

**A Species Action Plan for the
Rim Rock Crowned Snake
(*Tantilla oolitica*)**

**Final Draft
November 1, 2013**



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EXECUTIVE SUMMARY

The Florida Fish and Wildlife Conservation Commission developed this plan in response to the determination that the rim rock crowned snake (*Tantilla oolitica*) be maintained as a Threatened species on the Florida Endangered and Threatened Species List.

The goal of this plan is to improve the conservation status of the population of the rim rock crowned snake to the point that the species is secure within its historical range. There are 3 objectives given in this plan. The first objective is to maintain the area of occupancy and extent of occurrence of the rim rock crowned snake. The second is to maintain or improve the extent and/or quality of habitat available for the rim rock crowned snake. The final objective is that the rim rock crowned snake population exceeds 10,000 mature individuals with at least 1 location having more than 1,000 individuals. There are 3 high-priority actions for these objectives: 1) to acquire, restore, protect, and manage as much suitable habitat as possible; 2) to continue the removal of non-native species; and 3) to research the species' life history.

This plan details the actions necessary to improve the conservation status of the rim rock crowned 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.

TABLE OF CONTENTS

RIM ROCK CROWNED SNAKE ACTION PLAN TEAM ii
EXECUTIVE SUMMARY iii
LIST OF TABLES v
LIST OF FIGURES vi
GLOSSARY OF TERMS AND ACRONYMS..... vii
INTRODUCTION 1
 Biological Background..... 1
 Conservation History..... 2
 Threats and Recommended Listing Status 3
CONSERVATION GOALS AND OBJECTIVES 6
CONSERVATION ACTIONS 7
 Habitat Conservation and Management 7
 Population Management..... 9
 Monitoring and Research 9
 Rule and Permitting Intent 11
 Law Enforcement 12
 Incentives and Influencing 12
 Education and Outreach 14
 Coordination with Other Entities 14
LITERATURE CITED 17

LIST OF TABLES

Table 1. Conservation Action Table 15

LIST OF FIGURES

Figure 1. Locality records from Florida Natural History Museum, Florida Natural Areas Inventories, and the literature for the rim rock crowned snake. 2

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.

CCAA: Candidate Conservation Agreements with Assurances

DEP: Florida Department of Environmental Protection

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

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.

F.S.: Florida Statutes

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

GIS: Geographic Information System

HCP: Habitat Conservation Plan

ISMP: Imperiled Species Management Plan

IUCN: International Union for Conservation of Nature, a professional global conservation network.

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.

NWR: National Wildlife Refuge

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.

SLAMM: Sea Level Affecting Marshes Model

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

GLOSSARY OF TERMS AND ACRONYMS

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.

USFWS: United States Fish and Wildlife Service, the federal agency mandated to protect and manage the nation's native wildlife and freshwater fish resources.

INTRODUCTION

Biological Background

Taxonomy

This plan is for the rim rock crowned snake (*Tantilla oolitica*). The rim rock crowned snake is in the family Colubridae. The closest taxonomic relative to the rim rock crowned snake is the southeastern crowned snake (*T. coronata*) (Ernst and Ernst 2003), although geographically the Florida crowned snake (*T. relicta*) is closer. The rim rock crowned snake (Telford 1966) was described from an adult male collected in April 1955, when the species was elevated from a subspecies of the southeastern crowned snake (*T. coronata wagneri*).

Life History

Nothing is known regarding the reproduction, longevity, or diet of the rim rock crowned snake, but if it is similar to the closely related southeastern crowned snake, it probably matures at 2 years old and may live to be at least 5 years old in the wild (Todd et al. 2008). Because of warmer temperatures and the longer growing season in south Florida, the rim rock crown snake may reach sexual maturity at earlier age. There may be 3 eggs in a clutch, and they may be able to produce 2 clutches annually (Ernst and Ernst 2003). Prey probably consists of centipedes, insects, and other small invertebrates, similar to the diet of other members of the genus *Tantilla* (Ernst and Ernst 2003). Two rim rock crowned snakes were found inside a road-killed eastern coral snake (*Micrurus fulvius*) (Hines 2011). It may also be preyed upon by the slender brown scorpion (*Centruroides gracilis*), which is abundant in its habitat (Porras and Wilson 1979).

Description

The rim rock crowned snake is a small species that is colored tan to beige (thus the name *Tantilla*) on its back, with a belly of pinkish white to cream. There is often a pale blotch just behind the eye. Specimens from the Keys may have a pale neckband that is not present in mainland specimens (Porras and Wilson 1979). The maximum recorded size is 29.2 cm (11.5 in) total body length including the tail. Females reach a greater length than do males, but have shorter tails (Ernst and Ernst 2003).

Geographic Range

The rim rock crowned snake is endemic to the southern tip of Florida including the Keys ([Figure 1](#)). On mainland Florida, the rim rock crowned snake is known from various localities in Miami, including Brownsville, Coconut Grove, Coral Gables, Cutler, Cutler Ridge, Kendall, Leisure City, North Miami, and Perrine (Duellman and Schwartz 1958, (Florida Museum of Natural History [FLMNH] 2011 and Florida Natural Areas Inventory [FNAI] 2011). The rim rock crowned snake also occurs in the Upper and Middle Keys, but the only record from the Lower Keys (Key West in 1938) has been considered questionable (Telford 1966, Campbell and Moler 1992). However, the discovery of a specimen on Big Pine Key in 2007 (Yirka et al. 2010) confirmed the occurrence of the species in the Lower Keys.

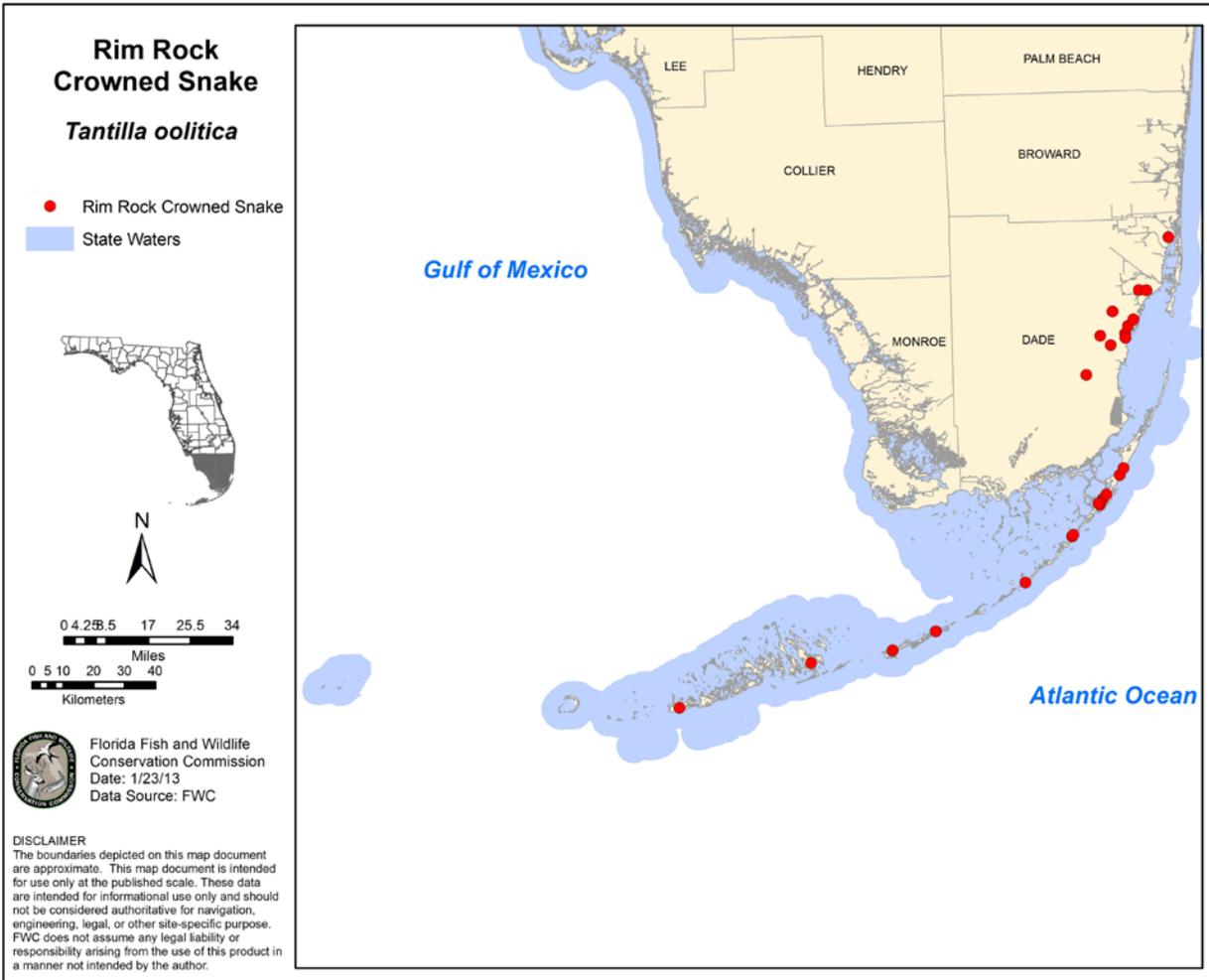


Figure 1. Locality records from FLNMH, FNAI, and the literature for the rim rock crowned snake. Specific localities are from Krysko et al. (2011).

Habitat

The rim rock crowned snake inhabits pine rocklands and tropical hardwood hammocks in the Miami area and the Florida Keys, but there are records from human-altered habitats such as roadsides, vacant lots, and pastures with shrubby growth and slash pines (*Pinus elliottii*) (Duellman and Schwarz 1958, Campbell and Moler 1992, Hines 2011). The rim rock crowned snake is a fossorial species (spends time in underground refuges) that inhabits shallow soil over oolitic limestone formations. It can sometimes be found in rotten stumps and under anthropogenic surface detritus (including piles of damp clothing and rotten boards), fallen logs, and rocks (Duellman and Schwarz 1958, Bartlett 2002, Rochford et al. 2010, Yirka et al. 2010 Hines 2011). Eroded cavities in the limestone may provide underground refuges (Porras and Wilson 1979). It apparently comes to the surface after rains (Porras and Wilson 1979), possibly because of flooding of its underground refuges.

Conservation History

The State of Florida listed the rim rock crowned snake as a Threatened species in 1975. This listing provided legal protection from direct take without a permit. Through the Florida Forever

program and its predecessors, the state has acquired significant tracts of native habitat throughout the Florida Keys supporting numerous imperiled species, including the rim rock crowned snake. There are currently 3 active Florida Forever projects in the Keys. The North Key Largo Hammocks project in the Upper Keys was approved in 1983. As of February 2012, 16.8 km² (6.5 mi²) of the total 20.3-km² (7.8-mi²) project area is now in public ownership. The Coupon Bight Key Deer project located on Big Pine Key and No Name Key was approved in 1985. As of February 2012, 6.9 km² (2.7 mi²) of the total 13.5-km² (5.2-mi²) project has 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, conserve 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, which resulted in a major acquisition of habitat for Keys species. Additional amendments since 2005 by multiple sponsors have brought the entire area of the FKE project to 52.9 km² (20.4 mi²). As of February 2012, 18.2 km² (7 mi²) of the FKE has been placed in public ownership leaving 34.7 km² (13.4 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 decline in the rim rock crowned snake population is suspected mainly because of habitat destruction, degradation, and fragmentation (FWC 2011). Development on suitable habitat (particularly near Miami) has severely fragmented or eliminated subpopulations of the rim rock crowned snake; these rockland and hammock habitats are now embedded in a matrix of agricultural and residential landscapes (O'Brien 1998). Approximately 98% of the original Miami Rock Ridge pinelands outside of Everglades National Park has been lost (Snyder et al. 1990). Many of the tropical hardwood hammocks on the Keys and mainland were cleared for agriculture, firewood, and charcoal in the 1800s, and almost all pinelands were clear-cut by 1950 (Snyder et al. 1990). One to 10 snakes were consistently found at each visit to a lot containing an abandoned house in Miami; this site has since been developed (Hines 2011). The most recent mainland records are from property on the Barnacle Historic State Park in 2007 (Hines 2011) and Zoo Miami (formerly Miami MetroZoo) in 2009. The Barnacle Historic State Park supports a population, despite containing only 1.6 ha (4 ac) of hammock (Hines 2011). The most recent records from the Keys are from 1988 on Upper and Lower Matecumbe keys, from 1998 on Grassy Key, from 2002 on Vaca Key (Marathon), and from 2007 on Big Pine Key and Key Largo (Hines 2011, FLMNH 2011, FNAI 2011). Records compiled by Hines (2011) show 6 observations from 1930 to 1950, 6 from 1951 to 1970, 18 from 1971 to 1990, and 12 since 1991 (this does not include the Zoo Miami record). Snakes are often found on roads, and vehicle-caused mortality may be a factor, particularly in areas with a dense network of roads. Besides direct mortality from vehicles, roadways fragment snake populations, making them more vulnerable to extinction through the reduction of genetic diversity (Jochimsen et al. 2004).

Sea Level Rise and Hurricanes

Rim rock crowned snakes and their prey, especially amphibians, are probably 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 the species is unknown. Seawater surges and short-term flooding of upland habitats in the Keys may kill some snakes and their prey. For example, after Georges, a Category 2 hurricane, 4 of 15 monitored freshwater holes in the Lower Keys had salinities > 15 parts per thousand because of the storm surge that remained in some places months later (Lopez et al. 2004). A stronger storm (i.e., greater than Category 3) would have a greater impact due to stronger winds and greater surge. A storm surge of 4 m (13 ft) would result in the complete submersion of Big Pine Key and No Name Key, which together provide about 51% of the 276 freshwater sources for the Key deer (*Odocoileus virginianus clavium*) and, presumably, the rim rock crowned 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 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 the salt content of freshwater ponds and brackish ponds to an extent that would eliminate them as suitable habitat. Sea level rise will increase maximum high tides and will likely exacerbate the effects of storms surges (Florida Oceans and Coastal Council 2009), which may impact 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 (0.08 in) per year. This rate appears to be increasing, according to trend analyses by the National Oceanic and Atmospheric Administration (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 for the Great White Heron National Wildlife Refuge (NWR) in the lower and middle Keys, predicts the loss of 77% of mangrove habitat, 98% of beach, 94% of irregularly flooded marsh, and 69% of regularly flooded marsh (Warren Pinnacle Consulting 2011a). Similarly, SLAMM predicts that Crocodile Lake NWR in the upper Keys will be impacted causing the loss of up to 98% of refuge mangrove, which comprises the vast majority of the NWR. Simulations using SLAMM predict Key West NWR will be severely impacted under every sea level rise scenario tested. Under the scenario where sea level rises 1.5 m (59 in) by 2100, the entire NWR would be under water (Warren Pinnacle Consulting 2011b).

Non-native species

The red imported fire ant (*Solenopsis invicta*) has invaded southern Florida and the Keys, and predation by this non-native species may be a contributing factor for declines in some oviparous (egg laying) snake populations in the Southeastern Coastal Plain (Mount 1981). Because of its fossorial nature and small size, the rim rock crowned snake may be particularly susceptible to

fire ants. In a study conducted in the Lower Keys, transects with the highest probability of the presence of fire ants were those closest to roads and with the largest amount of development within a 150-m (492-ft) radius (Forys et al. 2002). The increasing numbers of introduced lizard species in the Miami area and on some of the Keys (Meshaka et al. 2004) could have some impact; the Cuban treefrog (*Osteopilus septentrionalis*), cane toad (*Rhinella marina*), and several of the introduced lizard species are capable of preying on small snakes (Meshaka et al. 2004). Some introduced lizard species, especially the litter dwellers, might compete for food with the rim rock crowned snake. Feral and free-roaming domestic animals may also be a threat to this species. Opossums (*Didelphis virginiana*) from the Upper Keys were recently introduced to the Lower Keys (R. Grau, FWC, personal communication). These potential predators benefit from human alteration of natural environment (intentional and unintentional), and may be present in higher than natural numbers. Unnatural levels of predation may be a significant threat, especially in combination with other threats.

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 rim rock crowned snake. The FWC convened a biological review group (BRG) of experts on the rim rock crowned snake to assess the biological status of the species using criteria specified in Chapter 68A-27.001, Florida Administrative Code (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](#).

The BRG for the rim rock crowned snake concluded from the biological assessment that it met a [criterion](#) necessary to warrant listing it as a Threatened species. The rim rock crowned snake meets the definition of a population with a very restricted area with an extent of occurrence of 3,160 km² (1,220 mi²) and an area of occupancy of 140.4 km² (54.2 mi²). Due to the rim rock crowned snake's limited natural range and limited number of locations, it may always meet Criterion D. As a result, it is expected that this taxon will always remain on the Florida Endangered and Threatened Species List. However, actions in this plan are designed to address the continuing decline documented in the [Biological Status Review](#) (BSR). The objectives of this plan are designed to maintain or improve the quality of existing habitat, expand the amount of available habitat where possible, maintain the integrity of existing populations, and ensure that existing populations are protected from stochastic (random) events whenever possible.

CONSERVATION GOALS AND OBJECTIVES

Goal

The conservation status of the rim rock crowned snake is improved to the point that the species is secure within its historical range.

Objectives

I. Maintain the area of occupancy and extent of occurrence of the rim rock crowned snake.

Rationale

According to the BSR for the rim rock crowned snake, Criterion D was triggered by an estimated extent of occurrence of 3,160 km² (1,220 mi²) and an area of occupancy of 140.4 km² (54.2 mi²). Because this species occupies a spatially limited area, it is unlikely that the area of occupancy or extent of occurrence will increase beyond the minimum area of occupancy defined under Criterion D. However, the current area of occupancy and extent of occurrence can be maintained, and possibly even slightly expanded, through the protection and management of existing potential habitat.

II. Maintain or improve the extent and/or quality of habitat available for the rim rock crowned snake.

Rationale

Future development within the Keys and Miami-Dade County is expected to lead to a reduction in the already limited amount of suitable habitat present for this species. Since the potential for expanding suitable habitat within the restricted land area of the Florida Keys is relatively limited, maintaining and improving habitat quality within the species' extent of occurrence is critical for securing the rim rock crowned snake within its historic range. Maintaining and improving habitat will accommodate population growth, making this taxon less susceptible to threats like severe weather events.

III. Ensure that the rim rock crowned snake exceeds 10,000 mature individuals, with at least 1 location having more than 1,000 individuals.

Rationale

FWC listing Criterion C (adopted from IUCN listing criteria for Vulnerable) gives the threshold for a stable population as 10,000 mature individuals. Criterion D gives the threshold of 1,000 individuals at a minimum of 1 location. These criteria must be met in order to maintain a stable population. There is a lack of confidence regarding the data for this species, with little available information on population status. The population size of the rim rock crowned snake is currently unknown. Due to this uncertainty, it is important to confirm whether the taxon exceeds these criteria and to revisit these criteria if it is found that the taxon does not meet them.

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 the rim rock crowned snake 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 that 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 having rim rock crowned snake populations or the potential to support them, the FWC should be consulted (as statutorily required), and the lead management agency is encouraged to include FWC as part of the management plan advisory group. If implemented, this action would ensure conservation lands are managed in a fashion compatible with the needs of the species.

Further research is needed to determine habitat needs on conservation lands currently in public ownership as well as on future conservation land acquisitions within the range of the rim rock crowned snake ([Action 6](#)). The habitat needs of the rim rock crowned snake 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 as a result of human activity. Improving conditions for this species will help stop the decline and help enhance its potential for surviving extreme weather events.

Action 2 To the greatest extent practical, maintain existing suitable habitat, restore existing altered habitat, and acquire or otherwise protect as much potential habitat as possible for the rim rock crowned snake.

Imperiled species endemic to southern Florida and the Keys present a unique conservation challenge. The total habitat available to these species is constrained by the fact that they exist on a small portion of Miami-Dade County and a relatively small chain of islands. The total area of the Florida Keys is estimated at about 356 km² (137.5 mi²). The limited size of this area also constrains human use of the land, leading to higher-intensity land usages that are often incompatible with the needs of imperiled species. Although there are historic rim rock crowned snake sightings in disturbed areas, development of suitable habitat has severely fragmented or eliminated subpopulations of the rim rock crowned snake. These rockland and hammock habitats

are now embedded in a matrix of agricultural and residential landscapes (O'Brien 1998). In addition to protections described in Actions [1](#), [9](#), [10](#), [11](#), and [12](#), the highest-priority action to ensure the long-term conservation of this species is the acquisition and management of as much suitable habitat as possible within the species' range. To achieve this, coordination with local, state, and federal land managers will be needed to prioritize parcels for acquisition and management that protect the highest-quality habitat for rim rock crowned snakes. Reliable, dedicated funding sources and imperiled species management should be top concerns when evaluating conservation land acquisitions within the range of the rim rock crowned snake. With the exception of several donated parcels, the entire FKWEA consists of lands purchased under Florida Forever. All prioritization of land acquisition under this program should consider the potential presence of these 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.

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 on lands such as roadsides, vacant lots, and pastures with shrubby growth and slash pines (*Pinus elliottii*). Methods, if employed in the Lower Keys, that can minimize the effects of roads on snake populations would benefit all listed snake species in that area. Jochimsen et al. (2004) reviews many of those measures.

Programs are available that can provide technical assistance and funding to landowners interested in managing their lands for imperiled species ([Action 10](#)). Restoration and management of rim rock crowned snake habitats should follow habitat management recommendations to provide the greatest benefit for the species ([Action 3](#)). A method must be developed for measuring of the relative quality or suitability of identified potential habitat patches ([Action 5](#)).

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

Habitat management recommendations need to be developed to guide land managers (on both public and private lands) on habitat management goals, actions, and management techniques to ensure that high-quality habitat is available for this species. These are not to be confused with other pre-existing best management 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, and include avoidance and minimization measures as well as measures designed to promote species recovery through improvements in ecosystem health. Habitat management recommendations also need to take into consideration other factors that may need to be addressed, such as control of non-native animals or free-roaming domestic animals that may present a threat to rim rock crowned snakes. Unfortunately, we lack data on the rim rock crowned snake, and many knowledge gaps exist regarding proper management for these animals. These gaps need to be filled (to the best of our ability) in order to develop sound, comprehensive habitat management recommendations for this species ([Action 6](#)). Managing habitat for the needs of these snakes will help stem their decline and enhance their ability to survive severe weather events.

Action 4 Continue the removal of non-native species.

Non-native species pose threats to rim rock crowned snake and other native species in southern Florida. 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 actively removed from public and private lands in the Keys. These efforts should continue and expand to include specific non-natives identified as a potential threat to the rim rock crowned snake and its habitat.

Population Management

No actions specific to population management are identified at this time. Under the right circumstances, a captive breeding program could be considered, but no such program is currently proposed.

Monitoring and Research

Action 5 Conduct surveys of existing habitat (survey habitat and determine quality of habitat). Conduct population surveys of rim rock crowned snakes using methods to be determined.

Because of the relative rarity and secretive nature of the rim rock crowned snake, many aspects of the life history of this species, its population status, and trends are poorly known. The relative scarcity of the species will make it extremely difficult to use traditional survey techniques to collect sufficient data to produce a clear picture of its population status. As such, at least in the near term, conclusions on the conservation status of this species will have to be based on indirect observations of existing habitat and less-robust survey methodology relying on presence and absence observations. In spite of these difficulties, research into aspects of the life history, habitat needs, and population trends is critical to guide management decisions intended to ensure the long-term conservation of this species.

Habitat Surveys

The extent of suitable habitat found within the range of the rim rock crowned snake is poorly known. Existing geographic information system (GIS)-based models of rim rock crowned snakes are out-dated. Never verified in the field, they are considered to have low accuracy (Cox and Kautz 2000). To provide a more complete picture of the current status of habitat in Monroe and Miami-Dade counties, a baseline survey must be conducted to delineate existing potential habitat throughout the species' range. A measure of the relative quality or suitability of identified potential habitat patches needs to be developed ([Action 5](#)). In addition, the ownership of remaining patches of potential habitat should be determined. If areas containing significant population clusters of rim rock crowned snakes occur outside of lands under the management of FWC, partnerships will need to be developed in order to ensure their long-term viability on these lands ([Action 14](#)).

Population Surveys

As identified in the [BSR](#), virtually no information exists on the population status and trends of the rim rock crowned snake. The relative rarity of the species makes reliably capturing the

species extremely difficult using traditional techniques. Regardless of the inherent difficulty in finding these animals, a baseline survey of the species is needed to determine patterns of presence and absence within its existing habitat and potential range. Survey protocol should be robust enough that reliable conclusions on the presence and absence of the species at any particular site can be determined.

Because of the relatively high value of any verifiable observation of a rim rock crowned snake, a mechanism should be established for reporting sightings of this snake by natural resource professionals and the general public. Such a database and reporting process would be beneficial for several other rare Keys species ([Action 8](#)). Knowledge of populations and existing habitats will help management of this species.

Action 6 Research the life history of the rim rock crowned snake.

Little information is available regarding the species' basic life history. The rim rock crowned snake is considered to be among the rarest snakes in Florida. Prior to 2000, FNAI only had 11 confirmed records of occurrences of this snake (Cox and Kautz 2000). An intensive survey effort conducted in 2009 by the Institute for Regional Conservation resulted in only 2 sightings (Hines 2011). Much of the life history information for this species is inferred from similar species. Its reproduction, longevity, and diet are completely unknown. Most of the habitat information is at least 20 years old and needs to be updated (Duellman and Schwarz 1958, Campbell and Moler 1992, Hines 2011). To successfully manage for this species, research should be conducted on life history and habitat preferences.

Action 7 Develop a long-term monitoring strategy for the rim rock crowned snake.

Over the long term, it will be critical to periodically re-assess the status of identified subpopulations of rim rock crowned snakes and their habitat to determine if conservation strategies are working and whether other conservation actions need to be taken to mitigate for new or expanding threats. An evaluation of suitable habitat for the species should be conducted every 10 years to assess changes in habitat quality or quantity and to determine if changes in land ownership or land use are having an effect on the viability of the species. Population monitoring surveys should also be conducted (if feasible) to examine patterns of presence and absence in patches of suitable habitat and to determine if these strategies are providing conservation benefit for the species.

Action 8 Establish a program for reporting and tracking sightings of rim rock crowned snakes.

Because rim rock crowned snakes are difficult to detect using traditional survey methods, incidental observations of these animals are a potentially valuable data source. There is currently no mechanism for sharing incidental observations by members of the conservation community or the general public to conservation agencies or interested organizations, except for contributing voucher sightings to natural history museums or FNAI. An internet database may be a simple, user-friendly mechanism for collecting incidental observations. FWC has several models for such a database, and these allow uploading of voucher photos and georeferencing through graphic mapping interface or smart phone application. Once a database is developed, training

and outreach materials would need to be distributed among members of the conservation community (partner agencies such as the Florida Department of Environmental Protection's [DEP's] Division of Recreation and Parks, USFWS, non-profit organizations such as Audubon, Florida Reptile and Amphibian Working Group, and North American Center for Snake Conservation) and interested members of the public. Training information could include web tutorials on surveying and reporting as well as identification guides designed for field use. Partners will be consulted on the creation of the website. The reporting system will be publicized through outreach to local conservation groups, hobbyists, and biologists. The database will also be publicized on the FWC website and should be easily accessed through a website search for rim rock crowned snakes. An easy reporting process and provision of training materials should help foster public interest in the conservation of imperiled species in southern Florida in addition to increasing our knowledge of the species.

Rule and Permitting Intent

Rule Intent

Listing as a Threatened species provides adequate regulatory protection for the rim rock crowned snake.

Permitting Structure

Although the regulatory structure is sufficient to protect populations from take, as stated above, in practical application permits allow individuals to legally conduct activities prohibited or limited in rule. In recognition of the distinctiveness and limited distribution of the rim rock crowned snake population, all permitted activities should be carefully considered to prevent undue stress and the resultant declines to this population. In recognition of the poor understanding of the taxonomy of this species, we recommend that tissue samples be taken when researchers encounter the rim rock crowned snake and that those tissue samples be provided to the FWC researchers. FWC will hold on to samples until enough are collected to be analyzed.

Intentional Take for Conservation or Research Purposes

Having a scientifically informed listing process requires that researchers be able to "take" species when necessary. Even the gentlest methods might be considered harassment when the animals are handled or their movements are impeded. [Rule 68A-27.007, F.A.C.](#), Permits and Authorizations for the Take of Florida Endangered and Threatened Species, provides factors to be considered for the issuance of permits for scientific or conservation purposes. These criteria are sufficient for the issuance for permits that promote conservation while mitigating potentially threatening activities. We recommend that these permits be issued for scientific or educational purposes that contribute to the objectives of this plan or the conservation of the rim rock crowned snake. We recommend that, as a condition of the permit, be permittees report information collected about this species to the FWC, FNAI, and the FMNH within 1 year of completion of the work.

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

- whether the purpose for which the permit required is adequate to justify removing specimens of the species from the wild

- the probable direct or indirect effect which issuing the permit would have on the wild population of the species sought to be taken
- whether the permit would conflict with any program intended to enhance the survival of the species sought to be taken
- whether the purpose of the permit would likely reduce the threat of extinction for the species sought to be taken
- the opinions or views of subject matter (species) experts concerning the species sought to be taken
- whether the expertise, facilities, or other resources available to the applicant are adequate to successfully accomplish the objective stated in the application

Law Enforcement

Action 9 Develop and implement a training program for FWC law enforcement officers on the identification of the rim rock crowned snake, and rules and regulations pertaining to this protected species.

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 and other management plans because they 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 Florida's protected rim rock crowned snakes, they are aware of all applicable rules and regulations pertaining to these species, and they are able to explain to the public the ecological importance of rim rock crowned snakes.

In turn, an important component 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, 7 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. Protecting this species from take will help stem the decline of the taxon.

Incentives and Influencing

Action 10 Develop less-than-fee acquisitions on private lands where the rim rock crowned snake is or is likely to be present.

Because funding for direct land acquisition and 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 they might not otherwise perform.

Because of the unique nature of habitats within the Florida Keys, many properties in 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, which may allow consideration of 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 based on less-than-fee programs specifically for the Keys to address the unique nature of these areas. Because of the limited amount of habitat available for the rim rock crowned snake (as well as other potentially occurring 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 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 available 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. Any protection and suitable management of the extremely limited remaining habitat may turn out to have an important role in ensuring the long-term viability of this population.

Florida also provides tax incentives including property tax exemptions under [s.196.26, F.S.](#), for landowners who 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.

Action 11 Coordinate with USFWS staff and evaluate [Habitat Conservation Plans \(HCPs\)](#) and [Candidate Conservation Agreements with Assurances \(CCAAs\)](#) as means to provide a conservation benefit for rim rock crowned snake and to provide incentives to private landowners.

Action 12 Implement as appropriate HCPs and CCAAs to benefit the conservation of rim rock crowned snakes with interested landowners.

Because the USFWS was recently petitioned to list the rim rock crowned snake as a federally Threatened species, HCPs and CCAAs may provide incentives for private landowners to conduct activities that benefit rim rock crowned snakes on private lands. HCPs are planning documents developed during the application process for an incidental take permit for a federally listed species. These plans outline the effects of anticipated future impact and proposed actions to be undertaken to minimize and mitigate such impacts. HCPs can apply to both listed and non-listed species, including those that are candidates or have been proposed for listing. CCAAs are proactive, voluntary agreements between the USFWS and a private party allowing a property

owner to voluntarily implement conservation measures on lands that benefit the species in the agreement, while providing regulatory assurances to the landowner should the species become federally listed under the Endangered Species Act. The FWC will work cooperatively with landowners and the USFWS to determine if HCPs and CCAAs are useful tools for furthering the conservation of rim rock crowned snakes. Implementing these actions will aid in stopping the decline of rim rock crown snakes and help enhance the ability of the taxon to survive severe weather events.

Education and Outreach

Action 13 Direct outreach to local conservationists and 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 should encourage public observation reports through local conservation groups and partners (e.g., DEP's Division of Recreation and Parks, USFWS, Audubon, Florida Reptile and Amphibian Working Group, and North American Center for Snake Conservation).

Coordination with Other Entities

Action 14 Coordinate with and provide technical assistance to local governments on local environmental issues and occurrences of rim rock crowned snakes.

Staff of the FWC will meet with local government staff to provide technical assistance and to share research, range and distribution information, GIS information, and land-development conservation measures. Information will be provided for local governments to distribute (through permitting programs) to property owners who potentially have rim rock crowned snakes on their property. Information could be distributed with permit information or materials. FWC will encourage development and enforcement of listed species and habitat protections 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 13](#).

Monroe and Miami-Dade counties' Comprehensive Plans address land development and protection of native habitats. Local government's implementation and enforcement of these laws are vital for the goals outlined in this plan. Regulations do not specifically address listed species but do have provisions for protection of native habitats in the Monroe County Comprehensive Plan. Miami-Dade County's Comprehensive Plan also addresses protection of native habitats and threatened wildlife but does not specifically mention the rim rock crowned snake. In addition to county regulations, the City of Miami, the City of Homestead, the Village of Islamorada, the City of Marathon, and the City of Key West have comprehensive plans that address protecting native habitats and species.

Table 1. Rim Rock Crowned Snake (*Tanilla oolitica*) 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?
2	2	1	Apply management that accommodates the needs of the rim rock crowned snake 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, Miami-Dade 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 given level 2 priority.
2	1	2	To the greatest extent practical, maintain existing suitable habitat, restore existing altered habitat, and acquire or otherwise protect as much potential habitat as possible for the rim rock crowned snake.	Habitat Conservation & Mgmt	ONGOING	YES	NO	TBD	Trust fund, legislature, donations, and other	HSC	DEP, State Parks, USFWS, UF, Monroe County, The Nature Conservancy, Miami-Dade County	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.
2	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, Miami-Dade County	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 level 2 priority because it will improve habitat.
2	1	4	Continue the removal of non-native species.	Habitat Conservation & Mgmt	EXPANDED	YES	YES	TBD	Grants legislature, existing budget	HSC	DEP, State Parks, USFWS, Monroe County, Local Governments, UF, Miami-Dade County	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	1	5	Conduct surveys of existing habitat (survey habitat and determine quality of habitat). Conduct population surveys of rim rock crowned snake using methods to be determined.	Monitoring & Research	NEW	YES	NO	\$50-100k	Grant	HSC and FWRI	State Parks, USFWS, UF, Monroe County, Miami-Dade 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.
3	1	6	Research life history of the rim rock crowned snake.	Monitoring & Research	NEW	YES	NO	TBD	Grant	FWRI	State Parks, USFWS, Monroe County, Miami-Dade County	Unlikely, to have successful surveys, but any success will greatly increase our knowledge of this species.	Yes it is feasibility, but it is not practical. It will require many hours to gain any knowledge but it is important for the conservation of this species. Relationships exist.	No, surveys will not reduce critical threats to the survival of this species, but is this work must be conducted first prior to other conservation actions.
1	2	7	Develop a long-term monitoring strategy for the rim rock crowned snake.	Monitoring & Research	NEW	YES	NO	TBD	Unknown	HSC and FWRI	State Parks, USFWS, UF, Monroe County, Miami-Dade 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 and tracking sightings rim rock crowned snakes.	Monitoring & Research	NEW	YES	YES	\$0-25k	Existing budget	HSC and FWRI	State Parks, USFWS, UF, Monroe County, Center for Snake Conservation, Miami-Dade 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 greatly aid monitoring.
1	3	9	Develop and implement a training program for FWC law enforcement officers on the identification of the rim rock crowned snake, and rules and regulations pertaining to this protected species.	Law Enforcement	ONGOING	YES	YES	TBD	Existing budget	HSC	State Parks, USFWS, Monroe County, Local Governments and National Park Service, Miami-Dade 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 the species from take.
2	2	10	Develop less-than-fee acquisitions on private lands where the rim rock crowned snake is or is likely to be present.	Incentives & Influencing	EXPANDED	YES	YES	TBD	Unknown	HSC	DEP, USFWS, UF, Monroe County, Local Government, Miami-Dade County	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. Rim Rock Crowned Snake (*Tantilla oolitica*) 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?
2	3	11	Coordinate with USFWS staff and evaluate Habitat Conservation Plans (HCPs) and Candidate Conservation Agreements with Assurances (CCAAs) as means to provide a conservation benefit for rim rock crowned snake and to provide incentives to private landowners.	Incentives & Influencing	NEW	YES	YES	TBD	Unknown	HSC	USFWS, 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 could improve habitat.
2	3	12	Implement as appropriate HCPs and CCAAs to benefit the conservation of rim rock crowned snakes with interested landowners.	Incentives & Influencing	NEW	YES	YES	TBD	Unknown	HSC	USFWS, 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 could improve habitat.
1	3	13	Direct outreach to local conservationists and interested members of the public.	Education & Outreach	NEW	YES	YES	\$0-25k	Grant/ existing budget	OCR, HSC	State Parks, USFWS, UF, Monroe County, Miami-Dade 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	14	Coordinate and provide technical assistance to local governments on local environmental issues and occurrences of rim rock crowned snakes.	Coordination with Other Entities	ONGOING	YES	YES	\$0-25k	Existing budget	HSC	State Parks, USFWS, UF, Monroe County, Miami-Dade 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:

- CCAA: 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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