys and we believe this loss of habitat is not significant to the species.

We have also identified about 1,427 acres (I3) of at-risk land in the "other" category. At-risk lands in the "other" lands category include those lands outside Monroe County's parcel layer not subject to the ROGO program and include a composite of state- and federally-owned lands. Development on these lands is unlikely and would probably consist of recreational use areas (*i.e.*, trailheads, canoe launches, etc.). Since recreational development in Monroe County is typically 1.38 percent of the total lands, we estimated that about 19.7 acres (0.0138*1,427=19.7) of the "other" lands may be developed. Development on these lands is considered in our cumulative effects analysis (Table EA-17).

Habitat fragmentation

The majority of the suitable marsh rabbit habitat in the Keys is protected, and we previously determined that the loss of 0.43 percent of the suitable habitat would not result in a significant effect to the rabbit. These development activities may also result in some minor fragmentation of habitat, however, much of the at-risk habitat is already fragmented. Therefore, we expect the impacts due to fragmentation to be minimal.

Indirect effects

Mortality from feral and domestic cats may be the greatest current threat to the persistence of the Lower Keys marsh rabbit (Forys and Humphrey 1999). No detailed studies on the diets of feral cats in the keys are available; however, studies elsewhere found feral cats consumed rabbits as a component of their 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. Rabbits appear to be equally susceptible to cat predation, regardless of gender or age, and 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 rabbits, we used the 500-meter buffer surrounding all identified suitable habitat as outlined previously. The 500-meter buffer is based on the estimated distance domestic cats will travel from their homes (Frank, personal communication, 1996). Based on our GIS analysis, we determined that there are about 17,568 acres (P4, EA-11a) of buffer lands surrounding potential suitable marsh rabbit habitat, of which 9,562 acres (P5) (54.4 percent) are on conservation lands protected from future development. There are 3,805 vacant parcels (P7) in the buffer area. Some of these lie within the Big Pine and No Name Keys HCP and cat predation was addressed previously and some are in CBRA zones that are not subject to the NFIP. An additional 8,927 residential parcels (P8) within the buffer lands are already developed. Table EA-11a shows the detailed breakdown of these at-risk lands and parcels.

We base our cat predation analysis on the estimated number of cats within the buffer lands surrounding the Lower Keys marsh rabbit habitat. Research shows that 34 percent of residences have cats and each of these household has 2.1 cats (FWC 2003). This research also suggests that, on average, 40 percent of these cats are exclusively indoor pets and 60 percent occasionally go outdoors and stalk prey. Based on these numbers, the 8,927 existing residences (B16) in the buffer lands have about 3,824 cats (C16) which are occasionally outdoors.

The FWC (2003) study also provides an estimate that feral cats comprise 66 percent of the population of domestic cats. Based on the number of domestic cats, there is an estimated feral cat population of 4,249 cats (D16) in lower Keys buffer lands. Therefore, the combined number of outdoor cats (domestic and feral) living in buffer lands that could affect marsh rabbits is about 8,074 cats (F16).

Although we cannot quantify the amount of take from cat predation, we believe this threat could cause a significant adverse effect and has the potential to adversely affect survival and recovery. Hence, we analyzed the potential increase in outdoor cats resulting from the proposed action as a surrogate. We show calculations in Table EA-11a and EA-11b and provide discussion below.

Lower Keys (suitable habitat): As determined in the previous habitat analysis, we anticipate an additional 18 residences (J17) in Tier 1 suitable habitat in the lower Keys and an additional 3 residences (J16) on Big Pine and No Name Keys to result from the NFIP. In this area, the ROGO allotment (871 units [I20]) exceeds the available SPA and Tier 3 parcels with marsh rabbit habitat (257 units [Σ J18, J19,K18, and K19]). Therefore, we assume that all of SPA and Tier 3 parcels (257) will be developed by year 2023. Five (5) of these parcels (K19) are not subject to the NFIP.

The sum total of new residences subject to NFIP is 273 units (J20). The additional 273 residences subject to the NFIP could result in 117 new (C17) outdoor domestic cats and 130 new (D17) feral cats. We estimate the projected free-roaming cat population will increase by 247 (E17) cats over the 13-year period due to NFIP projects within suitable habitat.

As discussed above, a portion of the Tier I habitat in the lower Keys is on lands outside the purview of the NFIP. Therefore, we assume the remaining 16 ROGO allotments in Tier 1 habitat (K17), 2 ROGO allotments on Big Pine and No Name Keys (K16), and development of 5 Tier 3 parcels (K19) will occur on lands that are not subject to the NFIP. The 23 additional residences (K20) will result in 10 new outdoor domestic cats (C20) and 11 new feral cats (D20). The projected outside cat population over the 13-year period is estimated to increase by 21 cats (E20) due to development outside the scope of the NFIP. We consider this increase in our cumulative effects section since this development is not subject to the NFIP.

Lower Keys (buffer lands): The lands at risk of development in the buffer area (8,006 acres) (P6) consists of 2,814 acres of Tier 1 lands (D6+K6),1,633 acres within the HCP (B6+I6), 1,609 acres in Tier 4 (G6+ N6), 319 acres in undesignated tiers (H6+O6), 215 acres in Tier 0 (C6+J6), and 110 acres in Tier 2 (E6+L6). Cat predation effects associated with buffer lands within Big Pine and No Name Key were addressed previously by the Service and are excluded from our current evaluation. Cat predation effects associated with lands with CBRA (3,484 acres) (Σ J6:O6) are not subject to NFIP and are considered as a component of our cumulative effects assessment.

Because we assumed the Tier 1 ROGO and HCP Tier 1 ROGO allocations would occur within suitable habitat, they would no longer be available for use in the buffer; therefore, we anticipate no additional Tier 1 or HCP Tier 1 development in the buffer in our calculations. The remaining

at-risk buffer lands (2,865 acres) (Σ B6, C6,E6,F6,G6, and H6) subject to development are located outside of Tier 1ROGO and the HCP Tier 1ROGO. Further details are in Table EA-11a.

Monroe County's ROGO system allots 191 units per year to unincorporated SPA and Tier 3 areas. As shown in Table EA-10, we assume the use of 64 units per year in the lower Keys, 832 units from 2010 through 2023. Because we previously accounted for 257 (Σ J18, J19, and K19, EA-11b) of these in our analysis of development within suitable habitat, 575 remain (L20) for use in the buffer area. As shown in Table EA-11a and b, the remaining ROGO units were distributed proportionally to the CBRA (50 units) (N18+ N19) and non-CBRA (525 units) (O18+O19) lands at-risk in the buffer.

The number of vacant SPA and Tier 3 parcels (1,310) (+E7+ F7) in the buffer that are subject to NFIP exceeds the available ROGO allotment (525 units) (O20). Therefore, we assume that the entire ROGO allotment available (525) will be developed by year 2023. The additional 525 residences result in 225 new outdoor domestic cats (C18) and 250 new feral cats (D18). We estimate the projected free-roaming cat population over the 13-year period to increase by 474 cats (E18), a 5.9 percent increase (F18) over the existing cat population.

As discussed above, a portion of the SPA and Tier 3 habitat in the lower Keys is on lands outside the purview of the NFIP. Therefore, we assume that the 50 CBRA parcels (N20) will be developed without the NFIP. These 50 additional residences will result in 22 new outdoor domestic cats (C21) and 24 new feral cats (D21). The projected free-roaming cat population over the 13-year period is estimated to increase by 46 cats (E21) due to development outside the scope of the NFIP. We consider this increase in our cumulative effects section since this development is not subject to the NFIP.

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. In addition, 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 the previous BOs*

In general, the habitat loss and indirect effects identified in this analysis more accurately reflect the potential 13-year development scenario than estimated in previous BOs. Our current methodology benefited from advances in GIS data, including updated parcel and habitat maps, a spreadsheet-based calculation system, and a detailed lot-by-lot review guided by the ROGO allocation process. The development scenario assumed in previous BOs identified the acres at risk from the proposed action as 30 acres over 24 parcels (Service 2006c). Our current analysis incorporates the ROGO development restrictions as well as the updated parcel data and identifies the acres of habitat at risk from the proposed action as 81 acres (J16, EA-10) over about 274 parcels in the lower Keys (J18, EA-10). We believe our impact estimate is more accurate than in previous BOs; however, it is still a worst-case scenario estimate because we cannot adequately account for increased land conservation that continues to occur in the Keys.

Our analysis has identified habitat loss from the proposed action to be the loss of 83.6 acres (J15+J16, EA-10) from development and an increase in the free roaming cat population of 721 cats (E19, EA-11b) with 247 (E17, EA-11b) from development in potential suitable habitat and 474 (E18, EA-11b) from development in the buffer lands. This level of habitat loss represents 0.43 percent (83.6/19,472=0.0043) of potential suitable habitat and the increase in free-roaming cats represents a 8.9 percent increase over the existing population. Our analysis identified an additional 17.1 acres (J14, EA-10) of non-federal development impacts and an increase in the free-roaming cat population of 66 new outside cats (E22, EA-11b) that are expected to occur outside of the purview of the NFIP. We consider these effects in our cumulative analysis.

The proposed action could directly result in the loss of a maximum of 83.6 acres of potential suitable marsh rabbit habitat, some of which is already fragmented. This represents 0.43 percent of the total suitable habitat available to this species in Monroe County and the direct loss of habitat may not be significant to the species. However, indirect impacts from development, notably the potential for increased mortality from domestic and feral cats, are a significant concern. As discussed in the status of the species, 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). Further studies by LaFever and Lopez (2006) of the marsh rabbit metapopulation on Boca Chica Key (Naval Air Station Key West) estimated the probability of this metapopulation persisting for ten years, under the current conditions, was 41.6 percent. Both studies found that control of cat populations on Boca Chica Key would likely have the greatest benefit to marsh rabbits, far more than any other management action considered. As a result, further development and the related indirect effects from domestic and feral cats in the range of the Lower Keys marsh rabbit could exacerbate an already precarious condition for this species. FEMA can address these concerns by implementing the technical assistance review process outlined at the end of this document.

Schaus swallowtail butterfly

Potential suitable native habitat is present for the Schaus swallowtail butterfly in unincorporated Monroe County and the Village of Islamorada. In 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.

Habitat loss

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. We consider the species range to include those lands in North Key Largo and hammocks remaining in South Key Largo, Upper and Lower Matecumbe Key, and Lignumvitae Key.
We determined there are 5,002 acres (Q3) of potential Schaus swallowtail habitat in Monroe County. Of these, 3,240 acres (Q4) (64.8 percent) are located on conservation lands not subject to development. Our GIS analysis shows that 4,312 parcels (Q7) containing 1,763 acres (Q5) of suitable habitat are at risk from development. Table EA-12 provides a detailed breakdown of the

acreages of Schaus swallowtail butterfly habitat within the two Keys communities where it is present.

Unincorporated Monroe County

North Key Largo: The lands in north Key Largo (the known occupied habitat) are about 2,486 acres (Σ B3:I3) of which 2,240 acres (Σ B4:I4) are in public ownership (90.1 percent). This leaves 246 acres (4,486-2,240=246) of habitat at risk, of which 134 acres (Σ B6:I6) fall on lands outside the purview of the NFIP. Of the habitat in north Key Largo, 2 acres (B3) fall inside the boundaries of the Nichols HCP (Service 1986) and 30 acres (C3) fall inside the boundaries of the Dressler Ocean Reef HCP (Service 1998). Because these HCPs have already addressed impacts to the Schaus swallowtail butterfly, and have exempted take within their boundaries, this BO addresses impacts on potential suitable habitat outside of the HCPs.

As a worst-case estimate, our analysis assumes that all 3 of the upper Keys Tier 1 ROGO allocations will be built within the known occupied habitat in north Key Largo. Based on the data in Table EA-12, the ROGO allocations would allow for development of 17.6 acres (F12) of suitable Schaus swallowtail habitat in north Key Largo. Only 2.4 acres (F16) of this would be subject to the NFIP. We have identified an additional 15.2 acres (F14) of development outside NFIP as component of our cumulative effects. We have also identified an additional acre (F15) of associated non-residential development to be an indirect effect of FEMA's NFIP action.

We have identified an additional 19.2 acres (D12) of additional development in at risk habitat (125 acres (D5)) in North Key Largo that are not subject to ROGO restrictions (portions of Ocean Reef Club). Of the 19.2 acres, 5.7 acres (D13) are outside NFIP and 13.5 acres (D15) are considered direct effects of FEMA's NFIP action. We have also identified an additional 0.65 acre (26 parcels times 0.025=0.65) of non-residential development to be an indirect effect of FEMA's NFIP action.

South Key Largo: The unoccupied suitable habitat in south Key Largo encompasses about 1,569 acres (Σ J3:N3) of which 843 acres (Σ J4:N4) (53.7 percent) are in public ownership. This leaves 726 acres (1,569-843=726) of habitat at risk, of which 42 acres (Σ J6:N6) fall on lands outside the purview of the NFIP. Because we assumed that all of the Tier 1 allocations would occur in occupied habitat, there would be no remaining Tier 1 allocations for use in south Key Largo. Therefore, all impacts would occur in SPA and Tier 3 lands. We considered that a third of the available ROGO allocations for all of unincorporated Monroe County would be used in the upper third of the Keys (including Key Largo). Based on the data in Table EA-12, the ROGO allocations would allow for development of 189.9 acres (L12+M12) of combined SPA and Tier 3 Schaus swallowtail habitat in south Key Largo. Most of this (179.5 acres) (L16+M16) would be subject to the NFIP. An additional 20.8 acres (L15+15) of associated non-residential development and 10.4 acres (L14+M14) of impacts outside the jurisdiction of NFIP are considered in our cumulative effects analysis.
Based on the data in Table EA-12, the ROGO permit allocations allow for the development of 17.6 acres (F12) of Tier 1 habitat in north Key Largo, 189.9 acres (L12+M12) of suitable habitat in SPA and Tier 3 lands in south Key Largo, and 19.2 acres in Ocean Reef Club (outside the HCP) (D12) for a total development acreage of 226.7 acres (189.9+17.6+19.2=226.7). A subset

of the impact acres (31.4 acres) (Σ E13:N13) is not subject to the NFIP. Therefore, we can reasonably anticipate that the NFIP will directly affect 195.3 acres (226.7-31.4=195.3) of Schaus swallowtail butterfly habitat in unincorporated Monroe County; this accounts for 3.9 percent (195.3/5,002=0.039) of the total suitable habitat in the county.

We have also identified about 349 acres (P3) of at-risk land in the "other" category. At-risk lands in the "other" lands category include those lands outside Monroe County's parcel layer not subject to the ROGO program and include a composite of state- and federally-owned lands. Development on these lands is unlikely and would probably consist of recreational use areas (*i.e.*, trailheads, canoe launches, etc.). Since recreational development in Monroe County is typically 1.38 percent of the total lands, we estimated that about 4.8 acres (0.0138*349=4.81) of the "other" lands may be developed. Development on these lands is considered in our cumulative effects analysis (Table EA-17).

Village of Islamorada

There are 599 acres (O3) of Schaus swallowtail butterfly habitat on Upper Matecumbe Key in the Village of Islamorada, of which 157 acres (O4) are on conservation lands. The remaining 442 acres (O5), located on 1,055 parcels (O7), are at risk of development; there are 19 acres (O6) not subject to the NFIP. The ROGO program allocates 28 units (O9) per year to the Village of Islamorada and the average suitable habitat on a parcel is 0.4 acre (O8). Based on the calculations in Table EA-12, the ROGO program would allow for the development of 152.4 acres (O12) of habitat, 6.6 acres (O13) of which fall outside the jurisdiction of the NFIP. Therefore, we can reasonably anticipate that 145.8 acres (O16) of habitat will be developed through the NFIP. This accounts for 2.9 percent (O17) of the total suitable habitat in the county. An additional 9.1 acres (O15) of associated non-residential development is considered to be an indirect effect of FEMA's NFIP action. We have also identified 6.5 acres (O14) of non-federal impacts outside the jurisdiction of NFIP are considered in our cumulative effects analysis.

Throughout the range of potential Schaus swallowtail habitat in the Keys, we anticipate the development of no more than 410.1 acres (Q12+Q15) from 2010 through 2023, considering the current building permit ROGO program. Of this, 372.2 acres (Q16+Q15) would be subject to the NFIP. Therefore, FEMA's implementation of the NFIP would result in the loss of no more than 6.8 percent (Q17) of the total Schaus swallowtail habitat in the Keys; we believe this loss of habitat is not significant.

Habitat fragmentation

The majority (64.8 percent) (3,240/5,002=0.648) of the potential suitable Schaus swallowtail habitat in the Keys is protected, and we previously determined that the loss of 6.8 percent of the suitable habitat due to development would not result in a significant effect to the Schaus swallowtail butterfly. These development activities may also result in some minor fragmentation of habitat; however, much of the at-risk habitat is already fragmented, as it is located in areas that have existing development. The County and municipalities are conducting efforts to avoid loss of native vegetation and the County's ROGO process requires preservation and restoration of habitat. These programs can reduce impacts due to fragmentation. Therefore, we expect the

impacts due to fragmentation to be minimal and we believe the potential for fragmentation by development will not be significant by itself.

Indirect effects

Indirect effects associated with the proposed action include the use of pesticides for mosquito control. The extensive use of commercial pesticides has contributed to the decline of the Schaus swallowtail butterfly (Service 1993a) and pesticide use for mosquito control would increase with an increase in population. Monroe County currently operates an active mosquito control program that uses Dibrom, Baytex, and Teknar; studies show that these pesticides are toxic to the related giant swallowtail (*Heraclides cresphontes*) in the laboratory (Emmel 1986b). The use of pesticides on or near butterfly habitat can result in direct mortality and can cause behavioral modification and impaired reproduction. Further indirect effects can occur due to pesticide application to food sources and other components of the habitat. 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. While we can reasonably assume that these indirect effects will occur, we are unable to determine what effect they will have on the overall population.

Summary *– Changes since the previous BOs*

In general, the habitat loss and indirect effects identified in this analysis more accurately reflect the potential 13-year development scenario than estimated in previous BOs. Our current methodology benefited from advances in GIS data, including updated parcel and habitat maps, a spreadsheet-based calculation system, and a detailed lot-by-lot review guided by the ROGO allocation process. The development scenario assumed in previous BOs identified the acres at risk from the proposed action as 207 acres over 978 parcels (Service 2006c). Our current analysis incorporates the ROGO development restrictions as well as the updated parcel data and identifies the acres of habitat at risk from the proposed action as 372.2 acres (Q16+Q15) over about 1,183 parcels (Q18). We believe this is a more accurate estimate based on current data; however, it is still a worst-case scenario estimate because we cannot adequately account for increased land conservation that continues to occur in the Keys.

The proposed action could directly result in the loss of a maximum of 372.2 acres (Q16+Q15) of potential suitable Schaus swallowtail habitat, some of which is already fragmented. This represents about 6.8 percent (Q17) of the total amount of potential suitable habitat available to this species in Monroe County. The Service believes that this loss of habitat will not be significantly detrimental to the health of the species considering the majority (64.8 percent) (3,240/5,002=0.648) of the suitable habitat for this species in the Keys is protected. County and municipal development regulations discourage development in remaining quality habitat and require minimal clearing of native habitats and the planting of native vegetation that benefits Schaus swallowtail butterflies. These processes, as well as the existing protected lands in the Keys, could provide a corridor that would allow the Schaus swallowtail butterfly to reclaim parts of its historic range in the future if the conditions that have reduced it improve. Furthermore, the technical assistance review process outlined at the end of this document can build upon the county and municipal oversight now in place and help FEMA avoid and minimize negative

effects.

Silver rice rat

Potential suitable native habitat for the silver rice rat is only present in unincorporated Monroe County, specifically 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. Little information is available on rice rat populations other then they are small, isolated, and widely distributed in their range. N. Perry (personal communication, 2006) found a mean silver rice rat density of 1.2 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. We based our assessment on the mean of this range (10,000 rats).

Habitat loss

The silver rice rat is endemic to the lower Keys and inhabits areas of salt marsh, transitional buttonwood, freshwater wetlands, and mangrove habitats. We determined suitable habitat based on the present known range, from Howe Key through the Saddlebunch Keys. We also considered potentially suitable, but unoccupied, habitat based on appropriate vegetation and proximity to known rice rat populations. We determined there are 21,748 acres (J3) of potential rice rat habitat in Monroe County. Of these, 14,256 acres (J4) are located on conservation lands not subject to development (65.6 percent). Our GIS analysis shows that 3,985 parcels (J7) containing 7,492 acres (J5) of suitable habitat are at risk from development.

Table EA-13 provides a detailed breakdown of the acreages of rice rat habitat within the Keys communities where it is present. Because the silver rice rat was not evaluated in the Big Pine and No Name HCP, we consider effects on Big Pine and No Name Key in our analysis. Critical Habitat has been designated for the silver rice rat and was not considered in our suitable habitat analysis because it is evaluated separately. We estimate there are 8,532 acres (J3, EA-15) of critical habitat in addition to the suitable habitat discussed here and we analyze effects to silver rice rat critical habitat in the next section.

Unincorporated Monroe County

There are 21,748 acres (J3) of rice rat habitat in unincorporated Monroe County, of which 14,256 acres (J4) are on conservation lands. This leaves 7,492 acres (J5) of habitat at risk, of which 3,243 acres (J6) fall on lands outside the purview of the NFIP. These acres do not include areas designated as Critical Habitat. Over half of the at-risk habitat (3,859 acres) (Σ B5 and D5) is on Tier 1 lands or on Big Pine and No Name Keys, areas where development is the most restricted. As a worst-case estimate, our analysis assumes that all 3 of the lower Keys Tier 1 ROGO allocations and all of the HCP Tier 1 ROGO allocations will be built within rice rat habitat. When evaluating impacts to SPA and Tier 3 lands, we considered that a third of the available ROGO allocations for all of unincorporated Monroe County would be used in the lower third of the Keys.

Based on the data in Table EA-13, the ROGO permit allocations allow for the development of 57.6 acres (D12) of Tier 1 habitat, 3.3 acres (B12) on Big Pine and No Name Keys, and all 139 acres of suitable habitat in SPA and Tier 3 lands, resulting in a maximum development acreage of 199.7 acres (J12) from 2010 through 2023. There are 28.4 acres (J13) of impacts not subject to the NFIP, but we will consider these lands in our cumulative effects analysis. We have also identified about 1 additional acre (J14) of associated non-residential development to be an indirect effect of FEMA's NFIP action. Therefore, we can reasonably anticipate that the NFIP will affect about than 172.3 acres (J15+J14) of habitat in unincorporated Monroe County suitable for the silver rice rat. FEMA's implementation of the NFIP would result in the loss of no more than 0.8 percent (172.3/21,748=0.00792) of the suitable rice rat habitat in the Keys and we believe this loss of habitat is not significant to the species.

We have also identified about 3,358 acres (I3) of at-risk land in the "other" category. At-risk lands in the "other" lands category include those lands outside Monroe County's parcel layer not subject to the ROGO program and include a composite of state- and federally-owned lands. Development on these lands is unlikely and would probably consist of recreational use areas (*i.e.*, trailheads, canoe launches, etc.). Since recreational development in Monroe County is typically 1.38 percent of the total lands, we estimated that about 46.3 acres (0.0138*3,358=46.3) of the "other" lands may be developed. Development on these lands is considered in our cumulative effects analysis (Table EA-17).

Habitat fragmentation

The majority of the suitable rice rat habitat in the Keys is protected, and we previously determined that the loss of 0.8 percent of the suitable habitat would not result in a significant effect to the rat. These development activities may also result in some minor fragmentation of habitat, however, the majority of the impacted acres will occur on Tier 3, where much of the at-risk habitat is already fragmented. In addition, an additional 8,532 acres (J3, EA-15) of Critical Habitat exists for the rice rat outside of the suitable habitat analyzed in this section. Therefore, we expect the impacts due to fragmentation to be minimal.

Indirect Effects

Mortality from feral and domestic cats may be the greatest current threat to the persistence of the silver rice rat. Cats consume mice and rats as a major component of their diets. The number of cats present in the 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 rice rats, we used the 500-meter buffer surrounding all identified suitable habitat as outlined previously. The 500-meter buffer is based on the estimated distance domestic cats will travel from their homes (Frank, personal communication, 1996). Based on our GIS analysis, we determined that there are about 5,206 acres (P4) of buffer lands surrounding potential suitable rice rat habitat, of which 1,673 acres (P5) (32.1 percent) are on conservation lands protected from future development. There are 3,346 vacant parcels (P6) at risk from development in the buffer area. Some of these lie within CBRA zones that are not subject to the NFIP. An additional 7,128 parcels (P8) within

the buffer lands are already developed. Table EA-14a shows the detailed breakdown of these at-risk lands and parcels.

We base our cat predation analysis on the estimated number of cats within the buffer lands surrounding the silver rice rat habitat. Research shows that 34 percent of residences have cats and that, on average, each household has 2.1 cats (FWC 2003). This research also demonstrates that, on average, 40 percent of these cats are exclusively indoor pets and 60 percent occasionally go outdoors and stalk prey. Based on these numbers, the 7,128 existing residences (B16) in the buffer lands have about 3,054 cats (C16) which are occasionally outdoors.

The FWC (2003) study also provides an estimate that feral cats comprise 66 percent of the population of domestic cats. Based on the number of domestic cats, there is an estimated feral cat population of 3,393 cats (D16) in lower Keys buffer lands. Therefore, the combined number of outdoor cats (domestic and feral) living in buffer lands that could affect silver rice rats is about 6,447 cats (E16).

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. Hence, we analyzed the potential increase in outdoor cats resulting from the proposed action as a surrogate. We show calculations in Tables EA-14a and EA-14b and provide discussion below.

<u>Lower Keys (suitable habitat)</u>: As determined in the previous habitat analysis, we anticipate an additional 17 residences (J17) in Tier 1 suitable habitat in the lower Keys and an additional 6 residences (J16) on Big Pine and No Name Keys to result from the NFIP. In this area, the ROGO allotment exceeds the available SPA and Tier 3 parcels with rice rat habitat. Therefore, we assume that all of SPA and Tier 3 parcels (483) (Σ J18, J19, and K19) will be developed by year 2023. Eight (8) of these parcels (K19) are not subject to the NFIP. The additional 497 residences (J20) subject to the NFIP could result in 213 new outdoor domestic cats (C17) and 237 new feral cats (D17). We estimate the projected free-roaming cat will increase by 449 cats (E17) over the 13-year period due to NFIP projects within suitable habitat.

As discussed above, a portion of the Tier I habitat in the lower Keys is on lands outside the purview of the NFIP. Therefore, we assume the remaining 15 ROGO allotments (K17) in Tier 1 habitat, 2 ROGO allotments (K16) on Big Pine and No Name Keys, and development of 8 Tier 3 parcels (K19) (total of 25) (K20) will occur on lands that are not subject to the NFIP. The 25 additional residences will result in 11 new outdoor domestic cats (C20) and 12 new feral cats (D20). The projected outside cat population over the 13-year period is estimated to increase by 23 cats (E20) due to development outside the scope of the NFIP. We consider this increase in our cumulative effects section since this development is not subject to the NFIP.

<u>Lower Keys (buffer lands)</u>: The lands subject to development in the buffer area are primarily in Tier 1 (864 acres) (D6 and K6) and in the HCP (1,308 acres) (B6 and I6). Because we assumed the Tier 1 ROGO and HCP Tier 1 ROGO allocations would occur within the suitable habitat, they would no longer be available for use in the buffer; therefore, we anticipate no additional Tier 1 or HCP Tier 1 development in the buffer in our calculations. The remaining at-risk buffer

lands (1,361 acres) (C6+E6:H6 and J6+K6:O6) subject to development are located outside of Tier 1 and the HCP Tier 1. Further details are in Table EA-14a.

Monroe County's ROGO system allots 191 units per year (Table EA-1) to unincorporated SPA and Tier 3 areas. As shown in Table EA-13, we assume the use of 64 units per year in the lower Keys, 832 units (Σ E10 and F10, EA-13) from 2010 through 2023. Because we previously accounted for 483 of these (Σ E17 and F17, EA-13) in our analysis of development within suitable habitat, 349 remain (832-483=349) for use in the buffer area. As shown in Table EA-14a and 14b, the remaining ROGO units were distributed proportionally to the CBRA (23 units) (N20) and non-CBRA (326 units) (O20) lands at-risk in the buffer.

The number of vacant SPA and Tier 3 parcels (1,160) (E7+F7) in the buffer that are subject to NFIP exceeds the available ROGO allotment. Therefore, we assume that the entire ROGO allotment available (326) will be developed by year 2023. The additional 326 residences (B18) result in 140 new outdoor domestic cats (C18) and 155 new feral cats (D18). We estimate the projected free-roaming cat population over the 13-year period to increase by 295 cats (E18), a 4.6 percent increase over the existing cat population.

As discussed above, a portion of the SPA and Tier 3 habitat in the lower Keys is on lands outside the purview of the NFIP. Therefore, we assume that the 23 CBRA parcels (N20) will be developed without the NFIP. These 23 additional residences (B21) will result in 10 new outdoor domestic cats (C21) and 11 new feral cats (D21). The projected free-roaming cat population over the 13-year period is estimated to increase by 21 cats (E21) due to development outside the scope of the NFIP. We consider this increase in our cumulative effects section since this development is not subject to the NFIP.

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. In addition, 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 the previous BOs*

In general, the habitat loss and indirect effects identified in this analysis more accurately reflect the potential 13-year development scenario than estimated in previous BOs. Our current methodology benefited from advances in GIS data, including updated parcel and habitat maps, a spreadsheet-based calculation system, and a detailed lot-by-lot review guided by the ROGO allocation process. Our current analysis incorporates the ROGO development restrictions as well as the updated parcel data and identifies the acres of habitat at risk from the proposed action as 172.3 acres (J15+J14), EA-13) over about 497 parcels (J17, EA-13) in the lower Keys. We believe our impact estimate is more accurate than in previous BOs; however, it is still a worst-case scenario estimate because we cannot adequately account for increased land conservation that continues to occur in the Keys.

Our analysis has identified habitat loss from the proposed action to be the loss of 172.3 acres (J15+J14), EA-13) from development and an increase in the free roaming cat population of 744 cats (E19, EA-14b) with 449 (E17, EA-14b) from development in potential suitable habitat and 295 (E18, EA-14b) from development in the buffer lands. This level of habitat loss represents 0.8 percent (172.3/21,748=0.0079) of potential suitable habitat and the increase in free-roaming cats represents a 11.5 percent increase (F19) over the existing population. Our analysis identified an additional 28.4 acres (J13, EA-13) of development impacts and an increase in the free-roaming cat population of 43 cats (E22, EA-14b) expected to occur outside of the purview of the NFIP. We consider these effects in our cumulative analysis.

The most recent data on the rice rat population (Perry et al. 2005) points to a stabilized population of 5,000 to 20,000 individuals and a range expansion to Big Pine and Ramrod Keys (Perry 2006). These studies assert that the population is resistant to modest increases in predation. Considering the above facts, the Service believes that the loss of less than 1 percent (172.3/21,748=0.0079) of all suitable habitat will not be significant to the species. Furthermore, our cat predation analysis predicts an increase of less than 12 percent (744/6,447=0.115) in the free-roaming cat population with a worst-case development scenario. This 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. Due to the stable population, it is likely able to withstand this increase in predation. FEMA can minimize these impacts by implementing the technical assistance review process outlined at the end of this document.

Silver rice rat critical habitat

The Service designated critical habitat for the silver rice rat, which includes all lands and waters above mean low tide on the following Keys: Little Pine, Big Torch, Middle Torch, Johnston, Raccoon, and the Water Keys. In addition, it includes Summerland Key north of U.S. 1, and the Saddlebunch Keys south of U.S. 1; but not lands in Township 67S, Range 27E, Section 8, nor the northern 1/5 of Section 17 (50 CFR 17.95). The critical habitat encompasses an area of about 9,362 acres, all of which falls within unincorporated Monroe County. This area is in addition to the suitable habitat acres identified in the previous section. Within the designated boundary, only 8,532 acres have the constituent elements required to be critical habitat for rice rats.

To estimate this acreage, we considered all habitat in our current GIS layers to have contained the required constituent elements at the time of listing and only those areas of open water were excluded. The difference between the habitat estimates at the time of listing and the current GIS overlay is considered to be the acres lost to habitat alteration. At the time of listing this value was 8,847 acres of habitat. Following this approach, we estimated that of the 9,362 acres within the listing boundaries, 515 acres constitute open water, 8,532 acres constitute lands with constituent elements, and the remaining lands, 315 acres were altered and/or developed.

Unincorporated Monroe County

We determined there are 8,532 acres (J3) of critical habitat with constituent elements for the silver rice rat in Monroe County. Of these, 6,750 acres (J4) (79.1 percent) are located on conservation lands not subject to development. Our GIS analysis shows that 644 parcels (J7) containing 1,782 acres (J5) of critical habitat are at risk from development. Table EA-15 provides a detailed breakdown of the acreages of rice rat critical habitat within the Keys communities where it is present.

There are 1,782 acres (J5) of at-risk critical rice rat habitat in unincorporated Monroe County, of which 952 acres (J6) fall on lands outside the purview of the NFIP. There is no critical habitat within the boundaries of the Big Pine and No Name Key HCP. The majority of the at-risk critical habitat (1,283 acres) (D5) is on Tier 1 lands, where development is the most restricted. As a worst-case estimate, our analysis assumes that all 3 of the lower Keys Tier 1 ROGO allocations will be built within rice rat critical habitat. When evaluating impacts to SPA and Tier 3 lands, we considered that a third of the available ROGO allocations for all of unincorporated Monroe County would be used in the lower third of the Keys.

Based on the data in Table EA-15, the ROGO permit allocations allow for the development of 69.9 acres (D12) of Tier 1 critical habitat and 0.4 acre (F12) of critical habitat in Tier 3 lands, resulting in a maximum development acreage of 70.3 acres (J12) from 2010 through 2023, of which 34.6 acres(J13) is not subject to the NFIP. There are 33.9 acres (J14) of non-federal impacts not subject to NFIP and considered cumulative effects. We consider the 0.9 acre (J15) of associated non-residential development to be indirect effects of FEMA's NFIP action. Therefore, we can reasonably anticipate that the NFIP will directly affect no more than 36.6 acres (J16+J15) of silver rice rat critical habitat in unincorporated Monroe County. FEMA's implementation of the NFIP would result in the loss of no more than 0.4 percent (36.6/8,532=0.00428) of the remaining critical habitat for rice rats in the Keys and we believe this loss of critical habitat is not significant to the species.

If we consider that at the time of critical habitat designation, all available habitat containing critical elements, then out of the 9,362 acres in the listing, available habitat would have been 8,847 acres (515 acres of open water were excluded). Since listing, 315 acres no longer contain critical elements and represents a loss of 3.56 percent of available critical habitat (315/8,847=0.0356). The impacts associated with the NFIP would add an additional loss of 36.6 acres and represent a loss change from 3.56 percent to 3.97 percent (351.6/8,847=0.0397).

We have also identified about 466 acres (Q3) of at-risk land in the "other" category. At-risk lands in the "other" lands category include those lands outside Monroe County's parcel layer not subject to the ROGO program and include a composite of state- and federally-owned lands. Development on these lands is unlikely and would probably consist of recreational use areas (*i.e.*, trailheads, canoe launches, etc.). Since recreational development in Monroe County is typically 1.38 percent of the total lands, we estimated that about 6.4 acres (0.0138*466=6.4) of the "other" lands may be developed. Development on these lands is considered in our cumulative effects analysis (Table EA-17).

Habitat fragmentation

The majority of the critical rice rat habitat in the Keys is protected, and we previously determined that the loss of an additional 36.6 acres of the critical habitat would not result in a significant effect to the rat. These development activities may result in some minor fragmentation of critical habitat. However, an additional 21,748 acres of suitable habitat exists for the rice rat outside of the designated critical habitat analyzed in this section. Therefore, we expect the impacts due to fragmentation to be minimal.

Summary *– Changes since the previous BOs*

In general, the habitat loss and indirect effects identified in this analysis more accurately reflect the potential 13-year development scenario than estimated in previous BOs. Our current methodology benefited from advances in GIS data, including updated parcel and habitat maps, a spreadsheet-based calculation system, and a detailed lot-by-lot review guided by the ROGO allocation process. The development scenario assumed in previous BOs identified the acres of critical habitat at risk from the proposed action as 387 acres over 1,479 parcels (Service 2006c). Our current analysis incorporates the ROGO development restrictions as well as the updated parcel data and identifies the acres of critical habitat at risk from the proposed action as 36.6 acres (J16+J15, EA-15) over about 17 parcels (J18, EA-15). We believe this is a more accurate estimate based on current data; however, it is still a worst-case scenario estimate because we cannot adequately account for increased land conservation that continues to occur in the Keys.

We determined based on our GIS analysis that 36.6 acres (0.4 percent of the total) (J16+J15, EA-15) of silver rice rat critical habitat could be lost from the proposed action. We also determined that development has already occurred in about 315 acres of rice rat critical habitat (9,362-515(open water)-8,532 (J3) =315). This acreage combined with the projected loss is about 351.6 acres (315+36.6=351.6), which represents about 4 percent of the designated critical habitat (351.6/8,847=0.0397). Over 96 percent of the designated critical habitat will remain intact and it is unlikely that a significant amount of primary constituent elements will be lost to development in the future. Most primary constituent elements occur on parcels in the Tier I category, which is capped at a maximum of 3 ROGO permits per year and where only 36.6 acres of impact can occur in the next 13 years. 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 existing regulatory mechanisms in place at the Federal, State, and local levels that protect these habitat types, any impacts are likely to be avoided, minimized, and mitigated.

Our estimate of impacts to critical habitat is a conservative estimate based on the use of all lower keys Tier 1 ROGO units in silver rice rat critical habitat. This is unlikely as these Tier 1 ROGO units are spread throughout the lower Keys and our estimate is a worst-case scenario estimate.

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 rats and distributed widely. Because of these facts, we believe the action's impacts will not be significant for the species or its critical habitat. Furthermore, the technical assistance review process outlined at the end of this document can help FEMA avoid and minimize negative effects.

Stock Island tree snail

Potential suitable native habitat is present for the Stock Island tree snail in unincorporated Monroe County, Village of Islamorada, and the City of Marathon. There are currently 27 known populations of Stock Island tree snails in the Keys and two on the mainland. All of the known Keys' populations occur in unincorporated Monroe County and eight of these are on protected lands. Although suitable habitat exists throughout the Keys, there are no known populations outside of unincorporated Monroe County at this time. Many of the known snail populations are outside the snail's historic range on Stock Island, near Key West at the extreme southern end of the Florida Keys. For example, 21 populations exist on Key Largo. Because the Stock Island tree snail population is assessed by the number of populations, exact numbers of snails are unknown.

Habitat loss

Potential suitable Stock Island tree snail habitat includes all tropical hardwood hammocks and beach berms in the action area. We determined there are 9,207 acres (R3) of potential Stock Island tree snail habitat in Monroe County. Of these, 6,449 acres (R4) are located on conservation lands not subject to development (70 percent). Our GIS analysis shows that 5,607 parcels (R7) containing 2,758 acres (R5) of suitable habitat are at risk from development. Table EA-9 provides a detailed breakdown of the acreages of Stock Island tree snail habitat within the three Keys communities where it is present. None of the three HCPs in the Keys provide take for the Stock Island tree snail; therefore, these areas are considered in our direct effects analysis.

Unincorporated Monroe County

There are 7,684 acres (Σ B3:K3) of Stock Island tree snail habitat in unincorporated Monroe County, of which 5,959 acres (Σ B4:K4) are protected on conservation lands. Of the 1,725 acres (Σ B5:K5) of at-risk habitat, 500 acres (Σ B6:K6) fall on lands outside the purview of the NFIP. Most of the at-risk acres (1,014 acres) (G5) of Stock Island tree snail habitat occur on Tier 1 lands; however, development in Tier 1 lands is the most restricted. Based on the data in Table EA-9, the ROGO permit allocations allow for the development of 58.3 acres (G12) of Tier 1 habitat, 1.6 acres (B12) of habitat within Big Pine and No Name Keys, and all of the suitable habitat in SPA and Tier 3 lands (204 acres combined [Σ H12 and I12), for a total ROGO regulated development of 264.9 acres (Σ B12+ Σ G12:I12). An additional 4.6 acres (D12) of development not subject to ROGO restriction in Ocean Reef Club may also be developed for a total impact of 269.5 acres (Σ B12:I12). A subset of the total impact acres, 35.4 acres (Σ B13:I13) is not subject to the NFIP and is included in our cumulative effects. We also estimate an additional 2.71 acres (Σ B15:K15) of associated non-residential development to be an indirect effect of FEMA's NFIP action. Therefore, we can reasonably anticipate that the NFIP will affect 272.2 acres (269.5+2.71=272.2) of Stock Island tree snail habitat in unincorporated Monroe County; this accounts for only 2.96 percent (272.2/9,207=0.0296) of the total suitable habitat in the county.

We have also identified about 436 acres (Q3) of at-risk land in the "other" category. At-risk lands in the "other" lands category include those lands outside Monroe County's parcel layer not

subject to the ROGO program and include a composite of state and federally-owned lands. Development on these lands is unlikely and would probably consist of recreational use areas (*i.e.*, trailheads, canoe launches, etc.). Since recreational development in Monroe County is typically 1.38 percent of the total lands, we estimated that about 6.1 acres (0.0138*436=6.1) of the "other" lands may be developed. Development on these lands is considered in our cumulative effects analysis (Table EA-17).

Village of Islamorada

There are 445 acres (L3) of Stock Island tree snail habitat in the Village of Islamorada, of which 145 acres (L4) are on conservation lands. The remaining 300 acres (L5), located on 779 parcels (L7), are at risk of development; there is 1 acre (L6) not subject to the NFIP. The ROGO program allocates 28 units (L9) per year to the Village of Islamorada and the average suitable habitat on a parcel is 0.4 acre (L8). Based on the calculations in Table EA-9, the ROGO program would allow for the development of 140.1 acres (L12) of habitat, 0.6 acre (L33) of which not be subject to the NFIP. We estimate 0.5 acre (L14) of non-federal impacts outside of the NFIP to be cumulative effects. We also estimate 9.1 acres (L15) of additional non-residential development to be an indirect effect of FEMA's NFIP action. Therefore, we can reasonably anticipate that the NFIP will directly affect 145 acres (139.5+9.1=145) of Stock Island tree snail habitat in the Village of Islamorada; this accounts for only 1.57 percent (145/9,207=0.0157) of the total suitable habitat in the county.

City of Marathon

There are 588 acres (P3) of potential Stock Island tree snail habitat in the City of Marathon, of which 340 acres (P4) are on conservation lands. The remaining 249 acres (P5), located on 579 parcels (P7), are at risk of development. Twenty-eight (28) acres (P6) fall in areas not subject to the NFIP. The ROGO program allocates 30 units (P9) per year to the City of Marathon and the average suitable habitat on a parcel is 0.4 acre (P8). Based on the calculations in Table EA-9, the ROGO program would allow for the development of 167.4 acres (P12) of habitat, 18.8 acres (P13) of which not be subject to the NFIP. We estimate 16.8 acres (P14) of non-federal impacts outside of the NFIP to be cumulative effects. We also estimate 9.8 acres (P15) of additional non-residential development to be an indirect effect of FEMA's NFIP action. Therefore, we can reasonably anticipate that the NFIP will affect 158.4 acres (148.6+9.8=158.4) of Stock Island tree snail habitat in the City of Marathon; this accounts for only 1.7 percent (158.4/9,207=0.017) of the total suitable habitat in the county.

City of Key West

There are 48 acres (N3) of potential Stock Island tree snail habitat in the City of Key West, of which 5 acres (N4) are on conservation lands. The remaining 43 acres (N5), located on 102 parcels (N7), are at risk of development. Seventeen (17) acres (N6) fall in areas not subject to the NFIP. The ROGO program allocates 92 units (N9) per year to Key West and the average suitable habitat on a parcel is 0.4 acre (N8). Based on the calculations in Table EA-9, the ROGO program would allow for the development of all 43 acres (N12) of at-risk habitat, 17.3 acres (N13) of which not be subject to the NFIP. We estimate that 25.5 acres (N16) will be subject to

NFIP. We estimate 15.5 acres (N14) of non-federal impacts outside of the NFIP that will be considered in our cumulative effects analysis. We have also identified 29.9 acres (1,196 parcels*0.025=29.9) of impact associated with non-residential development. Since there is no remaining at-risk habitat, this development will have no additional habitat impacts on the affected species. Therefore, we can reasonably anticipate that the NFIP will directly affect 25.5 acres (N16) of Stock Island tree snail habitat in Key West; this accounts for only 0.3 percent (25.5/9,207=0.0277) of the total suitable habitat in the county.

City of Key Colony Beach

There are 5.5 acres (M3) of potential Stock Island tree snail habitat in the City of Key Colony Beach, all of which are at-risk and subject to the NFIP. The ROGO program allocates 22 units (M9) per year to Key Colony Beach and the average suitable habitat on a parcel is 0.1 acre (M8). Based on the calculations in Table EA-9, the ROGO program would allow for the development of all 5.5 acres (M12) of at-risk habitat. We have also identified 7.15 acres (286 parcels * 0.025=7.15) of impact associated with non-residential development. Since there is no remaining at-risk habitat, this development will have no additional habitat impacts on the affected species. Therefore, we can reasonably anticipate that the NFIP will directly affect 5.5 acres (M16) of Stock Island tree snail habitat in Key Colony Beach; this accounts for only 0.06 percent (5.5/9,207=0.00059) of the total suitable habitat in the county.

City of Layton

There is less than an acre (0.1 acre) (O3) of Stock Island tree snail habitat in the City of Layton. This small area falls on one lot (O18) which is unprotected and subject to the NFIP. The ROGO program allocates 3 units (O9) per year to Layton and the average suitable habitat on a parcel is 0.1 acre (O8). Based on the data in Table EA-9, the ROGO permit allocations allow for the development of all of the suitable habitat in Layton, which is considered a direct effect of the NFIP. We have also identified 0.97 acre (39 parcels *0.025=0.097) of impact associated with non-residential development (O15). Since there is no remaining at-risk habitat, this development will have no additional habitat impacts on the affected species.

<u>Stock Island tree snail summary – habitat loss</u>

Throughout the range of potential Stock Island tree snail habitat in the Keys, we anticipate the development of no more than 638.7 acres (R12) from 2010 through 2023, considering the current building permit ROGO program. Of this, 587.4 acres (R16+R15) would be subject to the NFIP. Therefore, FEMA's implementation of the NFIP would result in the loss of no more than 6.4 percent (587.4/9,207=0.064) of the total Stock Island tree snail habitat in the Keys and we believe this loss of habitat is not significant.

Habitat fragmentation

As is the case with other species, unregulated development caused damage to Stock Island tree snail habitat. Development of canal subdivisions and clearing of tropical hardwood hammocks has fragmented Stock Island tree snail habitat. Despite these losses, a significant amount of

habitat is available for Stock Island tree snails in the Florida Keys and the number of Stock Island tree snail populations has increased over the past 15 years. Although the populations on private lands are at risk, the species is not habitat-limited. Therefore, we expect the impacts due to fragmentation to be minimal.

Indirect effects

Indirect effects associated with the proposed action can destroy or remove individual snails from the population and can adversely affect behavior and reproduction. The use of pesticides on or near snail habitat can kill snails or result in altered feeding and breeding behavior. Urbanization within or near snail habitat can promote the establishment of black rats, fire ants, and other snail predators, 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 exposing them to cold temperatures and desiccation. Collection of snails may increase concurrently with an increasing human population. While we can reasonably assume that some of these indirect effects will occur, we are unable to determine what effect they will have on the overall population.

Summary *– Changes since the previous BOs*

In general, the habitat loss and indirect effects identified in this analysis more accurately reflect the potential 13-year development scenario than estimated in previous BOs. Our current methodology benefited from advances in GIS data, including updated parcel and habitat maps, a spreadsheet-based calculation system, and a detailed lot-by-lot review guided by the ROGO allocation process. The development scenario assumed in previous BOs identified the acres at risk from the proposed action as 387 acres over 1,479 parcels (Service 2006c). Our current analysis incorporates the ROGO development restrictions as well as the updated parcel data and identifies the acres of habitat at risk from the proposed action as 587.4 acres (R16+R15) over about 1,994 parcels (R18). We believe this is a more accurate estimate based on current data; however, it is still a worst-case scenario estimate because we cannot adequately account for increased land conservation that continues to occur in the Keys.

The proposed action could directly result in the loss of about of 587.4 acres (R16+R15) of potential suitable Stock Island tree snail habitat, most of which is already fragmented. This represents 6.4 percent (587.4.6/9,207=0.0637) of the total amount of potential suitable habitat available to this species in Monroe County. Furthermore, the majority of the suitable habitat for this species in the Keys (70 percent) is protected and county and municipal development regulations discourage development in remaining quality habitat. The population has expanded from 5 known populations in 1996 to 27 known populations in 2010.

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 for the species. Furthermore, if FEMA implements the technical assistance process outlined at the end of this document, biological review of individual parcels will occur prior to development. This will allow for identification of additional tree snail populations and allow actions to be implemented, which help avoid and minimize negative effects.

Summary *- Beneficial, Direct and Indirect Effects*

Table EA-16 provides a summary of the effects the proposed action may have on species' potential suitable habitat in acres. In addition to direct impacts to habitat from development, the Service identified the following indirect effects from the action: 4 Key deer lost per year to traffic mortality, 98 new (E19, EA-8b) free-roaming cats in the range of the Key Largo cotton mouse and Key Largo woodrat, 721 new (E19, EA-11b) free-roaming cats in the range of the Lower Keys marsh rabbit, and 744 new (E19, EA-14b) free-roaming cats in the range of the silver rice rat.

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 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, as well as on lands owned by the State where NFIP insurance is not applicable. In addition to direct impacts to habitat from residential development for lands with CBRA units, we also considered that portion of impacts from associated non-residential development (commercial, public services, recreation, etc.) in CBRA units in our cumulative impacts, calculated at 0.25 acre per ROGO unit. Table EA-17 identifies the area of potential suitable habitat for threatened and endangered species in the Keys that could be affected by future actions not subject to the NFIP. We described the calculation methods and provided details on the cumulative effects on each species in the Effects of the Action, above.

Table EA-17 provides a summary of the cumulative effects on species' potential suitable habitat in acres. In addition to cumulative effects to habitat, the Service identified other potential cumulative effects on species: 41 new (E22, EA-8b) free-roaming cats in the range of the Key Largo cotton mouse and Key Largo woodrat, 66 new (E22, EA-11b) free-roaming cats in the range of the Lower Keys marsh rabbit, and 43 new (E22, EA-14b) free-roaming cats in the range of the silver rice rat.

The habitat loss outlined in the Table EA-17 represents a small proportion of potential suitable habitat for these species and for silver rice rat critical habitat; the Service believes the impact of this loss will not be significant in and of itself. The additional predation pressure on the silver rice rat is not likely to adversely affect the species; however, we are concerned that the additional predation pressure from free-roaming cats may affect the Key Largo cotton mouse, Key Largo

woodrat and Lower Keys marsh rabbit populations. The technical assistance review process outlined in the RPA at the end of this BO should minimize these effects on listed species.

In addition to the above cumulative effects, the Service is aware of an electrical substation proposed by the Florida Keys Electric Cooperative that would impact the Key Largo woodrat Key Largo cotton mouse, Schaus swallowtail butterfly and eastern indigo snake. An HCP is now under development for this project.

CONCLUSION

After reviewing the status of the nine threatened and endangered species, the environmental baseline, the direct, indirect, and cumulative effects of the proposed action, it is the Service's biological opinion that over the 13-year period of assessment (through 2023), that FEMA's continued issuance of flood insurance policies 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 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 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 marsh rabbit: We believe the continuing administration of the NFIP in the Keys will jeopardize the continued existence of the endangered Lower Keys marsh 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 17: 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 18: Summary of Direct and Cumulative Impacts (Acres of Habitat Impacted) 13-Year period of review (through 2023)

Species	Estimated Acres in Consultation Area	Total Acreage Conserved	Percent Protected	FEMA Action Impact (acres)	Cumulative Impact (acres)	Estimated Total Impact (acres)	Percent Habitat impacted	Species Status
Eastern Indigo Snake	65,552	42,012	64.1%	1,789	645	2,433	3.7%	Declining
Key deer	30,482	20,226	66.4%	291	81	372	1.2%	Stable or Increasing
Key Largo cotton mouse	4,191	2,928	69.9%	218	35	252	6.0%	Stable
Key Largo woodrat	4,191	2,928	69.9%	218	35	252	6.0%	Declining
Key tree-cactus	9,207	6,449	70.0%	587	70	658	7.1%	Uncertain
Lower Keys marsh rabbit	19,472	13,714	70.4%	84	37	120	0.6%	Declining
Schaus swallowtail	5,002	3,240	64.8%	372	43	415	8.3%	Stable
Silver rice rat	21,748	14,256	65.6%	172	75	247	1.1%	Stable
Critical Habitat - Silver rice rat	8,532	6,750	79.1%	37	40	77	0.9%	---
Stock island tree snail	9,207	6,449	70.0%	587	70	658	7.1%	Uncertain

Table 19: Summary of Indirect Effects - 13-Year period of review (through 2023)

Type	Species	Species Population	FEMA Action	Cumulative	Estimated Total	Percent of Population
			Number of Key Deer deaths			
Traffic	Key deer	650	4 per year	--	52	0.08%
			Number of additional Cats – life of permit			
Predators (Cats)	Key Largo cotton mouse	17,000	98	41	139	--
Predators (Cats)	Key Largo woodrat	<200	98	41	139	--
Predators (Cats)	Lower Keys marsh rabbit	500	721	66	787	--
Predators (Cats)	Silver rice rat	5,000 – 20,000	744	43	787	--

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 (RPAs) 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 result 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 RPA.

The Court's March 2005 Order criticized the 2003 RPA 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 based on habitat loss and indirect effects from development expected to occur over a 13-year period of implementation of the NFIP. Therefore, we base this RPA, on both habitat loss and indirect effects from development. The indirect effects from development apply to free roaming cat predation of the Key Largo cotton mouse, Key Largo woodrat, and Lower Keys marsh rabbit and traffic impacts associated with Key deer.

1. The Service will create and maintain an updated list of all real estate numbers of parcels (either vacant lots or built upon lots) that are within the Species Focus Area Maps. The Species Focus Area Maps were developed by the Service, based on the best available science, and indicate potentially suitable, federally threatened or endangered species habitat for the species subject to the prohibitions of this RPA. Companion buffer zone maps were also created and maintained for the Key Largo cotton mouse, Key Largo woodrat, and Lower Keys marsh rabbit. The Service will provide these maps to FEMA for distribution to all participating communities in the Florida Keys portion of Monroe County. The updated real estate parcel list will be completed within 60 days of acceptance of this BO by the Court, and then updated as needed by the Service. We do not anticipate that updates would occur frequently, but may be needed as habitat changes

or new information (habitat or species) becomes available.

2. Pursuant to 44 CFR 60.3(a)(2), FEMA will require Monroe County and other participating communities in the Florida Keys to revise their Flood Damage Prevention Ordinance(s) to reference and use the updated real estate list (referenced in RPA paragraph 1) within 120 days of acceptance of this BO by the Court. In the event that the real estate list is updated by the Service, the new list is used. FEMA will also require the county and participating communities as per 44 CFR 60.3(a)(2) to incorporate Service review recommendations (or Reasonable and Prudent Measures resulting from formal consultation) under section 7 and section 10 incidental take exemption and implementing terms and conditions as enforceable conditions in their development permits.

3. In areas mapped as containing unsuitable habitat, participating communities in Monroe County will place a form letter in their permit file that indicates:

    a. the individual that made the determination,

    b. the date of the determination; and

    c. the date of the Species Focus Area Map and real estate parcel list used to make the determination.

    After this form letter is completed, 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. Any issuance of building and/or clearing (development) permits for all activities that will remove native vegetation will require further consultation for the real estate parcels within the Species Focus Area Maps for the federally listed species for which incidental take was provided in this BO. Specifically, participating communities in Monroe County will forward weekly to the Service, those applications proposing clearing of lot(s) or new development on vacant parcels and development on parcels with a structure that will: 1) expand the footprint of the structure; or 2) expand associated clearing of, or placement of fencing into native habitat. The Service will then determine either of the following:

    a) Determine that a proposed action would not adversely affect federally threatened or endangered species or designated critical habitat either individually or cumulatively. If the Service determines that the action would not adversely affect threatened or endangered species or designated critical habitat, they will notify FEMA, the participating community, and the applicant of the not likely to adversely affect determination. The Service may condition a finding of “may affect, not likely to adversely affect” on the implementation of specific modifications to a proposed action to avoid possible impacts on species. The determination and its specific project modifications are binding conditions that must be incorporated into the county’s or municipality’s building and/or clearing permit. This action may be achieved by the Service through the development of an assessment key. The assessment key would provide a step-wise process for applicants, the county and NFIP participating communities, and FEMA to follow that may results in Service concurrence determinations through acceptance of the key’s requirements. An applicant signed and community co-signed copy of the

acceptance form will be maintained in the building permit file. FEMA will provide a yearly report of how many permits were issued by NFIP participating jurisdictions that were assessed through the use of the assessment key and species affected.

b) Determine that a proposed action may adversely affect threatened or endangered species or designated critical habitat either individually or cumulatively. In this event, the Service would notify FEMA, the participating community, and the applicant by letter of the "may affect" determination and the need for additional action under section 7 or section 10 of the Act. The "may affect" determination letter and any specific project modifications required upon further review are binding conditions that must be incorporated into the county's or municipality's building and/or clearing permit. Participating communities and FEMA will work with the applicant and the Service to ensure compliance with either section 7 or section 10 of the Act and that the amount incidental take exempted through compliance with section 7 or section 10 of the Act does not exceed the levels of incidental take individually or cumulatively exempted in this BO. FEMA will provide a yearly report of how many permits were issued by NFIP participating jurisdictions and the amount of incidental take exempted under the incidental take provision in this BO.

5. Pursuant to 44 CFR 60.3(a)(2), FEMA will require participating communities to establish written procedures within 150 days of acceptance of this BO by the Court for referring floodplain development building and/or clearing permit applicants to the Service for review as outlined in RPA paragraph 4. FEMA will require participating communities to incorporate the Service's conditions of any "not likely to adversely affect" concurrence or any section 7 or section 10 incidental take statement(s) and associated terms and conditions or Incidental Take Permit conditions into the participating community's building and/or clearing permit.

   The participating community will exercise its enforcement authority to require the permittee to comply with the Service's conditions that are incorporated as conditions of the participating community's building and/or clearing permit. In the event of non-compliance with permit conditions by the applicant, the participating community will request, as outlined in RPA paragraph 8(b), that FEMA deny individual flood insurance for the subject property.

6. Free-Roaming Cats: FEMA will coordinate with participating communities in Monroe County in their development of a brochure, information on a website, and other materials for addressing predation by domestic and feral cats in areas within endangered and threatened species habitat and buffer zones in the Special Flood Hazard Area. Participating communities will be required to provide this brochure to all permit applicants seeking a clearing permit, to build a new structure, or expand an existing structure. This brochure will describe how to protect threatened and endangered species by keeping pets indoors. FEMA will provide a yearly report of how many permits were issued by NFIP participating communities for each of the buffer zones by species affected in the Special Flood hazard Area.

7. Pursuant to 44 CFR 59.24, FEMA will monitor the participating communities' compliance with the conditions of any "not likely to adversely affect" effect determination or any section 7 or section 10 incidental take authorizations and their implementing terms and conditions. FEMA will coordinate with the Service every 6 months to evaluate the extent of compliance with the Act for proposed construction or other development in participating communities in Monroe County. FEMA will require the communities to maintain either the Section 10(a)(1)(B) permit or the completed section 7 consultation in the administrative record for the floodplain clearing and/or development permit for future review by FEMA during their community assistance visits. FEMA will visit participating communities in Monroe County every 6 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 actions described in this RPA to ensure compliance with the RPA requirements. 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 RPA 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 deficiencies and remedying the violation.

   Correcting deficiencies and remedying violations can take a variety of forms depending upon their type and nature. The following are examples of possible actions that FEMA would expect the community to undertake within 60 days or to include as part of a remediation plan to correct any remaining program deficiencies and 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 clearing and/or 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. The enforcement action can include, through coordination with the Service, restoration of the site to pre-impact conditions.

   (b). Should enforcement actions proposed by the participating community not be complied with by the applicant, the participating community will submit a request for 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 or section 10 incidental take exemption by the Service. Upon submission of a valid declaration, FEMA then will deny the flood insurance to that property.

(c). If corrective actions referenced in RPA paragraph 8(a) are 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 correcting the deficiencies referenced in RPA paragraph 8(a). 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).

(d). Rescission of the permit for any building or other floodplain development if the participating community issued a permit in contravention to the Service's technical assistance recommendations or the Service's section 7 or section 10 incidental take authorizations and implementing terms and conditions.

(e). Seek civil or criminal penalties or other appropriate legal action against the property owner as provided for in the participating community's ordinance or code.

9. If FEMA determines the participating community's non-compliance with this RPA has caused take of threatened or endangered species that cannot be corrected or offset, FEMA will initiate procedures outlined in 44 CFR 59.24 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 that 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.

10. FEMA, in conjunction with the Service, will conduct training sessions with public officials and local building officials on the requirements of these RPAs.

11. 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 and otherwise make it generally available. FEMA and the participating communities will coordinate with the Service in developing this communication to the public.

RPA considered, but rejected

The Service has considered but is not requiring the option of having FEMA require the participating communities to revise their tier maps to place habitat areas in the non-development or limited development tier (Tier I and SPAs in the current system). The Service is not including such a requirement in the RPA for three key reasons:

- 1) It does not appear that FEMA has the legal authority to impose such a condition on community eligibility for flood insurance. Because FEMA does not have such authority, requiring the communities to revise their tier systems does not meet the criteria for an RPA as set forth in 50 CFR 402.02.

- 2) If FEMA does have the legal authority to require communities to revise tier maps based on species habitat, the Service is concerned that such an action raises constitutional concerns. This action would likely expose the participating communities, FEMA, and the Service to litigation by property owners or other stakeholders who wish to challenge the inclusion or omission of particular parcels from particular tier categories. We are concerned that this potential for further litigation resulting from the mapping would be a significant drain on Service staff resources and would detract from other, more biologically important conservation related actions of the Service. We are unaware of any other example of a situation where a BO issued by a Service office resulted in such a direct and far-reaching influence on local government permitting decisions.

- 3) If FEMA has the requisite legal authority to compel the communities to modify their tier maps and the associated constitutional concerns could be resolved appropriately, we would still not choose to include a requirement for tier map revisions as part of this RPA. This is because we are confident that the other recommended components will be sufficient for FEMA to meet its obligations to avoid jeopardy and to conserve species.

The Service believes the RPA in this BO will avoid the likelihood of jeopardy to the species and adverse modification of designated critical habitat (50 CFR 402.14(h)(3) if implemented by the action agency. Without the process implemented by this RPA, the Service would not have the opportunity to review all development projects for potential impacts to listed species. Some development projects requiring permits from the Corps under Section 404 of the Clean Water Act may come to the Service for review, while other projects do not require 404 or other Federal permits. Similarly, a permit under Section 10 of the Act would be required for private individuals whose proposed development may take listed animal species, but in many cases, the developers and the Service are not necessarily aware of the exact locations of species within habitat that appears suitable until site-specific reviews occur. Therefore, many potential applicants would not necessarily approach the Service for incidental take authorization under the Act absent this process. This RPA results in the Service working directly with each applicant and participating communities in Monroe County to analyze direct, indirect, and cumulative effects of the development (including land clearing) and to provide measures to avoid, minimize, 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 this RPA will not jeopardize the survival and recovery of the nine species evaluated in this BO 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 anticipates incidental take in the form of harm and harassment 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 Keys tree cactus, and endangered Lower Keys marsh rabbit.

Incidental take of individuals of a species may be difficult to enumerate when it is an indirect effect of the Federal action and occurs later in time. Incidental take may also be difficult to enumerate in terms of numbers of animals when a species is short lived, small in size, cryptic in its habits, or inhabits areas that make their detection difficult. This is the case for the species considered in this opinion with the exception of the Key deer. In cases where the actual number of a species incidentally taken will be difficult to detect (*i.e.*, eastern indigo snake, Schaus swallowtail butterfly, Stock Island tree snail, silver rice rat, Key Largo woodrat, Key Largo cotton mouse, Keys tree cactus, and Lower Keys marsh rabbit), the Service will use acres of habitat that may be affected by the proposed Federal action as an ecological surrogate instead of a number.

For the Service to substitute a surrogate for actual numbers, a clear determination must be made that: (1) no such numerical value could be practically obtained and (2) that the use of ecological conditions (habitat) as a surrogate for defining incidental take is linked to the take of the protected species (The applicable criteria were spelled out by the Court of Appeals and the District Court in the Miccosukee Tribe of Indians case, Case No. 05-23045[S.D. Fla]).

To evaluate if a numerical value could be practically obtained, the Service examined the following: (1) availability and quality of the actual or estimated population data, (2) the ability to measure incidental take, and (3) the ability to determine the extent of incidental take attributed to the Federal action as opposed to other factors.

Availability and quality of the actual or estimated population data:

Key deer: The last official Key deer population estimate was in 1975 (Silvy 1975). Population estimates in succeeding years were based on observational road surveys of Key deer in subdivisions, spotlight nighttime surveys, and annual traffic mortality data. The Service has been collecting traffic mortality data on a consistent basis since 1996 (Morkill, personal communication, 2010). The observational road surveys and annual traffic mortality do not provide an estimate of the actual number of deer, but instead provide data on observational trends in habitat use, species presence, and an assessment of traffic risk factors (Lopez 2001; Lopez et al. 2004a). For example, the number of car-deer crashes are related to road densities, traffic volumes, and area specific habitat parameters. Given the routine monitoring of Key deer traffic mortality data, and traffic volume data that can be related indirectly to the Federal action, the Service will enumerate incidental take in terms of individuals for this species.

Eastern indigo snake: The indigo snake is suspected to occur in very low numbers in the Keys and, according to Lazell (1989), the remote, isolated, and possibly distinct Lower Keys populations have not been systematically surveyed. The most recent observation of an eastern indigo snake occurred on Little Knockemdown Key in 2009. Photo verification of the individual was provided to the NKDR via e-mail (Service 2010). The previous verified observation was in North Key Largo in 1998 (Duquesnel 1998). The eastern indigo snake is not typically identified using standard snake survey methods such as drift fences (Enge 1997). In 2003, Smith and Dyer conducted a study to test the efficiency and applicability of three commonly used herpetological survey techniques (drift-fence arrays, road cruising, and burrow camera surveys). None of these methods proved effective for surveying eastern indigo snakes. Using a variety of survey

techniques, Schmidt et al. (2008) conducted a herpetological inventory of Big Pine Key and No Name Key in 2006 and 2007. Although documenting 27 species, the researchers did not observe the eastern indigo snake. No other recent indigo surveys have been conducted in the Keys. Accordingly, there is no robust or reliable data to determine individual numbers of eastern indigo snakes in the action area or an estimate of the snake population trends.

Key Largo woodrat and cotton mouse: The Key Largo woodrat and Key Largo cotton mouse are small nocturnal species with cryptic foraging habits making a valid estimate of actual numbers impractical. Sporadic efforts to monitor these species began in 1970 (Frank et al. 1997). Long intervals (5 to 10+ years) between monitoring events and the use of various study designs and estimation techniques make Key largo woodrat and cotton mouse population trends difficult to interpret and unreliable (Barbour and Humphrey 1982; Humphrey 1988; McCleery 2003; Potts et al. 2007; Frank et al. 1997; Florida Fish and Wildlife Conservation Commission [FWC] 2005; McCleery et al. 2006b; and Winchester 2007).

• *Key Largo woodrat*: Recent Key Largo woodrat surveys suggest a declining population that is currently at very low densities (FWC 2005; McCleery et al. 2006b; Winchester 2007). The most recent and most intensive trapping study to date conducted by McCleery et al. (2006b) provided a 2002 population estimate of 106 individuals with a range between 30 and 182 individuals. This population estimate was based on model projections from trapping conducted over 60 sampling grids that captured only 16 individuals, 3 of which were recaptures. McCleery et.al. (2006b) further discuss that there is no appropriate estimate of population size to more precisely assess the severity of the decline, although population trends can be shown using current capture-recapture trapping studies.

McCleery et al. (2006b) conducted a companion survey over the same sampling grids in 2004 and estimated a population of 40 individuals with a range between 5 and 104 individuals. This population estimate was based on the capture of only 5 individuals. The study estimated 0.019 individuals per acre with a range between 0.0024 to 0.05 individuals per acre. We note that the authors also provided population estimates that are specific to hammock ages with young hammocks (those hammocks disturbed after 1971) showing much higher woodrat densities, an average of 1.6 individuals per acre in 2002, versus the average woodrat density across all age hammocks reported for the same period (0.051 individuals per acre). A similar variability was shown for the 2004 data, with young hammocks having an average density of 0.49 individuals per acre versus an average density of 0.019 individual per acre across all hammocks. Given the variability in this data, we believe this information has limited utility for estimating the number individuals for a given area.

• *Key Largo cotton mouse:* Density estimates for this species result from disparate survey methods and locations, and demonstrate no clear population trend. Researchers have reported a range from 6.2 cotton mice per hectare (15.3 per acre) (Frank et al. 1997) to 21.2 cotton mice per hectare (52.4 per acre) (Humphrey 1988). The most recent population estimate (2007) was 17,000 individuals with an increasing trend from April to December (Castleberry et al. 2008). This study is very similar to the McCleery et al. (2006b) study. It examines capture-recapture trap data over 34 grids with three primary capture periods and four secondary periods, evaluating 557 unique individual captures. Based on preliminary data from 2007, the researchers have

provided a population estimate ranging from 9,350 individuals (plus or minus 3,138, spring sample) to 17,127 individuals (plus or minus 1,849, winter sample). We believe variability in this data, as was identified for the woodrat, limit the utility of this information for estimating the number individuals per area.

Key tree-cactus: 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.

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

As of 2009, the known distribution of this species is restricted to seven populations on four islands of the Florida Keys (Big Pine Key, Long Key, Lower Matecumbe Key, and Upper Matecumbe Key) (Adams and Lima 1994; Service 1999; Maschinski 2009a; Florida Natural Areas Inventory 2009). Six of seven populations are on lands protected through acquisition or agreements (Maschinski et al. 2009). One is located on private, developable property currently used for aquaculture. 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 (asexual). Seed dispersal by birds (*Cardinalis cardinalis*, for example) is indicated for this species (Austin 1980). Given the Key tree-cactus' preference for naturally disturbed patches of hammock and the fact that these patches are subject to change as a result of natural succession and disturbance events, predicting where a new population may be found is problematic.

Lower Keys marsh rabbit: Researchers have not formally surveyed the range-wide status and distribution of the marsh rabbit since the mid-1990s. Three methods have been used traditionally to measure rabbit density: spotlight counts, live trapping, and fecal-pellet counting. Spotlight surveys give only indices of population numbers, not counts, and become inaccurate when vegetation prevents a clear view of the rabbits. Pellet counting is biased by defecation rate, pellet-decay rate, and clumping of deposits, but it can be an efficient and fairly accurate method when used correctly (Forys and Humphrey 1994). Since the mid-1990s, pellet counting has been used, although not systematically, to establish patch occupancy in the Keys. Furthermore, pellet counts have not been used consistently in the Keys to count actual numbers of individuals. However, they have been used to provide wide-ranging population estimates and general population trends.

Schaus swallowtail butterfly: No detailed status surveys have been conducted for the Schaus swallowtail since 2003. The Schaus swallowtail butterfly is restricted to areas 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. Schaus swallowtail butterflies have a single annual flight season, primarily in May and June, where adults are active; most sightings have been recorded between mid-April and mid-July (FWS 1982). There is only one generation of Schaus swallowtail butterfly per year and adults are short-lived (Emmel 1985). Several methods are employed to survey for this species. Time intensive surveys that rely on transect and mark-recapture surveys are used to provide estimates of population densities. More common and less labor intensive are surveys that rely on presence or absence based on visual observations of the adult butterflies in flight in suitable or historical habitat. Transect surveys are conducted to address specific research needs and density estimates from these surveys are based on site specific assessments. The site-specific estimates are applied to the study area and are generally referenced as a number of individuals per acre. One important factor limiting the value of transect survey data is the timing of the survey. Specifically, the emergence of adults is highly dependent on rain, and timing is often of major significance in the accuracy of survey results in giving a reliable picture of the number of individuals (Salvato, personal communication, 2009).

Silver rice rat: The rice rat population is not routinely monitored and survey efforts have been sporadic. The most recent rice rat surveys were conducted in 2004 and 2005 (Perry 2006, Perry et.al. 2005). Prior surveys were conducted by Mitchell (2000), Forys et al. (1996), and Goodyear (1992). The silver rice rat is restricted to a narrow range of wetland habitat types and populations are widely distributed and occur at extremely low densities (Forys et al. 1996). Silver rice rats are nocturnal and range extensively (Spitzer 1983; Mitchell 2000). 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 mile in a single night. The most common survey method for this species is the capture-mark-recapture trap method referenced for the Key Largo woodrat and Key Largo cotton mouse. The challenges of this survey method to estimate densities of this species are more pronounced for the silver rice rats because of its large home range and inaccessibility of its preferred habitat (e.g., areas subject to daily tidal inundation).

Stock Island tree snail: Few data are available on Stock Island tree snail abundance or population trends since the publication of the South Florida Multi-Species Recovery Plan (Service 1999). Rigorous estimates are not known for any population. Their status is currently assessed by the number of discrete populations that are known. They are arboreal except when they move to the forest floor for nesting or traveling and are active mainly during the wet season. The Service (2004a) recommended surveys for this species be conducted during a rain event in either August and September or December and January. Surveys focus specifically on presence or absence and are not reliable for estimating densities.

In summary, as we discussed previously in the Status of the Species and summarized above for individual species, reliable population estimates are not available for the nine species considered in this opinion. Most, but not all, of the listed species in the Keys have been studied extensively. However, differences in survey methodologies, irregular survey frequencies, and the fact that all suitable habitats for these species have not been surveyed contribute to the lack of dependable population estimates.

The ability to measure incidental take and whether it is attributable to the Federal action:

The proposed Federal action is the issuance of flood insurance policies by FEMA for new residences, large additions, and businesses in the Florida Keys. As described earlier, direct effects include potential impacts to listed species habitat from construction of insured structures. Indirect effects include increases in traffic, increases in free roaming cats, and loss and fragmentation of habitat.

Indirect effects, although reasonably certain to occur, may occur later than direct effects and over time. For example, although a home is constructed as a result of receiving flood insurance, it may be several years before the family living there decides to buy a cat and let it roam outdoors where it could potentially prey upon a Key Largo cotton mouse. In addition, if the cat was not neutered or spayed, it could breed with other cats, increasing the population of feral cats. Enumerating the incidental take resulting from this indirect effect in this example is further exacerbated by the fact that the cat's potential prey, the cotton mouse, is small, cryptic, and recovery of the carcass would be unlikely.

For each species in this BO, we evaluated a number of threats to the species in addition to the effects of the Federal action. For example, we evaluated sea level rise and habitat succession; hurricanes, droughts, loss and fragmentation of habitat, predation, exotic species, chemical contaminants in the environment, and mortality from existing traffic. Since threats not associated with the Federal action can also result in the loss of listed species (predation, habitat changes, competition from exotic species, road mortality from non-residents, and hurricane caused contamination), we believe it is difficult to make a distinction between incidental take of a listed species resulting from the proposed action and the loss that may be caused by these other, non-project generated threats. For example, habitat fragmentation can occur from storm events as well as from new development and both may cause loss of individuals to the species. Similarly, a distinction between predation by existing raccoons or feral cats and predation from free roaming house cats associated with new development resulting from the Federal action is difficult to discern.

Conclusion: As discussed previously, for the Service to substitute a surrogate for actual numbers, a clear determination must be made that (1) no such numerical value could be practically obtained and (2) that the use of ecological conditions (habitat) as a surrogate for defining incidental take is linked to the take of the protected species. In the previous discussion, we have demonstrated that no numerical value could be practically obtained because of the: (1) lack of reliable estimates of population data, (2) difficulty in being able to measure incidental take of individuals, and (3) difficulty in determining the extent that incidental take is attributed to the Federal action as opposed to other environmental factors.

We believe a surrogate for actual species numbers is appropriate and are using acres of habitat loss to detect and measure take. We are using habitat loss because we believe there is a reasonable nexus between the indirect effects of the action and adverse effects to the species discussed in the Status of the Species and Effects of the Action sections of this BO. Furthermore, our species focus area maps and the habitat-mapping units (Appendix 1) will facilitate tracking of incidental take. For example, the silver rice rat's critical habitat is

determined by the presence of constituent elements. The constituent elements include mangrove swamp, salt marsh, and freshwater marsh. Our habitat-mapping units used to assess project related effects to the silver rice rat included mangrove swamp, saltwater marsh, and freshwater marsh as well as additional mapping units that may contain these habitat communities. As Appendix 1 demonstrates, the habitat types in our effects assessment directly match the preferred species' habitat types, or include composites of these habitat communities.

The Service believes that the level of take for the species assessed in this BO can be anticipated by habitat loss within each species' range (Table 18) and take will be monitored by summing habitat lost from NFIP 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 (Table 19). The Service anticipates an increase in road mortality of 4 deer per year over the 13-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 RPA 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 provisions 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.

5. The Service recommends that FEMA assist with any monitoring programs for candidate species in the Keys. This would include any on-going monitoring of existing candidate populations as well as assessment of hurricane-related impacts to candidate species.

Community Rating System

The Service 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 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 that 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 that 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 from FEMA of the conservation recommendations carried out.

REINITIATION NOTICE

This concludes formal consultation on the action of the FEMA'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.

Incidental take would be exceeded when the take exceeds that identified in Table 18 and 19 above, which is exempted from the prohibitions of Section 9 by this BO. The Service appreciates the cooperation of FEMA during this consultation. We would like to continue working with you and your staff regarding this implementation of the NFIP in Monroe County, Florida. For further coordination, please contact Paul Souza, Field Supervisor, for our South

Florida Office at 772-562-3909 extension 285 or Patrick Leonard, Assistant Regional Director for Ecological Services, Atlanta, GA at 404-679-7085.

Sincerely,

for Cynthia K. Dohner
Regional Director

cc: Regional Section 7 Coordinator, FWS, Atlanta, Georgia
Field Supervisor, FWS, Vero Beach, Florida
Director, FWS

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Appendix 1

Habitat mapping units referenced in Monroe County's 2009 habitat classification maps in the Florida Keys used by federally listed threatened and endangered species evaluated in this BO.

Species Name	Range	Acres of Habitat	Habitat Description
Eastern indigo snake	Throughout the Florida Keys	**65,552**	Hammock, pineland, exotics, scrub mangrove, freshwater wetland, salt marsh, buttonwood, mangrove, beach berm, exotic, and undeveloped land as identified in Monroe County's 2009 habitat classification maps.
Key deer	Occupies 20 to 25 keys from Ohio Key south to Saddle Hill Key	**30,482**	Pinelands and hammock, as well as all other habitat types identified in Monroe County's 2009 habitat classification maps.
Key Largo cotton mouse	Throughout Key Largo	**4,191**	Hammock and undeveloped land as identified in Monroe County's 2009 habitat classification maps.
Key Largo woodrat	Throughout Key Largo.	**4,191**	Hammock and undeveloped land as identified in Monroe County's 2009 habitat classification maps.
Key tree-cactus	Throughout the Florida Keys	**9,207**	Hammock and beach berm as identified in Monroe County's 2009 habitat classification maps.
Lower Keys (=marsh) rabbit	Annette, Big Munson, Big Pine, Boca Chica, East Rockland, Geiger, Mayo, No Name, Porpoise, Saddlebunch, Saddlehill, and Sugarloaf	**19,472**	Pineland, scrub mangrove, freshwater wetland, salt marsh, buttonwood, and beach berm as identified in Monroe County's 2009 habitat classification maps.
Schaus' swallowtail butterfly	Elliot Key south to, and including, Lower Matecumbe Key	**5,002**	Hammock, undeveloped land, and beach berm as identified in Monroe County's 2009 habitat classification maps.
Silver rice rat	Little Pine, Big Pine, Howe, Water, Middle Torch, Big Torch, Summerland, Raccoon, Johnston, Cudjoe, Upper Sugarloaf, and Saddlebunch.	**21,748**	Hammock, pineland, scrub mangrove, freshwater wetland, salt marsh, buttonwood, mangrove, and beach berm as identified in Monroe County's 2009 habitat classification maps.
Stock Island tree snail	Throughout the Florida Keys	**9,207**	Hammock and beach berm as identified in Monroe County's 2009 habitat classification maps.

Habitat mapping units referenced in Monroe County's 2009 habitat classification maps in the Florida Keys used by federally listed threatened and endangered species evaluated in this BO.

Species	2009 Monroe County Land Cover Classifications												
	Developed Land (1)	Undeveloped Land (2)	Impervious Surface (3)	Hammock (4)	Pineland (5)	Exotic (6)	Scrub Mangrove (7)	Freshwater Wetland (8)	Salt Marsh (9)	Buttonwood (10)	Mangrove (11)	Beach Berm (12)	Water (13)
Eastern Indigo Snake		●		●	●	●	●	●	●	●	●	●	
Key Largo Woodrat		●		●								●	
Key Largo Cotton Mouse		●		●								●	
Schaus Swallowtail Butterfly		●		●								●	
Key Tree Cactus				●								●	
Stock Island Tree Snail				●								●	
Lower Keys Marsh Rabbit					●		●	●	●	●		●	
Silver Rice Rat				●	●		●	●	●	●	●	●	
Key Deer	●	●	●	●	●	●	●	●	●	●	●	●	●

Monroe County Habitat Classifications

1) Developed Land: Comprised of areas of intensive use with much of the land covered by structures. Examples are dwellings, strip developments, industrial and commercial complexes, landfills, golf courses and parks. All impervious surface areas below 0.5 acres will also be included within this category. Developed Lands are easily identified by their sizes, shapes, and character of the associated developed area. Structures range from square to rectangular. The roof areas sometime appear to cover more than half of the lot area. Roads, small recreational areas, and small public spaces serving the development are included.

2) Undeveloped Land: Includes open, scarified or disturbed lands, which tend to have uncertain land uses and may contain native species. Signatures may range from heavily vegetated to a disturbed, scoured, white appearance. The ground may also appear to be scraped and worked, usually with angular or geometric boundaries.

3) Impervious Surface: Includes all surfaces above 0.5 acres, which do not allow, or minimally allows, the penetration of water. Examples are building roofs, concrete and asphalt pavements/parking lots and some fine grained soils such as clays. The photo signature for impervious surface is usually a smooth, bright white or green/grey color typically from roofs, concrete and asphalt parking lots and major roads.

4) Hammock: Used to designate most of the upland and upland hammock vegetation found throughout the Keys that is natural and generally undisturbed. As a result, of the mixture of species present within this category, signatures are typically a complex blend of colors, textures, and crown shapes. On CIR photography conifers will appear as dull brick red to purple-red in color and hardwoods will exhibit red/pink returns. Color returns will be greenish, bluish, reds and dark brownish reds of all these varied species.

5) Pineland: This is an upland forest community with an open canopy dominated by the native slash pine composed of known species. Rounded, asymmetrical and "feathered" brick red canopies; individual trees visible. Grassy understories may be pale green with various pinkish tones. Saw palmetto may be visible as irregular shaped pink to pinkish red patches with relatively smooth textured tops.

6) Exotic: Invasive exotic species include Melaleuca, Australian Pine, Brazilian Pepper, Leatherleaf and Sapodilla north of the seven mile bridge. Australian Pine have a texture similar to dense broad-leaved canopies, with a fluffy overlapping crown pattern. This signature is variable with respect to color return. In some areas, generally inland, this community provides a bright red color while coastal occurrences result in a dark brownish red or purple return. Brazilian Pepper are generally scarlet, "fluffy," asymmetrical crowned shrubs and can be unevenly spaced and tend to grow in clumps. They may be of different ages and heights giving a "cottony" and mottled pattern to the area.

7) Scrub Mangrove: Typically found in the lower Keys, coastal scrub mangrove of dwarf mangrove are dominated by known species. Plants are typically less than 5’ tall. Scrub Mangrove have a mottled irregular pattern with small crowns and a bright red signature. Water or sand is usually evident between the open canopy displaying a gray or white signature.

8) Freshwater Wetland: Wetland areas with either standing water or saturated soil or both where the water is fresh or brackish composed of known species. Some Freshwater Wetlands are isolated and therefore not subject to the MMU of 0.5 acres. Rather, photo interpreters will delineate them without regard to the MMU. Signatures are very diverse, as a result of the variety of vegetation and land forms that make up freshwater wetlands. Communities may have dark patchy and irregular signatures with a variety of height, colors and textures. Open water or water staining may be evident where the canopy is open. These communities are temporarily to seasonally flooded and may dry out for extended periods.

9) Salt marsh: The salt marsh community is a wetland area subject to tidal influence, and the vegetation is dominated by non-woody groundcovers and grasses. The signature can appear white (dry sandy areas or very shallow water), gray (mud or murky water), or even light brown in some tannin-stained areas. Salt marshes usually occur adjacent to mangrove communities.

10) Buttonwood: Designates the transitional areas located between tidal mangroves and hammocks that are dominated by Buttonwood. The Buttonwood wetland is a wetland that is usually present in the more landward zone of the transitional wetland area, and may intermix with more upland communities. Signature is dark red or brown, with medium crowns, usually packed tightly together in the transitional zones. Can be found intermixed with upland species in the coastal areas

11) Mangrove: A wetland plant association subject to tidal influence where the vegetation is dominated by Black, White or Red mangroves, containing both shrub and tree size vegetation. Broad crowns and bright red signature primarily found in, but not limited to, coastal areas subject to periodic or continual inundation by salt or brackish water**.** Stressed mangroves from hurricane damage may result in a bright gray color and a rough or stippled texture.

12) Beach Berm: A bare sandy shoreline, coastal dune or a mound or ridge of unconsolidated sand that is immediately landward of, and usually parallel to, the shoreline. The sand is calcareous material that is the remains of marine organisms such as corals, algae and mollusks. The berm may include forested, coastal ridges and may be colonized by hammock vegetation. The photo signature is usually a smooth, bright white or tan color adjacent to the coastline throughout the work area. A mixture of grasses, shrubs and trees on the berm exhibit smooth pink and fluffy or "cottony" red textures with white patches of sand visible through the canopy.

13) Water: All water bodies, both fresh and tidal (saline). Water will exhibit a varying tone from very dark to medium depending on the turbidity and sediment load of the water. Highly turbid waters have a light blue or green signature due to the reflection from suspended solids in the water.

Appendix 2

Candidate Species in the Florida Keys

Bartram's hairstreak butterfly

Bartram's hairstreak butterfly is endemic to south Florida and the lower Keys. The species was locally common within the pine rockland habitat that occurred in Miami-Dade and Monroe counties, and less common and more sporadic within Collier, Palm Beach, and Broward counties (Baggett 1982; Smith et al. 1994; Salvato and Hennessey 2004). However, development has removed and/or fragmented pine rocklands from the majority of the hairstreak's former range (Salvato and Hennessey 2004). This rapid loss of habitat and the resulting increased distance between substantial populations of host plants in the remaining pine rocklands is the most likely cause for the disappearance of the hairstreak from most of its historic range.

Bartram's hairstreak is present only on Big Pine Key. Although relict pine rocklands can still be found on several other islands within NKDR, only Big Pine Key rocklands maintain pineland croton (Salvato 1999; Salvato and Hennessey 2003; 2004). Hennessey and Habeck (1991) and Salvato (1999) estimated that approximately 80 ha (198 ac) of croton-bearing pine rockland occurs on Big Pine Key.

Big Pine partridge pea

Big Pine partridge pea occurs primarily in pine rockland vegetation. Some populations can be found on roadsides (Hodges and Bradley 2005) or in cleared lots adjacent to pine rockland. It is capable of colonizing disturbed areas within pine rockland habitat, such as dirt roads. It does not persist in damp soil or depressions (Muir and Liu 2003).

The historical range of Big Pine partridge pea included Big Pine Key, Cudjoe Key, No Name Key, Ramrod Key, Little Pine Key, and perhaps Sugarloaf Key (all in the lower Keys) (Hodges and Bradley 2005). Today, the Big Pine partridge pea is widespread only on Big Pine Key. There, it is distributed throughout the range of pine rockland, though more widespread in the northern than southern portion of the key (Bradley 2006; Bradley and Saha 2009). In 2005, approximately 150 plants were found in pine rockland on Cudjoe Key (Hodges and Bradley 2005); this subpopulation covered about 0.2 ha (0.5 acres). During the summer of 2005, a subpopulation was also discovered along a county road on Lower Sugarloaf Key consisting of only a few plants (Hodges and Bradley 2005). This may represent a recent range expansion, since there is no additional suitable habitat for the species in the vicinity of this subpopulation (Hodges and Bradley 2005). This subpopulation could not be located after Hurricane Wilma, and the plants were probably killed by the tidal surge (Hodges and Bradley 2005).

Blodgett's silverbush (*Argythamnia blodgettii*)

In the Keys, this species grows in pine rockland, rockland hammock, coastal berm and on roadsides, especially in sunny gaps or edges (Bradley and Gann 1999). This species historically occurred in central and southern Miami-Dade County and throughout the Florida Keys from

Totten Key (latitude 25° 22.95') south to Key West (Bradley and Gann 1999).

Blodgett's silverbush is currently known from Windley Key southwest to Big Pine Key (Bradley and Gann 1999). More recently, Hodges and Bradley (2006) indicated that species' verified range extends from Miami-Dade County to Boca Chica Key.

Cape Sable thoroughwort

The historical range for Cape Sable thoroughwort was the Florida Keys from Key Largo to Boca Grande Key (12 miles west of Key West) and the southern mainland from the Cape Sable or Flamingo area to the Madeira Bay area in what is now ENP (Bradley and Gann 2004). Bradley and Gann (2004) found Cape Sable thoroughwort on five islands in the Keys (Upper Matecumbe Key, Lignumvitae Key, Big Munson Island, Boca Grande, Long Key) and one small area in ENP. Bradley and Gann (1999) summarized the habitat as follows, "This herb has been observed most commonly in open sun to partial shade at the edges of rockland hammock and in coastal rock barren." The species also occurs in buttonwood hammock and the ecotone between buttonwood hammock and coastal hardwood hammock in the southern Everglades (J. Sadle 2007).

The only large population is on Big Munson Island. Bradley and Gann (2004) stated that in the Keys "fewer than 5,000 plants are estimated to exist with all but about 500 of these present on a single privately owned island."

Everglades bully (*Sideroxylon reclinatum austrofloridense*)

There have been no records of this taxon ever being collected in the Keys. In Monroe County, Everglades bully is found only on the mainland (Hodges and Bradley 2006). Hodges and Bradley (2006) stated that if it had occurred in the Florida Keys, the most likely locations would have been pine rocklands on Key Largo, Big Pine Key, Cudjoe Key, or Lower Sugarloaf Key, all of which were surveyed for this species. Hodges and Bradley (2006) indicated that most of the sites on Key Largo have been developed.

Florida leafwing butterfly (*Anaea troglodyta floridalis)*

The Florida leafwing butterfly is endemic to south Florida and the lower Keys. However, development has removed and fragmented pine rocklands from the majority of the leafwing's former range (Service 1999; Salvato 1999). This species only occurs in pine rocklands with pineland croton. The Florida leafwing has not been seen on Big Pine Key since 2006 and may now be extirpated from the Keys (Salvato 2007; Minno 2009).

Florida prairie clover (*Dalea carthagenensis floridana*)

This shrub is found in pine rocklands, edges of rockland hammocks, coastal uplands, and marl prairie (Chafin 2000). This species was historically known from Miami-Dade, Collier, Monroe, and Palm Beach counties. In Monroe County it has been known historically from the Pinecrest region in the Big Cypress National Preserve. Although Florida prairie clover still occurs on the

mainland in Monroe County, no known occurrences are in the Keys. It was last documented in 1966 on Key Biscayne.

Florida semaphore cactus (*Consolea corallicola*)

This cactus grows close to salt water on bare rock with a minimum of humus-soil cover in hammocks near sea level (Small 1930; Benson 1982). Gann et al. (2002) characterize habitats as including low buttonwood transition areas between rockland hammocks and mangrove swamps and possibly other habitat such as openings in rockland hammocks. On Swan Key this species only occurs near the center of the island where it grows approximately 0 to 10 meters from the edge of the hammock, which is embedded in tidal swamp dominated by red mangrove (*Rhizophora mangle*) (Grahl and Bradley 2005).

Besides on Swan Key there is one other naturally occurring population of Florida semaphore cactus and a few outplanted populations. The Nature Conservancy owns and maintains the Torchwood Hammock Preserve on Little Torch Key in Monroe County where one population occurs in an area approximately 1.0 acre in size (Florida Natural Areas Inventory 2007). Three outplantings have occurred in Monroe County: (1) an outplanting of 96 cacti on an undisclosed island in the lower Keys; (2) a total of 4 outplantings (170 plants) at five different locations at Dagny Johnson Key Largo Hammock Botanical State Park on North Key Largo, which is managed by the Florida Department of Environmental Protection; and (3) outplantings (40 plants/key) were attempted on six separate lower Keys on Federal and State lands.

Miami blue butterfly (*Cyclargus (=Hemiargus) thomasi bethunebakeri*)

The Miami blue is a coastal butterfly reported to occur in openings and around the edges of hardwood hammocks, and other communities adjacent to the coast that are prone to frequent natural disturbances (e.g., coastal berm hammocks, dunes, and scrub) (Opler and Krizek 1984; Minno and Emmel 1994; Emmel and Daniels 2004), but also tropical pinelands (Minno and Emmel 1993) and along trails, using open sunny areas (Pyle 1981). In the Keys, it was most abundant near disturbed hammocks where weedy flowers provided nectar (Minno and Emmel 1994). It also occurred in pine rocklands on Big Pine Key (Calhoun et al. 2002) and elsewhere in Monroe and Miami-Dade Counties. On islands of the KWNWR, Cannon et al. (2007), found that "All areas occupied by Miami blue butterfly had a dune bordered by a berm hammock; human impact was minimal," but these were on remote islands. Currently there are two distinct metapopulations of the Miami blue, one at Bahia Honda State Park and one at KWNWR.

Red knot

Each year red knots make one of the longest distance migrations known in the animal kingdom, traveling approximately 30,000 kilometers annually between wintering grounds in southern South America and breeding areas within the Canadian Arctic. Migrating red knots are principally found in marine and estuarine habitats (Harrington 2001). During the spring migration, red knots stop over for a period of approximately two to three weeks along the Atlantic coast of the United States to rebuild energy reserves needed to complete the journey to the Arctic and arrive on the breeding grounds in good condition (Harrington 1996; Baker *et al.*

2004). In the southeastern and mid-Atlantic United States, red knots forage along sandy beaches, tidal mudflats, salt marshes, and peat banks. In Florida, the birds also use mangrove and brackish lagoons.

Sand flax (*Linum arenicola*)

Sand flax is found in pine rockland, disturbed pine rockland, marl prairie, roadsides on rocky soils, and disturbed areas (Bradley and Gann 1999; Hodges and Bradley 2006). Sand flax historically was distributed in Monroe County in the lower Keys and in central and southern Miami-Dade County (Bradley and Gann 1999). This taxon is currently rare in relatively undisturbed natural areas, with the exception of plants on Big Pine Key and the grounds of an office building on Old Cutler Road. Sand flax also exists at Lower Sugarloaf Key, Big Torch Key, and Middle Torch Key.

Wedge spurge (*Chamaesyce deltoidea serpyllum*)

Wedge spurge is known only from pine rockland vegetation on Big Pine Key (Bradley and Gann 1999). In addition to the more common associates, wedge spurge "…can grow in association with other rare taxa, including sand flax, and Big Pine partridge pea" (Bradley and Gann 1999).

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Habitat mapping units referenced in Monroe County's 2009 habitat classification maps in the Florida Keys used by federally listed candidate species.

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Bartram's hairstreak butterfly					●								
Big Pine partridge pea		●			●								
Blodgett's silverbush				●	●							●	
Cape Sable thoroughwort				●						●		●	
Everglades bully					●								
Florida leafwing butterfly					●								
Florida prairie clover				●	●							●	
Florida semaphore cactus				●						●	●		
Miami blue butterfly				●	●							●	
Red knot									●			●	
Sand flax		●			●								
Wedge spurge					●								

Appendix 3
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

1

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 39[1] 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 41[1] 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 inend 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 Claywill 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
Key West, FL 33041-1026
(305) 292-3470
Attorney for the Respondent
FBN: 058262

Franklin D. Greenman, Esq. (Date)
GREENMAN & MANZ
5800 Overseas Highway, Suite 40
Marathon, FL 33050
(305) 743-2351
Attorney for the Petitioners
FBN: 290815

MONROE COUNTY ATTORNEY
APPROVED AS TO FORM:

ROBERT B. SHILLINGER, JR.
ASSISTANT COUNTY ATTORNEY
Date 4/21/04

Appendix 4. Effects Analysis Figure and Tables

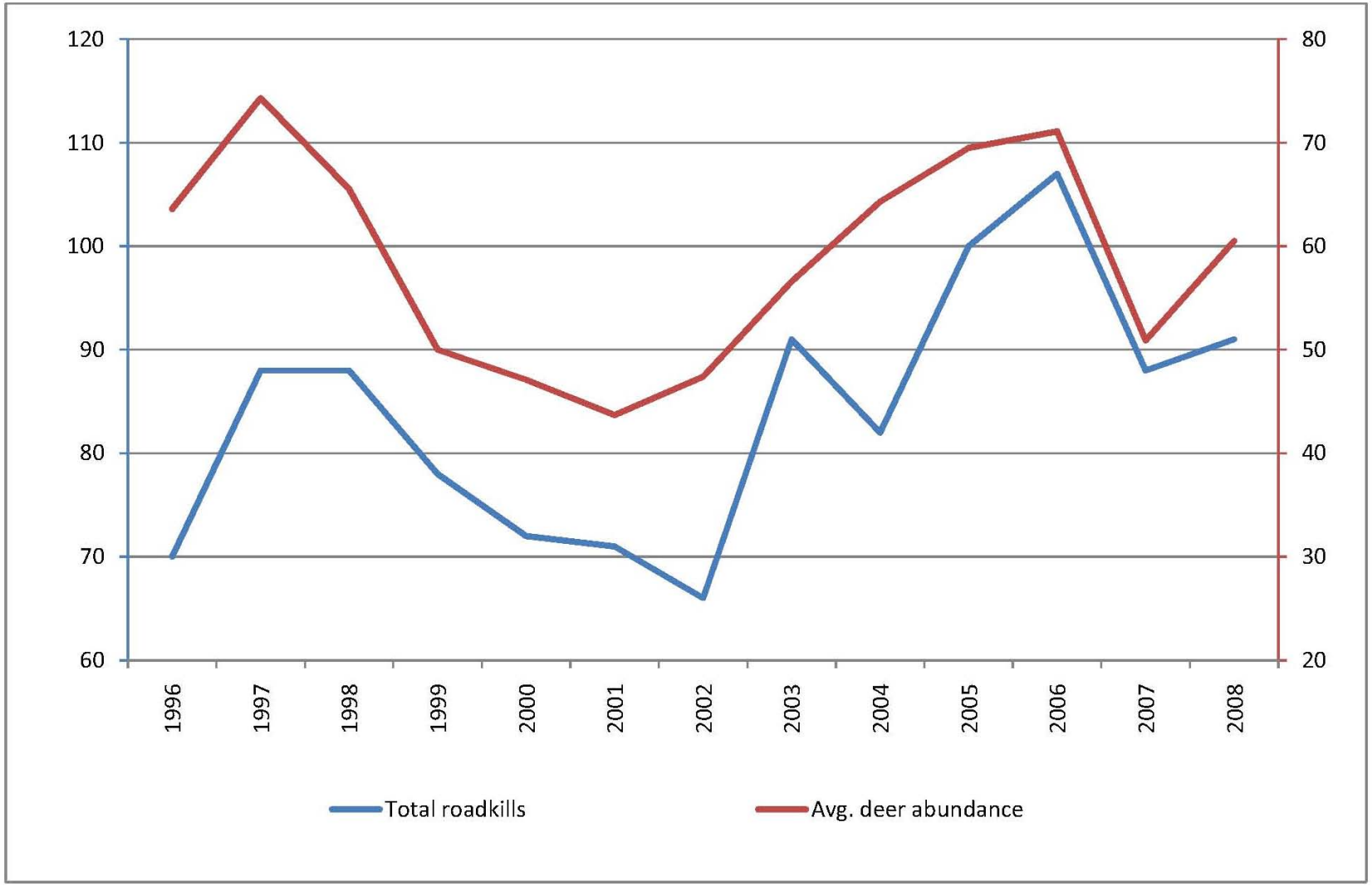

Figure EA-1: Graph showing the total number of Key deer killed by vehicles (blue line, left y-axis) as compared to the average deer abundance determined through road counts (red line, right y-axis).

LIFE OF PERMIT	13
ROGO UNITS - UNINCORPORATED MONROE COUNTY	197
Tier 1/year	6
Tier 1/year (LOW KEYS)	3
Tier 1/year (UPPER KEYS)	3
Outside Tier 1/year	191
Outside Tier 1/year (LOW KEYS)	64
Outside Tier 1/year (MIDDLE KEYS)	63
Outside Tier 1/year (UPPER KEYS)	64
Tier 1 in Big Pine-No Name HCP/Life of permit	10
Tier 1 Big Pine-No Name HCP issued	1
Tier 1 Big Pine-No Name HCP remaining	9
ROGO Units/Year - Village of Islamorada	28
ROGO Units/Year - City of Marathon	30
ROGO Units/Year - City of Layton	3
ROGO Units/Year - City of Key Colony Beach	22
ROGO Units/Year - City of Key West	92
ROGO Units/Year - Entire County	372
Additional Square Feet of Commercial/ROGO	239
Percent of residences with cats	34%
Avg # of cats/residence	2.1
% of residential cats that are "indoor only"	40%
% of residential cats that go outdoors	60%
Additional feral cat population in relation to domestic cats	2/3
Average Trips/Day	8

Table EA-1: A list of standard parameters that apply to the analyses

	ROGO/Yr	ROGO/Life of Permit	Additional service development (0.025 acre per ROGO)	Acres of PSH	Protected acres of PSH	At-risk acres of PSH	At-risk acres outside NFIP	At-risk acres subject to NFIP	Undeveloped lots containing PSH	All At-risk Lots	RE numbers (including multi-family)*
Unincorporated Monroe Co.*	197	2,561	64	63,411	40,976	22,435	15,571	6,864	5,017	14,521	16,073
Village of Islamorada	28	364	9	2,077	671	1,406	1,350	57	439	1,433	2,384
City of Marathon	30	390	10	2,871	961	1,910	1,074	836	639	1,718	3,046
City of Layton	3	39	1	0.1	0.0	0.1	0.0	0.1	0	6	15
City of Key Colony Beach	22	286	7	20	0	20	20	0	11	112	566
City of Key West	92	1,196	30	869	165	703	376	328	29	434	2,199
Total Suitable Habitat	372	4,836	121	69,248	42,773	26,475	18,390	8,085	6,135	18,224	24,283

*RE numbers are the total number of "real estate parcel numbers" and include each multi-family unit as one RE number. Lots/Parcels in these tables are on-the-ground properties and multiple RE units on one property are counted as one.

Table EA-2a. Total suitable habitat (all species) by municipality. Undeveloped lots are vacant lots according to the property code.

2008 land use	2008 acres	2008 square feet	Percent increase by 2023	Additional sq. ft. in 2023	Additional sq. ft. per Residential Unit	Additional acres per Residential Unit
Education	565	24,611,400	15.4%	3,789,262	81	0.002
Public building	4,290	186,872,400	15.4%	28,771,567	612	0.014
Public Facilities	220	9,583,200	15.4%	1,475,465	31	0.001
Recreational	573	24,959,880	1.4%	344,446	7	0.000
Institutional	668	29,098,080	19.8%	5,761,420	123	0.003
Commercial *				0	239	0.005
Total	6,316	275,124,960		40,142,161	1,093	0.025
Total 2008 residential units	42,173					
New ROGO units by 2023	4,836					
Estimated 2023 residential units	47,009					

* Commerical square foot per ROGO and the increase in Recreational and Institutional uses are established in the Comp Plan

Table EA-2b. Acreage of non-residential development associated with the existing population.

Acres of Additional Protection	Public Conservation Lands	Conservation Lands NGO	Total New	Running Total	Percent added
Pre-1999 Protected Acres				**40,752**	
1999	1,522	0	1,522	42,274	3.73%
2000	839	0	839	43,113	1.98%
2001	500	0	500	43,613	1.16%
2002	529	0	529	44,142	1.21%
2003	174	568	742	44,884	1.68%
2004	113	0	113	44,997	0.25%
2005	330	27	357	45,354	0.79%
2006	469	0	469	45,823	1.03%
2007	280	0	280	46,103	0.61%
2008	116	0	116	46,219	0.25%
Total			**5,467**	**46,219**	**13.42%**
Average added per year			**547**		**1.27%**
Expected new lands to be added through 2023			**7,107**	**53,326**	**15.38%**

Table EA-2c. The addition of protected lands from 1999 through 2008.

Year	Population	% change
1980	63,188	-
1990	78,024	23.5%
1992	80,968	3.8%
2000	79,589	-1.7%
2004	78,284	-1.6%
2006	74,737	-4.5%
2008	72,243	-3.3%
2023 (est.)	83,366	15.4%
Source: U.S. Census Bureau		

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	EASTERN INDIGO SNAKE	Unincorporated Monroe County																	
2		BPNNK HCP**	NH HCP**	ORC HCP	ORC (outside HCP)	Tier 0	Tier 1	SPA (Tier 2)	Tier 3	Tier 4	Undesignated Tier	Islamorada	KCB	Key West	Layton	Marathon	Other	County-Wide (SUM)	
3	Total acres of Suitable Habitat (SH)	6,074	2	34	1,456	568	38,779	249	555	2,453	966	2,077	20	869	0	2,871	8,580	65,552	
4	SH on Conservation Lands	4,954	2	0	1,131	182	32,501	6	17	963	458	671	0	165	0	961	0	42,012	
5	At-risk acres of SH (row 3 - row 4)	1,120	0	34	324	385	6,278	243	538	1,491	508	1,406	20	703	0	1,910	8,580	23,541	
6	At-risk acres of SH outside NFIP	390	0	15	223	191	3,034	14	17	1,433	142	50	0	327	0	781	3,305	9,923	
7	At-risk parcels	2,035	1	75	328	239	3,588	386	2,598	91	1,370	1,433	112	433	6	1,718	0	14,413	
8	Acres per parcel (row 5/row7)	0.6	0.0	0.5	1.0	1.6	1.7	0.6	0.2	16.4	0.4	1.0	0.2	1.6	0.0	1.1	0.0		
9	ROGO allotment/year*	n/a	n/a	n/a	n/a	0	6	25	166	0	n/a	28	22	92	3	30	0		
10	ROGO allotment (Life of Permit)	5	0	0	0	0	73	321	2,162	0	0	364	286	1,196	39	390	0		
11	Acres of ROGO allowable impact (row 10 * row 8)	2.8	0.0	0.0	0.0	0.0	127.7	202.2	447.7	0.0	0.0	357.1	52.1	1,942.5	0.4	433.6	0.0	3,566.1	
12	Maximum impacted acres of SH (lesser of row 5 vs row 11). D12=D5*0.154; E12=E5*0.154	2.8	0.0	5.3	49.9	0.0	127.7	202.2	447.7	0.0	0.0	357.1	20.4	703.3	0.1	433.6	0.0	2,350.0	
13	Total Acres of impact outside NFIP (row 6/row 5 * row 12)	2.8	0.0	2.3	34.4	0.0	61.7	11.6	14.1	0.0	0.0	12.7	0.0	327.1	0.0	177.3	0.0	644.2	
14	Non-Federal Acres of Impact Outside NFIP - Cumulative Impacts (row 13 * 0.817)	2.2	0.0	1.9	28.1	0.0	50.4	9.5	11.6	0.0	0.0	10.4	0.0	267.3	0.0	144.8	0.0	526.3	
15	Additional associated development***	0.1	0.0	0.0	0.0	0.0	1.8	8.0	54.0	0.0	0.0	9.1	0.0	0.0	0.0	9.8	0.0	82.9	
16	Acres subject to NFIP impact - Direct Impacts (row 12 - row 13)	0.0	0.0	2.9	15.5	0.0	66.0	190.6	433.5	0.0	0.0	344.4	20.4	376.1	0.1	256.3	0.0	1,705.8	
17	Percent of total SH impacted by NFIP (row 16/cell R3)	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.3%	0.7%	0.0%	0.0%	0.5%	0.0%	0.6%	0.0%	0.4%	0.0%	2.6%	
18	Parcels affected by NFIP (row 16/row 8)	0	0	6	16	0	38	303	2,093	0	0	351	112	232	6	231	0	3,387	
19	*The 191 non-Tier-1 ROGO units are split between SPA and Tier 3 based on the relative percentage of parcels. Slight errors due to rounding occur in the calculation of the split allotment of the life of the permit.																		
20	**BPNNK and NH HCP impact acres are not counted because take for this species was accounted for in the HCP.																		
21	***Additional associated development is calculated at 0.025 acres per ROGO unit, or the remaining acres of SH habitat that is not being directly impacted, whichever is less.																		
22																			
23	**Breakdown of acres outside of the purview of the NFIP**																		
24	**OUTSIDE NFIP**	**Acres**	**%**																
25	Federal	1813	18%																
26	State	70	1%																
27	CBRA	8040	81%																
28	Sum	9923	100%																
29																			
30	Table EA-3: Eastern indigo snake suitable habitat data, ROGO allowance calculations, and anticiapted impacts. Green cells are data generated by GIS, the remainder of the cells are calculated.																		
31																			

	A	B	C	D	E	F	G	H	I	J	K
1	KEY DEER	Unincorporated Monroe County (LOWER KEYS ONLY)								County-Wide (SUM)	
2		BPNNK HCP**	Tier 0	Tier 1	SPA (Tier 2)	Tier 3	Tier 4	Undesignated Tier	Other		
3	Total acres of Suitable Habitat (SH)	7,203	108	19,053	110	147	233	117	3,510	30,482	
4	SH on Conservation Lands	5,088	27	14,889	1	2	216	3	0	20,226	
5	At-risk acres of SH (row 3 - row 4)	2,115	82	4,164	109	145	17	114	3,510	10,256	
6	At-risk acres of SH outside NFIP	508	43	1,805	1	1	17	9	1,833	4,217	
7	At-risk parcels	4,925	38	2,136	82	677	3	344	0	8,205	
8	Acres per parcel (row 5/row7)	0.4	2.1	1.9	1.3	0.2	5.6	0.3	0.0		
9	ROGO allotment/year*	n/a	0	3	7	57	0	0	0		
10	ROGO allotment (Life of Permit)	5	0	34	90	742	0	0	0		
11	Acres of ROGO allowable impact (row 10 * row 8)	2.1	0.0	66.3	119.8	159.0	0.0	0.0	0.0	347.2	
12	Maximum impacted acres of SH (lesser of row 5 vs row 11)	2.1	0.0	66.3	109.3	145.0	0.0	0.0	0.0	322.8	
13	Total Acres of impact outside NFIP (row 6/row 5 * row 12)	2.1	0.0	28.7	1.3	1.0	0.0	0.0	0.0	33.2	
14	Non-Federal Acres of Impact Outside NFIP - Cumulative Impacts (row 13 * 0.996)	2.1	0.0	28.6	1.3	1.0	0.0	0.0	0.0	33.0	
15	Additional associated development***	0.1	0.0	0.9	0.0	0.0	0.0	0.0	0.0	1.0	
16	Acres subject to NFIP impact - Direct Impacts (row 12 - row 13)	0.0	0.0	37.5	108.0	144.0	0.0	0.0	0.0	289.6	
17	Percent of total SH impacted by NFIP (row 16/cell J3)	0.0%	0.0%	0.1%	0.4%	0.5%	0.0%	0.0%	0.0%	1.0%	
18	Parcels affected by NFIP (row 16/row 8)	0	0	19	81	672	0	0	0	773	
19	*The 64 non-Tier-1, lower keys ROGO units are split between SPA and Tier 3 based on the relative percentage of parcels. Slight errors due to rounding										
20	**BPNNK HCP impact acres are not counted because take for this species was accounted for in the HCP.										
21	***Additional associated development is calculated at 0.025 acres per ROGO unit, or the remaining acres of SH habitat that is not being directly impacted, whichever is less.										
22											
23	**Breakdown of acres outside of the purview of the NFIP**										
24	**OUTSIDE NFIP**	**Acres**	**%**								
25	Federal	18	0.4%								
26	State	45	1.1%								
27	CBRA	4,154	98.5%								
28	**Sum**	**4,217**	**100.0%**								
29											
30	Table EA-4: Key deer suitable habitat data, ROGO allowance calculations, and anticiapted impacts. Green cells are data generated by GIS, the remainder of the cells are calculated.										
31											

TRAFFIC MORTALITY - KEY DEER					
Year	ALL ROADS	US1	% on US1	Trips/Day on Big Pine	Abundance (Road Count Based)
1996	70	45	64.3%		63.6
1997	88	50	56.8%		74.3
1998	88	47	53.4%		65.5
1999	78	38	48.7%		50.0
2000	72	31	43.1%		47.1
2001	71	26	36.6%		43.7
2002	66	34	51.5%		47.4
2003	91	45	49.5%		56.6
2004	82	40	48.8%	14,499	64.3
2005	100	45	45.0%	19,667	69.5
2006	107	51	47.7%		71.1
2007	88	49	55.7%		50.9
2008	91	44	48.4%	14,866	60.5
Total	**1,092**	**545**	**49.9%**		
Average	**84**	**42**	**49.9%**	**16,344**	**58.8**

Table EA-5: Summary of traffic data and related Key deer abundance from 1996 through 2008.

TRAFFIC MORTALITY - KEY DEER	ROGO/Year affecting Key Deer	Life of permit	Build Out TPD	25% TPD	Half-life TPD
Unincorporated Monroe County	67	871	6,968	1,742	871
City of Marathon	15	195	1,560	390	195
City of Key West	46	598	4,784	1,196	598
Total	128	1,664	13,312	3,328	1,664
		Trips per year	4,858,880	1,214,720	607,360
		Resulting Key deer strikes	34	9	4

Table EA-6: Analysis of additional trips generated by new residences

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1		Unincorporated Monroe County (UPPER KEYS - North Key Largo)								Unincorporated Monroe County (UPPER KEYS - South Key Largo)							
2	**KEY LARGO COTTON MOUSE and KEY LARGO WOOD RAT**	**NH HCP****	**ORC HCP****	**ORC (outside HCP)**	**Tier 0**	**Tier 1**	**SPA (Tier 2)**	**Tier 3**	**Undesignated Tier**	**Tier 0**	**Tier 1**	**SPA (Tier 2)**	**Tier 3**	**Undesignated Tier**	**Other**	**County-Wide (SUM)**	
3	Total acres of Suitable Habitat (SH)	2	30	229	71	2,157	0	0	0	18	947	159	141	149	287	4,191	
4	SH on Conservation Lands	2	0	105	9	2,124	0	0	0	1	673	6	2	6	0	2,928	
5	At-risk acres of SH (row 3 - row 4)	0	30	125	62	34	0	0	0	17	274	153	139	143	287	1,263	
6	At-risk acres of SH outside NFIP	0	11	37	61	29	0	0	0	0	25	14	2	0	127	306	
7	At-risk parcels	0	75	236	27	75	0	0	0	40	667	316	964	861	0	3,261	
8	Acres per parcel (row 5/row7)	0.0	0.4	0.5	2.3	0.5	0.0	0.0	0.0	0.4	0.4	0.5	0.1	0.2	0.0		
9	ROGO allotment/year*	n/a	n/a	n/a	0	3	0	0	0	0	0	16	48	0	0		
10	ROGO allotment (Life of Permit)	0	0	0	0	39	0	0	0	0	0	205	627	0	0		
11	Acres of ROGO allowable impact (row 10 * row 8)	0.0	0.0	0.0	0.0	17.6	0.0	0.0	0.0	0.0	0.0	99.6	90.1	0.0	0.0	207.3	
12	Maximum impacted acres of SH (lesser of row 5 vs row 11); D12=D5*0.154	0.0	0.0	19.2	0.0	17.6	0.0	0.0	0.0	0.0	0.0	99.6	90.1	0.0	0.0	226.5	
13	Acres of impact outside NFIP (row 6/row 5 * row 12)	0.0	0.0	5.7	0.0	14.9	0.0	0.0	0.0	0.0	0.0	8.9	1.0	0.0	0.0	30.5	
14	Additional associated development***	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	5.1	15.7	0.0	0.0	21.8	
15	Acres subject to NFIP impact (row 12 - row 13)	0.0	0.0	13.5	0.0	2.7	0.0	0.0	0.0	0.0	0.0	90.7	89.1	0.0	0.0	196.0	
16	Percent of total SH impacted by NFIP (row 15/cell P3)	0.0%	0.0%	0.3%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	2.2%	2.1%	0.0%	0.0%	4.7%	
17	Parcels affected by NFIP (row 15/row 8)	0	0	26	0	6	0	0	0	0	0	187	619	0	0	838	
18	*The 64 non-Tier-1, upper keys ROGO units are split between SPA and Tier 3 based on the relative percentage of parcels. Slight errors due to rounding occur in the calculation of the split allotment of the life of the permit.																
19	**NH HCP and ORC HCP impact acres are not counted because take for this species was accounted for in the HCP.																
20	***Additional associated development is calculated at 0.025 acres per ROGO unit, or the remaining acres of SH habitat that is not being directly impacted, whichever is less.																
21	Note: There are no at-risk federal lands with suitable habitat, therefore the impacts from row 13 are the cumulative impacts																
22																	

23	**Breakdown of acres outside of the purview of the NFIP**		
24	**OUTSIDE NFIP**	**Acres**	**%**
25	Federal	0	0.0%
26	State	3	1.0%
27	CBRA	303	99.0%
28	**Sum**	**306**	**100.0%**

29

30 Table EA-7: Key Largo cotton mouse and Key Largo woodrat suitable habitat data, ROGO allowance calculations, and anticiapted impacts. Green cells are data generated by GIS, the remainder of the cells are calculated.

31

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	PROJECTED CAT POPULATIONS (North Key Largo)	Habitat Buffer Lands - North Key Largo (500 meter buffer)																
2		Non-CBRA								CBRA								
3		NH HCP	ORC HCP	ORC (outside HCP)	Tier 0	Tier 1	SPA (Tier 2)	Tier 3	Undesignated Tier	NH HCP	ORC HCP	ORC (outside HCP)	Tier 0	Tier 1	SPA (Tier 2)	Tier 3	Undesignated Tier	Buffer Total
4	Acres of buffer around SH	0	20	1,023	5	69	1	74	1	1	11	1,004	177	3,599	0	1	0	5,988
5	Acres of buffer lands in conservation	0	0	0	0	1	0	0	0	1	0	809	124	3,387	0	0	0	4,322
6	At-risk acres of buffer lands (row 4 - row 5)	0	20	1,023	5	68	1	74	1	0	11	195	52	212	0	1	0	1,666
7	Vacant at-risk buffer parcels	1	34	120	0	26	5	71	6	0	21	32	0	10	0	1	0	327
8	Developed residential buffer parcels	0	26	719	0	43	0	280	2	0	4	80	0	36	0	0	0	1,190
9	Combined existing residential and vacant parcels (row 7 + row 8)	1	60	839	0	69	5	351	8	0	25	112	0	46	0	1	0	1,517
10	Anticipated future residences (factoring in ROGO allotments)	0	0	0	0	0	5	71	0	0	0	0	0	0	0	1	0	77

11 HABITAT BUFFER - Buffer lands around the occupied north key largo suitable habitat by ROGO category, shown as either in the CBRA boundary (CBRA) or outside of the CBRA boundary (Non-CBRA)

12

13 Table EA-8a: Key Largo cotton mouse and Key Largo woodrat buffer data, ROGO allowance calculations, and anticiapted buffer impacts. Green cells are data generated by GIS, the remainder of the cells are calculated.

14

15	PROJECTED CAT POPULATIONS (North Key Largo)	residences	domestic outdoor cats	associated feral cats	total free-roaming cats	Percent increase
16	Existing	1,190	510	566	1,076	
17	New residences in habitat (NFIP)	32	14	15	29	2.7%
18	New residences in buffer (NFIP)	76	33	36	69	6.4%
19	Direct Cat Impacts				98	9.1%
20	New residences in CBRA habitat (non-NFIP)	44	19	21	40	3.7%
21	New residences in CBRA buffer (non-NFIP)	1	0	0	1	0.1%
22	Cumulative Cat Impacts				41	3.8%

23

North Key Largo ONLY (See Table EA-7)	Total available ROGO units	Used directly in Habitat (NFIP)	Used directly in Habitat (CBRA)	Remaining
HCPs	0	0	0	0
ORC (outside HCP)	n/a	26	11	0
Tier 1	39	6	33	0
SPA	205	0	0	205
Tier 3	627	0	0	627
Sum	871	32	44	832

24 Table EA-8b: Summary of existing residences, expected new residences, and the expected increase in free-roaming cats on north Key Largo.

25

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	KEYS TREE CACTUS and STOCK ISLAND TREE SNAIL	Unincorporated Monroe County																
2		BPNNK HCP	NH HCP	ORC HCP	ORC (outside HCP)	Tier 0	Tier 1	SPA (Tier 2)	Tier 3	Tier 4	Undesignated Tier	Islamorada	KCB	Key West	Layton	Marathon	Other	County-Wide (SUM)
3	Total acres of Suitable Habitat (SH)	971	2	30	200	92	5,782	166	46	98	298	445	5	48	0	588	436	9,207
4	SH on Conservation Lands	848	2	0	104	31	4,768	6	1	31	167	145	0	5	0	340	0	6,449
5	At-risk acres of SH (row 3 - row 4)	123	0	30	95	61	1,014	159	45	67	131	300	5	43	0	249	436	2,758
6	At-risk acres of SH outside NFIP	53	0	11	32	67	249	13	1	67	7	1	0	17	0	28	183	729
7	At-risk parcels	387	1	75	158	65	1,357	369	773	15	901	779	45	102	1	579	0	5,607
8	Acres per parcel (row 5/row7)	0.3	0.0	0.4	0.6	0.9	0.7	0.4	0.1	4.5	0.1	0.4	0.1	0.4	0.0	0.4	0.0	
9	ROGO allotment/year*	n/a	n/a	n/a	n/a	0	6	62	129	0	0	28	22	92	3	30	0	
10	ROGO allotment (Life of Permit)	5	0	0	0	0	78	802	1,681	0	0	364	286	1,196	39	390	0	
11	Acres of ROGO allowable impact (row 10 * row 8)	1.6	0.0	0.0	0.0	0.0	58.3	346.2	96.9	0.0	0.0	140.1	34.7	501.8	1.5	167.4	0.0	1,348.4
12	Maximum impacted acres of SH (lesser of row 5 vs row 11); D12=D5*0.154, E12=E5*0.154	1.6	0.0	4.6	14.7	0.0	58.3	159.2	44.6	0.0	0.0	140.1	5.5	42.8	0.0	167.4	0.0	638.7
13	Total Acres of impact outside NFIP (row 6/row 5 * row 12)	0.7	0.0	1.6	5.0	0.0	14.3	12.7	1.1	0.0	0.0	0.6	0.0	17.3	0.0	18.8	0.0	72.1
14	Non-Federal Acres of Impact Outside NFIP - Cumulative Impacts (row 13 * 0.893)	0.6	0.0	1.5	4.4	0.0	12.8	11.4	1.0	0.0	0.0	0.5	0.0	15.5	0.0	16.8	0.0	64.4
15	Additional associated development**	0.1	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	9.1	0.0	0.0	0.0	9.8	0.0	20.9
16	Acres subject to NFIP impact - Direct Impacts (row 12 - row 13)	0.9	0.0	2.9	9.7	0.0	44.0	146.5	43.4	0.0	0.0	139.5	5.5	25.5	0.0	148.7	0.0	566.5
17	Percent of total SH impacted by NFIP (row 16/cell R3)	0.0%	0.0%	0.0%	0.1%	0.0%	0.5%	1.6%	0.5%	0.0%	0.0%	1.5%	0.1%	0.3%	0.0%	1.6%	0.0%	6.2%
18	Parcels affected by NFIP (row 16/row 8)	3	0	7	16	0	59	340	753	0	0	362	45	61	1	346	0	1,994

19 *The 191 non-Tier-1 ROGO units are split between SPA and Tier 3 based on the relative percentage of parcels. Slight errors due to rounding occur in the calculation of the split allotment of the life of the permit.

20 **Additional associated development is calculated at 0.025 acres per ROGO unit, or the remaining acres of SH habitat that is not being directly impacted, whichever is less.

21

22 **Breakdown of acres outside of the purview of the NFIP**

23	OUTSIDE NFIP	Acres	%
24	Federal	78	10.7%
25	State	17	2.3%
26	CBRA	634	87.0%
27	**Sum**	**729**	**100.0%**

28

29 Table EA-9: Key tree-cactus suitable habitat data, ROGO allowance calculations, and anticiapted impacts. Green cells are data generated by GIS, the remainder of the cells are calculated.

30

	A	B	C	D	E	F	G	H	I	J	K
1	LOWER KEYS MARSH RABBIT	Unincorporated Monroe County (LOWER KEYS ONLY)								County-Wide (SUM)	
2		BPNNK HCP	Tier 0	Tier 1	SPA (Tier 2)	Tier 3	Tier 4	Undesignated Tier	Other		
3	Total acres of Suitable Habitat (SH)	4,298	67	12,110	20	37	1,451	62	1,427	19,472	
4	SH on Conservation Lands	3,626	26	9,466	0	1	588	7	0	13,714	
5	At-risk acres of SH (row 3 - row 4)	672	41	2,644	20	36	863	54	1,427	5,758	
6	At-risk acres of SH outside NFIP	209	20	1,216	0	1	863	10	778	3,098	
7	At-risk parcels	1,298	55	1,869	14	243	62	169	0	3,710	
8	Acres per parcel (row 5/row7)	0.5	0.7	1.4	1.4	0.1	13.9	0.3	0.0		
9	ROGO allotment/year*	n/a	0	3	3	61	0	0	0		
10	ROGO allotment (Life of Permit)	5	0	34	45	787	0	0	0		
11	Acres of ROGO allowable impact (row 10 * row 8)	2.6	0.0	48.1	64.8	115.4	0.0	0.0	0.0	230.8	
12	Maximum impacted acres of SH (lesser of row 5 vs row 11)	2.6	0.0	48.1	20.0	35.6	0.0	0.0	0.0	106.3	
13	Total Acres of impact outside NFIP (row 6/row 5 * row 12)	0.8	0.0	22.1	0.0	0.8	0.0	0.0	0.0	23.7	
14	Non-Federal Acres of Impact Outside NFIP - Cumulative Impacts (row 13 * 0.720)	0.6	0.0	15.9	0.0	0.6	0.0	0.0	0.0	17.1	
15	Additional associated development**	0.1	0.0	0.9	0.0	0.0	0.0	0.0	0.0	1.0	
16	Acres subject to NFIP impact - Direct Impacts (row 12 - row 13)	1.8	0.0	26.0	20.0	34.9	0.0	0.0	0.0	82.6	
17	Percent of total SH impacted by NFIP (row 16/cell J3)	0.0%	0.0%	0.1%	0.1%	0.2%	0.0%	0.0%	0.0%	0.4%	
18	Parcels affected by NFIP (row 16/row 8)	3	0	18	14	238	0	0	0	273	
19	*The 64 non-Tier-1, lower keys ROGO units are split between SPA and Tier 3 based on the relative percentage of parcels. Slight errors due to rounding occur in the calculation of the split allotment of the life of the permit.										
20	**Additional associated development is calculated at 0.025 acres per ROGO unit, or the remaining acres of SH habitat that is not being directly impacted, whichever is less.										
21											
22	**Breakdown of acres outside of the purview of the NFIP**										
23	**OUTSIDE NFIP**	**Acres**	**%**								
24	Federal	866	28.0%								
25	State	13	0.4%								
26	CBRA	2,219	71.6%								
27	**Sum**	**3,098**	**100.0%**								
28											
29	Table EA-10: Lower Keys marsh rabbit suitable habitat data, ROGO allowance calculations, and anticiapted impacts. Green cells are data generated by GIS, the remainder of the cells are calculated.										
30											

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	PROJECTED CAT POPULATIONS (Lower Keys)	Habitat Buffer Lands - Lower Keys Marsh Rabbit (500 meter buffer)														
2		Non-CBRA							CBRA							Buffer Total
3		BPNNK HCP	Tier 0	Tier 1	SPA (Tier 2)	Tier 3	Tier 4	Undesignated Tier	BPNNK HCP	Tier 0	Tier 1	SPA (Tier 2)	Tier 3	Tier 4	Undesignated Tier	
4	Acres of buffer around SH	1,279	102	1,572	103	1,193	60	207	2,013	154	8,515	8	116	2,109	137	17,568
5	Acres of buffer lands in conservation	68	2	339	1	2	0	6	1,591	39	6,935	0	2	560	19	9,562
6	At-risk acres of buffer lands (row 4 - row 5)	1,211	100	1,233	102	1,191	60	201	422	115	1,580	8	114	1,549	118	8,006
7	Vacant at-risk buffer parcels	1,280	11	366	32	1,278	0	202	302	5	189	6	114	0	20	3,805
8	Developed residential buffer parcels	2,643	5	381	53	4,337	0	281	658	5	180	8	310	0	66	8,927
9	Combined existing residential and vacant parcels (row 7 + row 8)	3,923	16	747	85	5,615	0	483	960	10	369	14	424	0	86	12,732
10	Anticipated future residences (factoring in ROGO allotments)	0	0	0	29	496	0	0	0	0	0	2	48	0	0	575
11	HABITAT BUFFER - Buffer lands around the lower keys marsh rabbit suitable habitat by ROGO category, shown as either in the CBRA boundary (CBRA) or outside of the CBRA boundary (Non-CBRA)															
12																
13	Table EA-11a: Lower keys marsh rabbit buffer data, ROGO allowance calculations, and anticiapted buffer impacts. Green cells are data generated by GIS, the remainder of the cells are calculated															
14																

15	PROJECTED CAT POPULATIONS - LKMR (lower Keys)	residences	domestic outdoor cats	associated feral cats	total free-roaming cats	Percent increase
16	Existing	8,927	3,824	4,249	8,074	
17	New residences in habitat (NFIP)	273	117	130	247	3.1%
18	New residences in buffer (NFIP)	525	225	250	474	5.9%
19	Direct Cat Impacts				721	8.9%
20	New residences in CBRA habitat (non-NFIP)	23	10	11	21	0.3%
21	New residences in CBRA buffer (non-NFIP)	50	22	24	46	0.6%
22	Cumulative Cat Impacts				66	0.8%
23						
24	Table EA-11b: Summary of existing residences, expected new residences, and the expected increase in free-roaming cats in the lower keys					
25						

LKMR (See Table EA-10)	Total available ROGO units	Used directly in Habitat (NFIP)	Used directly in Habitat (CBRA)	Remaining	% Buffer lands that are in CBRA	Units to CBRA	Units to non-CBRA
HCP	5	3	2	0	61.1%	0	0
Tier 1	34	18	16	0	84.4%	0	0
SPA	45	14	0	31	6.9%	2	29
Tier 3	787	238	5	544	8.9%	48	496
Sum	871	273	23	575		50	525

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1		Unincorporated Monroe County (UPPER KEYS - North Key Largo)								Unincorporated Monroe County (UPPER KEYS - South Key Largo)								
2	**SCHAUS SWALLOWTAIL BUTTERFLY**	**NH HCP****	**ORC HCP****	**ORC (outside HCP)**	**Tier 0**	**Tier 1**	**SPA (Tier 2)**	**Tier 3**	**Undesignated Tier**	**Tier 0**	**Tier 1**	**SPA (Tier 2)**	**Tier 3**	**Undesignated Tier**	**Islamorada**	**Other**	**County-Wide (SUM)**	
3	Total acres of Suitable Habitat (SH)	2	30	229	68	2,156	0	0	0	17	945	159	141	306	599	349	5,002	
4	SH on Conservation Lands	2	0	105	9	2,123	0	0	0	1	671	6	2	163	157	0	3,240	
5	At-risk acres of SH (row 3 - row 4)	0	30	125	59	33	0	0	0	16	274	153	139	143	442	349	1,763	
6	At-risk acres of SH outside NFIP	0	11	37	58	29	0	0	0	0	25	14	2	0	19	122	317	
7	At-risk parcels	0	75	236	27	73	0	0	0	40	665	316	964	861	1,055	0	4,312	
8	Acres per parcel (row 5/row7)	0.0	0.4	0.5	2.2	0.5	0.0	0.0	0.0	0.4	0.4	0.5	0.1	0.2	0.4	0.0		
9	ROGO allotment/year*	n/a	n/a	n/a	0	3	0	0	0	0	0	16	48	0	28	0		
10	ROGO allotment (Life of Permit)	0	0	0	0	39	0	0	0	0	0	205	627	0	364	0		
11	Acres of ROGO allowable impact (row 10 * row 8)	0.0	0.0	0.0	0.0	17.6	0.0	0.0	0.0	0.0	0.0	99.6	90.4	0.0	152.4	0.0	360.0	
12	Maximum impacted acres of SH (lesser of row 5 vs row 11); E12=E5*0.154	0.0	0.0	19.2	0.0	17.6	0.0	0.0	0.0	0.0	0.0	99.6	90.4	0.0	152.4	0.0	379.2	
13	Total Acres of impact outside NFIP (row 6/row 5 * row 12)	0.0	0.0	5.7	0.0	15.3	0.0	0.0	0.0	0.0	0.0	9.1	1.3	0.0	6.6	0.0	37.9	
14	Non-Federal Acres of Impact Outside NFIP - Cumulative Impacts (row 13 * 0.997)	0.0	0.0	5.7	0.0	15.2	0.0	0.0	0.0	0.0	0.0	9.1	1.3	0.0	6.5	0.0	37.8	
15	Additional associated development***	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	5.1	15.7	0.0	9.1	0.0	30.9	
16	Acres subject to NFIP impact - Direct Impacts (row 12 - row 13)	0.0	0.0	13.5	0.0	2.4	0.0	0.0	0.0	0.0	0.0	90.5	89.1	0.0	145.8	0.0	341.3	
17	Percent of total SH impacted by NFIP (row 16/cell Q3)	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.8%	1.8%	0.0%	2.9%	0.0%	6.8%	
18	Parcels affected by NFIP (row 16/row 8)	0	0	26	0	5	0	0	0	0	0	187	618	0	348	0	1,183	
19	*The 64 non-Tier-1, upper keys ROGO units are split between SPA and Tier 3 based on the relative percentage of parcels. Slight errors due to rounding occur in the calculation of the split allotment of the life of the permit.																	
20	**NH HCP and ORC HCP impact acres are not counted because take for this species was accounted for in the HCP.																	
21	***Additional associated development is calculated at 0.025 acres per ROGO, or the remaining acres of SH habitat that is not being directly impacted, whichever is less.																	
22																		
23	**Breakdown of acres outside of the purview of the NFIP**																	
24	**OUTSIDE NFIP**	**Acres**	**%**															
25	Federal	1	0.3%															
26	State	5	1.6%															
27	CBRA	311	98.1%															
28	**Sum**	**317**	**100.0%**															
29																		
30	Table EA-12: Schaus swallowtail butterfly suitable habitat data, ROGO allowance calculations, and anticiapted impacts. Green cells are data generated by GIS, the remainder of the cells are calculated.																	
31																		

	A	B	C	D	E	F	G	H	I	J	K
1	SILVER RICE RAT	Unincorporated Monroe County (LOWER KEYS ONLY)								County-Wide (SUM)	
2		BPNNK HCP	Tier 0	Tier 1	SPA (Tier 2)	Tier 3	Tier 4	Undesignated Tier	Other		
3	Total acres of Suitable Habitat (SH) - outside of CH	5,765	98	12,089	53	87	208	89	3,358	21,748	
4	SH on Conservation Lands	4,766	49	9,228	0	2	206	5	0	14,256	
5	At-risk acres of SH (row 3 - row 4)	998	49	2,861	53	86	2	84	3,358	7,492	
6	At-risk acres of SH outside NFIP	368	30	1,274	0	2	2	13	1,555	3,243	
7	At-risk parcels	1,525	50	1,689	63	420	2	236	0	3,985	
8	Acres per parcel (row 5/row7)	0.7	1.0	1.7	0.8	0.2	1.1	0.4	0.0		
9	ROGO allotment/year*	n/a	0	3	8	56	0	0	0		
10	ROGO allotment (Life of Permit)	5	0	34	109	723	0	0	0		
11	Acres of ROGO allowable impact (row 10 * row 8)	3.3	0.0	57.6	91.5	147.7	0.0	0.0	0.0	300.0	
12	Maximum impacted acres of SH (lesser of row 5 vs row 11)	3.3	0.0	57.6	53.1	85.8	0.0	0.0	0.0	199.7	
13	Total Acres of impact outside NFIP (row 6/row 5 * row 12)	1.2	0.0	25.6	0.0	1.6	0.0	0.0	0.0	28.4	
14	Additional associated development**	0.1	0.0	0.9	0.0	0.0	0.0	0.0	0.0	1.0	
15	Acres subject to NFIP impact - Direct Impacts (row 12 - row 13)	2.1	0.0	31.9	53.1	84.2	0.0	0.0	0.0	171.3	
16	Percent of total SH impacted by NFIP (row 15/cell J3)	0.0%	0.0%	0.1%	0.2%	0.4%	0.0%	0.0%	0.0%	0.8%	
17	Parcels affected by NFIP (row 15/row 8)	3	0	19	63	412	0	0	0	497	
18	*The 64 non-Tier-1, lower keys ROGO units are split between SPA and Tier 3 based on the relative percentage of parcels. Slight errors due to rounding occur in the calculation of the split allotment of the life of the permit.										
19	**Additional associated development is calculated at 0.025 acres per ROGO unit, or the remaining acres of SH habitat that is not being directly impacted, whichever is less.										
20	Note: There are only 3 acres of at-risk federal lands with suitable habitat (0.1% of the total), therefore the impacts from row 13 are the cumulative impacts										
21											
22	**Breakdown of acres outside of the purview of the NFIP**										
23	**OUTSIDE NFIP**	**Acres**	**%**								
24	Federal	3	0.1%								
25	State	14	0.4%								
26	CBRA	3,227	99.5%								
27	**Sum**	**3,244**	**100.0%**								
28											
29	Table EA-13: Silver rice rat suitable habitat data, ROGO allowance calculations, and anticiapted impacts. Green cells are data generated by GIS, the remainder of the cells are calculated.										
30											

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	PROJECTED CAT POPULATIONS (Lower Keys)	Habitat Buffer Lands - Silver Rice Rat (500 meter buffer)														
2		Non-CBRA							CBRA							
3		BPNNK HCP	Tier 0	Tier 1	SPA (Tier 2)	Tier 3	Tier 4	Undesignated Tier	BPNNK HCP	Tier 0	Tier 1	SPA (Tier 2)	Tier 3	Tier 4	Undesignated Tier	Buffer Total
4	Acres of buffer around SH	1,122	61	559	70	909	0	115	727	126	1,371	8	60	53	25	5,206
5	Acres of buffer lands in conservation	42	0	54	0	1	0	1	500	25	1,012	0	0	39	0	1,673
6	At-risk acres of buffer lands (row 4 - row 5)	1,080	61	504	69	909	0	114	228	101	360	8	60	14	25	3,533
7	Vacant at-risk buffer parcels	1,234	6	266	30	1,130	0	181	274	1	132	4	75	0	13	3,346
8	Developed residential buffer parcels	2,639	2	330	53	3,647	0	233	79	1	45	4	90	0	5	7,128
9	Combined existing residential and vacant parcels (row 7 + row 8)	3,873	8	596	83	4,777	0	414	353	2	177	8	165	0	18	10,474
10	Anticipated future residences (factoring in ROGO allotments)	0	0	0	30	296	0	0	0	0	0	4	19	0	0	349
11	HABITAT BUFFER - Buffer lands around the silver rice rat suitable habitat by ROGO category, shown as either in the CBRA boundary (CBRA) or outside of the CBRA boundary (Non-CBRA)															
12																
13	Table EA-14a: Silver rice rat buffer data, ROGO allowance calculations, and anticiapted buffer impacts. Green cells are data generated by GIS, the remainder of the cells are calculated															
14																

15	PROJECTED CAT POPULATIONS - SRR (lower Keys)	residences	domestic outdoor cats	associated feral cats	total free-roaming cats	Percent increase
16	Existing	7,128	3,054	3,393	6,447	
17	New residences in habitat (NFIP)	497	213	237	449	7.0%
18	New residences in buffer (NFIP)	326	140	155	295	4.6%
19	Direct Cat Impacts				744	11.5%
20	New residences in CBRA habitat (non-NFIP)	25	11	12	23	0.4%
21	New residences in CBRA buffer (non-NFIP)	23	10	11	21	0.3%
22	Cumulative Cat Impacts				43	0.7%

SRR (See Table EA-13)	Total available ROGO units	Used directly in Habitat (NFIP)	Used directly in Habitat (CBRA)	Remaining	% Buffer lands that are in CBRA	Units to CBRA	Units to non-CBRA	Units based on avail parcels
HCP	5	3	2	0	39.3%	0	0	0
Tier 1	34	19	15	0	71.1%	0	0	0
SPA	109	63	0	46	9.9%	4	42	30
Tier 3	723	412	8	303	6.2%	19	284	296
Sum	871	497	25	349		23	326	326

23

24 Table EA-14b: Summary of existing residences, expected new residences, and the expected increase in free-roaming cats in the lower keys

25

	A	B	C	D	E	F	G	H	I	J	K
1	**SILVER RICE RAT CRITICAL HABITAT Constituent Acres Within FR Boundary**	**Unincorporated Monroe County (LOWER KEYS ONLY)**								**County-Wide (SUM)**	
2		**BPNNK HCP**	**Tier 0**	**Tier 1**	**SPA (Tier 2)**	**Tier 3**	**Tier 4**	**Undesignated Tier**	**Other**		
3	Total acres of constituent elements within FR Boundary									8,532	
4	Total acres of protected constituent elements									6,750	
5	Unprotected Constituent Acres Within FR Boundary	0	11	1,283	0	0.4	16	5	466	1,782	
6	Unprotected Constituent Acres Within FR Boundary OUTSIDE NFIP	0	7	628	0	0.4	16	0	301	952	
7	Unprotected parcels	0	9	624	0	1	2	8	0	644	
8	Acres per parcel (row 5/row7)	0.0	1.2	2.1	0.0	0.4	8.1	0.7	0.0		
9	ROGO allotment/year*	n/a	0	3	0	64	0	0	0		
10	ROGO allotment (Life of Permit)	5	0	34	0	832	0	0	0		
11	Acres of ROGO allowable impact (row 10 * row 8)	0.0	0.0	69.9	0.0	317.7	0.0	0.0	0.0	387.6	
12	Maximum impacted acres of SH (lesser of row 5 vs row 11)	0.0	0.0	69.9	0.0	0.4	0.0	0.0	0.0	70.3	
13	Total Acres of impact outside NFIP (row 6/row 5 * row 12)	0.0	0.0	34.2	0.0	0.4	0.0	0.0	0.0	34.6	
14	Non-Federal Acres of Impact Outside NFIP - Cumulative Impacts (row 13 * 0.981)	0.0	0.0	33.6	0.0	0.4	0.0	0.0	0.0	33.9	
15	Additional associated development**	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.9	
16	Acres subject to NFIP impact - Direct Impacts (row 12 - row 13)	0.0	0.0	35.7	0.0	0.0	0.0	0.0	0.0	35.7	
17	Percent of total CH impacted by NFIP (row 16/cell J3)	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	
18	Parcels affected by NFIP (row 16/row 8)	0	0	17	0	0	0	0	0	17	
19	*The 64 non-Tier-1, lower keys ROGO units are split between SPA and Tier 3 based on the relative percentage of parcels. Slight errors due to rounding occur in the calculation of the split allotment of the life of the permit.										
20	**Additional associated development is calculated at 0.025 acres per ROGO unit, or the remaining acres of SH habitat that is not being directly impacted, whichever is less.										
21											

22	**Breakdown of acres outside of the purview of the NFIP**		
23	**OUTSIDE NFIP**	**Acres**	**%**
24	Federal	18	1.9%
25	State	0	0.0%
26	CBRA	934	98.1%
27	**Sum**	**952**	**100.0%**
28			

29 Table EA-15: Silver rice rat critical habitat data, ROGO allowance calculations, and anticiapted impacts. Green cells are data generated by GIS, the remainder of the cells are calculated.

30

NFIP IMPACTS	City of Key West		City of Layton		City of Marathon		Key Colony Beach		Village of Islamorada		Unincorporated Monroe		"Other"		Monroe County - Total		
Species	Impacts (acres)	Suitable habitat (acres)	Impacts (acres)	Suitable habitat (acres)	Impacts (acres)	Suitable habitat (acres)	Impacts (acres)	Suitable habitat (acres)	Impacts (acres)	Suitable habitat (acres)	Impacts (acres)	Suitable habitat (acres)	Impacts (acres)*	Suitable habitat (acres)	Impacts (acres)	Suitable habitat (acres)	Percent impacts (NFIP)
Eastern indigo Snake	376.1	868.6	0.1	0.1	266.0	2,871.0	20.4	20.4	353.5	2,077.0	772.5	51,135.9		8,579.6	1,788.7	65,552.5	2.7%
Key deer											290.6	26,971.9		3,509.9	290.6	30,481.8	1.0%
Key Largo Cotton Mouse											217.8	3,904.1		287.0	217.8	4,191.1	5.2%
Key Largo Wood Rat											217.8	3,904.1		287.0	217.8	4,191.1	5.2%
Key tree-cactus	25.5	48.2	0.0	0.0	158.4	588.5	5.5	5.5	148.6	444.9	249.5	7,683.9		436.3	587.5	9,207.3	6.4%
Lower Keys marsh rabbit											83.6	18,044.7		1,427.5	83.6	19,472.1	0.4%
Schaus swallowtail									154.9	599.0	217.2	4,054.4		349.0	372.1	5,002.4	7.4%
Silver rice rat											172.3	18,389.4		3,358.2	172.3	21,747.6	0.8%
Critical Habitat - Silver rice rat											36.5	1,315.9		466.0	36.5	1,781.9	2.1%
Stock island tree snail	25.5	48.2	0.0	0.0	158.4	588.5	5.5	5.5	148.6	444.9	249.5	7,683.9		436.3	587.5	9,207.3	6.4%

*Other lands are believed to be state-owned as they fall outside of the parcel layer depitcting property ownership. Therefore, they will likely not be subject to the NFIP.

Table EA-16: A summary of the acres of direct impacts from the action as compared to the total acres of suitable habitat available by Keys' community and overall.

CUMULATIVE IMPACTS	City of Key West		City of Layton		City of Marathon		Key Colony Beach		Village of Islamorada		Unincorporated Monroe		"Other"		Monroe County - Total		
Species	Impacts (acres)	Suitable habitat (acres)	Impacts (acres)	Suitable habitat (acres)	Impacts (acres)	Suitable habitat (acres)	Impacts (acres)	Suitable habitat (acres)	Impacts (acres)	Suitable habitat (acres)	Impacts (acres)	Suitable habitat (acres)	Impacts (acres)*	Suitable habitat (acres)	Impacts (acres)	Suitable habitat (acres)	Percent cumulative impacts
Eastern Indigo Snake	267.3	868.6	0.0	0.1	144.8	2,871.0	0.0	20.4	10.4	2,077.0	103.8	51,135.9	118.4	8,579.6	644.7	65,552.5	1.0%
Key deer											33.0	26,971.9	48.4	3,509.9	81.5	30,481.8	0.3%
Key Largo Cotton Mouse											30.5	3,904.1	4.0	287.0	34.5	4,191.1	0.8%
Key Largo Wood Rat											30.5	3,904.1	4.0	287.0	34.5	4,191.1	0.8%
Key tree-cactus	15.5	48.2	0.0	0.0	16.8	588.5	0.0	5.5	0.5	444.9	31.7	7,683.9	6.0	436.3	70.4	9,207.3	0.8%
Lower Keys marsh rabbit											17.1	18,044.7	19.7	1,427.5	36.8	19,472.1	0.2%
Schaus swallowtail									6.5	599.0	31.3	4,054.4	4.8	349.0	42.6	5,002.4	0.9%
Silver rice rat											28.4	18,389.4	46.3	3,358.2	74.8	21,747.6	0.3%
Critical Habitat - Silver rice rat											33.9	1,315.9	6.4	466.0	40.4	1,781.9	2.3%
Stock island tree snail	15.5	48.2	0.0	0.0	16.8	588.5	0.0	5.5	0.5	444.9	31.7	7,683.9	6.0	436.3	70.4	9,207.3	0.8%

*Other lands are believed to be state-owned, and the most likely development use would be for public recreational uses. This use is calculated by Monroe county to be 1.38% of the total land use, therefore, the impacts are estimated at 1.38% of the "Other" lands.

Table EA-17: A summary of the acres of cumulative impacts (areas not subject to NFIP and associated service development) as compared to the total acres of suitable habitat available by Keys' community and overall.

Species	Estimated Acres in Consultation Area	Total Acreage Conserved	Percent Protected	Direct Impact Acres	Cumulative Impact Acres	Estimated Total Impact	Percent Habitat impacted	Species Status
Eastern Indigo Snake	65,552	42,012	64.1%	1,789	645	2,433	3.7%	Declining
Key deer	30,482	20,226	66.4%	291	81	372	1.2%	Stable or Increasing
Key Largo Cotton Mouse	4,191	2,928	69.9%	218	35	252	6.0%	Stable
Key Largo Wood Rat	4,191	2,928	69.9%	218	35	252	6.0%	Declining
Key tree-cactus	9,207	6,449	70.0%	587	70	658	7.1%	Uncertain
Lower Keys marsh rabbit	19,472	13,714	70.4%	84	37	120	0.6%	Declining
Schaus swallowtail	5,002	3,240	64.8%	372	43	415	8.3%	Stable
Silver rice rat	21,748	14,256	65.6%	172	75	247	1.1%	Stable
Critical Habitat - Silver rice rat	8,532	6,750	79.1%	37	40	77	0.9%	---
Stock island tree snail	9,207	6,449	70.0%	587	70	658	7.1%	Uncertain

Table EA-18: Summary of Direct and Cumulative Impacts

Figure 1. The action area for the FEMA's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2010

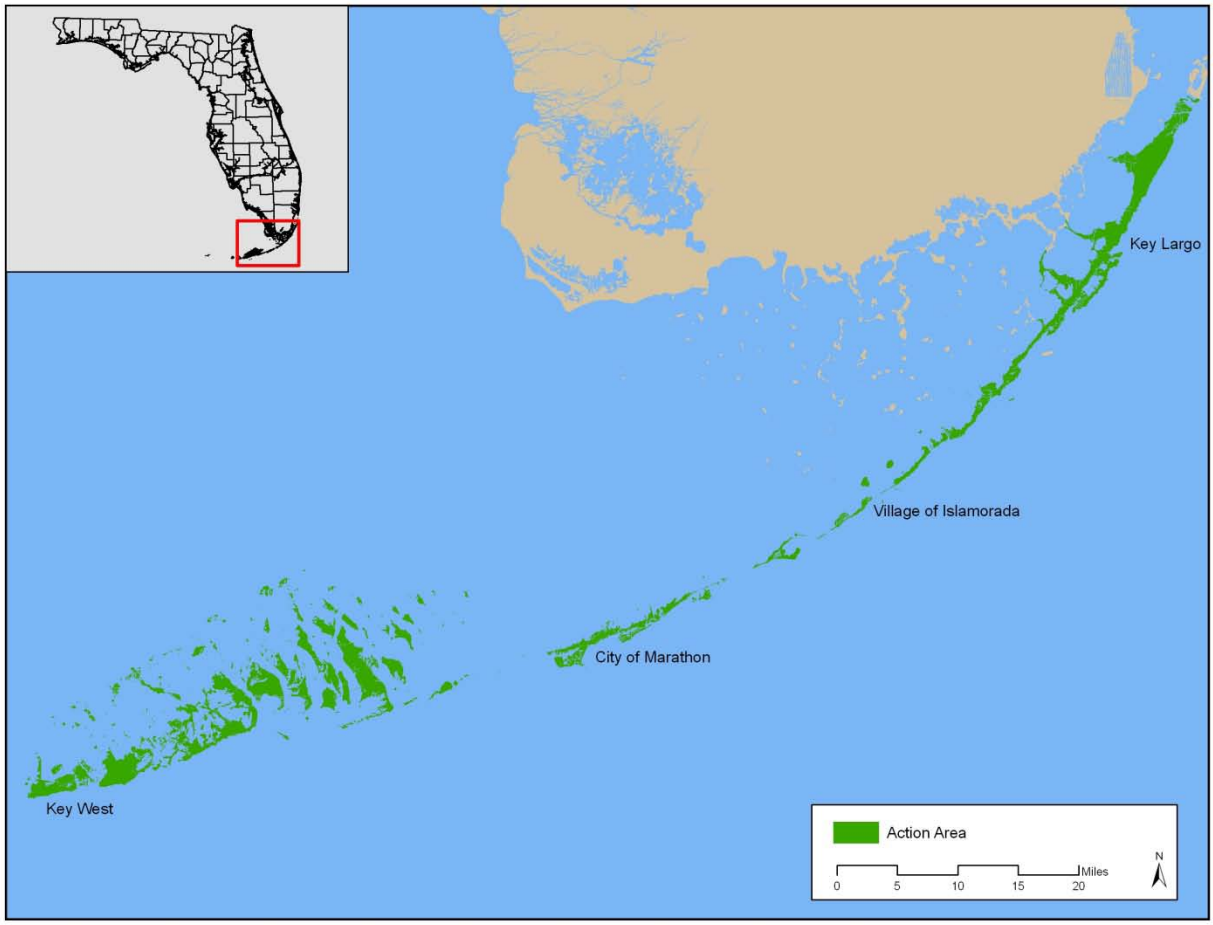

Figure 2. The silver rice rat critical habitat for the FEMA's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2010

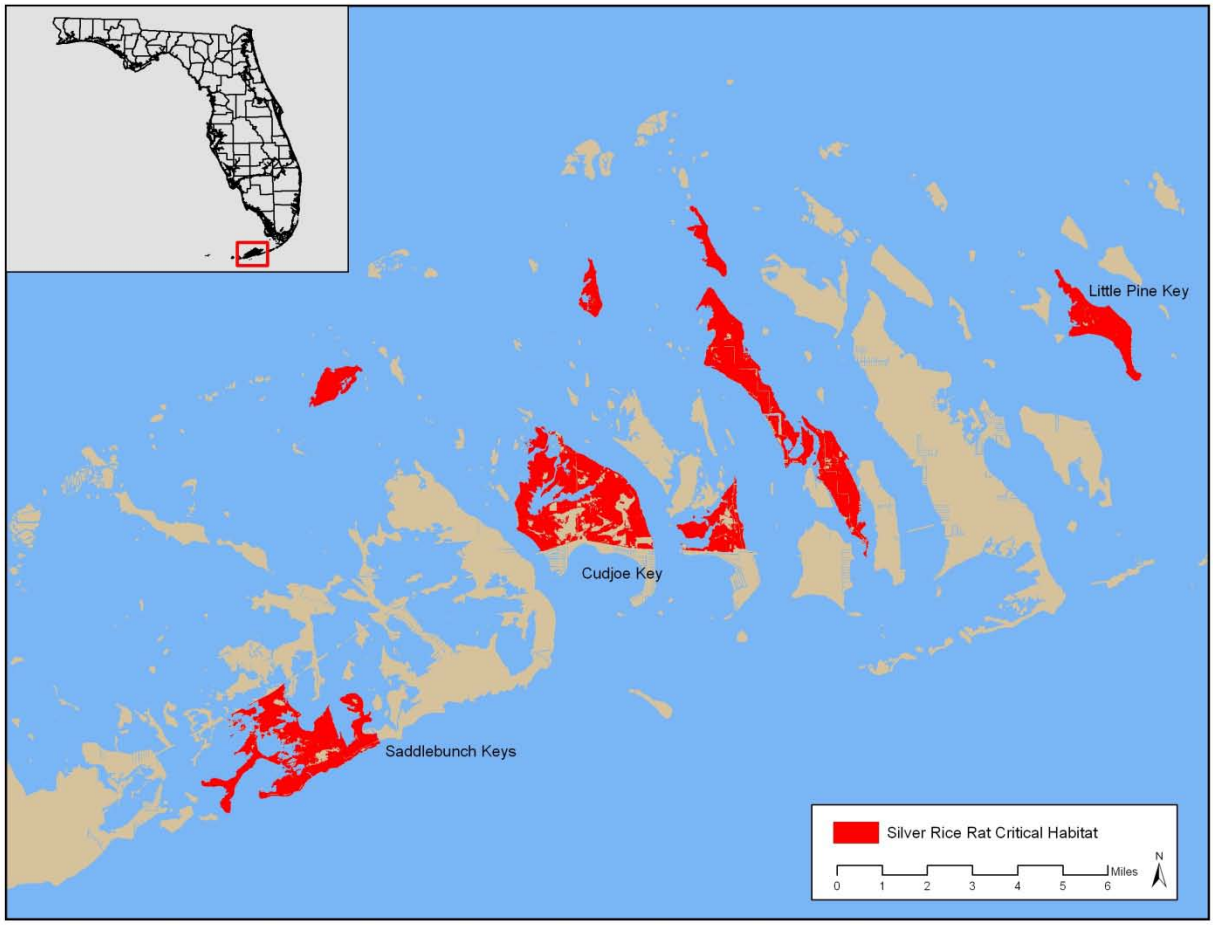

Figure 3. Focus area for the eastern indigo snake for the FEMA's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2010

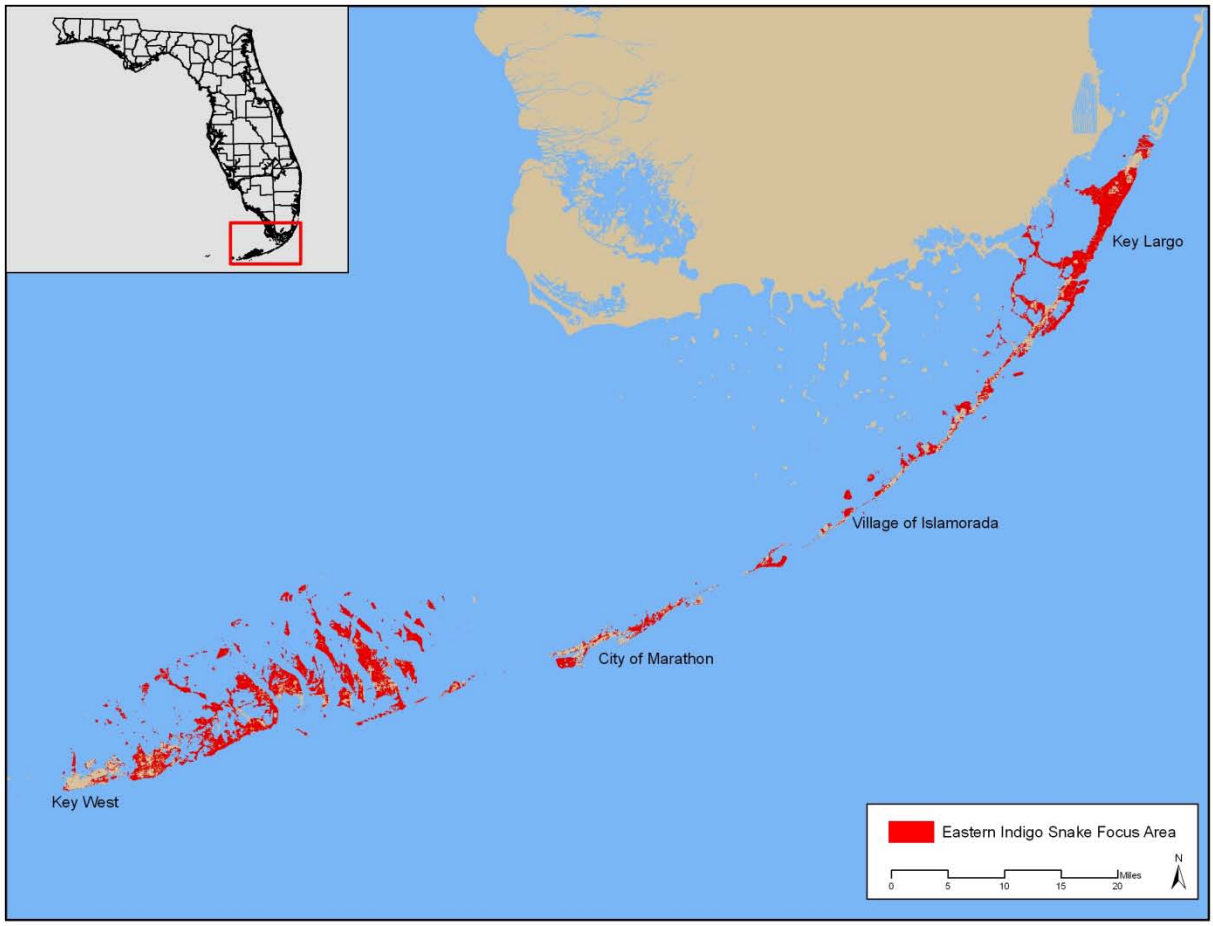

Figure 4. Focus area for the key deer for the FEMA's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2010

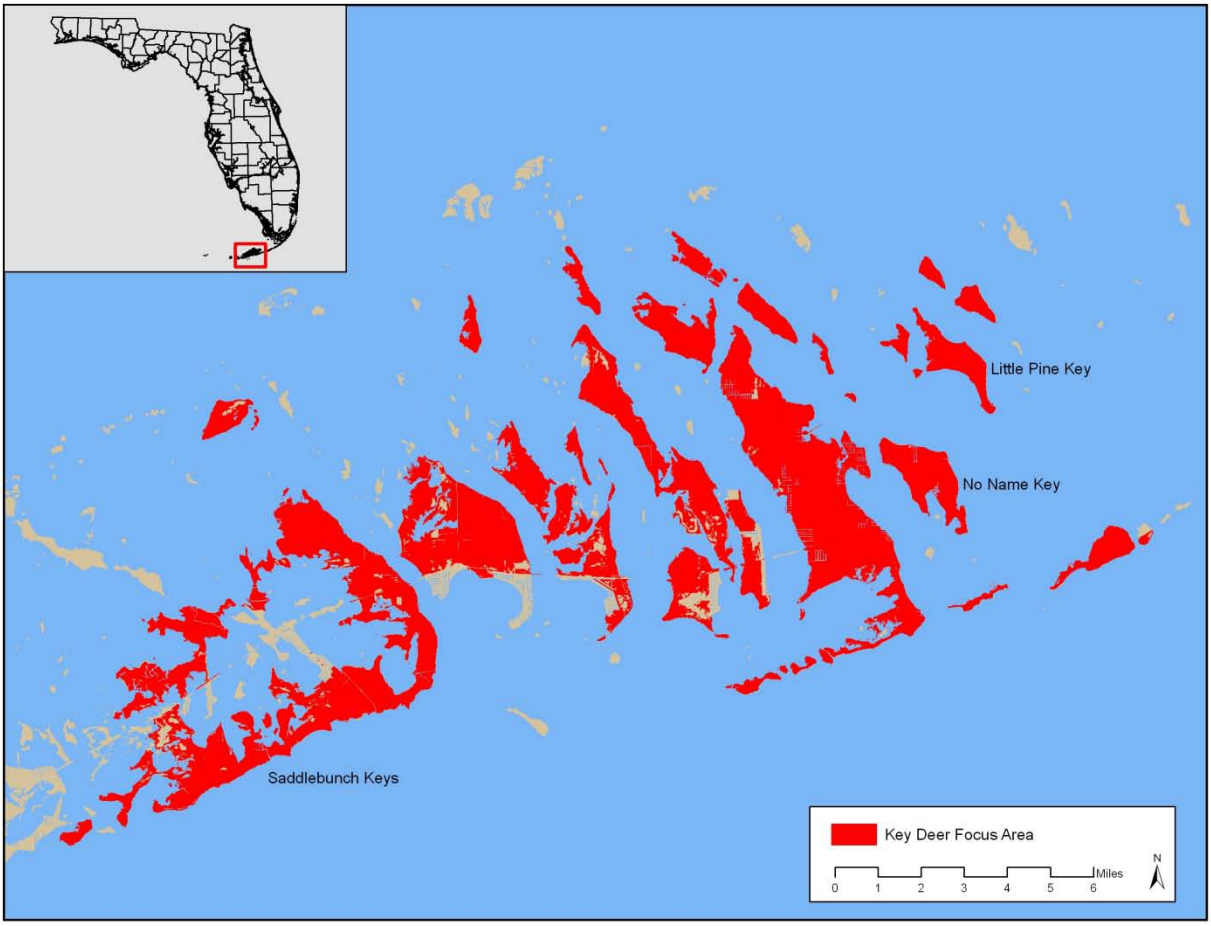

Figure 5. Focus area for the Key Largo cotton mouse for the FEMA's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2010

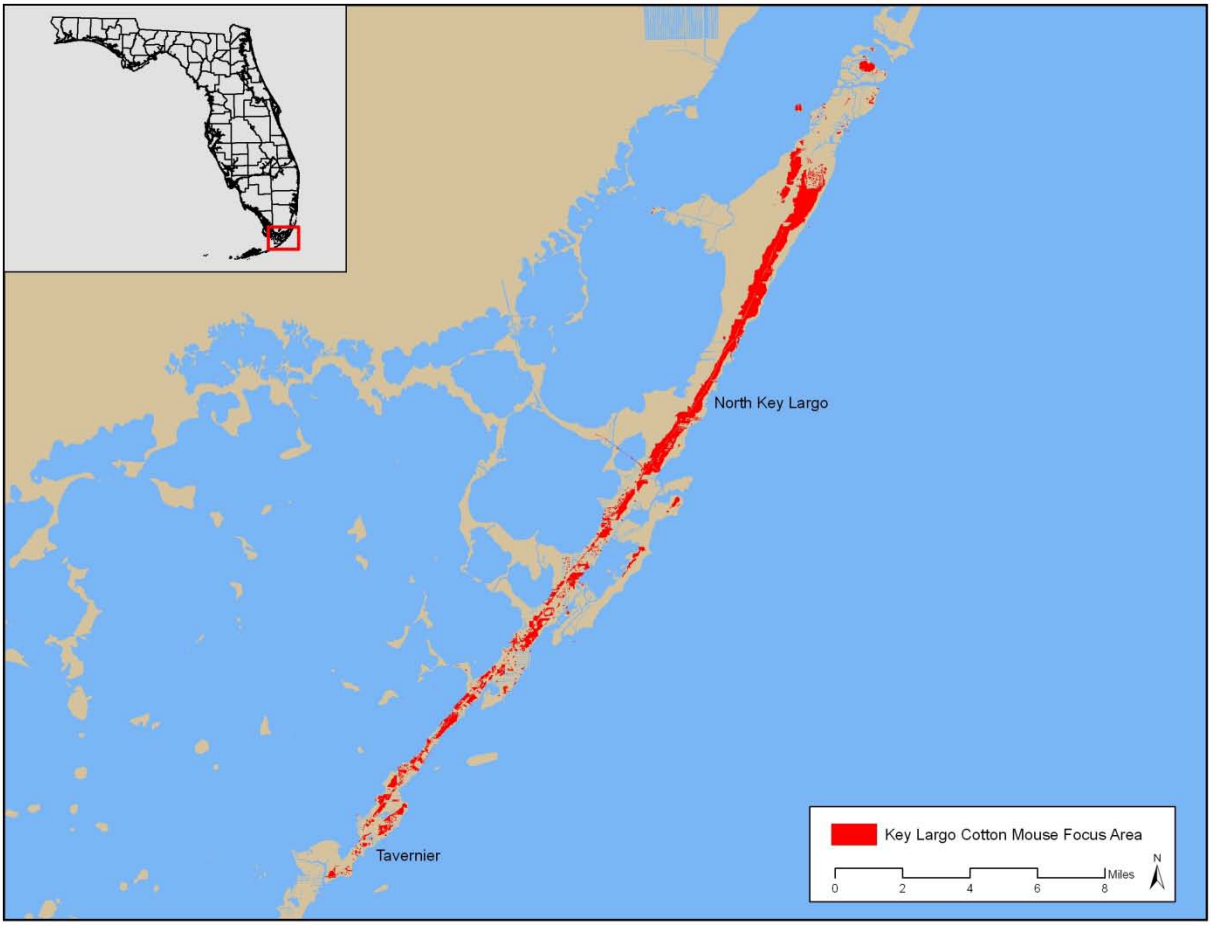

Figure 6. Focus area for the Key Largo woodrat for the FEMA's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2010

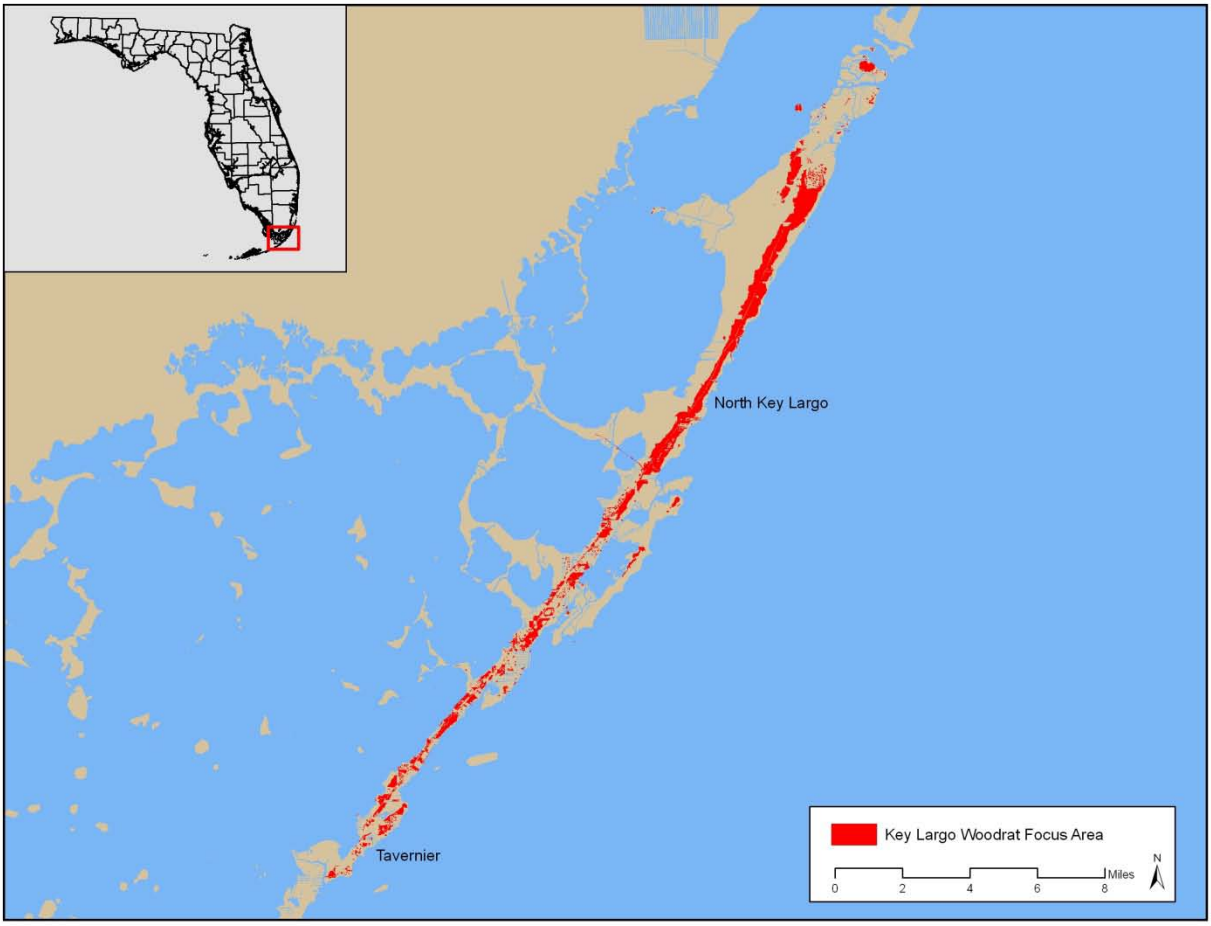

Figure 7. Focus area for the Keys tree-cactus for the FEMA's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2010

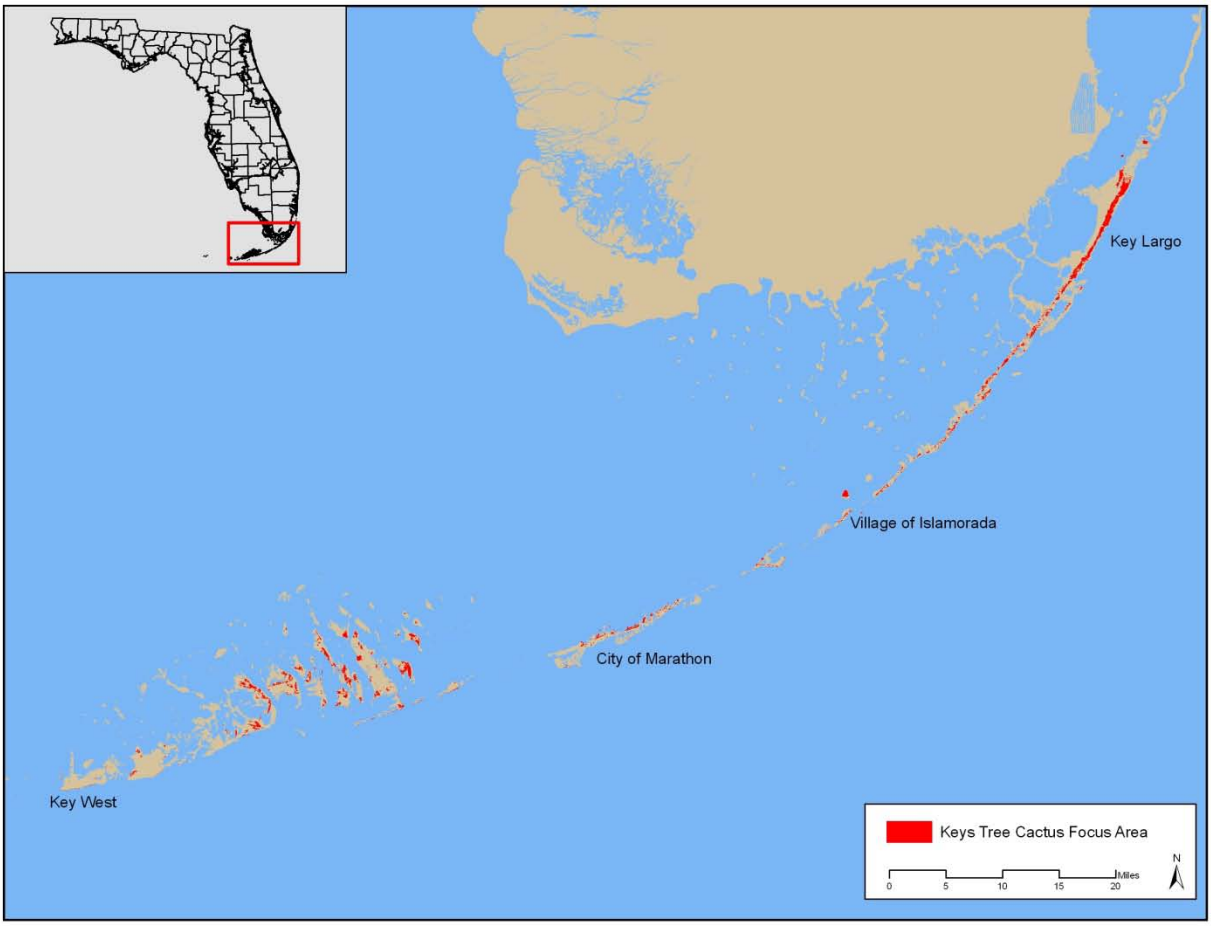

Figure 8. Focus area for the Lower Keys marsh rabbit for the FEMA's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2010

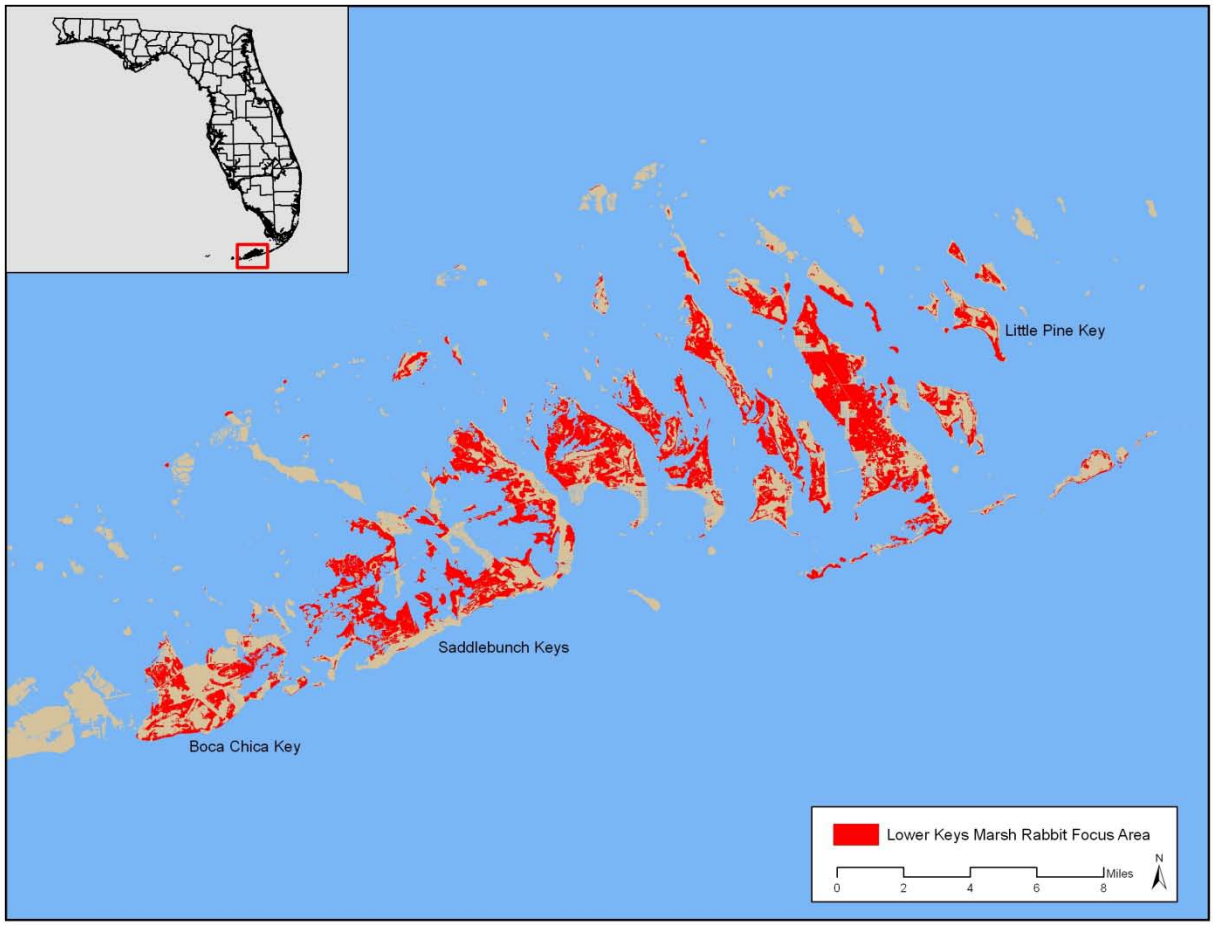

Figure 9. Focus area for the Schaus swallowtail butterfly for the FEMA's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2010

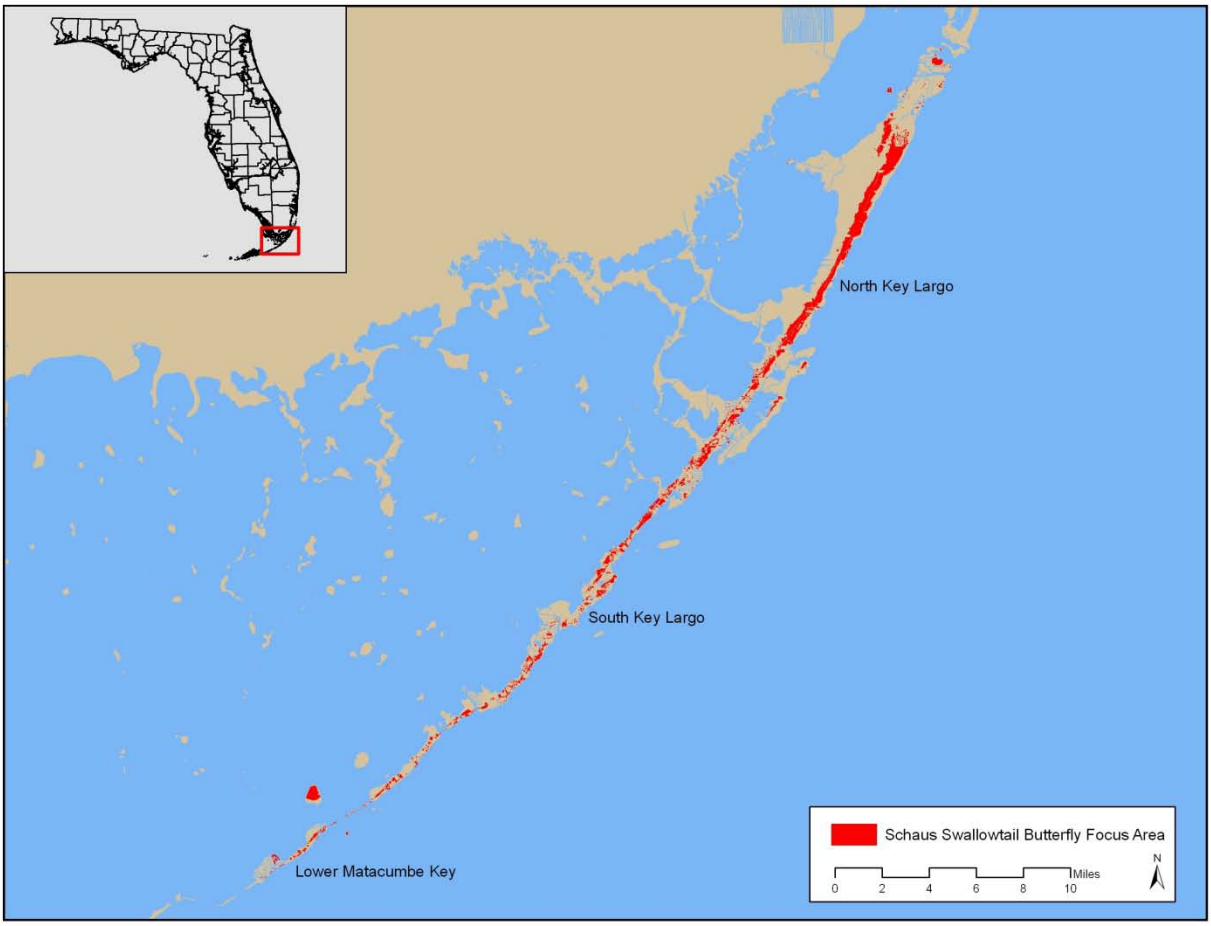

Figure 10. Focus area for the silver rice rat for the FEMA's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2010

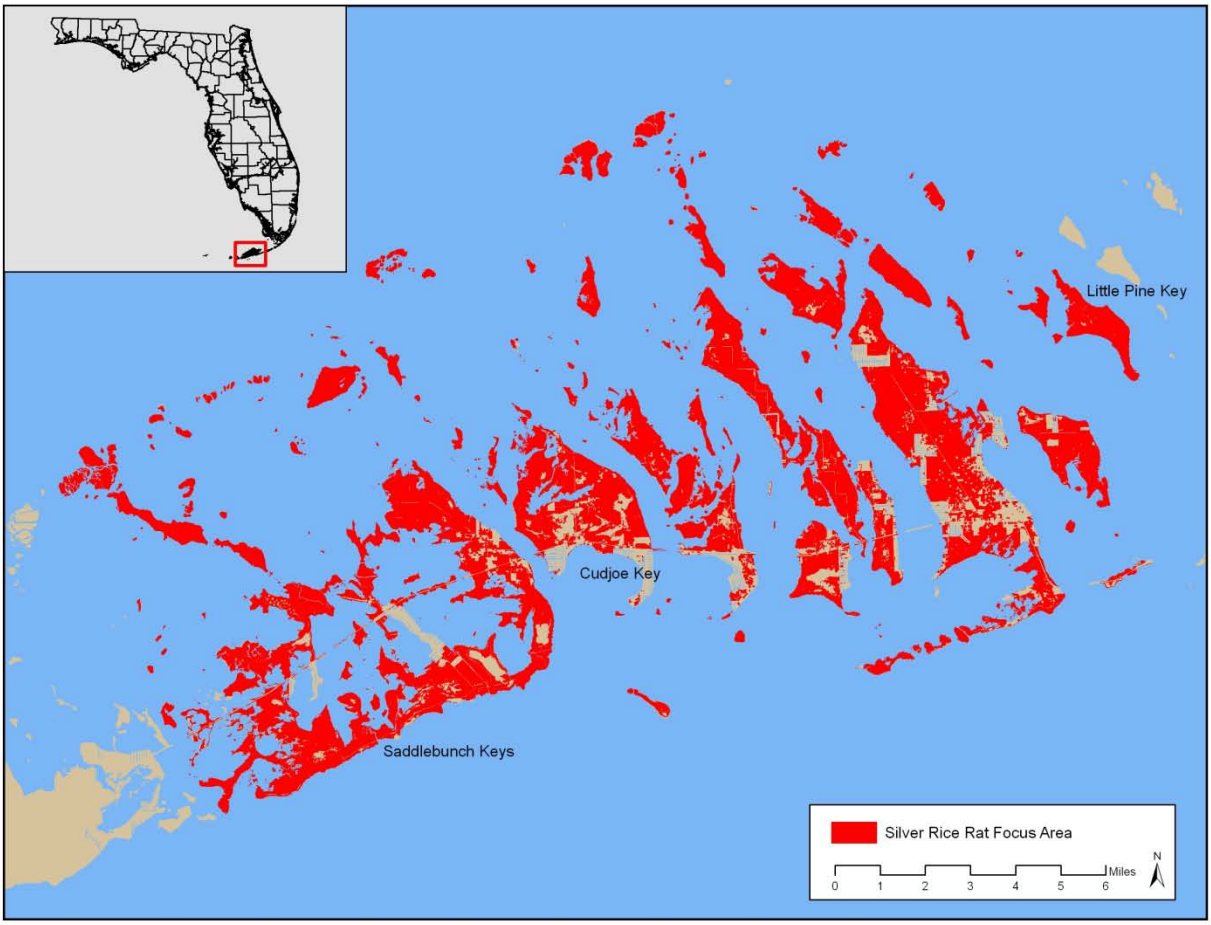
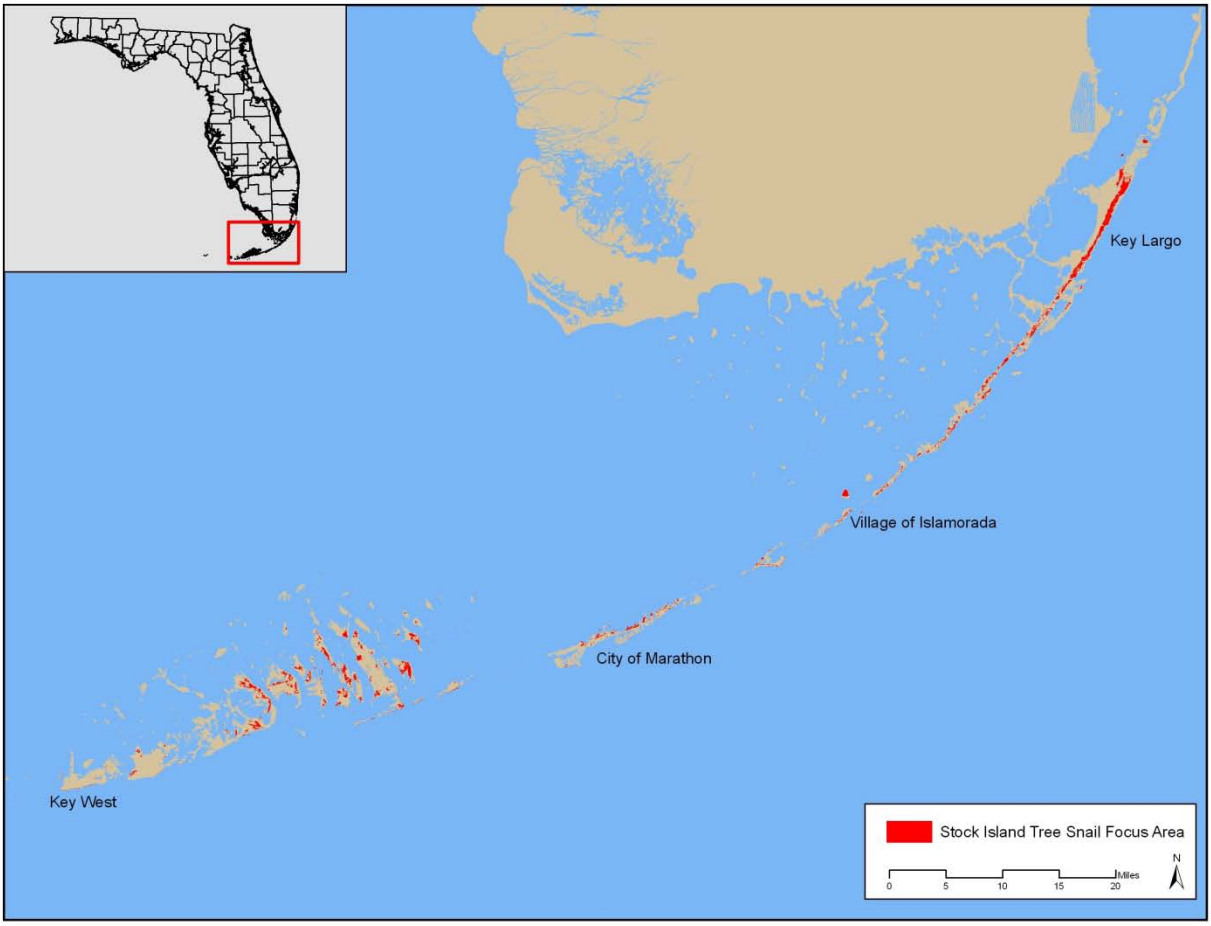
Figure 11. Focus area for the Stock Island tree snail for the FEMA's consultation on their National Flood Insurance Program in the Florida Keys, Monroe County, Florida 2010