

**A Species Action Plan for the
Lower Keys Population of the Red Rat Snake
(*Pantherophis guttatus*)**

**Final Draft
November 1, 2013**



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EXECUTIVE SUMMARY

The Florida Fish and Wildlife Conservation Commission developed this plan following determination that the Lower Keys population of the red rat snake (*Pantherophis guttatus*) should no longer be listed as a Species of Special Concern, and not be listed on the Florida Endangered and Threatened Species List. There is no known taxonomic distinction from mainland rat snakes, but there are differences in appearance. Furthermore, a biological status review found that this population did not meet listing criteria. Because of its distinct appearance and location, this population has been targeted by the pet trade, and is threatened by hurricanes, climate change, and increased predation. For these reasons, the population needs to be given special consideration.

The goal of this plan is to maintain the Lower Keys population of the red rat snake so it does not require future listing. The objective is to maintain the area of occupancy and extent of occurrence of the Lower Keys population of the red rat snake. The following are several high-priority actions to achieve this objective: acquire, restore, protect and manage as much suitable habitat as possible, continue non-native species removal, regulate the harvest of red rat snakes in the Keys through continuation of rules limiting harvest, and investigate the genetics of red rat snake populations in the Lower Keys.

This plan details the actions necessary to improve the conservation status of the Lower Keys population of the red rat snake. A summary of this plan will be included in the Imperiled Species Management Plan (ISMP), in satisfaction of the management plan requirements in Chapter 68A-27, Florida Administrative Code, Rules Relating to Endangered or Threatened Species. The ISMP will address comprehensive management needs for 60 of Florida's imperiled species and will include an implementation plan; rule recommendations; permitting standards and exempt activities; anticipated economic, ecological, and social impacts; projected costs of implementation and identification of funding sources; and a revision schedule. The imperiled species management planning process relies heavily on stakeholder input and partner support. This level of involvement and support is also critical to the successful implementation of the ISMP. Any significant changes to this plan will be made with the continued involvement of stakeholders.

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GLOSSARY OF TERMS AND ACRONYMS

Area of Occupancy: The area within its extent of occurrence (see Extent of Occurrence), which is occupied by a taxon, excluding cases of vagrancy. This reflects the fact that a taxon will not usually occur throughout the area of its extent of occurrence, which may contain unsuitable or unoccupied habitats (as defined by International Union for Conservation of Nature [IUCN]).

BRG: Biological review group, a group of taxa experts convened to assess the biological status of taxa using criteria specified in Rule 68A-27, Florida Administrative Code, and following the protocols in the Guidelines for Application of the IUCN Red List Criteria at Regional Levels (Version 3.0) and Guidelines for Using the IUCN Red List Categories and Criteria (Version 8.1).

BSR: Biological status review report, the summary of the biological review group's findings. Includes a Florida Fish and Wildlife Conservation Commission (FWC) staff recommendation on whether or not the species status meets the listing criteria in Rule 68A-27.001, Florida Administrative Code. These criteria, based on IUCN criteria and IUCN guidelines, are used to help decide if a species should be added or removed from the Florida Endangered and Threatened Species List. In addition, FWC staff may provide within the report a biologically justified opinion that differs from the criteria-based finding.

Endemic: Found only in a particular locality or region.

Extent of Occurrence: The geographic area encompassing all observations of individuals of a species, including intervening areas of unoccupied habitat. Synonymous with range. See also Area of Occupancy (as defined by IUCN).

F.A.C.: Florida Administrative Code. The Department of State's Administrative Code, Register and Laws Section is the filing point for rules promulgated by state regulatory agencies. Agency rulemaking is governed by Chapter 120, Florida Statutes, the Administrative Procedures Act. Rules are published in the Florida Administrative Code.

FKE: Florida Keys Ecosystem

FKWEA: Florida Keys Wildlife and Environmental Area

FLNHM: Florida Natural History Museum

FNAI: The Florida Natural Areas Inventory, a non-profit organization administered by Florida State University and dedicated to gathering, interpreting, and disseminating information critical to the conservation of Florida's biological diversity.

FRAWG: Florida Reptile and Amphibian Working Group

FWC: The Florida Fish and Wildlife Conservation Commission, the state agency constitutionally mandated to protect and manage Florida's native fish and wildlife species.

GIS: Geographic Information System

IPCC: Intergovernmental Panel on Climate Change work is shared among three Working Groups, a Task Force, and a Task Group. The activities of each Working Group and of the Task Force are coordinated and administered by a Technical Support Unit. The IPCC Working Group I (WG I) assesses the physical scientific aspects of the climate system and climate change. The IPCC Working Group II (WG II) assesses the vulnerability of socio-economic and natural systems to climate change, negative and positive consequences of climate change, and options for adapting to it. The IPCC Working Group III (WG III) assesses options for mitigating climate change through limiting or preventing greenhouse gas emissions and enhancing activities that remove them from the atmosphere.

ISMP: Imperiled Species Management Plan

IUCN Red List (IUCN Red List of Threatened Species): An objective, global approach for evaluating the conservation status of plant and animal species, the goals of which are to: Identify and document those species most in need of conservation attention if global extinction rates are to be reduced; and provide a global index of the state of change of biodiversity.

Less-than-fee acquisition: The acquisition of limited property rights by an outside entity on lands owned by a landowner, usually through a written contract. Less-than-fee acquisitions can occur through direct purchase of specified and agreed-upon rights by the outside entity, or through donation of those rights by the landowner. Examples of less-than-fee acquisitions include the purchase/donation of easements, leases, limited use permits, cooperative agreements, etc.

NOAA. The National Oceanic and Atmospheric Administration

Pine rockland: A natural community unique to extreme southern Florida characterized by an open canopy of South Florida slash pine (*Pinus elliottii* var. *densa*) with a diverse understory and herbaceous layer. Rare and endemic plant and animal species are abundant in pine rocklands. The substrate consists of exposed oolitic limestone with numerous depressions and solution holes where nutrient poor soil and organic debris accumulate. Pine rockland is a fire-dependent natural community, and similar habitat occurs in the Bahamas, where Caribbean pine (*Pinus caribaea*) is the dominant pine.

Subsidized predation: When humans directly or indirectly alter resource availability in such a way as to increase the density of a predator population above levels that would occur without the additional resources.

Take: As defined in Rule 68A-1.004, F.A.C. (General Prohibitions) “Taking, attempting to take, pursuing, hunting, molesting, capturing, or killing any wildlife or freshwater fish, or their nests or eggs by any means whether or not such actions result in obtaining possession of such wildlife or freshwater fish or their nests or eggs.”

Tropical hardwood hammock: Also called rockland hammock, is a highly diverse upland forest rich in rare and endemic plant and animal species. The forest floor is mostly covered with a thin layer of well-drained organic soil and leaf litter. Exposed limestone and solution holes are common. Over 120 species of native trees and shrubs can be found in tropical hardwood hammocks along with a number of rare epiphytes, cacti, and herbaceous plants. Many of the plant species are also native to the Bahamas, the West Indies, and the Yucatan peninsula, and most occur in Florida at the northern limit of their range. Typical canopy trees include gumbo limbo (*Bursera simaruba*), wild tamarind (*Lysiloma latisiliquum*), pigeon plum (*Coccoloba diversifolia*), strangler fig (*Ficus aurea*), Jamaican dogwood (*Piscidia piscipula*), poisonwood (*Metopium toxiferum*), and West Indies mahogany (*Swietenia mahagoni*). In the continental United States, remaining tropical hardwood hammock only occurs in southern Florida, where it is restricted to coastal areas of southern Miami-Dade County, the Florida Keys, and a small area of Big Cypress National Preserve in Monroe and Collier counties.

INTRODUCTION

Biological Background

Taxonomy and Description

This species is often called by its unofficial common name, the “rosy” rat snake (*Elaphe guttata rosacea*). In 1888, Cope first described the Lower Keys population of the red rat snake as a new species, *Coluber rosaceus* (Wright 1935). Neill (1949) and Dowling (1952) concluded that this population be considered a subspecies of the corn or red rat snake (*Elaphe guttata*) instead of as its own species. The physical appearance of red rat snakes changes along with geographical gradient from north to south in number of dorsal blotches and amount of black pigment. Several scientists have concluded that it should be considered the same species as *E. g. guttata* (Duellman and Schwartz 1958, Thomas 1974, Mitchell 1977; however, see Paulson 1968). The Lower Keys population of red rat snakes exhibits a wide degree of variation in color, and many specimens are identical to those in the Miami area (Mitchell 1977, Love 1978, Lazell 1989, Bartlett 2002). However, Christman (1980) considered the Lower Keys population of the red rat snake to be noteworthy for its lighter dorsal color, absent or very narrow dorsal blotch borders, very high ventral and subcaudal scale counts, and more slender body. Using genetic data, Burbrink (2002) found that *Elaphe guttata* was comprised of 3 related groups, which he elevated to species level, restricting *E. guttata* to populations east of the Mississippi River. Genetic data indicates that New World *Elaphe* are part of an ancestral group outside of Old World species, and *Pantherophis* was resurrected for most North American species (Utiger et al. 2002); hence, the correct species name is now *Pantherophis guttatus*. We will refer to the population as the Lower Keys population of the red rat snake because that is the nomenclature used in the rule listing it as a Species of Special Concern, although the most recent common name is red cornsnake (Crother 2008).

Geographic Range

The red rat snake has a statewide distribution (Enge et al. 2011). Currently, the extent of suitable red rat snake habitat in the Lower Keys is poorly delineated. The Lower Keys population of the species has been found on the following Keys: Bahia Honda, Big Pine, Big Torch, Boca Chica, Cudjoe, Geiger, Johnston, Key Vaca, Key West, Indian, Little Pine, Little Torch, Middle Torch, Ramrod, Saddlebunch, Stock Island, Sugarloaf, and Summerland (Weaver et al. 1992, Florida Museum of Natural History [FLMNH] 2011 and Florida Natural Areas Inventory [FNAI] 2011) [Figure 1](#).

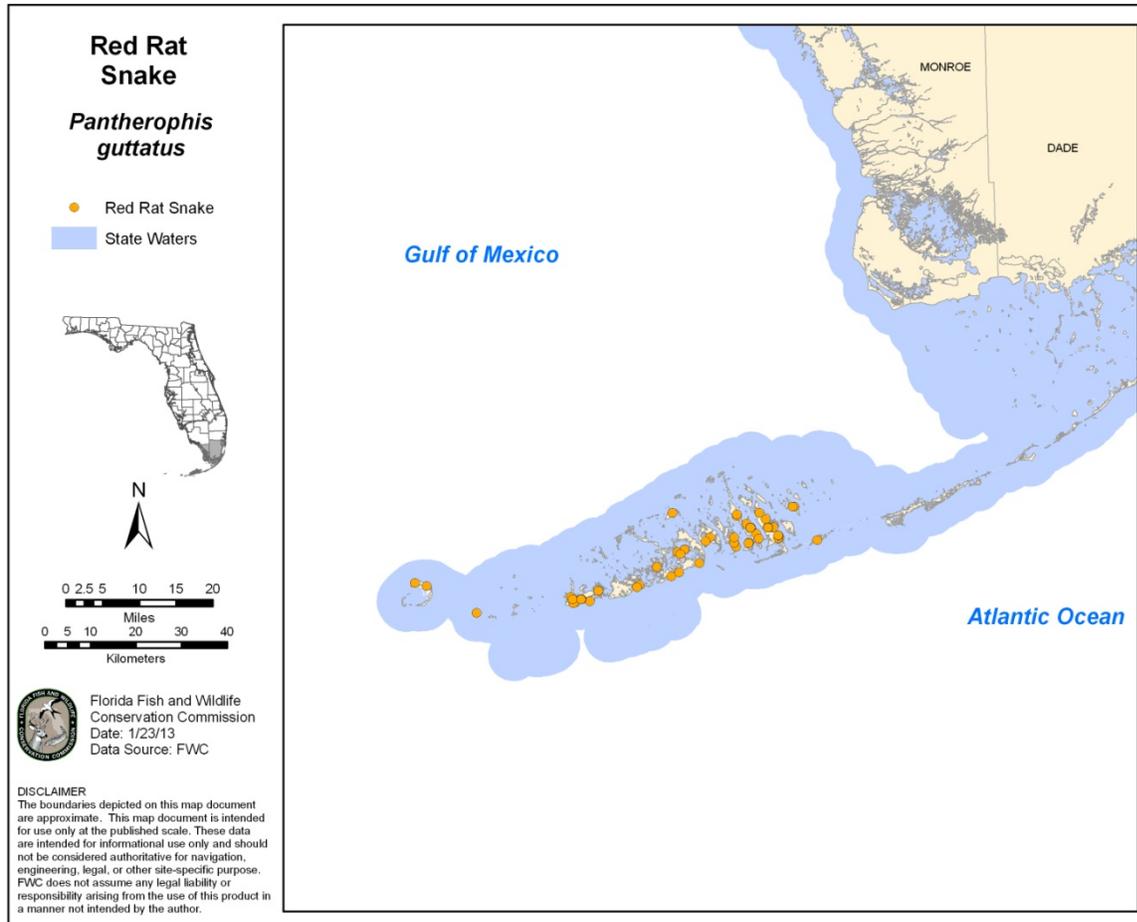


Figure 1. Locality records from the Florida Natural History Museum and Florida Natural Areas Inventory for the red rat snake in the Lower Florida Keys. Specific localities are from Krysko et al. (2011).

Habitat

The Lower Keys population of the red rat snake inhabits pine rockland, rockland hammock, mangrove forest, and a variety of disturbed habitats, including urban areas (Love 1978, Lazell 1989, Weaver et al. 1992). It is very adaptable and can be found in altered habitats, sometimes in bushes, trees, walls, and buildings, but also hiding beneath a variety of debris, including logs, rocks, plywood, and paper plates (Love 1978, Lazell 1989, Weaver et al. 1992). It is a good climber but has also been found underground, burrowing into loose sand or using existing burrows (Weaver et al. 1992).

Life History

The red rat snake often preys on small mammals, birds, bird eggs, and lizards. In many urban settings in Florida, red rat snakes primarily prey on non-native lizard species, such as the abundant brown anole (*Anolis sagrei*) (Enge 1993). This is also true in the Lower Keys (Love 1978, Wilson and Porras 1983). Red rat snakes lay 3 to 40 eggs per clutch, with an average of 14 eggs (Ernst and Ernst 2003). The Lower Keys population of the red rat snake tends to attain

smaller sizes than those on the Florida mainland, which may cause their clutch sizes to be proportionately smaller.

Conservation History

The State of Florida listed the Lower Keys population of the red rat snake as Threatened in 1975. In 1979, the listing status changed to Species of Special Concern. The listing as Threatened and Species of Special Concern prohibited direct take without a permit. Through the Florida Forever land acquisition program and its predecessors, the state has acquired significant tracts of native habitat throughout the Florida Keys supporting numerous imperiled species, including the Lower Keys population of red rat snake. There are currently 2 active Florida Forever projects in the Lower Keys. The Coupon Bight Key Deer project on Big Pine Key and No Name Key was approved in 1985, and as of February 2012, 6 km² (2.32 mi²) of the total 13 km² (5.02 mi²) project have been acquired. The largest project, the Florida Keys Ecosystem, (FKE) was created in 1995 by combining 2 existing projects, the Hammocks of the Lower Keys and Tropical Flyways. These projects were created in 1991 and 1992 under the sponsorship of The Nature Conservancy and the National Audubon Society to preserve disappearing tropical hardwood hammocks, imperiled plant, and animal species and to protect critical foraging and resting habitat for numerous migratory bird species. In 2004, the Florida Fish and Wildlife Conservation Commission (FWC) and the United States Fish and Wildlife Service (USFWS) co-sponsored a major expansion of the FKE project in the Lower Keys, resulting in a major acquisition of habitat for Keys species. Additional amendments since 2005 by multiple sponsors have brought the entire acreage of the FKE project to 53 km² (20.46 mi²). As of February 2012, 18 km² (6.95 mi²) of the FKE has been placed in public ownership, leaving 34 km² (13.13 mi²) remaining to be acquired. FWC manages the majority of the FKE lands as the Florida Keys Wildlife and Environmental Area (FKWEA). With the exception of several significant parcels acquired by donation, the entire FKWEA consists of lands purchased through Florida Forever.

Threats and Recommended Listing Status

Habitat Loss and Fragmentation

A highly adaptable species, the red rat snake is found in almost every habitat in the Lower Keys, including tropical hardwood hammock, pine rockland, mangrove forest, and disturbed habitats. It is unknown to what extent tree clearing and other types of human development have impacted populations because this species is often found near human development, sheltering in old buildings and walls (Lazell 1989). Clearing pine rockland and hardwood hammock habitats has probably eliminated the Lower Keys population of the red rat snake from some areas, but it is possible that populations are higher in some human-altered habitats than in the former natural habitats. A possible reduction in warm-blooded prey in human-altered habitats may be compensated for by an abundance of non-native lizard species, particularly brown anoles (Wilson and Porras 1983). People intentionally kill red rat snakes, and many are killed on roads by vehicles (K. Enge, FWC, personal communication); many of the specimens in (FLMNH 2011 and FNAI 2011) are road-killed red rat snakes. Vehicle-caused mortality may be of concern, particularly in areas on Big Pine Key, which has a dense network of roads. Besides direct mortality, roads fragment snake populations, making them more vulnerable to extinction through the reduction of genetic diversity (Jochimsen et al. 2004).

Non-native species

Feral and free-roaming domestic animals may also pose a threat to this species. Opossums (*Didelphis virginiana*) from the Upper Keys have been recently introduced to the Lower Keys, (R. Grau, FWC, personal communication). These potential predators are in higher numbers due to human alteration (intentional and unintentional) of the natural environment. Unnatural levels of predation may be a significant threat, especially in combination with other threats.

Sea Level Rise and Hurricanes

Red rat snakes and their prey are likely impacted by storm surges that increase the salinity of freshwater wetlands. Their persistence indicates that they are either resistant to or recover from storm surges. The level of storm surge required to extirpate these species is unknown. Hurricanes and associated seawater surges and short-term flooding of upland habitats in the Keys may kill some snakes and their prey. For example, after Hurricane Georges, a Category 2 hurricane, 4 of 15 monitored freshwater holes in the Lower Keys had salinities >15 parts per thousand due to the storm surge that remained months later in some places (Lopez et al. 2004). A stronger storm (i.e., greater than Category 3) would have a greater impact due to stronger winds and greater storm surge; a storm surge of 4 m (13 ft) would result in the complete submersion of Big Pine Key and No Name Key, which collectively provide about 51% of the 276 freshwater sources for the Key deer (*Odocoileus virginianus clavium*) and presumably the red rat snake (Lopez et al. 2004). In 2005, Hurricane Wilma (Category 3) passed just north of the Florida Keys, causing 2 storm surges. The second storm surge caused maximum storm tides of 1.5 to 1.8 m (5 to 6 ft) above mean sea level in Key West, flooding approximately 60% of the city. Hurricane Wilma caused a storm surge of 1.5 to 2.4 m (5 to 8 ft) on Boca Chica and Big Pine keys (Kasper 2007). Although the species has survived many hurricanes, severe saltwater overwash from very large storms has the potential to increase salt content of freshwater and brackish ponds to an extent that would eliminate suitable habitat. Sea level rise will increase the maximum high tides and will likely exacerbate the effects of storms surges (Florida Oceans and Coastal Council 2009), which would probably have greater impacts to this species.

Climate change and associated sea level rise present exceptional challenges to vulnerable species in the Florida Keys. Globally, sea level is rising at an increasing rate (Florida Oceans and Coastal Council 2009). Sea level rose in Key West approximately 22.25 cm (8.76 in) between 1913 and 2006, a rate of about 2.24 mm (0.09 in) per year. This rate appears to be increasing, according to trend analyses by the National Oceanic and Atmospheric Administration (NOAA) (NOAA 2013). While sea level rise is a gradual change, it compounds the effects of many other weather events, including spring tides and storm surges, causing habitat damage, migration, elimination, and conversion into other habitat types. Sea level rise has been modeled extensively for the Florida Keys, especially for the National Wildlife Refuges. [Sea Level Affecting Marshes Model](#) (SLAMM) modeling shows that there will likely be significant habitat loss in the Florida Keys that will affect many Keys species. For example, SLAMM modeling predicts a loss of 77% of mangrove habitat, 98% of beach, 94% of irregularly flooded marsh, and 69% of regularly flooded marsh for the Great White Heron National Wildlife Refuge (NWR) in the Lower and Middle Keys (Warren Pinnacle Consulting 2011a). Similarly, SLAMM predicts that Crocodile Lake NWR in the upper Keys will be impacted. Up to 98% of refuge mangrove, which comprises the vast majority of the refuge, is predicted to be lost. Simulations using SLAMM

predict Key West NWR will be severely impacted under every sea level rise scenario tested. In the scenario in which sea level rises 1.5 m (59 in) by 2100, the entire refuge would be under water (Warren Pinnacle Consulting 2011b).

Collection

The red rat snake is the most heavily harvested snake species for the pet trade in Florida, with an average of over 5,000 snakes collected annually in 1990 to 1994, two-thirds of which were harvested south of Lake Okeechobee (Enge 2005). Even though the Lower Keys population is currently listed as a Species of Special Concern and legally protected from harvest, some illegal harvest occurs (K. Enge, FWC, personal communication). To most people, the so-called rosy rat snake is not as desirable as many of the other more colorful varieties. Some breeders do produce them, although they may not advertise them as such because of their protected status (Tennant 1997).

Recommended Listing Status

In 2010, FWC directed staff to evaluate the status of all species listed as Threatened or Species of Special Concern that had not undergone a status review in the past decade. To address this charge, staff conducted a literature review and solicited information from the public on the status of the Lower Keys population of the red rat snake. The FWC convened a biological review group (BRG) of experts on the red rat snake to assess the biological status of the species using criteria specified in Chapter 68A-27.001, F.A.C. This rule includes a requirement for BRGs to follow the Guidelines for Application of the International Union for Conservation of Nature (IUCN) Red List Criteria at Regional Levels (Version 3.0) and Guidelines for Using the IUCN Red List Categories and Criteria (Version 8.1). FWC staff developed an initial draft Biological Status Review report (BSR), which included the BRG's findings and a preliminary listing recommendation from staff. The draft was sent out for peer review, and the reviewers' input was incorporated into a final [report](#).

Chapter 68A-27, Florida Administrative Code (F.A.C.), contains all of the rules pertinent to regulation of species listed as Threatened or Species of Special Concern by the FWC, including the intent, definitions, listing procedures, and regulatory structure of the FWC listing process. In Rule 68A-27.001, F.A.C., Definitions (3), a Threatened species can be a species, subspecies, or isolated population of a species or subspecies. The Lower Keys population of the red rat snake does not fit into any of these categories and did not meet [FWC listing criteria](#); therefore, it was not recommended for listing. Additionally, the BRG concluded from the biological assessment that the Lower Keys population of the red rat snake did not meet criteria necessary to warrant listing it as Threatened. The objective below addresses maintaining the area of occupancy and extent of occurrence.

CONSERVATION GOALS AND OBJECTIVES

Goal

The conservation status of the Lower Keys population of the red rat snake remains the same or is improved so that that it does not warrant listing on the Florida Endangered and Threatened Species List.

Objective

I. Maintain the area of occupancy and extent of occurrence of the Lower Keys population of the red rat snake.

Rationale

According to the [Biological Status Review](#) (BSR) for Lower Keys population of the red rat snake, the area of occupancy is estimated at 136 km² (52.51 mi²) and the extent of occurrence is 137 km² (52.9 mi²). Because this population is found on a spatially limited island chain, it is unlikely that the area of occupancy or extent of occurrence will increase; extent of occurrence can be maintained through the protection and management of existing potential habitat. Although not taxonomically distinct, red rat snakes are part of the biodiversity of the Lower Keys and should be maintained. Although this plan details actions for conserving the red rat snake in the Lower Keys, several of these actions ([Actions 2, 3, 4, 6, and 11](#)) benefit a suite of species or simply add the red rat snake to other conservation efforts ([Actions 1, 5, 8, 9, 10, and 12](#)) with little additional cost or effort.

CONSERVATION ACTIONS

The following sections describe the conservation actions that will make the greatest contribution toward achieving the conservation objectives. Actions are grouped by category (e.g., Habitat Conservation and Management, Population Management). The Conservation Action Table ([Table 1](#)) provides information on action priority, urgency, potential funding sources, likely effectiveness, identified partners, and leads for implementation.

Habitat Conservation and Management

Action 1 Apply management that accommodates the needs of this species within its known range.

Many public conservation lands are required to have a management plan approved by the Acquisition and Restoration Council or their governing board. Specifically, s. 253.034(5), Florida Statutes (F.S.), says in part, “all land management plans shall include an analysis of the property to determine if significant natural resources, including listed species, occur on the property.” If significant natural resources occur, the plan shall contain management strategies to protect the resources. The Florida Forever Act (s. 259.105, F.S.) adds that all state lands that have imperiled species habitat shall include, as a consideration in the management plan, restoration, enhancement, management, and repopulation of such habitats. For lands identified by the lead management agency as with existing Lower Keys populations of the red rat snake or the potential to support the species, the FWC should be consulted (as statutorily required), and the lead agency is encouraged to include FWC as part of its management plan advisory group. Implementation of this action will ensure conservation lands are managed with consideration of the species’ needs.

Action 2 Maintain existing suitable habitat, restore existing altered habitat, and acquire or otherwise protect as much potential habitat as possible for the Lower Keys population of the red rat snake.

The Lower Keys population presents an unusual conservation challenge, because the total habitat available is constrained by the fact that it exists on a chain of islands that is relatively small. The [BSR](#) estimated the total area of the Florida Keys is about 356 km² (134.45 mi²). The relatively limited size of these islands also constrains human use of the land, leading to higher-intensity land usages that are often incompatible with the needs of imperiled species. While historical red rat snake sightings throughout Florida are known from disturbed areas, they may not be tolerant of high-intensity alterations or extensive urbanization. In addition, only a limited subset of the land area within the Florida Keys may be suitable for particular species. Data summarized within the [BSR](#) indicates that potential habitat for the Lower Keys population of the red rat snake exists on 136 km² (52.51 mi²) of land within the islands. Because of the limited amount of potential habitat available to the Lower Keys population of the red rat snake, the highest-priority action for long-term conservation of this population is the acquisition and management of as much suitable habitat as possible within the species’ range. In order to achieve this objective, coordination with local, state, and federal land managers is needed to develop lists of priority parcels to be directly acquired and managed that protect the highest-quality suitable habitat for the Lower Keys population of the red rat snakes ([Action 13](#)). Reliable and dedicated funding sources must be

allocated to land acquisition and management, and imperiled species management should be a primary concern when evaluating conservation land acquisitions within the Lower Keys. The entire FKWEA, with the exception of several donated parcels, consists of lands purchased under Florida Forever. All prioritization of land acquisition under this program should consider the potential presence of Lower Keys red rat snakes on proposed acquisitions within its range. In addition to state-owned Florida Forever lands, the USFWS and Monroe County Land Authority also have acquired significant tracts of land for conservation purposes.

On conservation lands currently in public ownership, as well as on future conservation land acquisitions within the range of the Lower Keys population of the red rat snake, the habitat needs of this and other imperiled species should be a high priority during land management planning. Habitat restoration should be considered within potential habitat that has been degraded over time because of human activity. In addition, where opportunities allow, land management for this species on private lands with willing landowners could be beneficial. This species shows some tolerance for certain levels of habitat alteration, and has been found in various habitat such as bushes, trees, walls, and buildings, but also hiding beneath a variety of debris, including logs, rocks, plywood, and paper plates (FWC 2011). Methods that minimize the effects of roads on reptile populations, if employed in the Lower Keys, would benefit all of the listed reptile species in that area. Jochimsen et al. (2004) review many of those methods. Programs are available to provide technical assistance and funding for landowners interested in managing their lands for imperiled species ([Action 11](#)). Restoration and management of the Lower Keys population of the red rat snake habitats should follow habitat management recommendations (see [Action 3](#)) in order to provide the greatest benefit for the species.

Action 3 Develop habitat management recommendations for land managers and owners.

Habitat management recommendations need to be developed for the Lower Keys population of the red rat snake in conjunction with other species to focus land managers (on both public and private lands) on habitat management goals, actions, and techniques that ensure high-quality habitat is available for imperiled terrestrial species in the Lower Keys. These approaches are not to be confused with other pre-existing best practices programs, such as agricultural or water management programs, which are administered by other state agencies and fit within various regulatory frameworks. The habitat management recommendations proposed here are a stand-alone tool designed specifically to provide guidance for wildlife habitat management, including avoidance and minimization measures as well as measures designed to promote species recovery through improvements in ecosystem health. Habitat management recommendations also need to consider factors outside of habitat management, such as control of non-native animals or free-roaming domestic animals that may present a threat to the Lower Keys population of the red rat snakes.

Action 4 Continue non-native species removal.

Non-native species in the Lower Keys pose threats to red rat snakes and many other native species living there. Currently, there are several non-native animals in the Keys targeted for rapid-response removal such as black spiny-tail iguanas (*Ctenosaura similis*), tegus (*Tupinambis* spp.), monitor lizards (*Varanus* spp.), and large-bodied snakes. In addition, numerous non-native

invasive plant species are being actively removed from public and private lands in the Florida Keys. These efforts need to continue and expand in cases where specific non-native species potentially threaten the Lower Keys population of the red rat snake as well as its required habitats.

Population Management

There are no actions identified for population management.

Monitoring and Research

Action 5 Investigate the taxonomy and genetics of the Lower Keys population of the red rat snake.

There has been much debate about the taxonomy of the Lower Keys population of the red rat snake since it was first described by Cope in 1888 as a distinct species (Wright 1935). The Lower Keys population of the red rat snake is not currently considered a distinct species or subspecies from the peninsular red rat snake. If genetic analysis of the Lower Keys population finds the population to represent a subspecies or a distinct population, the Lower Keys population of the red rat snake could be considered for listing as a state Threatened species.

Red rat snakes in the Lower Keys are considered relatively common and not distinct from red rat snakes living throughout Florida. However, enough morphological variation exists that these snakes are considered somewhat unique compared to mainland populations. This species is vulnerable to collection due to its perceived uniqueness, representing a potential source of take. This take could reduce the area of occupancy or extent of occurrence, thus making this population susceptible to relisting as a Threatened species on the Florida Endangered and Threatened Species List. By investigating population genetics and taxonomy of the red rat snake population extant in the Lower Keys, we can gain a better understanding of gene flow, population stability, and evolutionary factors affecting this population and adjust management accordingly.

Action 6 Conduct surveys of existing habitat (survey and determine quality of habitat). Conduct population surveys using methods to be determined for the Lower Keys population of the red rat snake.

Population status and trends are poorly understood for the red rat snake in the Lower Keys because the species is difficult to survey and little effort has been invested in attempting to gain these data. For these reasons, at least in the near term, conservation of this species will have to be informed by using habitat as a proxy for direct population trend estimates. While surveying habitat to gain data for informed management, it is cost efficient to collect data about population trends. Data sets from both habitat and population surveys are critical to inform management decisions intended to ensure the species' long-term conservation.

Habitat Surveys

Currently, the suitable habitat extent in the Lower Keys population for the red rat snake is poorly understood. Endries et al. (2009) provided a geographic information system (GIS)-based analysis

of potential habitat using existing GIS datasets. FWC staff refined this model during the [BSR](#) process to create a baseline estimate of potential habitat (136 km² [52.51 mi²]). However, these models are based on old data, and little of the identified potential habitat has been verified. The habitat needs of this species are so poorly understood, it is difficult to create a model of potential habitat, and the results of these models must be used with caution. In order to provide a better assessment of habitat status for the Lower Keys population of the red rat snake, a baseline survey of existing potential habitat should be conducted throughout its species' range. If areas containing significant population clusters of the Lower Keys population of the red rat snake occur outside of lands under the management of FWC, partnerships are needed to ensure the long-term viability of populations on these lands ([Action 13](#)).

Population Surveys

As identified in the [BSR](#), virtually no information exists on the population status and trends of the Lower Keys population of the red rat snake. The estimates that were made were based on estimates from the mainland population. A baseline survey of potential habitat within its range needs to be conducted to determine, at minimum, patterns of presence and absence within existing habitat. Survey protocol should be robust enough to determine reliable conclusions on species' presence and absence at any particular site.

Because of the relatively high value of any verifiable observation of the Lower Keys population of the red rat snake, a mechanism allowing for individual sighting reports (by natural resource professionals and the public) should be established for this and several other rare wildlife species in the Keys ([Action 8](#)).

Action 7 Develop a long-term monitoring strategy for the Lower Keys population of the red rat snake.

It is critical to periodically assess the status of identified populations of the Lower Keys population of the red rat snakes and their habitat to determine if conservation strategies are working to ensure its long-term viability, or to inform further conservation actions that may need to be taken to mitigate for new or expanding threats. An evaluation of suitable habitat for the species should be conducted on a 10-year timeframe to determine changes in habitat quality or quantity, as well as to determine if changes in land ownership or land use are having a beneficial or detrimental effect on the viability of the species. Population monitoring surveys (to the degree feasible) should be conducted on a 10-year timeframe to examine patterns of presence and absence in patches of identified suitable habitat, in order to determine if habitat management strategies have conservation benefit. An evaluation of suitable habitat for the taxon should be conducted on a 10-year cycle to determine changes in habitat quality or quantity, as well as to determine if changes in land ownership or land use are beneficial or detrimental to taxon viability. Population trend information is a primary measure of conservation success. Given the difficulty in surveying for this species, and that most applicable survey techniques capture other species as well, a monitoring strategy could easily cover a suite of species (e.g., ribbon snake [*Thamnophis sauritus sackeni*], red rat snake, Lower Keys population of Florida brown snakes [*Storeria victa*], and Key ringneck snakes [*Diadophis punctatus acricus*]).

Action 8 Establish a program for reporting sightings of the Lower Keys population of the red rat snake.

Members of the conservation community and the public do not have a mechanism to share incidental observations with conservation agencies or interested organizations, with the exception of contributing voucher sightings to natural history museums, or organizations such as FNAI. An internet database would be a simple, user-friendly mechanism for collecting incidental observations. FWC has several internet-based databases that could serve as models, and these allow both uploading of voucher photos as well as georeferencing through interfaces such as a graphic mapping interface or smart-phone application. Once a database is developed, training and outreach materials need to be distributed among members of the conservation community (partner agencies such as DEP’s Division of Recreation and Parks, USFWS, non-profit organizations such as Audubon, Florida Reptile and Amphibian Working Group [FRAWG], and North American Center for Snake Conservation) as well as interested members of the public within the Keys. Training information could include web tutorials on surveying and reporting as well as identification guides designed for field use. This website should be created in consultation with partners. The reporting system will be publicized by using media and outreach to local conservation groups, hobbyists, and biologists. The database will also be publicized on the FWC website and should be easily accessible through a website search for red rat snakes. An easy reporting process and provision of training materials should help foster public interest in the conservation of imperiled species in the Keys. This system could be applied to all imperiled species, or species of interest in the Keys, to provide current information on their extent of occurrence and area of occupancy, both factors important to biological status evaluations.

Rule and Permitting Intent

Protections

Action 9 Protect the Lower Keys population of the red rat snake from unsustainable take.

Although there is a general prohibition on the take of wildlife, take of reptiles is authorized in Rule 68A-25.002, F.A.C., so snakes may be taken throughout the year in unlimited numbers. The Lower Keys population of the red rat snake’s coloration differs from most mainland populations, and it has been targeted by the pet trade. Considering the threat of hurricanes, climate change, subsidized predation, and non-native species predation, coupled with the small occupied area, the Lower Keys population of the red rat snake should be protected from harvest. The authors of this plan do not support allowance of recreational take. Commercialization of the Lower Keys population of the red rat snake should be avoided as this provides an economic incentive for higher levels of take.

Permitting Recommendations

If take or possession is limited as recommended in this plan, permits will be needed for activities exceeding those limits. We recommend that those permits be issued for scientific or educational purposes that further the objectives of this plan or the conservation of the Lower Keys population of the red rat snake. We recommend that as a condition of the permit, information collected

about this species be reported to the FWC and the FLMNH within 1 year of the completion of the work.

The following factors should be considered in determining whether there is a scientific or conservation purpose, which will benefit the survival potential of the species:

- Whether the purpose for which the permit is required is adequate to justify removing specimens from the wild
- The probable direct or indirect effect of permit issuance on the population
- Whether the permit would conflict with any program intended to enhance the survival of the species
- Whether the purpose of the permit would likely reduce the threat of extinction for the species
- The opinions or views of scientists or other persons or organizations having species expertise
- Whether the expertise, facilities, or other resources available to the applicant are adequate to successfully accomplish the objective stated in the application

Law Enforcement

The FWC's Division of Law Enforcement, in conjunction with federal, state, and local partners, is responsible for enforcing Florida's wildlife and fisheries laws. FWC's law enforcement officers are vital to the success of achieving the goals and objectives of this plan because they both ensure the enforcement of conservation laws and educate the public on how to identify and report violations.

FWC staff will provide adequate training to FWC law enforcement officers to ensure that they are able to accurately identify protected species endemic to the Florida Keys, are aware of all applicable rules and regulations pertaining to these species, and are able to explain to the public the ecological importance of these species.

Action 10 Develop and implement a training program for FWC law enforcement officers on the identification of the red rat snake and the rules and regulations pertaining to protected species endemic to the Florida Keys.

FWC biologists educate law enforcement officers through the development, circulation, and interpretation of identification tools, distribution maps, and other training materials. These media should be comprehensive to the regional needs encompassing all regulated species, not merely focusing on red rat snakes in the Lower Keys.

One of the most important components of the enforcement strategy is ensuring compliance through public education. FWC law enforcement officers understand the importance of explaining wildlife laws to the public to avoid unintentional violations. However, FWC law enforcement officers actively pursue and recommend prosecution for those who intentionally violate wildlife laws. The FWC's Division of Law Enforcement administers the Wildlife Alert program, which receives information via a toll-free number (1-888-404-3922) that is answered 24 hours a day, seven days a week. Cash rewards are offered to callers who provide information

about any illegal activity that results in an arrest. Callers may remain anonymous and are not required to testify in court.

Incentives and Influencing

Action 11 Develop less-than-fee acquisitions on private lands.

Because funding for direct land acquisition (as well as for land management) is often lacking, or the timeframe for acquisition may not be appropriate, less-than-fee acquisitions on private land should be considered as a land-protection strategy. Less-than-fee acquisitions may come in the form of easements or agreements with private landowners who are willing to promote conservation of imperiled species on their lands. These types of acquisitions are often incentive based to promote participation and to ensure that private landowners receive a benefit from voluntary conservation actions that they might not usually perform.

Because of the unique nature of habitats within the Florida Keys, many properties within these areas do not fall neatly within the parameters established by currently existing programs. For instance, some of these programs have minimum acreage requirements that will be difficult to meet on properties within the Keys. However, administrators of these programs often have latitude, and may be able to consider critical properties in the Keys. FWC biologists can provide technical assistance and advice to landowners interested in participating in these programs. In addition, FWC and other agencies may need to consider new incentives or less-than-fee programs specifically for the Keys in order to address the unique nature of these areas. Because of the limited amount of habitat available for the Lower Keys population of the red rat snake (as well as other imperiled species), this could likely be achieved at a relatively low cost, when compared to similar programs occurring on the mainland.

In general, it is expected that less-than-fee acquisitions in the Florida Keys will likely be a limited opportunity practice, due to land use patterns, the relatively small size of parcels available, as well as the limited amount of suitable potential habitat available on parcels that may be considered for less-than-fee tools. In addition, existing tools are generally not designed for the unique land-use patterns found in the Keys. However, less-than-fee acquisitions may still be important even if they are rare, for the same reasons.

Florida also provides tax incentives including property tax exemptions under s. 196.26, F.S., for landowners that put a perpetual conservation easement on their land. Additional incentives may include exemption from permits for activities that enhance wildlife habitat such as removal of invasive non-native vegetation, as long as it is not a precursor to development.

Education and Outreach

Action 12 Direct outreach to local conservationists and provide education to interested members of the public.

There are many local conservationists and recreational herpetologists who could provide sighting information and supplement the monitoring program where funding and resources are lacking.

[Action 8](#) calls for an internet database where the public could add sightings. Outreach to local conservation groups and partners (DEP's Recreation and Parks, USFWS, Audubon, Florida Reptile and Amphibian Working Group, and North American Center for Snake Conservation) can encourage reports of sightings from the public.

Coordination with Other Entities

Action 13 Coordinate and provide technical assistance to local governments about local environmental issues and occurrences.

FWC staff will meet with local government staff to provide technical assistance and share research, range information, distribution information, GIS information, and land-development conservation measures. Information will be provided to property owners through their local government permitting program. Coordination with local, state, and federal land managers is needed to develop lists of priority parcels (those that protect the highest-quality suitable habitat) for acquisition and management. Information could be distributed with permit information or materials. FWC will encourage development and enforcement of listed species and habitat protection in local comprehensive plans and ordinances. Local governments could also assist in distributing information to businesses receiving occupational licenses such as contractors, landscapers, and golf courses. Coordination with local conservationists is also discussed in [Action 12](#).

Monroe County's Comprehensive Plan addresses land development and protection of native habitats. The local government's implementation and enforcement of these protections are vital to achieving the goal outlined in this plan. The Monroe County Comprehensive Plan and Land Development Regulations do not specifically address the Lower Keys population of the red rat snake, but do have provisions for protection of native habitats. In addition to county regulations, the City of Marathon and the City of Key West have comprehensive plans that address protecting native habitats and species.

Table 1. Lower Keys Population of the Red Rat Snake (*Pantherophis guttatus*) Conservation Action Table

NOTE: An explanation of acronyms used is below the table.

Objective(s) Addressed	Team Assigned Priority Level	Action Item Number	Action Items	Conservation Action Category	Ongoing, Expanded or New Effort?	Authority	Man Power	Estimated Cost To Implement	Funding Source(s)	Lead for Implementation: FWC Program(s) and/or Section(s)	External partners	Likely Effectiveness	Feasibility	Urgent?
1	2	1	Apply management that accommodates the needs of this species within its known range.	Habitat Conservation & Mgmt	ONGOING	YES	NO	TBD	Trust fund, legislature, donations, and other	HSC	DEP, State Parks, USFWS, UF, Monroe County, Nature Conservancy	Highly Likely.	Yes it can be done, yes it is practical, and relationships exist.	No, this will not reduce the critical threats, but will make this species more secure in its range; that is why this action is giving 2 priority.
1	1	2	Maintain existing suitable habitat, restore existing altered habitat, and acquire or otherwise protect as much potential habitat as possible for the Lower Keys population of the red rat snake.	Habitat Conservation & Mgmt	ONGOING	YES	NO	TBD	Trust fund, legislature, donations, and other	HSC	DEP, State Parks, USFWS, UF, Monroe County, Nature Conservancy	Highly Likely.	Yes it can be done, yes it is practical, and relationships exist. If programs like Florida Forever are funded this could facilitate the process.	No, this will not reduce the critical threats, but this is one of the most important things to do for this species. There is very limited habitat available to the Lower Keys population. The population will not recover without adequate habitat.
1	2	3	Develop habitat management recommendations for land managers and owners.	Habitat Conservation & Mgmt	NEW	YES	YES	TBD	Existing budget, maybe grant funding	HSC	DEP, State Parks, USFWS, Monroe County, the Nature Conservancy, Local Governments, Private Land Owners	Likely.	Yes it can be done, yes it is practical and relationships exist.	No, this will not reduce the critical threats, but this is given a 2 priority because it will improve habitat.
1	1	4	Continue non-native species removal.	Habitat Conservation & Mgmt	EXPANDED	YES	YES	TBD	Grants legislature, existing budget	HSC	DEP, State Parks, USFWS, Monroe County, Local Governments, UF	Likely.	Feasibility and practicality depends on the species, relationships exist.	No, this will not reduce the critical threats, but this is one of the most important things to do for this species. Non-native predators released on islands can quickly reproduce to numbers that could threaten the recovery of this species.
1	3	5	Investigate the taxonomy and genetics of the Lower Keys population of the red rat snake.	Monitoring & Research	NEW	YES	YES	\$5,000	Existing budget	FWRI	State Parks, USFWS, FSU	Very Likely.	Yes it can be done, yes it is practical and relationships exist.	No, this will not reduce the critical threats, but this could affect future listing status.
1	1	6	Conduct surveys of existing habitat (survey habitat and determine quality of habitat). Conduct population surveys using methods to be determined for the Lower Keys population of the red rat snake.	Monitoring & Research	NEW	YES	NO	\$50-100k	Grant	HSC and FWRI	State Parks, USFWS, UF, Monroe County	Moderately likely.	Yes, but can't predict level of detail of data collected.	No, surveys will not reduce critical threats to the survival of this species, but this work must be conducted first prior to other conservation actions.
1	2	7	Develop a long-term monitoring strategy for the Lower Keys population of the red rat snake.	Monitoring & Research	NEW	YES	NO	TBD	Unknown	HSC and FWRI	State Parks, USFWS, UF, Monroe County	Unknown	Unknown, because it is a data deficient species a certain level of knowledge will need to be obtained before this is known.	No, this will not reduce the critical threats, but this is essential to determining status and recovery.
1	2	8	Establish a program for reporting sightings of the Lower Keys population of the red rat snake.	Monitoring & Research	NEW	YES	YES	\$10,000	Existing budget	HSC and FWRI	State Parks, USFWS, UF, Monroe County, Center for Snake Conservation	Likely.	Yes it can be done, yes it is practical and some of the relationships exist.	No, this will not reduce the critical threats, but this will greatly aid monitoring.
1	3	9	Protect the Lower Keys population of the red rat snake from unsustainable take.	Protections & Permitting	ONGOING	YES	YES	TBD	Existing budget	LE, HSC	USFWS	Likely.	Yes it can be done, yes it is practical and relationships exist.	No, this will not reduce the critical threats.
1	3	10	Develop and implement a training program for FWC law enforcement officers on the identification of the red rat snake and the rules and regulations pertaining to protected species endemic to the Florida Keys.	Law Enforcement	ONGOING	YES	YES	TBD	Existing budget	HSC	State Parks, USFWS, Monroe County, Local Governments and National Park Service	Likely.	Yes it can be done, yes it is practical and relationships exist.	No, this will not reduce the critical threats, but this will aid in protecting the species from take.
2	2	11	Develop less-than-fee acquisitions on private lands.	Incentives & Influencing	EXPANDED	YES	YES	TBD	Unknown	HSC	DEP, USFWS, UF, Monroe County, Local Government	Likely.	Yes it can be done, yes it is practical, and relationships exist. It is more practical on larger parcels and if it is closely located to other conservation land.	No, this will not reduce the critical threats, but this could improve habitat.

Table 1. Lower Keys Population of the Red Rat Snake (*Pantherophis guttatus*) Conservation Action Table

Objective(s) Addressed	Team Assigned Priority Level	Action Item Number	Action Items	Conservation Action Category	Ongoing, Expanded or New Effort?	Authority	Man Power	Estimated Cost To Implement	Funding Source(s)	Lead for Implementation: FWC Program(s) and/or Section(s)	External partners	Likely Effectiveness	Feasibility	Urgent?
1	3	12	Direct outreach to local conservationists and interested members of the public.		NEW	YES	YES	\$5,000	Grant/ existing budget	OCR, HSC	State Parks, USFWS, UF, Monroe County	Likely.	Yes it can be done, yes it is practical and some of the relationships exist.	No, this will not reduce the critical threats, but this will aid monitoring.
1	2	13	Coordinate and provide technical assistance to local governments on local environmental issues and occurrences.		ONGOING	YES	YES	\$1,500	Existing budget	HSC	State Parks, USFWS, UF, Monroe County	Likely.	Yes it can be done, yes it is practical and relationships exist.	No, this will not reduce the critical threats, but this will aid in protecting this species and its habitat.

Acronyms used in this table:

- CCCA: Candidate Conservation Agreement with Assurances
- DEP: Florida Department of Environmental Protection
- FSU: Florida State University
- FWC: Florida Fish and Wildlife Conservation Commission
- FWRI: Fish and Wildlife Research Institute, the research branch of the Florida Fish and Wildlife Conservation Commission
- HCP: Habitat Conservation Plan
- HSC: Habitat and Species Conservation, a Division of the Florida Fish and Wildlife Conservation Commission
- LE: Law enforcement
- OCR: Office of Community Relations, administered by the Florida Fish and Wildlife Conservation Commission
- TBD: To be determined
- UF: University of Florida
- USFWS: United States Fish and Wildlife Service

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