United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

May 16, 2007

Memorandum

To: Jeffrey Weller, Chief of Planning and Permitting, Southeast Regional Office
Attention: Victoria Davis

From: Paul Souza, Field Supervisor, South Florida Ecological Services Office

Subject: Biological opinion addressing effects of issuing a recovery permit (TE130177-0) to Nadia Spencer to survey for the Key Largo woodrat and Key Largo cotton mouse and relocate Stock Island tree snails

This document transmits the Fish and Wildlife Service's (Service) biological opinion based on our review of the proposed issuance of a section 10(a)(1)(A) recovery permit to conduct surveys for the endangered Key Largo woodrat (*Neotoma floridana smalli*) (KLWR) and the endangered Key Largo cotton mouse (*Peromyscus gossypinus allapaticola*) (KLCM) within their remaining habitat on Key Largo, Monroe County, Florida. This document also addresses the proposed surveying and relocation of the threatened Stock Island tree snail (*Orthalicus reses reses*) within select habitats on Key Largo. This document is prepared in accordance with section 7 of the Endangered Species Act of 1973, as amended (ESA) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*).

This biological opinion is based on published literature, research reports, the permit application and subsequent correspondence, telephone conversations, field investigations, the captive propagation and reintroduction plan for the KLWR (Service 2003), and other sources of information. A complete administrative record of this consultation is on file at the South Florida Ecological Services Office (SFESO) in Vero Beach, Florida.

Consultation History

On June 22, 2006, Nadia Spencer submitted a recovery permit application to the Service's Southeast Regional Office. Permit number TE 130177-0 was assigned for the proposed survey.

On June 26, 2006, the SFESO received a request from the Southeast Regional Office for formal consultation on the recovery permit mentioned above.

On July 19, 2006, the SFESO contacted the Southeast Regional Office via email to concur that the proposed action was likely to adversely affect the listed species and initiated formal consultation.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The proposed research will occur on Key Largo within the current and historic range of the KLWR and KLCM. KLWR and KLCM will be captured using live traps (vented Sherman traps with raccoon [*Procyon lotor*] proof latches, model number PXLF15). Because the Applicant will be conducting small mammal surveys in various locations, none of which will occur on Federal or state lands, and for an undetermined period of time, Service staff will be notified in writing at least 2 months prior to any trapping event. Once KLWR/KLCM are trapped at a selected area, the Applicant will no longer conduct trapping at that location.

Traps will be baited with a mixture of oats, sunflower seeds, and peanut butter to provide attractive bait for the small mammals. Traps will be set on 4 consecutive nights per trapping session and checked daily no later than 2 hours after sunrise. Traps will remain on-site and baited during the day throughout each trapping event. In the unlikely event that small diurnal mammals, such as the hispid cotton rat (*Sigmodon hispidus*) enter the traps during daylight hours, then the traps will be closed after checking them in the morning and re-opened in the late afternoon. Four trapping events will be conducted annually (fall, winter, spring, summer) for 2 years. The presence of the KLWR/KLCM may be documented in a single trapping period if individuals are captured. However, the absence of these species may only be determined if no individuals are captured for 2 years of consecutive seasonal trapping (8 trapping events total). Therefore, the trapping proposed for this survey will run for 2 consecutive years at quarterly intervals, or until either the KLWR or KLCM is documented to be using the study area. In some instances trapping may only be feasible and practical for shorter durations than outlined above. However, duration of trapping events may be reduced only following prior documented coordination with the Service. Under a reduced trapping duration the Applicant will assume presence of either the KLWR or KLCM.

Trapping data will be recorded daily and shall include the total number of traps set, the total number of traps disturbed (sprung), species captured, and the location of the capture on the trapping array. Data recorded for any small mammal captured will include species, sex, age, weight, and reproductive status. All KLWR and KLCM will be handled as briefly as possible in a humane manner during the time it takes to examine, and identify the mammals. To avoid stress on captured small mammals, trapping will not be conducted when nighttime temperatures are forecast to be below 60° F. In addition, if temperatures are forecast to be in the mid to low 60's, cotton balls will be placed in the trap along with the bait to provide insulation against the bare metal of the Sherman trap. All KLWR and KLCM will be immediately released at the point of capture following the data collection discussed above.

Trap baits can greatly influence the trapping success of small mammals, but can also increase the attractiveness of traps to non-target mammals, such as raccoons, a species known to cause significant trap disturbance in trapping studies of small mammals. If raccoon disturbance becomes a problem using attracting baits such as peanut butter, then the use of these attractants will be discontinued and plain oats will be used. If raccoon disturbance is continuing at a level

that is believed to adversely influence the results of the survey, the Service will be consulted on appropriate action which may include the trapping and removal of raccoons from the study area. Trapping for raccoons will only be conducted in close coordination with the Service. Methods for trapping raccoons and the disposition of any captured animals will be determined by the Service prior to the initiation of any raccoon trapping activities. If any feral cats (*Felis cattus*) are captured during raccoon trapping, the Service will be notified and the cats will be brought to the local animal shelter. Any black rats (*Rattus rattus*) captured during woodrat trapping will be euthanized.

Red imported fire ants (*Solenopsis invicta*) are capable of inflicting serious injury and death on small mammals while restrained in live traps. To avoid the potential injury or mortality of live-trapped small mammals, fire ant control will be initiated prior to and during the entire study period. Extinguish Professional Fire Ant Bait (Extinguish) will be used to exterminate and deter fire ants in the vicinity of the trapping sites. Extinguish uses an insect growth regulation hormone (Methoprene) to control reproduction and reduce fire ant colonies within 8 to 10 weeks following application. All application of Extinguish will follow label instructions.

Extinguish will be broadcast over the entire upland trapping area at the rate of 1.2 to 1.7 grams (g) of product per hectare (1 to 1.5 pounds [lbs] of product per acre) using a hand broadcast spreader. Application will begin 2 months prior to the initiation of trapping, and will continue quarterly throughout the 24-month study period. In addition to broadcast application, all visible fire ant mounds located throughout the study area and on the adjacent roadsides will be treated with 44.4 to 74 milliliters (3 to 5 tablespoons) of Extinguish placed directly onto the fire ant mound.

Surveys for the Stock Island tree snail will be conducted August and September or December and January and only during a rain event. A minimum of two visual surveys, each 30 minutes in duration will be conducted. The surveys will be conducted within at least two of the months specified above. Each 30-minute survey is to be conducted between the hours of 9 AM and 12 PM on each survey date. During each survey, the property Real Estate number and location by Global Position Satellite (GPS) will be recorded. Survey conditions will be noted, specifically, temperature, humidity, precipitation and cloud cover. The number, height, diameter (dbh), and species of trees surveyed (*e.g.* wild tamarind [*Lysiloma latisiliquum*], Jamaican dogwood [*Piscidia piscipula*]) will be noted. The number and species of tree snails observed, number of aggregations, activity (feeding, aestivating, etc), tree species, tree diameter (dbh), height in tree, location in tree (crevice, trunk, fork, etc). Any survey that proves positive for the Stock Island tree snail will be immediately reported to the Service to coordinate possible relocation efforts. Stock Island trees snails will not be relocated until the Service is contacted and has provided details regarding the translocation of the snails, including a translocation site and how the snails are to be moved.

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. The Service has determined that the action area for this project to be Key Largo, Florida.

STATUS OF THE SPECIES AND CRITICAL HABITAT RANGEWIDE

The following information includes descriptions from the South Florida Multi-Species Recovery Plan (MSRP) (Service 1999), as well as recent research and monitoring results. Ongoing research has focused on identifying the cause or causes of recent population declines, and on determining the current distribution and population size for the KLWR and KLCM.

Key Largo Woodrat

Species/critical habitat description

The KLWR was first listed as a threatened species under the Endangered Species Conservation Act of 1969, which afforded it protection on Federal lands. The KLWR was recognized as a candidate for listing in a notice of review on July 28, 1980 (45 FR 49961). The KLWR was listed as endangered for 240 days on September 21, 1983, through an emergency listing action (48 FR 43040), to ensure that it was considered during consultation with the Rural Electrification Administration. The KLWR was proposed for listing as an endangered species with critical habitat on February 9, 1984, (49 FR 4951) and was finally listed as endangered on August 31, 1984 (49 FR 34504). The listing cited habitat modification and development pressure as the primary threats to this species. The proposal to designate critical habitat was withdrawn on February 18, 1986 (51 FR 5746).

The KLWR is a small mammal endemic to the tropical hardwood hammocks of Key Largo, Monroe County, Florida (Schwartz 1952, Sherman 1955). It is a subspecies of the more widely-distributed eastern woodrat (*N. floridana*), which occurs throughout the southeastern United States. While eastern woodrats are locally common in north-central Florida, they do not occur in southern peninsular Florida, and the southernmost occurrence reported in peninsular Florida is from DeSoto County (Greer 1978). The KLWR is geographically separated from the nearest population of eastern woodrats by approximately 241 kilometers (km) (150 miles).

The KLWR is a medium-sized rodent with grey-brown fur on its back, shading into cinnamon coloration on the sides, and cream or white on the underside. The forefeet are white to the wrist, and the hindfeet are primarily white to the ankles. The woodrat has large round ears, large protuberant eyes, and a hairy tail. The head-and-body length ranges from 120 to 230 millimeters (mm) (4.7 to 9.1 inches), with a total length (including the tail) of 250 to 420 mm (9.8 to 16.5 inches). On average, males weigh approximately 258 g (0.57 lbs), and females weigh 210 g (0.46 lbs) (Hersh 1981).

Life History

The KLWR is a resident of tropical hardwood hammocks on Key Largo, which is the climax vegetation of upland areas in the Keys. Hammocks provide a shady, humid microclimate with less wind and temperature variation than more exposed habitats. The soils are poorly developed, typically consisting of shallow humus and litter overlaying the limestone substrate. The hammocks on the Keys are dominated by an overstory 9 to 12 m (29.5 to 39.4 feet) in height and

composed of a variety of tropical species of trees, shrubs, and vines that occur throughout the West Indies. Common overstory species include gumbo limbo (*Bursera simaruba*), pigeon plum (*Cocoloba diversifolia*), poisonwood (*Metopium toxiferum*), and wild tamarind (*Lysoloma latisiliquum*). Understory vegetation is similarly composed of a variety of tropical shrubs.

Vegetative composition and structure influence density and distribution of woodrats by affecting their ability to find food resources, nest materials, and secure cover. KLWRs have been reported to reach their highest densities in the oldest, most mature tropical hardwood hammocks (Barbour and Humphrey 1982, Hersh 1981). However, survey results from the 1990's suggest that rock piles (including junk, building materials, tree-trimming refuse, and coral rock from agricultural and road-building operations) provide sites preferred by woodrats for their burrows and stick piles (Humphrey 1992). Humphrey (1992) indicates that density of small mammals or signs of activity are often very high where trash is piled adjacent to roads, in utility rights-of way and in forest tracts in which surface rock has been piled or windrowed by heavy machinery. McCleery et al. (2006) indicated that KLWR nest in rock and debris piles more readily than other materials. Additionally, Humphrey (1992) suggests that, if not developed, a forest with a variety of seral ages can be suitable to KLWRs. Results of the many recent trapping efforts (2003-2005), have resulted in woodrat captures in various hammock age classes (B. Muiznieks, U.S. Fish and Wildlife Service, personal observation 2005). However, McCleerly et al. (2006) reported the highest levels of capture within young hammock age classes, those 30 years in age of below.

Woodrats construct stick nests, and the availability of sticks and building material appear to be important to allow nest construction. Goodyear (1985) determined that stick nests are not a necessary component of habitat used by woodrats. In recent years, stick nests have not been observed regularly within the hammocks on Key Largo and the reason for their disappearance is currently under investigation.

KLWRs are nocturnal omnivores that feed primarily upon a variety of leaves, buds, seeds, and fruits (Brown 1978a). A variety of tropical fruits that occur in the hammocks is probably the dietary staple. KLWRs probably also consume a variety of invertebrates. As do other woodrat species, KLWRs cache food, such as seeds, for long periods of time.

Both male and female KLWRs are reported to reach sexual maturity at an age of approximately 5 months (Hersh 1981). The gestation period for the KLWR is estimated to be about 37 to 41 days (T. Dean, Service, personal communication 2006), which is similar to the 30 to 37 day gestation reported for the eastern woodrat (Timm et al. 2000). KLWRs can breed year-round, though peaks in productivity appear to occur in the winter, and they may produce two broods annually (Brown 1978a). Captures of pregnant and nursing females suggest a peak in reproductive activity during the summer (Hersh 1981). The litter size in KLWRs ranges from one to four young, with two being the most common. After birth, young probably remain with females for several months, but probably leave the natal territory within 3 to 4 months. The life expectancy for the KLWR remains unknown, but is probably similar to that for the eastern woodrat, with an average life expectancy of approximately 1 year, and a maximum of approximately 3 years (Fitch and Rainey 1956, Goertz 1970).

KLWRs are generally territorial, and both males and females maintain home ranges (Hersh 1981). Overlapping ranges occur more frequently among females than among males, who appear to have low tolerance for one another (McCleery 2003). Home range size is approximately 0.24 ha (0.59 acres) (Hersh 1978), which is similar to that for the eastern woodrat. Nest sites may be focal points of territories. Dispersal patterns and timing remain largely unknown.

Eastern woodrats are believed to be highly susceptible to predation because of their moderate size and terrestrial mode of life (Rainey 1956). For the same reasons, KLWRs are vulnerable to predation from such potential predators as red-shouldered hawks (*Buteo lineatus*), bobcats (*Lynx rufus*), corn snakes (*Elaphe guttata*), diamondback rattlesnakes (*Crotalus adamanteus*), eastern indigo snakes (*Drymarchon corais couperi*), Florida black racers (*Coluber constrictor priapus*), Keys rat snakes (*Elaphe obsoleta deckerti*), barn owls (*Tyto alba)*, raccoons, and feral and domestic cats (*Felis domesticus*). Natural and increased levels of predation pose a major threat to the survival of these rodents. The drastic decline of Allegheny woodrats in Pennsylvania was attributed primarily to predation by great horned owls (*Bubo virginianus*) and exposure to raccoon roundworms (*Baylisascaris procyonis*) (Balcom and Yahner 1996).

Population Dynamics

Eastern woodrats appear to be more limited by availability of shelter than by food, and the same may also be true for KLWRs. The destruction of hammock trees can directly affect the KLWR's ability to build its large stick nests which provide a place for shelter, nesting, feeding, and breeding. The availability of stick nest material and ground cover may be essential for KLWR survival. Loss of hammock trees also results in the loss of arboreal habitat used by this species. Sufficient available habitat is also necessary for the development of social interactions and systems of organization (Kinsey 1977). Where shelter is sparse and stick nests are limited, territorial and competitive behaviors are exhibited more frequently. These behaviors result in a breakdown of social organization and aggressive behaviors that may result in death or casting out of subordinate animals (Kinsey 1977, McClure 1981). The majority of currently known KLWR nests occur within rock/rubble piles or old debris piles (i.e. boats, refrigerators, discarded concrete) and to a lesser degree in stick nests or nests with obvious stick piling (C. Winchester University of Georgia, personal communication 2006).

Although woodrats are omnivorous, habitat destruction or degradation directly affects food resources and the ability of woodrats to forage. Without adequate nutrition, reproductive behaviors may be impaired. Under normal conditions, some small mammal mothers expend lactation energy equally between male and female offspring, but when food resources are limited, the mothers tend to a greater bias for nursing female young over males (McClure 1981). When KLWR mothers are faced with limited food resources, they may respond similarly by either favoring female offspring, or reducing the fitness of large litters. Either way, a reduction in fitness in the young may be a maternal response to adverse environmental conditions (Sikes 1995).

Physical separation caused by habitat loss and fragmentation leads to increased difficulty locating a mate and can isolate populations. Any lack of recruitment of juveniles into the population will result in a decline of the population. Small, isolated populations are subject to inbreeding depression, which can cause populations to decline over time. An increase in urbanization also results in an increase in the need for roads that separate and fragment habitats. The KLWR requires a minimum habitat size for daily activities, and habitat destruction can directly reduce home range size and disrupt movement and dispersal patterns. The hammocks on north Key Largo are bisected by a high-speed road (CR-905), which disrupts the integrity of the hammocks and causes road mortality of dispersing woodrats.

The apparent decline in the woodrat population has been dramatic, and there is no evidence that the population is recovering. During the period of greatest decline, there was almost no loss of tropical hardwood hammock habitat on upper Key Largo. To date, the cause or causes of the decline remain poorly understood.

Status and Distribution

Efforts to monitor the status of the KLWR population began in the 1970s and have continued intermittently (Frank et al. 1997). Past studies and monitoring efforts indicate that the KLWR population has experienced a substantial decline sometime in the late 1980s and early 1990s (Frank et al., 1997).

Key Largo woodrat densities on north Key Largo have been variously estimated at 1.2 animals per ha (Brown 1978a), 2.2 per ha (Barbour and Humphrey 1982), 2.5 per ha (Hersh 1981), and 7.6 per ha (Humphrey 1988). The large differences in the density estimates of Barbour and Humphrey (1982) and Humphrey (1988) apparently result from differences in sampling techniques. The methods used by Humphrey (1988) are statistically based and may provide the most reliable estimate of population densities. Overall, Key Largo woodrat populations occurred in low densities (Barbour and Humphrey 1982). Both male and female densities follow a similar pattern of gradual increase in late summer to early fall (Hersh 1981). Populations adjacent to housing complexes usually have much lower densities (3.1 per ha), than areas removed from development (12.2 per ha).

Goodyear (1985), Frank et al. (1997), Keith and Gaines (2002), McCleery (2003), and McCleery et al. (2006) all conducted trapping along transects or grids that were widely distributed throughout hammock vegetation on north Key Largo. Goodyear (1985) reported that KLWRs were present on 30 of the 45 transects (67 percent) where they trapped. Frank et al. (1997) reported KLWR presence on 14 of the 41 transects (34 percent) where they trapped. Keith and Gaines (2002) reported the presence of KLWRs on 21 of 35 transects sampled from 1997 to 1999. McCleery (2003) placed traps in 60 randomly-placed trapping grids on north Key Largo in 2002 and trapped KLWRs on only 10 (17 percent) of them. Since intensive trapping of KLWRs began in 1976 (Hersh 1981), trap success has declined. In 1976, the average number of trap nights required to capture one KLWR was only 15, compared with 250 in 2001 (McCleery 2003).

Barbour and Humphrey (1982) conducted a status survey in 1979 and estimated that there were 3,666 KLWR stick nests and 645 individual KLWRs over an area of 90 ha (222 acres). The largest decline appears to have occurred between 1986 and 1995, when no KLWR monitoring was conducted, and the population appears to have continued this decline since 1995. McCleery et al. (2006) reported estimates 106 and 40 individual woodrats during 2002 and 2004, respectively. In 2005, a combined trapping effort by Service biologist B. Muiznieks and graduate student C. Winchester (University of Georgia) yielded 88 individual woodrats captured in 2005. While data on current population estimates appears variable, these data do continue to indicate a decline in species density from historic levels. The population may have declined to the point where extinction is likely (Frank et al. 1997), and even if limiting factors are ameliorated, it will be many generations before the population size rebounds.

The KLWR is restricted to the northern one-third of Key Largo and is separated from other United States woodrat populations by the southern third of the Florida peninsula (Hersh 1981). Key Largo is the first and largest of the chain of keys or islands of the Florida Keys. Woodrats formerly occurred throughout uplands on all of Key Largo, but are now restricted to tropical hardwood hammocks on north Key Largo, representing about one-half of their original distribution (Brown 1978a, 1978b; Barbour and Humphrey 1982). Key Largo woodrats were once believed to be restricted to mature hammocks, but are now known to use a variety of microhabitats within tropical hardwood hammocks.

Schwartz (1952) captured woodrats near Rock Harbor in the southern portion of Key Largo, though attempts to collect them there in recent years have been unsuccessful (Barbour and Humphrey 1982). Goodyear (1985) also trapped woodrats slightly outside the range delineated by Barbour and Humphrey (1982), documenting their presence in the Garden Cove area northeast of the U.S. Highway 1 – CR-905 intersection. A population of KLWRs was introduced and established in 1970 on Lignumvitae Key (Brown and Williams 1971, Barbour and Humphrey 1982), but that population was considered to be extirpated by 1997 (Frank et al. 1997).

Much of the original tropical hardwood hammock on Key Largo was cleared in the past for development or agriculture, and the southern portion of Key Largo is nearly completely developed. Habitat loss and fragmentation have caused the isolation of KLWR populations, and make the KLWR more vulnerable to natural catastrophes such as hurricanes or fire, both of which have damaged significant portions of north Key Largo hammocks.

Effects of residential housing and commercial construction activity in tropical hardwood hammocks have been more extreme in the Upper Keys than in the Lower Keys. By 1991, 41.2 percent of the deciduous seasonal forests (1,985 ha) had been either cleared or filled to meet human needs (Strong and Bancroft 1994). Although much of northern Key Largo is protected, there are still areas where development could occur, and southern Key Largo has experienced extensive habitat destruction and fragmentation.

The KLWR historically occurred throughout the forested uplands of Key Largo, but is currently restricted to approximately half of its historical range, now occurring only north of the

U.S. Highway 1 – CR-905 intersection. The decline in its range and its apparent extirpation from Key Largo south of the U.S. Highway 1 – CR-905 intersection has been generally attributed to land clearing followed by residential and commercial development (Brown 1978a, 1978b; Hersh 1981). Habitat loss and fragmentation are the primary threats. Hammock vegetation on Key Largo has been removed or thinned by construction practices that remove all vegetation, then grade and fill the limestone substrate. In addition to land clearing practices, there are other threats to the hardwood hammock habitat resulting from human encroachment that also indirectly affect the woodrat. Increasing habitat fragmentation, combined with a decreased range, makes the KLWR more vulnerable to genetic isolation, and to natural catastrophes such as hurricanes or fire (Service 1993).

Remaining hardwood hammock habitats are critical for the survival of the KLWR. Brown (1978b) estimated that only about 120 to 160 ha (297 to 396 acres) of hammock suitable for woodrats remained on north Key Largo. Barbour and Humphrey (1982) estimated that 475 ha (1,174 acres) remained there, supporting an estimated 654 woodrats. Humphrey (1988) estimated that 851 ha (2,103 acres) of remaining forest supported average densities of 3.1 woodrats per ha. McCleery et al. (2006) and other ongoing monitoring studies on Key Largo have since reported population estimates of 40 to 106 individuals, suggesting the a substantial decrease in KLWR numbers following a high point in the mid-1980's.

Hurricanes influence vegetational succession in the Florida Keys. Undisturbed hammocks are presumably more resistant to storms than hammocks that have been fragmented or have had surrounding mangrove and transitional vegetation removed. In August 1992, Hurricane Andrew hit Elliott Key, a few miles north of north Key Largo. The northern one-third of Key Largo suffered the most extensive damage, with about 240 to 280 ha (593 to 692 acres) affected. The area of greatest impact, comprising about 80 ha (198 acres), suffered 70 percent canopy loss.

The majority of high quality hammock habitat available for KLWRs on north Key Largo has been protected through acquisition and management by the Service and State of Florida. CLNWR was acquired in 1980, and KLHSBS was acquired in 1982. Approximately 880 ha (2,175 acres) of the remaining 1,011 ha (2,498 acres) of tropical hardwood hammock are protected within the boundaries of these two sites, and acquisitions continue. Many tracts on these two sites were cleared for development or agriculture earlier this century, but hammock vegetation has returned in many areas. The remaining forest is now composed of a variety of successional stages of tropical hardwood hammock vegetation, reflecting the time since disturbance. As a result of these efforts and current land use regulations in place by Monroe County, the threat of occupied habitat loss from development on northern Key Largo is low.

The Service (1999) identified a variety of potential threats to the KLWR, including habitat modification, predators, competition, trash dumping, poisoning, and others. However, the specific mechanisms responsible for the decline of the KLWR have not been identified. A number of possible threats exist, including the following.

Several exotic species have colonized north Key Largo and may be impacting KLWR populations. Fire ants and free-roaming cats are both likely to kill KLWR under some circumstances, and the black rat may be a competitor for resources.

Fire ants have been identified as a threat to small mammals (Killion and Grant 1993), ground-nesting birds (Allen et al. 1995), and other species. Newborn or hatching animals are susceptible to being killed by fire ants, as well as any confined animal (Vinson 1997). Fire ants would not normally pose a threat to adults that are capable of escaping.

Free-roaming cats almost certainly would pursue and kill KLWRs if the opportunity arose (Churcher and Lawton 1987, Hawkins et al. 1999, Castillo 2001). Cats have been observed within the tropical hardwood habitats where the KLWR occurs (B. Muiznieks, Service, personal communication, 2005). Clarke and Pacin (2002) report that between 1995 and 1999 a managed cat colony consisting 500 to 1000 individuals has been maintained at the Ocean Reef Club on the north end of Key Largo. This location is immediately adjacent to tropical hardwood hammock habitats that at one time supported the KLWR.

Black rats are recent invaders of north Key Largo. They are potential competitors with the KLWR, and have been cited as a potential threat by several researchers (Hersh 1981; Sasso 1999). Although actual debris may not greatly affect the KLWR, trash dumping may encourage invasion by black rats. However, black rat populations appear to have also declined. Although Hersh (1981) reported that black rat densities sometimes were equal to or greater than KLWR densities, few black rats have been captured in recent years (Sasso and Gaines 2002), and the black rat population appears to have declined substantially. Rodent control agents used for black rats or Norway rats also pose a threat to the woodrat (Service 1993).

Long-term habitat impacts resulting from development-related disturbance in the 1960s and 1970s degraded habitat conditions on Key Largo. The permanent loss of habitat on the southern end of Key Largo, and the clearing of large areas within the northern portion of Key Largo may have resulted in changes in habitat structure, vegetation species composition, or other characteristics. There is little information on forest characteristics prior to development impacts on Key Largo, and it is consequently difficult to evaluate this potential threat.

The Florida Keys Electric Cooperative removed 108 tons of debris from the right-of-way along CR-905 in 1993 and 1994 (D. Shaw, Florida Keys Electric Cooperative, personal communication, 2004). In hindsight, this action may have reduced the structural complexity that KLWRs may rely on for shelter from predators. The virtual absence of free-standing stick nests and the occupation of many of the remaining refuse piles within the hammock may support this idea. Natural runways in the form of fallen logs may be reduced compared to natural historical forest structure. Hersh (1981) suggested that runways are a key habitat component for the KLWR.

Successional changes towards more mature habitat may have detrimentally altered KLWR habitat. Management of the remaining tropical hardwood hammock on Key Largo has focused on maintaining the climax community conditions of mature hammock vegetation. This habitat

type has consistently been reported as the "preferred" habitat of both the KLWR and the KLCM (Barbour and Humphrey 1982, Goodyear 1985). However, the natural disturbance regime for this vegetative community may be important in maintaining conditions favorable for KLWRs. Within mature hardwood hammocks in their current condition, there may be insufficient natural materials available for KLWR to maintain nest structures or refugia.

Many of the above threats may affect or have affected the KLWR populations. While each of these factors alone may not have substantially affected the KLWR population, the cumulative effects of the various threats may result in severe consequences. Previous loss of large areas of tropical hardwood hammock and reduction in KLWR population size may also have detrimentally affected the demography, genetics, or population structure of the KLWR. These affects may not have manifested themselves until many years after the initial impacts occurred.

A captive KLWR breeding population was established in April 2002, when a juvenile male and a juvenile female were brought to Lowry Park Zoo, in Tampa, Florida. In 2005, captive propagation efforts expanded when the captive population at Lowry Park Zoo was split, and 11 KLWRs were transferred to Disney's Animal Kingdom, in Orlando, Florida, to found a second captive population. Since the inception of captive propagation program, a total of 17 wild-caught KLWRs have been brought into captivity for the purpose of captive propagation, and 33 KLWRs were born in captivity. Several deaths of captive KLWRs have occurred, and at the end of 2006, 28 individuals (4 wild-caught and 24 captive born) remained in captivity. Successful reproduction in captivity appears to be a primary factor limiting the captive population. During 2005, there were no KLWR births in captivity, despite well over 100 captive breeding attempts. In 2006, there were 6 successful births in captivity, but it appears that intensive efforts are sometimes required to successfully breed KLWRs in captivity.

Key Largo Cotton Mouse

The KLCM was recognized by the Service in a notice of review on July 28, 1980, (45 FR 49961). It was listed as endangered for 240 days on September 21, 1983, through an emergency listing action (48 FR 43040). The emergency listing was necessary to provide full protection during Service consultation on a loan from the Rural Electrification Administration to the Florida Keys Electric Cooperative. The loan was to upgrade electrical delivery capability, potentially accelerating residential development on north Key Largo. The KLCM was proposed as endangered with critical habitat on February 9, 1984 (49 FR 4951) and was listed as an endangered species on August 31, 1984 (49 FR 34504). The listing cited habitat modification and development pressure as the primary threats to this species. The proposed critical habitat was withdrawn on February 18, 1986 (51 FR 5746).

Species/Critical Habitat Description

The KLCM is a subspecies of the cotton mouse (*Peromyscus gossypinus*) that occurs throughout much of south Florida and the southeastern United States. The Key Largo subspecies is larger and more reddish in color than other subspecies of cotton mice from peninsular Florida. The pelage is red dorsally, with dusky brown sides and white underparts, and the tail is bicolored,

darker brown on top and whiter underneath. They range in length from 170 to189 mm (6.7 to 7.4 inches) (Service 1999).

Life History

The KLCM is omnivorous and feeds on a wide variety of fruits, seeds, and invertebrates (Brown 1978b). Over 70 percent of the tropical hardwood hammock trees and shrubs produce fruits and berries that may provide important food items for the KLCM.

The KLCM builds leaf-lined nests in logs, tree hollows, and rock crevices. Occupied holes measure 3 to 9 centimeters in diameter, are often partially covered by leaves or bark, and may be located at the bases of trees and near or in woodrat nests (Goodyear 1985).

The KLCM is capable of breeding year-round and may rear 2 to 3 litters per year, with an average of four young per litter (Brown 1978b). The average life expectancy is approximately 5 months, with a potential longevity of 2 to 3 years. The reproductive strategies of the KLCM have not been well documented, and it is unknown if there are seasonal fluctuations in reproductive output. Other Florida populations of cotton mice have high reproduction in the fall and early winter (Bigler and Jenkins 1975, Smith and Vrieze 1979) and reproduction may be affected by agonistic behavior by males or decrease in food supply (Smith 1982, Smith et al. 1984). Cotton mice in the Everglades exhibit highly variable breeding patterns (Smith 1982).

The KLCM can move at least 2 km (1.2 miles) in 1 to 2 days (Service 1999). Males have larger home ranges than females, and home ranges overlap because cotton mice do not defend territories (Service 1999).

Population Dynamics

The KLCM is an endemic subspecies that formerly occupied hardwood hammock forests on all of Key Largo, Monroe County, Florida. Historically, it was found as far south as Plantation Key, near Tavernier (Layne 1974, Brown 1978a, 1978b), but it is currently restricted to hammocks on the northern portion of Key Largo (Humphrey 1992). Attempts to collect the cotton mouse in southern Key Largo have been unsuccessful in recent years and it is now restricted to that portion of the Key north of the U.S. Highway 1 – CR-905 intersection (Brown 1978a, 1978b; Barbour and Humphrey 1982). This area is commonly referred to as north Key Largo. The KLCM was introduced to Lignumvitae Key in 1970 (Brown and Williams 1971), but was apparently unable to successfully establish a population.

The KLCM uses a variety of tropical hardwood habitats including recently burned, early successional, and mature hammock forests, and glasswort (*Salicornia*)-bearing coastal strands (sparsely-vegetated saline mud flats) adjacent to these forests (Humphrey 1992). Hammocks provide a shady, humid microclimate with less wind and temperature variation than more exposed habitats.

The KLCM is restricted to the northern portion of Key Largo and relies on the availability of natural cover for refugia and nest sites. Observations of animals released from traps suggest that they seek cover in limestone crevices, within hollow logs, and other cover. These features are relatively abundant in most of the tropical hardwood hammocks on Key Largo and are probably not limiting. Barbour and Humphrey (1982) report that KLCM occurred at lower densities in medium-aged forest than in mature forest, but Frank et al. (1997), Goodyear (1985), and others, report capturing the KLCM in habitats ranging from mature hammock to recently burned early successional sites and uniform glasswort distribution. These data suggest that KLCM may be habitat generalists within their restricted range.

Status and Distribution

The KLCM is restricted to a fraction of its former range. Prior to development, the Upper Keys contained 4,816 ha (11,901 acres) of deciduous or hardwood hammock forests (Strong and Bancroft 1994). Much of the original tropical hardwood hammock on Key Largo was cleared in the past for development or agriculture, and the southern portion of Key Largo is nearly completely developed. Habitat loss and fragmentation have caused the isolation of KLCM populations. The physical separation caused by these activities makes it increasingly difficult to locate a mate and to disperse. Tropical hardwood hammock fragments up to 4 ha (9.9 acres) in size remain on south Key Largo, but may no longer be able to support the KLCM. These hammocks may be too small and isolated to support viable cotton mouse populations (Service 1999).

Habitat fragmentation, combined with a decreased range, makes the KLCM more vulnerable to natural catastrophes such as hurricanes or fire, both of which have damaged significant portions of north Key Largo hammocks. Tropical storms and hurricanes pose serious threats to the viability of the remaining cotton mice populations. The small size and low elevation of the Keys uplands make it difficult for KLCM to find shelter from damaging winds and storm surge. Monroe County has experienced 20 hurricanes between 1900 and 1990, with 11 of these Category III or greater (NMFS 1995). In 1992, over 240 ha (593 acres) of vegetation in north Key Largo were severely damaged by Hurricane Andrew. Since that time, there is still evidence of habitat destruction, but signs of KLCM use have been observed.

Measures of trapping success over time have indicated a declining trend. Few survey data are available for the KLCM, and there is variability among the survey data. Humphrey (1988) reported KLCM densities of 15.5 to 26.9 cotton mice per ha. Frank et al. (1997) report an average KLCM density of 6.2 mice per ha. Ongoing surveys continue to record the KLCM in nearly all locations where they have been previously reported, but at a density of approximately half of what was previously reported. There is no apparent explanation for the observed decline, and habitat availability has changed little.

Factors other than habitat loss appear to be impacting the cotton mouse. Frank et al. (1997) failed to document the KLCM at the southern end on north Key Largo, an area where only black rats were captured and exotic fire ants were abundant. Animals caught in traps where exotic fire ants were abundant were either dead or badly injured by the ants and trapping was discontinued

in these areas following the initial night. This southern section of north Key Largo is generally disturbed; there are three residential subdivisions partly developed and commercial development. Much of the undeveloped area in this vicinity is highly disturbed from past land clearing, unfinished developments, and rock mining. The hammock habitat in this area is bisected by old roads, and several large abandoned buildings associated with the unfinished Port Bougainville development are present. Free-roaming cats are abundant in this area.

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 birds and small mammals, is well documented (Churcher and Lawton 1989). Cats are extremely 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). Free-roaming cats on north Key Largo undoubtedly impact KLCM populations, and in areas of relatively dense human population could be a principal factor in the absence of this species in this area.

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

Dumping of trash increases the size of black rat populations, and rodent control agents used for black rats also kill KLCM. Black rats may compete against KLCM, but the effects on the KLCM are not known (Service 1999).

Stock Island tree snail

Species/Critical Habitat Description

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

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

white or dilute chestnut in old shells. The characteristics that most distinguish this species from *O. reses nesodryas* are the white apex and white columella and parietal callus. These characteristics are chestnut-brown or darker in *O. reses nesodryas.* "

Life History

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

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

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

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

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.

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

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

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

Status and Distribution

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

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

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

ENVIRONMENTAL BASELINE

The environmental baseline includes the effects of past and ongoing human and natural factors leading to current status of the species and their habitats.

Key Largo Woodrat

Status of the species/critical habitat within the action area

The entire known range for the KLWR occurs within the action area. Information presented in the preceding section establishes the Environmental Baseline for the KLWR. The information from that section is incorporated here by reference.

No critical habitat has been designated for the KLWR.

Factors affecting the species habitat within the action area

Long-term habitat impacts from development-related disturbance in the 1960s and 1970s have resulted in degraded habitat conditions on Key Largo. Much of the original tropical hardwood hammock on Key Largo was cleared in the past for development or agriculture, and the southern portion of Key Largo is nearly completely developed. In addition, the hammocks on northern Key Largo are bisected by a high-speed road (C.R. 905), which disrupts the integrity of the hammocks and causes road mortality of dispersing cotton mice.

Habitat fragmentation, combined with a decreased range, makes the KLWR more vulnerable to genetic isolation and natural catastrophes such as hurricanes or fire, both of which have damaged significant portions of north Key Largo hammocks. Hurricanes influence vegetational succession in the Florida Keys. Undisturbed hammocks are presumably more resistant to storms than hammocks that have been fragmented or have had surrounding mangrove and transitional vegetation removed. In August 1992, Hurricane Andrew hit Elliott Key, a few miles north of Key Largo. The northern one-third of Key Largo suffered the most extensive damage, with about 240 to 280 ha (593 to 692 acres) affected. The area of greatest impact, comprising about 80 ha (198 acres), suffered 70 percent canopy loss.

The majority of remaining high quality hammock habitat on north Key Largo has been protected through acquisition and management by the Service and State of Florida. CLNWR was acquired in 1980, and DJBSP was acquired in 1982. Approximately 880 ha (2,175 acres) of the remaining 1,011 ha (2,498 acres) of tropical hardwood hammock are protected within the boundaries of these two sites, and acquisitions continue. Therefore based on these acquisitions and current land use regulations in place by Monroe County, the threat of occupied habitat loss from development on northern Key Largo is low. Many tracts on these two conservation sites were cleared for development or agriculture in the early 1900's, but hammock vegetation has returned in many areas. The remaining forest is now composed of a variety of successional stages of tropical hardwood hammock vegetation, reflecting the time since disturbance. However, even given these large tracts of land within CLNWR and DJBSP, populations of KLWR continue to

decline. McCleery et al. (2006) indicates that the KLWR largely occur within young hammocks, but with only 87 ha of this age class occurring on northern Key Largo, management practices that encourage additional new forest growth will be necessary to improve survival chances for the species.

Key Largo Cotton Mouse

Status of the species/critical habitat within the action area

The entire known range for the KLCM occurs within the action area. Information presented in the preceding section establishes the Environmental Baseline for the KLCM. The information from that section is incorporated here by reference.

No critical habitat has been designated for the KLCM.

Factors affecting the species habitat within the action area

Long-term habitat impacts from development-related disturbance in the 1960s and 1970s have resulted in degraded habitat conditions on Key Largo. Much of the original tropical hardwood hammock on Key Largo was cleared in the past for development or agriculture, and the southern portion of Key Largo is nearly completely developed. In addition, the hammocks on northern Key Largo are bisected by a high-speed road (C.R. 905), which disrupts the integrity of the hammocks and causes road mortality of dispersing cotton mice.

Habitat fragmentation, combined with a decreased range, makes the KLCM more vulnerable to genetic isolation and natural catastrophes such as hurricanes or fire, both of which have damaged significant portions of north Key Largo hammocks. Hurricanes influence vegetational succession in the Florida Keys. Undisturbed hammocks are presumably more resistant to storms than hammocks that have been fragmented or have had surrounding mangrove and transitional vegetation removed. In August 1992, Hurricane Andrew hit Elliott Key, a few miles north of Key Largo. The northern one-third of Key Largo suffered the most extensive damage, with about 240 to 280 ha (593 to 692 acres) affected. The area of greatest impact, comprising about 80 ha (198 acres), suffered 70 percent canopy loss.

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Stock Island Tree Snail

Status of the species/critical habitat within the action area

McNeese (1997) concluded that the Stock Island tree snail was extinct on Stock Island. However, snails were observed there two years ago in the botanical garden (Hughes, personal communication, 2006). Recently, a new population was discovered in Key Largo. At least 3 populations now exist in South Key Largo. Viable populations are apparently successful in North Key Largo. Today, populations of snails occur throughout the Keys in hardwood hammocks. The Service has current records of 28 populations, many believed to be populations distributed by collectors.

Factors affecting the species habitat within the action area

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.

EFFECTS OF THE ACTION

This section includes an analysis of the direct and indirect effects of the proposed action on the species and/or critical habitat and its interrelated and interdependent activities. All activities authorized by the Service under section 10(a)(1)(A) of the ESA must meet permit issuance criteria at 50 CFR 17.22 and 17.32. All activities considered must be justified in relation to enhancement of survival and recovery, effects to the wildlife species, peer review, and qualifications of permittees. By definition, authorized activities should benefit species recovery with minimal adverse effects by qualified permittees.

Factors to be considered

The presence/absence surveys that will be conducted under the proposed research will be help to determine the status of the KLMR, KLCM, and Stock Island tree snail within remaining hardwood hammock habitats outside of Federal and state lands. Identification of additional KLWR and KLCM populations and appropriate habitat will aid Federal, state and county agencies and private entities to develop management actions to protect these species. Identification of additional Stock Island tree snail populations will allow the Service to coordinate relocation efforts.

Analysis for effects of the action

Beneficial effects - The proposed research will collect data to assist with management planning and will help to identify additional KLWR and KLCM populations. This research will also identify additional Stock Island tree snail populations and allow for their translocation to Service approved locations. The expected benefit of the proposed research is that it will ultimately aid in the recovery of the KLWR and KLCM.

Adverse effects - Handling of the KLWR, KLCM, and Stock Island tree snails may result in incidental injury or death of individuals. While this type of effect is uncommon with proper training or experience in handling of rodents or snails, the potential for such injuries remains.

Species' response to the proposed action

Although the Applicant considers it unlikely that any KLWR or KLCM will be collected during these surveys, should trapping of these species occur, it may result in injury or mortality of some individuals. Once confined within traps, the rodents may be subject to depredation by predators, such as raccoons or fire ants. All live traps will have a mechanism to prevent raccoons from opening traps that contain rodents to minimize the potential for this type of mortality. The Sherman live traps have locking doors to prevent raccoon predation. Fire ants have been known to attack and kill rodents confined within the traps (B. Muiznieks, Service, personal communication, 2004). Use of approved pesticides, such as Extinguish, around traps in areas where fire ants are known to occur will prevent ants from killing captured rodents in most cases. Because rodents confined within traps are unable to behaviorally avoid extreme temperatures, hyperthermia is a potential threat if traps are not checked early in the morning before temperatures rise.

The Applicant will inform the Service of all Stock Island tree snail observations. Following confirmation the Service will coordinate with the Applicant on appropriate locations for relocation. In addition, the Applicant will coordinate with the Service to monitor the snails at their relocation sites to help determine any potential adverse effects. Knowing more precisely where Stock Island tree snail populations occur will greatly aid in the monitoring and conservation of the species.

The capture, handling, and monitoring of KLWR and KLCM is needed to help determine their status on southern Key Largo. The capture, handling and possible translocation of the Stock Island tree snail will allow the Service to conserve and protect additional populations of this species on Key Largo. Data collected on each of the above species will assist with management planning for these species. The expected benefit of the proposed research is that it will ultimately aid in the recovery of the KLWR, KLCM, and Stock Island tree snail.

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 biological opinion. 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 ESA.

Because nearly all of the remaining potential habitat for the KLWR, KLCM, and Stock Island tree snail occur within publicly-owned land, actions resulting in adverse cumulative effects are unlikely. The Service is not aware of any State, local, or private activities that are reasonably certain to occur within the action area that would adversely affect the KLWR, KLCM, or the Stock Island tree snail.

SUMMARY OF EFFECTS

Although short-term, adverse effects to the KLWR, KLCM, and the Stock Island tree snail may occur in the form of, injury, or death; this research will lead to an increased understanding of the status these endangered and threatened species within the action area. The net effect of the research is beneficial.

CONCLUSION

After reviewing the current status of the KLWR, KLCM, and the Stock Island tree snail the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the issuance of a recovery permit, as proposed, is not likely to jeopardize the continued existence of the KLWR, KLCM, and the Stock Island tree snail. No critical habitat has been designated for these species; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a 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 such as 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 ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by the Service so that they become binding conditions of any grant or permit issued, as appropriate, for the exemption in action 7(o)(2) to apply. The Service has a continuing duty to regulate the activity covered by this incidental take statement. If the Service (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Service and researchers must report the progress of the action and its impact on the species as specified in the incidental take statement.

AMOUNT OR EXTENT OF TAKE

Incidental take is expected to occur from trapping and handling KLWR and KLCM. For the Stock Island tree snail, incidental take is expected to occur in the form of trapping, handling and relocating. The Service anticipates that the trapping and handling associated with monitoring may result in the injury or death of one individual KLWR and the injury or death of one individual KLCM. The Service anticipates that the trapping, and handling associated with monitoring and possible translocation may result in the injury or death of one individual Stock Island tree snail.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to these species.

REASONABLE AND PRUDENT MEASURES

The Service believes the applicant has incorporated all reasonable and prudent measures necessary and appropriate to minimize impacts of incidental take of the KLWR, KLCM, and the Stock Island tree snail. However, to monitor the effect and extent of take, the applicant must provide a written report on the results of the research activities. These written reports must be provided annually and also immediately following any trapping or monitoring event that proves positive for KLWR, KLCM, and the Stock Island tree snail activity.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the ESA, the Service must comply with the following terms and conditions, which implement the reasonable and prudent measures, described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. The Service shall require the applicant and designated agents acting on behalf of the applicant to contact the Service (Cindy Schulz, Supervisory Fish and Wildlife Biologist, South Florida Ecological Services Office; 1339 20th Street; Vero Beach, FL 32960; 772-562-3909, extension 305, once a recovery Fish and Wildlife Biologist has been assigned to Crocodile Lake National Wildlife Refuge, P.O. Box 370, Key Largo, FL 33037, this person will replace Cindy Schulz as the Service point of contact) in writing at least 2 months prior to conducting any small mammal surveys on Key Largo to indicate proposed trapping locations and duration. No small mammal surveys may be conducted without prior coordination with the Service.

2. The Service shall require the applicant and designated agents acting on behalf of the applicant to furnish resumes or summary of qualifications demonstrating their ability to safely conduct trapping and handling. Only those individuals who can demonstrate that they hold all necessary permits and have sufficient experience to trap and handle the KLWR and

KLCM with a minimum of risk to the rodents, and those individuals that are capable of recognizing indications of injury or ill health in the rodents will be permitted.

3. The reporting and monitoring requirements outlined in the section 10(a)(1)(A) permit will also satisfy the reporting/monitoring requirements required pursuant to section 7 of the ESA and its implementing regulations.

4. Permit issuance will be conditioned to require the permittee and designated agents acting on behalf of the permittee to immediately cease all activities if an individual KLWR or KLCM is injured and to report any such injury to the Service (Field Supervisor, South Florida Ecological Services Office; 1339 20th Street; Vero Beach, FL 32960; 772-562-3909; AND Permit Coordinator; 1875 Century Boulevard, Suite 200; Atlanta, Georgia 30345-3301; 404-679-4176.

5. Upon locating a dead, injured, or sick specimen, initial notification must be made to the nearest Service Law Enforcement Office (9549 Koger Boulevard, Suite 111; St. Petersburg, Florida 33702; 727-570-5398). 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 specimens to ensure effective treatment and care or in the handling of dead specimens to preserve biological material in the best possible state for later analysis as to the cause of death. In conjunction with the care of sick or injured specimens or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed. Permitted activities that appear to be resulting in excessive injury or death will be immediately suspended until more protective measures or an alternative resolution can be initiated.

6. Upon locating a Stock Island tree snail the Service shall require the permittee to immediately contact the Service (Cindy Schulz, Supervisory Fish and Wildlife Biologist, South Florida Ecological Services Office; 1339 20th Street; Vero Beach, FL 32960; 772-562-3909, extension 305, once a recovery Fish and Wildlife Biologist has been assigned to Crocodile Lake National Wildlife Refuge, P.O. Box 370, Key Largo, FL 33037, this person will replace Cindy Schulz as the Service point of contact) to confirm the observation and to coordinate possible relocation efforts.

7. Upon completion of all survey work that proves positive for the KLMR, KLCM, or Stock Island tree snail for a given site the permittee will immediately provide the Service with a detailed report of findings. This reporting and monitoring requirement is in addition to those outlined above in Terms and Condition Number 3.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and

threatened species. Conservation recommendations are discretionary agency activities to further minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service should continue to implement the MSRP.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects, or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on this action as outlined in the Plan. As required by 50 CFR 402.16, reinitiation of formal consultation is required if:

1. The amount or extent of incidental take is exceeded;
2. New information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion;
3. The 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.

In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have any questions, please contact Mark Salvato at 772-562-3909, extension 340.

cc:
Service, Key Largo, Florida (Steve Klett)

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