

**A Species Action Plan for the
Lower Keys Population of the
Peninsula Ribbon Snake
(*Thamnophis sauritus sackenii*)**

**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 peninsula ribbon snake (Lower Keys population) (*Thamnophis sauritus sackenii*) 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 ribbon snakes but there are physiological and morphological differences. This population continues to be threatened by hurricanes, climate change, and increased predation. For these reasons, the Lower Keys subpopulation should be given special consideration.

The goal of this plan is to maintain the population of peninsula ribbon snakes in the Lower Keys. The first objective of this plan is to maintain the area of occupancy and extent of occurrence of the peninsula ribbon snake in the Lower Keys. The second objective is to maintain or improve the extent and quality of habitat for the peninsula ribbon snake in the Lower Keys. The last objective is that the peninsula ribbon snake population in the Lower Keys continues to exceed 10,000 mature individuals with at least 1 location having more than 1,000 individuals.

This plan details the actions necessary to improve the conservation status of the peninsula ribbon 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 and 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 the 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

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

FLMNH: Florida Museum of Natural History

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.

GLOSSARY OF TERMS AND ACRONYMS

FRAWG: Florida Reptile and Amphibian Working Group

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.

GIS: Geographic Information System

Habitat: The area used for any part of the life cycle of a species (including foraging, breeding, and sheltering).

HCP: Habitat Conservation Plan

ISMP: Imperiled Species Management Plan

IUCN: International Union for Conservation of Nature

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

GLOSSARY OF TERMS AND ACRONYMS

Take: As defined in 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 U.S., 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 and Description

The peninsula ribbon snake (*Thamnophis sauritus sackeni*) population in the Lower Florida Keys has a tan to brown dorsum with a buff to tan-colored middorsal stripe that can be indistinct or completely absent. Most specimens are 45 to 63 cm (17.7 to 24.8 in) and have 8 supralabial scales (scales that border the mouth opening on the upper jaw). The middorsal stripe in the lower Keys population is yellow, orange, or tan bordered on each side by a narrow black stripe (Weaver et al. 1992). The number of supralabial scales is occasionally 7 instead of 8 (Christman 1980), although 10 specimens examined by Lazell (1989) had 8 supralabial scales. In Florida, peninsula ribbon snake characteristics exhibit gradual (clinal) variation from north to south with the Lower Keys population representing the southern end of that variation. Although no genetic analysis has been conducted, the Keys population is recognized as taxonomically distinct in most scientific literature.

Geographic Range

The peninsula ribbon snake (*Thamnophis sauritus sackeni*) ranges from extreme southern South Carolina through the Georgia Coastal Plain and south through the Florida peninsula to the Lower Keys. In the Lower Keys, this species has been documented on Big Pine, Cudjoe, Little Torch, Middle Torch, No Name, Saddlebunch, Sugarloaf, and Upper Sugarloaf keys ([Figure 1](#)). There are some records of peninsula ribbon snakes in the Upper Keys on Key Largo (Lazell 1989, Weaver et al. 1992, (Florida Museum of Natural History [FLMNH] 2011 and Florida Natural Areas Inventory [FNAI] 2011).

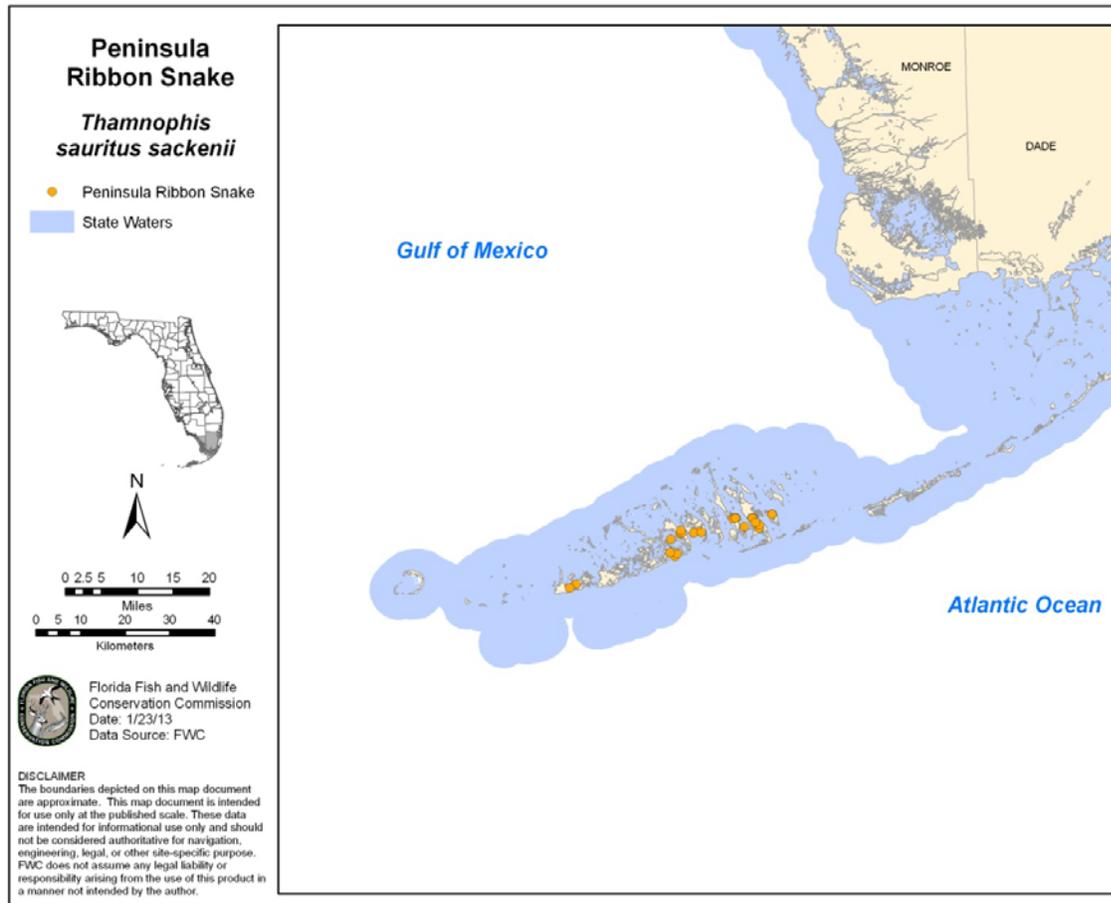


Figure 1. Locality records from FLMNH and FNAI for peninsula ribbon snakes in the Lower Florida Keys.

Life History

The peninsula ribbon snake occurs along freshwater habitats, where it forages and shelters in grassy and shrubby vegetation. Lazell (1989) states that this species is “tightly tied to open freshwater habitats: the rare, tiny marshes left in the Lower Keys.” According to Weaver et al. (1992), this snake also inhabits mangrove systems and *Spartina* marshes in the Lower Keys. The peninsula ribbon snake is not entirely restricted to fresh water in the Keys and, tolerant of some salinity, can live in brackish zones. FNAI records indicate that ribbon snakes have been found in both pine rockland and hardwood hammock habitats. Ribbon snakes bear live offspring with an average litter size of 10 to 12 (Ernst and Ernst 2003). Two females from the Lower Keys had 5 and 8 young (Lazell 1989). Snakes in Everglades National Park were gravid (carrying eggs) in June and from August to October (Dalrymple et al. 1991). Peninsula ribbon snakes are active during both day and night. In the Keys, they have been found crossing roads at night (Lazell 1989, Weaver et al. 1992). They are good climbers and swimmers. Lizards are the primary prey in the Lower Keys but peninsula ribbon snakes also consume frogs and fish (Weaver et al. 1992, Ernst and Ernst 2003).

Conservation History

The Lower Keys population of the peninsula ribbon snake was state-listed as a Threatened species in 1974. This listing required a permit for take. 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 ribbon snake. There are currently 2 active Florida Forever projects in the Lower Keys. 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 plants, and animal species and to protect critical foraging and resting habitat for numerous migratory bird species. In 2004, 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 FKWEA consists of lands purchased through Florida Forever.

Threats and Recommended Listing Status

Habitat Loss and Fragmentation

Clearing of hammocks and areas around wetlands has probably eliminated peninsula ribbon snakes (Lower Keys population) from some areas, particularly those snakes using habitats close to sources of fresh water with surrounding grassy and shrubby vegetation. However, populations may persist in areas where the landscape has been cleared and left vacant to undergo ecological succession, especially where fresh water remains. Adults are threatened by road mortality (Paulson 1968, Lazell 1989, Ernst and Ernst 2003). Big Pine Key, with its dense network of roads, seems a prime area for vehicle-caused mortality. Besides direct mortality from vehicles, roads fragment snake populations, making them more vulnerable to extinction through the reduction of genetic diversity (Jochimsen et al. 2004).

Climate Change, Sea Level Rise and Hurricanes

Climate change and associated sea level rise presents exceptional challenges to ribbon snake populations in the Lower 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. According to trend analyses by the National Oceanic and Atmospheric Administration (2013), this rate appears to be increasing. 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 (NWRs). [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 NWR in the Lower and Middle Keys predicts a loss of 77% of mangrove habitat,

98% of beach, 94% of irregularly flooded marsh, and 69% of regularly flooded marsh (Warren Pinnacle Consulting 2011a). Loss of the freshwater marsh and mangrove habitat will impact ribbon snakes occupying those habitats in the Lower Keys. 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 refuge would be under salt water and would be therefore unsuitable for ribbon snakes (Warren Pinnacle Consulting 2011b).

Sea Level Rise and Hurricanes

Lower Keys populations of peninsula ribbon snakes and their prey, especially amphibians, are impacted by storm surges that increase the salinity of freshwater wetlands. Hurricanes and associated seawater surges and short-term flooding of upland habitats in the Keys probably 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 storm surge, which remained for months 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 together provide about 51% of the 276 freshwater sources for the Key deer (*Odocoileus virginianus clavium*); these sources are probably important to the peninsula ribbon 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 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 would likely impact this species.

Predation and Commercialization

There are no specific observations of predation on ribbon snakes in the Lower Keys, but raccoons (*Procyon lotor*), crabs (*Brachyura*), raptors, and domestic cats and dogs are known to kill and eat small snakes and may be a threat. The non-native cane toad (*Rhinella marina*) and Cuban treefrog (*Osteopilus septentrionalis*) are known to eat small snakes (Meshaka et al. 2004, Krysko and Halvorsen 2010) and may be a threat to small peninsula ribbon snakes. Opossums (*Didelphis virginiana*) from the Upper Keys have been recently introduced to the Lower Keys (R. Grau, FWC, personal communication). Unnatural levels of predation may be a significant threat, especially in combination with other threats. Because the population of peninsula ribbon snakes in the Lower Keys occupies a small area and is potentially under heavy predation pressure, the additional pressure of commercial harvest is likely unsustainable.

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 peninsula ribbon snake. The FWC convened a biological review group (BRG) of experts on the Lower Keys population of the peninsula ribbon 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 peninsula ribbon snake (Lower Keys population) BRG concluded from the biological assessment that the Lower Keys population of the peninsula ribbon snake met 2 [criteria](#) for listing as a Threatened species. However, since the population is not recognized as distinct from mainland populations, FWC staff recommended that this population be delisted. After peer review, staff recommended delisting the taxon, and the Commissioners approved this decision. The 2 criteria that the Lower Keys population of the peninsula ribbon snake met were its small extent of occurrence and area of occupancy. The Lower Keys population of the peninsula ribbon snake met listing Criterion B(b)(1), a population with a very restricted extent of occurrence (estimated as 137 km² [53 mi²]) that is fragmented (occurring in fewer than 10 locations) and declining. The Lower Keys population of the peninsula ribbon snake met listing Criterion B(b)(2), a population with a very restricted area of occupancy (estimated as 62 km² [24 mi²]) that is fragmented (occurring in fewer than 10 locations) and declining (FWC 2011). These criteria were designed by the IUCN to indicate whether a species or population has a high risk of extinction in the wild. While the extent of occurrence and fragmentation are probably the natural conditions for this species, the estimated declines in area of occupancy can be stabilized or reversed. The objectives below focus on habitat quality, habitat range, and population size as the best means for stabilizing declines and maximizing area of occupancy for the Lower Keys populations of peninsula ribbon snakes. Although this snake is being removed from the Florida Endangered and Threatened Species List, it is important for maintaining biodiversity in the Lower Keys.

CONSERVATION GOALS AND OBJECTIVES

Goal

The conservation status of the peninsula ribbon snake Lower Keys population is maintained or improved so that the species will not again need to be listed on the Florida Endangered and Threatened Species List.

Objectives

I. Maintain the extent of occurrence of the peninsula ribbon snake in the Lower Keys.

Rationale

According to the [Biological Status Review](#) (BSR) for the peninsula ribbon snake, Criteria B and D were triggered by an estimated area of occupancy found at only 1 or 2 locations and an extent of occurrence of 137.3 km² (53 mi²) along with an area of occupancy of 61.5 km² (23.7 mi²). Because this population is found on a small island chain of limited space, 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 even slightly expanded through the protection and management of existing habitat. Maintaining or increasing the current extent of occurrence of peninsula ribbon snakes in the Lower Keys should reduce the likelihood of this species' extirpation, which is important for maintaining the natural biodiversity of the Lower Keys.

II. Maintain or improve the extent and quality of habitat available for the Florida (peninsula) ribbon snake in the Lower Keys.

Rationale

Future development within the Keys is expected to lead to a reduction in the already limited amount of suitable habitat present for this population. The potential is limited for expanding suitable habitat within the spatially restricted area of the Florida Keys. Maintaining and improving habitat quality within the species' extent of occurrence is the most critical goal for securing the peninsula ribbon snake within its historical range.

III. Ensure that the Lower Keys population of the Florida peninsula ribbon snake exceeds 10,000 mature individuals, with at least 1 location having more than 1,000 individuals.

Rationale

Population size of the peninsula ribbon snake in the Lower Keys is suspected to be greater than 1,000 individuals. FWC listing Criterion C (adapted 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 should be met to reduce the risk of extirpation of ribbon snakes from the Lower Keys. Also, the BRG thought the Lower Keys population of ribbon snakes is in decline; it should be stabilized. There are few data from which to estimate population status or size for ribbon snakes in the Lower Keys, so some of the actions below seek to collect essential data for these estimates. After population trends and factors limiting populations are understood, then management can be adapted to maintain peninsula ribbon snake populations in the Lower Keys to preserve the area's overall biodiversity and maintain functional ecosystems.

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 Educate land managers within the known range of the peninsula ribbon snake (Lower Keys population) regarding microhabitat considerations and habitat management needs of this species.

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 Lower Keys populations of the peninsula ribbon snake (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. Achieving this action will facilitate maintaining long-term viability of the peninsula ribbon snake in the Lower Keys by maintaining or improving the extent and quality of its habitat, its area of occupancy, and its extent of occurrence.

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 peninsula ribbon snake (Lower Keys population).

Imperiled species endemic to the Florida Keys present a unique conservation challenge. The total habitat available is constrained by the fact that they exist on a chain of islands that is relatively small (the total area of the Florida Keys is estimated at about 356 km² [137.5 mi²]). The relatively limited size of these islands also constrains human use of the land, leading to higher-intensity land usage that is often incompatible with the needs of imperiled species. Ribbon snakes are thought to be generally intolerant of intense alterations or extensive urbanization; especially if access to fresh water is impacted (Lazell 1989). In addition, only a limited subset of the land area in the Florida Keys may be suitable for particular species. Data summarized within the [BSR](#) indicate that potential habitat for this snake exists on only 61.5 km² (23.7 mi²) of land within the islands. Our current best estimate indicates that less than 25% of the potential habitat for this snake is currently found on publicly managed lands (Endries et al. 2009). Because of the extremely limited amount of potential habitat available to the peninsula ribbon snake, highest priority action to ensure the long-term conservation of this subpopulation is the acquisition and management of as much suitable habitat as possible within its range. To achieve this, coordination with local, state, and federal land managers is needed to prioritize which parcels to

acquire and manage to protect the highest-quality suitable habitat for the peninsula ribbon snake (Lower Keys population). Reliable, dedicated funding sources and imperiled species management should be top concerns when evaluating conservation land acquisitions within the range of the snake. With the exception of several donated parcels, the entire FKWEA consists of lands purchased through 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.

On conservation lands currently in public ownership, as well as on future conservation land acquisitions within the range of the peninsula ribbon snake (Lower Keys population), 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 as a result of human activity. Management techniques that, if employed in the Lower Keys, minimize the effects of roads on snake populations and would benefit all listed snakes in that area. Jochimsen et al. (2004) review many of those measures. In addition, cooperation with private landowners willing to manage for this snake could be beneficial. Programs are available that provide technical assistance and funding to landowners interested in managing their lands for imperiled species ([Action 11](#)). Restoration and management of peninsula ribbon snake habitats should follow habitat management recommendations to provide the greatest benefit for the species ([Action 3](#)). Achieving this action will facilitate maintaining long-term viability of the peninsula ribbon snake in the Lower Keys by maintaining or improving the extent and quality of its habitat as well as its area of occupancy and extent of occurrence, which is important to reduce this species' risk of extirpation.

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

Habitat management recommendations need to be developed to guide land managers on public and private lands regarding habitat management goals, actions, and management techniques that ensure 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, 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 such as control of non-native animals or free-roaming domestic animals that may present a threat to peninsula ribbon snake (Lower Keys population). Achieving this action will help maintain long-term viability of the peninsula ribbon snake in the Lower Keys by improving the extent and quality of its habitat as well as its area of occupancy and extent of occurrence to reduce this species' risk of extirpation.

Action 4 Continue the removal of non-native species.

Non-native species pose threats to ribbon snakes and other native species in the Lower Keys. 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 Keys. These efforts should be continued and expanded to target species identified as a potential threat to the peninsula ribbon snake and its habitat. Achieving this action will facilitate maintaining long-term viability of the peninsula ribbon snake in the Lower Keys by increasing the likelihood of achieving populations of 10,000 mature individuals with at least 1 location having more than 1,000 individuals to reduce this species' risk of extirpation.

Population Management

No actions specific to population management are identified at this time.

Monitoring and Research

Action 5 Determine whether the peninsula ribbon snake population in the Lower Keys is taxonomically distinct or sufficiently isolated to warrant separate listing protection.

There are data gaps that need to be filled for the peninsula ribbon snake (Lower Keys population). There has not been a genetic analysis of the Keys population of ribbon snakes, but since the geographic variation is continuous, the Keys population is not considered taxonomically distinct. The taxonomic status could affect the future listing status of the ribbon snake. If the genetic analysis of the Keys population finds the population to represent a subspecies or a distinct population, the Lower Keys peninsula ribbon snake could meet criteria for listing in Florida as a Threatened species. Peninsula ribbon snake characteristics exhibit gradual (clinal) variation from north to south in Florida, and the lower Keys population represents the southern end of the cline. Genetic analysis is needed to answer these questions about taxonomy.

Peninsula ribbon snakes in the Florida Keys are considered a relatively common snake (L. Nester, FWC, personal observation) and are not considered distinct from other peninsula ribbon snakes living in peninsular Florida. However, enough morphological variation exists that these snakes are considered unique compared to mainland populations. While the species is recommended for delisting because of its similarity to mainland snakes, the species may be vulnerable to collection due to its perceived uniqueness, representing a potential source of take. Achieving this action will help maintain viable populations of this snake in the Keys and statewide by identifying conservation lands that merit specific attention. Maintaining genetic diversity is important to reducing the risk of extirpation of ribbon snakes from the Lower Keys.

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

Because of the secretive nature of peninsula ribbon snakes (Lower Keys population), its population status and trends are poorly known. The species cryptic nature and relative scarcity will make it extremely difficult to collect sufficient high-quality data for analysis of population status. As such, at least in the near term, conclusions on the conservation status of this population

will be based on indirect observations of existing habitat and less-robust survey methodology relying on presence and absence observations. In spite of these difficulties, active pursuit of research into aspects of the life history, habitat needs, and population trends is needed to guide management decisions intended to ensure the long-term conservation of peninsula ribbon snakes in the Lower Keys.

Habitat Surveys

Currently, the extent of suitable habitat found within the range of the Lower Keys population of peninsula ribbon snakes is poorly known. Endries et al. (2006) 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 come up with a baseline estimate of potential habitat (61.5 km² [23.7 mi²]). However, these models are based on data that is not current, and little of the identified potential habitat has been verified in the field. The habitat needs of this species are so poorly understood that it is difficult to create a model of potential habitat, and the results of these models must be used with caution. To provide a better assessment of the status of potential ribbon snake habitat in the Florida Keys, a baseline habitat survey needs to be conducted to delineate existing potential habitat throughout this species' range. If areas containing significant population clusters of ribbon snakes occur outside of lands under the management of FWC, partnerships will need to be developed to ensure the long-term viability of populations on these lands ([Action 14](#)).

Population Surveys

As identified in the [BSR](#), virtually no information exists on the population status and trends of the peninsula ribbon snake in the Lower Keys. The estimates that were made were based on estimates from the mainland population. A baseline survey of potential habitat within its range should be conducted to determine patterns of presence and absence within existing habitat. Need exists for a survey protocol robust enough to reliably determine presence or absence at any site. Because of the relatively high value of any verifiable observation of a peninsula ribbon 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 other rare Keys wildlife ([Action 8](#)). Knowledge of populations and existing habitats will improve species management.

Population surveys are necessary to measure progress towards [Objective III](#) and provide information for adapting habitat management regimes to maintain robust (10,000 mature individuals with at least 1 location having more than 1,000 individuals) populations of the peninsula ribbon snake in the Lower Keys.

Action 7 Develop a long-term monitoring strategy for the peninsula ribbon snake (Lower Keys population).

It is critical to periodically assess the status the Lower Keys populations of peninsula ribbon snakes and their habitat to measure the effectiveness of conservation strategies and to inform adaptive management. An evaluation of suitable habitat for this snake should be conducted on a 10-year timeframe to assess changes in habitat quality or quantity and to determine if changes in land ownership or land use are affecting the species. Population monitoring surveys (if feasible)

should also be conducted to determine if these strategies are providing conservation benefits for the species. Achieving this action will inform management to maintain viable populations of the peninsula ribbon snake in the Lower Keys.

Action 8 Establish a program for reporting sightings of peninsula ribbon snakes (Lower Keys population).

Because peninsula ribbon snakes are highly secretive and difficult to detect, incidental observations of these animals are a 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. A simple, user-friendly mechanism for collecting incidental observations may be an internet database. 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, the Florida Reptile and Amphibian Working Group, and the North American Center for Snake Conservation) and interested members of the public in the Keys. This training information could include web tutorials on surveying and reporting as well as identification guides designed to be printed out and taken in the field. Partners will be consulted on the creation of the website. The reporting system should 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 accessible through a web search for peninsula ribbon snakes. An easy reporting process and provision of training and informational materials should help foster public interest in the conservation of imperiled species in the Keys in addition to increasing our knowledge of the species.

Rule and Permitting Intent

Protections

Action 9 Protect peninsula ribbon snakes in the Lower Keys from unsustainable take.

Although a general prohibition forbids 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. Peninsula ribbon snakes in the Lower Keys are differently colored from mainland populations and may be targeted by the pet trade. Because of the threat of hurricanes, climate change, and predation, coupled with the small area that they occupy, peninsula ribbon snakes in the Lower Keys should be protected from harvest. It is the opinion of the authors of this plan that recreational take of Lower Keys ribbon snakes should not be allowed. Commercialization of peninsula ribbon snakes 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 these permits be issued for scientific or educational

purposes that contribute to the objectives of this plan or the conservation of the Lower Keys population of the peninsula ribbon snake. We recommend that, as a condition of the permit, be permittees report information collected about this species to the FWC, FNAI, and the FLMNH 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

This action will contribute to maintaining the peninsula ribbon snake in the Lower Keys by increasing the likelihood of meeting the desired population objective of 10,000 mature individuals with at least 1 location having more than 1,000 individuals.

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. The 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 snakes, are aware of all applicable rules and regulations pertaining to these species, and are able to explain to the public the ecological importance of Florida's protected snakes.

Action 10 Provide training opportunities specific to peninsula ribbon snake protections for law enforcement officers.

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 the peninsula ribbon snake from the Lower Keys.

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. Achieving this action will facilitate maintaining the peninsula ribbon snake in the Lower Keys by increasing the likelihood of meeting the desired population objective of 10,000 mature individuals with at least 1 location having more than 1,000 individuals and maintain the species' full area of occupancy and extent of occurrence.

Incentives and Influencing

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

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 that 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 that may allow some of these programs to still be applicable to 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 incentive-based or 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 Lower Keys population of the peninsula ribbon 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 likely be a limited opportunity practice because of 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. Any protection and suitable management of the extremely limited available potential habitat for the Lower Keys population of the peninsula ribbon snake (Lower keys population) may 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.

Achieving this action will facilitate maintaining long-term viability of the peninsula ribbon snake in the Lower Keys by maintaining or improving the extent and quality of its habitat as well as its area of occupancy and extent of occurrence.

Action 12 Coordinate with USFWS staff and evaluate [Habitat Conservation Plans \(HCPs\)](#) and [Candidate Conservation Agreements with Assurances \(CCAA\)](#) as means to provide a conservation benefit for the ribbon snake (Lower Keys population), and provide incentives to private landowners.

Action 13 Implement as appropriate HCPs and CCAA to benefit the conservation of the ribbon snake (Lower Keys population) with interested landowners.

Because the USFWS was recently petitioned to list the ribbon snake (Lower Keys population) as a federally Threatened species, HCPs and CCAAs may provide incentives for private landowners to conduct activities that benefit the ribbon snakes (Lower Keys population) 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 that allows 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 the ribbon snake (Lower Keys population). Implementing these actions (Actions [12](#) and [13](#)) will facilitate the long-term viability of the peninsula ribbon snake in the Lower Keys by maintaining or improving the extent and quality of its habitat and its area of occupancy and extent of occurrence.

Education and Outreach

Action 14 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. There will be outreach to encourage reports of sightings from the public through local conservation groups and partners (DEP's Division of Recreation and Parks, USFWS, Audubon, the Florida Reptile and Amphibian Working Group, and the North American Center for Snake Conservation). This action will facilitate maintaining long-term viability of the peninsula ribbon snake in the Lower Keys by ensuring that management efforts focus on protecting the species throughout its entire

area of occupancy and extent of occurrence and by involving the public and conservation professionals in data collection and making them aware of the needs of the species.

Coordination with Other Entities

Action 15 Coordinate and provide technical assistance to local governments on local environmental issues and occurrences.

FWC staff 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 to local governments to give to property owners that have peninsula ribbon snakes (Lower Keys population) on their property through the county or local government permitting program. Information could be distributed with their permit information or materials. FWC will encourage 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 14](#).

Monroe County's Comprehensive Plan addresses 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. The Monroe County Comprehensive Plan and Land Development Regulations do not specifically address peninsula ribbon snakes 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. Achieving this action will facilitate maintaining long-term viability of the peninsula ribbon snake in the Lower Keys by assuring that management efforts focus on protecting the species throughout its entire area of occupancy and extent of occurrence.

Table 1. Lower Keys Population of the Peninsula Ribbon Snake (*Thamnophis sauritus sackenii*) 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 | Educate land managers within the known range of the peninsula ribbon snake (Lower Keys population) regarding microhabitat considerations and habitat management needs of this species. | 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. |
| 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 peninsula ribbon snake (Lower Keys population). | 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. |
| 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 | 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. |
| 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 | 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. |
| 3 | 3 | 5 | Determine whether the peninsula ribbon snake population in the Lower Keys is taxonomically distinct or sufficiently isolated to warrant listing protection. | 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 peninsula ribbon snake (Lower Keys population). | 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 peninsula ribbon snake (Lower Keys population). | 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 peninsula ribbon snakes (Lower Keys population). | 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 peninsula ribbon snakes in the Lower Keys 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 | Provide training opportunities specific to peninsula ribbon snake protections for law enforcement officers. | 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. |

Table 1. Lower Keys Population of the Peninsula Ribbon Snake (*Thamnophis sauritus sackeni*) 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 | 2 | 11 | Develop less-than-fee acquisitions on private lands. | | 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. |
| 2 | 3 | 12 | Coordinate with USFWS staff and evaluate Habitat Conservation Plans (HCPs) and Candidate Conservation Agreements with Assurances (CCAA) as means to provide a conservation benefit for the ribbon snake (Lower Keys population), and provide incentives to private landowners. | | 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 | 13 | Implement as appropriate HCPs and CCAA to benefit the conservation of the ribbon snake (Lower Keys population) with interested landowners. | | 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 | 14 | 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 | 15 | 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

LITERATURE CITED

- Christman, S. P. 1980. Patterns of geographic variation in Florida snakes. *Bulletin of the Florida State Museum, Biological Sciences* 25:157–256.
- Dalrymple, G. H., T. M. Steiner, R. J. Nodell, and F. S. Bernardino, Jr. 1991. Seasonal activity of the snakes of Long Pine Key, Everglades National Park. *Copeia* 1991:294–302.
- Endries, M., T. Gilbert, and R. Kautz. 2009. The integrated wildlife habitat ranking system 2009. Florida Fish and Wildlife Conservation Commission, Tallahassee.
- Ernst, C. H., and E. M. Ernst. 2003. *Snakes of the United States and Canada*. Smithsonian Books, Washington, D.C.
- Florida Fish and Wildlife Conservation Commission [FWC]. 2011. Ribbon snake biological status review report. Florida Fish and Wildlife Conservation Commission, Tallahassee.
- Florida Natural Areas Inventory [FNAI]. 2011. Florida Natural Areas Inventory tracking list. <http://www.fnai.org/trackinglist.cfm>. Accessed 3 September 2011.
- Florida Natural History Museum. 2011. Search the herpetological master database. http://www.flmnh.ufl.edu/scripts/dbs/herps_pub.asp. Accessed 3 September 2011.
- Florida Oceans and Coastal Council. 2009. The effects of climate change on Florida's ocean and coastal resources. A special report to the Florida Energy and Climate Commission and the people of Florida. Florida Oceans and Coastal Council, Tallahassee.
- Jochimsen, D. M., C. R. Peterson, K. M. Andrews, and J. W. Gibbons. 2004. A literature review of the effects of roads on amphibians and reptiles and the measures used to minimize those effects. Report to the Idaho Fish and Game Department and the U.S. Department of Agriculture Forest Service.
- Kasper, K. 2007. Hurricane Wilma in the Florida Keys. NOAA/National Weather Service Forecast Office, Key West, Florida. <http://www.srh.noaa.gov/media/key/Research/wilma.pdf> > Accessed on 12 November 2010.
- Krysko, K. L., and M. D. Halvorsen. 2010. *Osteopilus septentrionalis* (Cuban treefrog) prey. *Herpetological Review* 41:339–340.
- Lazell, J. D., Jr. 1989. *Wildlife of the Florida Keys: a natural history*. Island Press, Covelo, California.
- Lopez, R. R., N. J. Silvy, R. F. Labisky, and P. A. Frank. 2004. Hurricane impacts on Key deer in the Florida Keys. *Journal of Wildlife Management* 67:280–288.

- Meshaka, W. E., Jr., B. P. Butterfield, and J. B. Hauge. 2004. The exotic amphibians and reptiles of Florida. Krieger Press, Malabar, Florida.
- National Oceanic and Atmospheric Administration. 2013. Tides & Currents. Mean Sea Level Trend 9824580 Key West, Florida.
<http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8724580%20Key%20West,%20FL>. Accessed 6 March 2013.
- Paulson, D. R. 1968. Variation in some snakes from the Florida Keys. Quarterly Journal of the Florida Academy of Sciences 29:295–308.
- Warren Pinnacle Consulting. 2011a. Application of the Sea-Level Affecting Marshes Model (SLAMM 6) to Great White Heron NWR. Report prepared for U.S. Fish and Wildlife Service, National Wildlife Refuge System, Division of Natural Resources and Conservation Planning, Arlington, Virginia.
- Warren Pinnacle Consulting. 2011b. Application of the Sea-Level Affecting Marshes Model (SLAMM 6) to Key West NWR. Report prepared for U.S. Fish and Wildlife Service, National Wildlife Refuge System, Division of Natural Resources and Conservation Planning, Arlington, Virginia.
- Weaver, W. G., S. P. Christman, and P. E. Moler. 1992. Florida ribbon snake, Lower Keys population, *Thamnophis sauritus sackeni* (Kennicott). Pages 162–165 in P. E. Moler, editor. Rare and endangered biota of Florida. Volume III. Amphibians and reptiles. University Press of Florida, Gainesville.