Rim rock crowned snake

Tantilla oolicta

Photograph by Dustin C. Smith.

Species Overview

Status: Listed as state Threatened on Florida's Endangered and Threatened Species List

Current Protections

- 68A-27.003(a), F.A.C., No person shall take, possess, or sell any of the endangered or threatened species included in this subsection, or parts thereof or their nests or eggs except as allowed by specific federal or state permit or authorization.
- 68A-27.001(4), F.A.C. Take – to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in such conduct. The term "harm" in the definition of take means an act which actually kills or injures fish or wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. The term "harass" in the definition of take means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering.

Cryptic Species

Cryptic species are those that may be difficult to detect due to behavior, habitat, or physical features, even when using standardized survey techniques in occupied habitat. Interpretation of when harm or harassment may occur is difficult without a clear understanding of essential behavioral patterns of the species or habitat features that may support those behavioral patterns. The documented difficulties in detecting cryptic species and the lack of a reliable detection methodology leads to different considerations for take due to harm.

- The permitting standards for incidental take policy in Florida's Imperiled Species Management Plan identifies the Rim rock crowned snake as a cryptic species.
- Permitting standards for the Rim rock crowned snake will focus on cooperation and acquiring information, with the understanding that as information is gained, permitting standards may need to be adjusted.
- For Rim rock crowned snakes, information on distribution and habitat use may constitute a scientific benefit. Even if surveys are conducted, detection is difficult because little is known about the life history, behavior, or biology of this species.

Biological Background

A species' biological background provides context for conservation measures and permitting guidelines. It focuses on the habitats that support essential behavioral patterns, threats to the species, and what may constitute significant disruption of essential behavioral patterns. Rim rock crowned snakes (Tantilla oolitica) are a seldom seen, cryptic, fossorial (adapted to dig and spend time underground) snake. Here, we define 'cryptic' as those species that may not be easily observed, tracked, or surveyed due to camouflage or behavior rather than rarity. Adult rim rock crowned snakes are small, slender snakes. The maximum size recorded is 11.5 in, and average size ranges from 7 to 9 inches. These snakes are colored beige to tan with a

pinkish white or cream belly. There may be a light brown crown or band on the neck of some individuals, primarily on individuals found within the Keys (Porras and Wilson 1979). Rim rock crown snakes are endemic to Florida and restricted to the Keys and limited localities near Miami (Yirka et al. 2010; Figure 1). The rim rock crowned snake occupies tropical hardwood hammocks and pine rockland habitats where it makes use of fallen trees and underground refugia such as solution holes (Porras and Wilson 1979, Bartlett 2002, Hines 2011). Rim rock crowned snakes are very mildly venomous; however, they are not considered to be a threat to humans (Bartlett and Bartlett 2003).

Rim rock crowned snakes are most often found in pine rockland habitat, although some have been observed in developed areas (Campbell and Moler 1992, Hines 2011), indicating that this species may be able to at least temporarily persist in marginal areas. Information regarding the ecology and life history of the rim rock crowned snake is sparse. For example, there is nothing known about the reproduction, longevity or diet of rim rock crowned snakes (FWC 2013), and most assumptions about this species life history are from closely related species (FWC 2013). Currently, FWC is conducting ongoing research in the Florida Keys to fill data gaps for reptile species. We are working to identify the most viable sampling methodologies for this species. Additionally, in July 2015 FWC issued a request for the public to submit sightings information for imperiled reptile species in the Keys; once verified, this information will assist in increased knowledge of this species' range. Therefore, these guidelines are subject to change as data gaps are filled.

Habitat Features that Support Essential Behavioral Patterns

The rim rock crowned snake uses pine rockland habitat and tropical hardwood hammocks. This fossorial snake will inhabit shallow soil over oolitic limestone formations. When above ground, rim rock crowned snakes may shelter under rocks, fallen logs and anthropogenic debris (e.g., rotten boards or piles of clothing).

Little is known about the rim rock crowned snake's habitat use, reproductive biology, and diet so we look to studies from other crowned snakes (Tantilla spp.) for guidance on habitat use, reproductive biology, feeding and sheltering. Based on other southeastern snakes within the Tantilla genus may live to be 5 years old and mature around 2 years (Todd et al. 2008). There may be 1 to 5 eggs per clutch and hatchlings are probably under 3 inches in length (Bartlett and Bartlett 2003). The main prey items are probably centipedes, insects and other small invertebrates (Ernst and Ernst 2003).

Pine rockland habitat. FWC Photograph.

Threats

Activities that would further fragment and/or degrade hardwood hammock or pine rockland are a source of habitat alteration that can significantly impair the essential behaviors (breeding, feeding, and sheltering) of the rim rock crowned snake. There are very little data on population trends for the rim rock crowned snake and research is needed to definitively establish population estimates. Populations of rim rock crowned snakes are suspected to be in decline (FWC 2011, 2013). Clearing and development of pine rocklands and tropical hardwood hammocks have already eliminated subpopulations of rim rock crowned snakes from some locations (FWC 2013). Nearly 98% of the original Miami Rock Ridge pinelands have been

developed (Snyder et al. 1990, USFWS 1999). Rim rock crowned snakes likely feed on centipedes and other small insects, so negative impacts to their prey base (e.g., chemical control) could cause negative cascading effects.

Pine rocklands are a pyrogenic ecosystem and are stressed by altered fire regimes (FWC 2012). Extended periods of fire exclusion may degrade this ecosystem to the point where it is no longer suitable for rim rock crowned snakes (Enge et al. 2003).

Roads present a risk to rim rock crowned snakes because of vehicle-caused mortality and fragmentation among roadways. This type of fragmentation can make snakes more vulnerable to extinction though reduction of genetic diversity (Jochimsen et al. 2004).

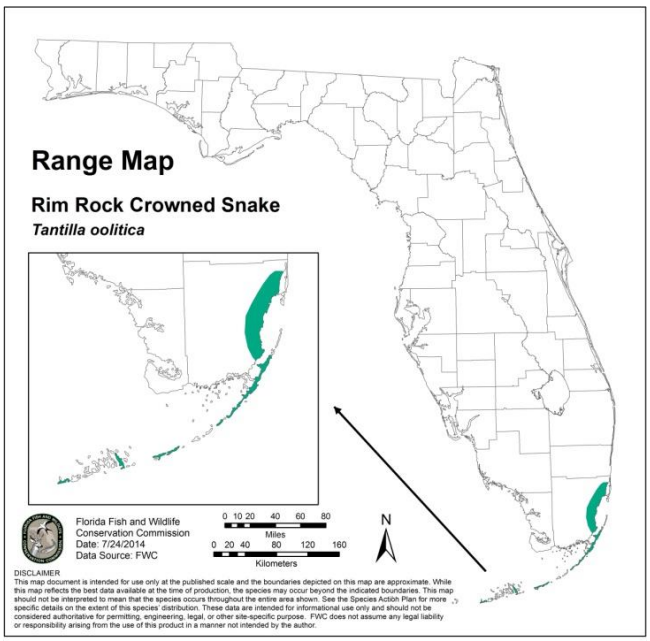
The rim rock crowned snake is also threatened by elements that may negatively impact many other Key species as well, including the spread of invasive plants and animals. Invasive plants and animals (e.g., red imported fire ants (Solenopsis invicta), cane toads (Rhinella marina), Cuban tree frogs (Osteopilus septentrionalis)) could have both direct and indirect impacts on the rim rock crowned snake. Therefore, while mitigation options that maintain pine rockland and tropical hardwood hammocks may be of higher value, invasive predator control could provide a conservation benefit as part of the mitigation process.

Potential to Significantly Impair Essential Behavioral Patterns

Little is known about the rim rock crowned snake breeding and feeding behaviors. However, its habitat needs are linked to intact pine rockland and tropical hardwood hammocks with intact top soil. Activities that cause soil compaction or tilling of the upper layers of soil would be harmful to the rim rock crowned snake and its prey base. Those activities could include, but are not limited to, development, agricultural practices, and other forms of land conversion. Clearing or fragmentation of pine rockland and tropical hardwood hammocks has already eliminated rim rock crowned snakes from some areas (FWC 2011, 2013). However, this species is possibly somewhat resilient to low intensity anthropogenic development, provided that key habitat features are left intact (Campbell and Moler 1992, Hines 2011).

Distribution and Survey Methodology

The range map (right) represents the principle documented occurrences of the rim rock crowned snake. This map is for informational purposes only and not for regulatory use.



Counties: Monroe

Recommended Survey Methodology

Surveys can be used to determine if Rim rock crowned snake are present in an area. Because this is a cryptic species, surveys conducted in accordance with the methodology described below may not detect this species. Rim rock crowned snakes are cryptic and fossorial, thus traditional methods such as coverboard and opportunistic surveys are not effective for this animal. For example, there have been under 20 observations of rim rock crowned snakes since

1991 (FWC 2011), and surveys have been largely unsuccessful when attempting to document this secretive animal (e.g., Enge et al. 2004, Hines and Bradley 2009). Because there are many data gaps in this species distribution, potential survey methodology is described below. Surveys for the Rim rock crowned snake should begin in March and continue through the rainy season (May through October), when reptiles are most active. Surveys are not required, but are recommended during project planning.

- Since the breeding season is not known, the best survey season is unknown. Reptiles are generally most active during the rainy season (May through October), which would coincide with increased likelihood of detection. Rim rock crowned snakes are likely less active in the winter, and during periods of drought (FNAI 2001, Bartlett and Bartlett 2003). Additionally, rim rock crowned snakes sheltering in solution holes may be active after periods of rain (Porras and Wilson, 1979).
- Surveys can be completed by methodically turning over cover objects (e.g., rocks, logs, manmade objects), gently raking through leaf litter, and by using coverboards (see below). However, these snakes are only rarely found beneath cover objects.
- Coverboard surveys will require online registration for a scientific collecting permit since the observer could injure a state-Threatened species when placing or replacing (after surveys) coverboards. Additionally, these coverboards will attract non-target species.
- Surveys are not recommended on sites with strictly impermeable surfaces, gravel, or planted sod with no leaf litter present.

The objective of the surveys is to detect the Rim rock crowned snake; thus, if observers detect this snake on the first survey date, there is no need to continue surveying. If Rim rock crowned snakes are found, the applicant should coordinate with FWC.

To maximize the chance of finding a Rim rock crowned snake, the following survey protocols can be used.

- Opportunistic surveys, where natural debris is turned to look for snakes should be conducted minimally every 2-3 days for 1-5 months, which should be focused from May through October. Opportunistic surveys do not require a permit if the observer is not touching the animal.
- Coverboard checks should be conducted minimally every 2 weeks for 3-5 months, which should be focused from May through October. The standard methodology for this type of coverboard survey is as follows:
- Coverboard surveys will require online registration for a scientific collecting permit since the observer could injure a state-Threatened species when placing or replacing (after surveys) coverboards. Additionally, these coverboards will attract non-target species.
- Coverboards should be 2 x 2 feet in size, made of untreated plywood; minimally, use 8 coverboards per site, set at 5 meter intervals.
- To develop suitable microhabitats under artificial refugia,

Coverboard placement in a tropical hardwood hammock. Photograph by Jonathan Mays.

coverboards should be seasoned for at least 30 days prior to sampling (Wilson and Gibbons 2009). Seasoning allows conditions to develop, such as rotting leaf litter, that mimic natural occurrences (e.g., fallen logs) and therefore coverboards should be placed on site in advance of a survey to naturally weather.

Recommended Conservation Practices

Recommendations are general measures that could benefit the species but are not required. No FWC permit is required to conduct these activities.

- Reduce soil compaction, particularly during the rainy season when rim rock crowned snakes are likely most active.
- Leave leaf litter and woody debris in place as microhabitat.
- Avoid placement of impermeable surfaces, such as roads or parking lots in and adjacent to intact pine rockland and tropical hardwood hammocks.
- Refrain from clearing or fragmenting key habitats (intact pine rockland).
- Design projects to minimize loss of tropical hardwood hammock.
- Consider provisions in the Monroe County Comprehensive Plan regarding protection of tropical hardwood hammocks and other native habitats (Monroe County 2016a).
- Adhere to Land Planning Regulations for the Florida Keys Area of Critical State Concern – Monroe County (Rule Chapter 28-20) and Sections 118-7, 118-10(1), and 118-10(4) of the Monroe County Land Development Code regarding designing development away from natural areas and sensitive habitats, restrictions to developing tropical hardwood hammock, and maintenance of native trees (State of Florida 2014, Monroe County 2015b).
- Develop a prescribed fire regime that minimizes woody encroachment into wetlands and uplands.
- Remove and control nonnative exotic species that may directly or indirectly impact the rim rock crowned snake.
- Avoid or minimize fertilizer, herbicide, and pesticide runoff into wetlands.
- To prevent the establishment and spread of invasive and exotic plants, avoid or minimize disturbance of the soil in areas where Rim rock crowned snakes are believed to be.
- Avoid or minimize fertilizer, herbicide, and pesticide runoff into wetlands.

Measures to Avoid Take

Avoidance Measures that Eliminate the Need for FWC Take Permitting

This section describes all measures that would avoid the need for an applicant to apply for an FWC take permit.

- Avoid impacts to pine rockland and tropical hardwood hammock habitats used by Rim rock crowned snakes. Specifically, avoid topsoil removal and compaction.

Examples of Activities Not Expected to Cause Take

This list is not an exhaustive list of exempt actions. Please contact the FWC if you are concerned that you could potentially cause take.

- Activities that occur on impacted land not consistent with Rim rock crowned snake habitat.
- Routine maintenance of vegetation in existing linear utility and highway right-of-way's.
- Water management actions for human health and safety, such as flood control.
- Mosquito control measures. The FWC recommends following guidelines described by the Florida Keys

Mosquito Control District (2016) which limit direct and indirect effects on non-target vertebrates.

Florida Forestry Wildlife BMP's and Florida Agricultural Wildlife BMP's

- Due to its geographic distribution, this species is not included in the Florida Forestry Wildlife BMP's or Florida Agricultural Wildlife BMP's program, and thus these practices do not apply.

Other authorizations for Take

- As described in Rule 68A-27.007(2)(c), F.A.C., land management activities (e.g., wetland restoration, prescribed fire, mechanical removal of invasive species; and herbicide application) that benefit wildlife and are not inconsistent with FWC Management Plans are authorized and do not require a permit authorizing incidental take.

Coordination with Other State and Federal Agencies

The FWC participates in other state and federal regulatory programs as a review agency. During review, FWC identifies and recommends measures to address fish and wildlife resources to be incorporated into other agencies' regulatory processes. For example, the FWC commented on the Big Pine Key and No Name Key Habitat Conservation Plan (HCP), which notes the importance of tropical hardwood hammock for federally listed species and restricts the loss native habitat for species covered under the plan. The HCP assists in determining the location of potential new development and in prioritizing mitigation areas on these keys. FWC coordinated with local jurisdictions on the Monroe County Comprehensive Plan (Monroe County 2015a), Chapter 118 of the Land Development Code, and the Land Planning Regulations for the Florida Keys Area of Critical State Concern – Monroe County (Chapter 28-20, F.A.C.; State of Florida 2014). Chapter 380 of the Florida Statutes addresses FWC's interactions with counties.

The FWC provides recommendations for addressing potential impacts to state listed species in permits issued by other agencies. If permits issued by other agencies adequately address all of the requirements for issuing a Species of Special Concern or state-Threatened species take permit, the FWC will consider these regulatory processes to fulfill the requirements of Chapter 68A-27, F.A.C., with no additional application process. This may be accomplished by issuing a concurrent take permit from the FWC, by a memorandum of understanding with the cooperating agency, or by a programmatic permit issued to another agency. These permits would be issued based on the understanding that implementation of project commitments will satisfy the requirements of Rule 68A-27.005 and Rule 68A-27.007, F.A.C.

Review of Land and Water Conversion projects with State-Listed Species Conditions for Avoidance, Minimization and Mitigation of Take

- FWC staff, in coordination with other state agencies, provide comments to federal agencies (e.g., the Army Corps of Engineers) on federal actions, such as projects initiated by a federal agency or permits being approved by a federal agency.
- FWC staff works with landowners, local jurisdictions, and state agencies such as the Department of Economic Opportunity on large-scale land use decisions, including long-term planning projects like sector plans, projects in Areas of Critical State Concern, and large-scale comprehensive plan amendments.
- FWC staff coordinates with state agencies such as the Department of Environmental Protection (DEP) and the five Water Management Districts on the Environmental Resource Permitting (ERP) program, which regulates activities such as dredging and filling in wetlands, flood protection, stormwater management, site grading, building dams and reservoirs, waste facilities, power plant development,

power and natural gas transmission projects, oil and natural gas drilling projects, port facility expansion projects, some navigational dredging projects, some docking facilities, and single-family developments such as for homes, boat ramps, and artificial reefs.

FWC Permitting: Incidental Take

As defined in Rule 68A-27.001, F.A.C., incidental take is take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Activities that result in impacts to Rim rock crowned snakes can require an Incidental Take Permit from the FWC (see above for actions that do not require a permit). Permits may be issued when there is a scientific or conservation benefit to the species and only upon showing by the applicant that that the permitted activity will not have a negative impact on the survival potential of the species. Scientific benefit, conservation benefit, and negative impacts are evaluated by considering the factors listed in Rule 68A-27.007(2)(b), F.A.C. These conditions are usually accomplished through a combination of avoiding take when practicable, minimizing take that will occur, and mitigating for the permitted take. This section describes the minimization measures and mitigation options available as part of the Incidental Take Permit process for take of Rim rock crowned snakes. This list is not an exhaustive list of options.

Minimization Measure Options

The options below are intended to address the evaluation factors required for consideration when issuing an incidental take permit. These options can lessen the impact of activities, and ultimately may reduce what is needed to achieve a conservation or scientific benefit (see below).

Seasonal, Temporal, and Buffer Measures

- Seasonality of rim rock crowned snake is not known, although activity levels likely increase during the rainy season (May through October). However, we are uncertain about how increased snake activity levels and likelihood of incidental take may be related.

Design Modification

- Minimize amount of suitable habitat (i.e., pine rockland) converted to other land uses.
- Design projects to leave leaf litter and course woody debris intact.
- Minimize area of soil compaction and tilling to the upper soil layers.
- Design roads away from suitable habitats to minimize road mortality.
- Design projects to minimize changes in timing, quantity, or quality of water that could degrade hydrologic features associated with optimal habitat.
- Design projects to avoid or minimize fertilizer, herbicide, and pesticide runoff into wetlands.
- Avoid placement of impermeable surfaces, such as roads or parking lots in and adjacent to intact pine rockland and tropical hardwood hammocks.

Method Modification

- When activities must occur within habitat occupied by the Rim rock crowned snake, refer to the Seasonal, Temporal, and Buffer Measures above to minimize take.
- Provide information to project personnel on identifying and avoiding directly crushing the Rim rock crowned snake and other cryptic species found in similar habitats.

Mitigation Options

Mitigation is scalable depending on the impact, with mitigation options for significant impairment or disruption of essential behavioral patterns constituting take. The Rim rock crowned snake is a cryptic species. Therefore, the permittee would satisfy mitigation under scientific benefit by providing any snake sighting

information for this species. In most cases, requirements outlined by the county will satisfy the applicant's responsibilities under Rule 68A-27, F.A.C., and associated enforcement policies. However, under certain circumstances, the FWC may require additional measures to achieve scientific or conservation benefit specific for take of Rim rock crowned snakes. Potential options for mitigation are described below.

Scientific Benefit

This section describes research and monitoring activities that provide scientific benefit, per Rule 68A-27.007, F.A.C. Conducting or funding these activities can be the sole form of mitigation for a project. Since this species is cryptic and there is limited information available, the options provided below are subject to change as new information becomes available. Projects that help to refine the survey method for the rim rock crowned snake would need to be conducted with FWC cooperation (SAP Action 5).

- Sharing sightings data (live and dead observations) with FWC, including photographs when available (SAP Actions 7, 8).
- Providing dead specimens to FWC for location vouchers and future genetics work (Actions 7, 8).
- Following established survey methods, projects to fill data gaps related to information on species reproduction including behavior, nesting locations, diet, microhabitat selection and population demographics (i.e., productivity and survivorship; SAP Action 6).
- Monitoring options can include multi-year monitoring or funding for multi-year monitoring that contributes to a portion of a statewide survey (SAP Actions 5, 7)

Habitat

- Habitat acquisition may be a mitigation option. Easements and/or land use agreements that would help to conserve pine rockland and hardwood hammock are preferred (SAP Actions 2, 11).
- Predator control, such as the removal or reduction of feral animals and invasive species including feral cats, red imported fire ants, black spiny-tail iguanas, tegus, and monitor lizards (SAP Action 4).
- Removal of exotic plant species in pine rockland and hardwood hammock habitats (SAP Action 4).

Funding

- No funding option has been identified at this time. However, funding options as part of mitigation will be considered on a case by case basis.

Information

- The information option for this cryptic species may rise to the level of scientific benefit for Rim rock crowned snakes.

Programmatic Options

- No programmatic option available.

Multispecies Options

- Protections provided for this snake will also benefit the Florida brown snake (also state-Threatened), peninsula ribbon snake, and red rat snake. When mitigation is provided for species like the white-crowned pigeon (*Patagioenas leucocephala*) in tropical hardwood hammock, that mitigation may provide a conservation benefit for the Rim rock crowned snake if it occurs within the range of those species.

FWC Permitting: Intentional Take

Intentional take is not incidental to otherwise lawful activities. Per Rule 68A-27, F.A.C., intentional take is prohibited and requires a permit. For state-Threatened species, intentional take permits may only be considered for scientific or conservation purposes (defined as activities that further the conservation or survival of the species taken). Permits are issued for state-Threatened species following guidance in Rule 68A-27.007(2)(a), F.A.C.

Intentional take for human safety

- There are no circumstances for which Rim rock crowned snakes may be taken for human safety.

Aversive Conditioning

- Not applicable for the Rim rock crowned snake.

Permits Issued for Harassment

- Not applicable for the Rim rock crowned snake.

Scientific Collecting and Conservation Permits

Scientific collecting permits may be issued for the Rim rock crowned snake using guidance found in Rule 68A-27.007(2)(a), F.A.C. Activities requiring a permit include any research that involves capturing, handling, or marking wildlife; conducting biological sampling; or other research that may cause take. Please note that these activities include any research that involves capturing, handling, or marking snakes; conducting biological sampling; or other research that may cause take.

Considerations for Issuing a Scientific Collecting Permit

1) Is the purpose adequate to justify removing the species (if the project requires this)?
    - Permits will be issued if the identified project is consistent with the goal of the Species Action Plan (i.e., improvement in status that leads to removal from Florida's Endangered and Threatened Species List), or addresses an identified data gap important for the conservation of the species.
2) Is there be a direct or indirect effect of issuing the permit on the wild population?
3) Will the permit conflict with program intended to enhance survival of species?
4) Will purpose of permit reduce likelihood of extinction?
    - Projects consistent with the goal of the Species Action Plan or that fill identified data gaps in species life history or management may reduce the likelihood of extinction. Applications should clearly explain how the proposed research will provide a scientific or conservation purpose for the species.
5) Have the opinions or views of other scientists or other persons or organizations having expertise concerning the species been sought?
6) Is applicant expertise sufficient?
    - Applicants must have prior documented experience with this or similar species; applicants should have met all conditions of previously issued permits; and applicants should have a letter of reference that supports their ability to handle the species.

Relevant to all Scientific Collecting for Rim Rock Crowned Snakes

- Walking, visual encounter and opportunistic surveys that do not involve touching the animals or altering the microhabitat do not require a permit.
- Any activity that requires trapping or handling a rim rock crowned snake requires a permit. For

example, these activities include taking a scale or tail clip for assistance in taxonomic analyses.

- Applications must include a proposal that clearly states the objectives and scope of work of the project, including a justification of how the project will result in a conservation benefit to the species. The proposal also must include a thorough description of the project's methods, time frame and final disposition of all individuals. Permit amendment and renewal applications must be "stand alone" (i.e., include all relevant information on objectives and methods).
- Permits may be issued to display a specimen if the specimen was obtained via rehabilitation facility or was encountered dead.
- Permits may be issued for captive possession (removal from the wild) if the individual is deemed non-releasable.
- Capturing and handling protocols, and a justification of methods, must be included in the permit application and should identify measures to lessen stress for captured snakes.
- Methodologies for any collection of tissues such as blood and scale clips should be clearly spelled out, including measures taken to reduce stress and injury to the snakes.
- Disposition involving captive possession for any period of time must include a full explanation of whether the facility has appropriate resources for accomplishing the project objectives and for maintaining the animals in a safe and humane manner.
- Any mortality should be reported immediately to the FWC at the contact information below. The FWC will provide guidance on proper disposition of specimens.
- Geographical or visual data gathered must be provided to FWC in the specified format.
- A final report should be provided to the FWC in the format specified in the permit conditions.

Additional information

Information on Economic Assessment of this guideline can be found at http://myfwc.com/wildlifehabitats/imperiled/management-plans/

Contact

For more species specific information or related permitting questions, contact the FWC at (850) 921-5990 or WildlifePermits@myfwc.com. For regional information, visit http://myfwc.com/contact/.

Literature Cited

Bartlett, R. D. 2002. Noted from the field. Krazy for the Keys: to see uncommon herps, take a trip way down south. Reptiles Magazine 10:22-26.

Bartlett, R. D., and P. Bartlett. 2003. Florida's snakes a guide to their identification and habits. University Press of Florida, Gainesville, Florida.

Campbell, H. W., and P. E. Moler. Rim rock crowned snake, *Tantilla oolitica* Telford. Pages 158-161 *in* P. E. Moler editor. Rare and endangered biota of Florida. Volume III. Amphibians and reptiles. University press of Florida, Gainesville.

Enge, K. M., B. A. Millsap, T. J. Doonan, J. A. Gore, N. J. Douglass, and G. L. Sprandel. 203. Conservation plans for biotic regions in Florida containing multiple rare or declining wildlife taxa. Final Report. Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida.

Enge, K. M., M. S. Robson, and K. L. Krysko. 2004. Reptile surveys of pine rockland habitat in six Miami-dade county parks. Biological Sciences 67:194-204.

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. 2011. Rim rock crowned snake biological status review report. Tallahassee, Florida.

Florida Fish and Wildlife Conservation Commission. 2012. Florida's wildlife legacy initiative: Florida's state wildlife action plan. Tallahassee, Florida.

Florida Fish and Wildlife Conservation Commission. 2013. A species action plan for the rim rock crowned snake. Tallahassee, Florida.

Florida Keys Mosquito Control District. 2016. Chemical Labels and MSDS. http://keysmosquito.org/labels/. Assessed 3 November 2016.

Florida Natural Areas Inventory. 2001. Field guide to the rare animals of Florida. Eds. D. Hipes, D. R. Jackson, K. Nesmith, D. Printiss, and K. Brandt.

Hines, K. N., and K. A. Bradley. 2009. Assessment of the status and distribution of the endemic rim rock crowned snake (*Tantilla oolitica*) in Miami-Dade and Monroe Counties, Florida. Final report submitted to U.S. Fish and Wildlife Service, Vero Beach, Florida.

Hines, K. N. 2011. Status and distribution of the rim rock crowned snake. *Tantilla oolitica*. Herpetological Review 42:352-356.

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.

Monroe County. 2016a. Monroe County comprehensive plan. http://keyscompplan.com/. Accessed 7 July 2016.

Monroe County. 2016b. Land development code documents. http://keyscompplan.com/facts-information-resources/land-development-code-documents/. Accessed 7 July 2016.

Porras, L., and L. D. Wilson. 1979. New distributional records for *Tantilla oolitica* Telford. (Reptilia, Serpentes, Colubridae) from the Florida Keys. Journal of Herpetology 13:218-220.

Snyder, J. R., A Herndon, and W. B. Robertson, Jr. 1990. South Florida rockland. Pages 230-277 in R. L. Myers and J. J. Ewel, editors. Ecosystems of Florida. University of Central Florida Press, Orlando.

State of Florida. 2014. Rule Chapter 28-20 land planning regulations for the Florida Keys area of critical state concern – Monroe County. Florida Administrative Code.

Todd, B. D., J. D. Wilson, C. T. Winne, R. D. Semlitsch, and J. W. Gibbons. 2008. Ecology of the southeastern crowned snake, *Tantilla coronata*. Copeia 2008:388-394.

United States Fish and Wildlife Service. 1999. South Florida multi-species recovery plan. Atlanta, Georgia.

Willson, J. D.**,** and J. W. Gibbons. 2009. Drift fences, coverboards, and other traps. *In:* Amphibian Ecology and Conservation: A Handbook of Techniques, C. K. Dodd, Jr., (Ed.), pp. 229-245. Oxford University Press, Oxford, UK.

Yirka, M. A., J. N. Flowers, M. D. Martin, K. R. Messenger, and N. A. Shepard. 2010. Geographic distribution: *Tantilla oolitica* (rim rock crowned snake). Herpetological Review 41:382.