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Technical Report · July 2014

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Threatened and Non-Game Species Management
ANNUAL REPORT

Reptile and Amphibian Research Subsection
Wildlife Research Section
Fish and Wildlife Research Institute

Project Number: 9325 221 1221

Project Title: Short-tailed Snake Reproduction

Project Investigator: Kevin Enge, Fish and Wildlife Research Institute, Wildlife Research Lab, 1105 SW Williston Road, Gainesville, FL 32601

Partners: Garrett Craft, Jordan Schmitt, and Glenn Bartolotti (RSVs)

Fiscal Year Covered: FY 2013-14

Prepared By: Kevin Enge

Date Prepared: July 30, 2014

BACKGROUND

TNSM funds were used to fund a study to collect information on reproduction in the state-threatened short-tailed snake (*Lampropeltis extenuata*). This species inhabits sandhill, scrub, and xeric hammock habitats (Van Duyn 1939, Carr 1940, Campbell and Moler 1992, Enge 1997). Most short-tailed snakes measure 300–500 mm total length (TL), with a record of 655 mm TL (Woolfenden 1962). They prey primarily on small, smooth-scaled snake species, particularly the crowned snake (*Tantilla relicta*), and sometimes on small lizards like ground skinks (*Scincella lateralis*) (Carr 1934, Allen and Neill 1953, Ashton and Ashton 1981, Mushinsky 1984, Campbell and Moler 1992, Rossi and Rossi 1993, Godley et al. 2008).

Although primarily fossorial, it is diurnally active on the surface in cooler months, apparently switching to nocturnal activity in warmer months (Highton 1956). It has been found every month of the year, but examination of 131 records with collection dates revealed that 27% were found in March–May and 58% in September–November. The March–May period is presumably the breeding season, but courtship has never been observed. This seasonal activity pattern is similar to that of the fossorial eastern coral snake (*Micrurus fulvius*) (Jackson and Franz 1981). Nothing is known regarding reproduction or clutch size of the short-tailed snake. Eggs are not present in female specimens in the Florida Museum of Natural History’s (FLMNH) herpetology collection, which contains more vouchers than any other museum. A juvenile snake measuring 190 mm snout-vent length (SV) and 215 mm TL that was captured on 14 April still retained its umbilical scar (Rossi and Rossi 1993). Dr. John Rossi, a reptile veterinarian in the Jacksonville
area, was once issued an FWC scientific research/collecting permit to collect reproductive data but failed to find a pair of snakes before his permit expired.

**Objective**

1. Collect reproductive data for the short-tailed snake, including clutch size, egg and hatchling size, breeding season, and behavior.

Life-history information is lacking for this species because of its cryptic nature and because its protected status has not allowed persons to attempt to breed it in captivity. A research and monitoring conservation action identified in the species action plan developed for the short-tailed snake is to initiate studies to fill data gaps on its life history, if an effective sampling method can be developed (FWC 2013). While soliciting sightings of the species as part of an upland snake status survey (Enge 2013), Garrett Craft, a Ph.D. student at the University of South Florida, reported seven observations in 2013 from sand roads in one subdivision in Hernando Co. This project became feasible because of his ability to find short-tailed snakes in an area where they appeared to be locally abundant (i.e., effective sampling method). Although short-tailed snakes are less readily found during spring, we still hoped that at least one pair could be found, particularly if additional snake hunters could be recruited and provided FWC permits to collect the species. Their small size and extremely slender body make short-tailed snakes difficult to detect on roads. For example, no short-tailed snake was found while driving roads in September–November 2013 and April–June 2014 as part of the upland snake status survey (Enge 2013).

**METHODS**

Individuals (Garrett Craft, Jordan Schmitt, and Glenn Bartolotti) who have experience at detecting short-tailed snakes on roads were signed up as FWC Regular Service Volunteers and issued permits to collect the species. These volunteers drove their personal vehicles and were reimbursed for mileage, which was the only expense incurred during this study. Collected specimens were given to the PI, who deposited dead ones in the Florida Museum of Natural History after determining sex and length, if possible. Dead females were dissected to look for the presence of ovarian follicles or eggs. Live specimens were typically released if they were < 300 mm total length (TL) and presumably sexually immature. Small, live specimens were measured, and large specimens retained for breeding were measured and weighed using a Pesola 50-g spring scale. If eggs had been laid, their length and width would have been measured with calipers and their mass recorded. Post reproduction, adult snakes would have been released at their capture locations. The temperature and duration of incubation would have been recorded, and hatchlings would have been measured and weighed before their release.

In March–May 2014, sand roads were driven in a subdivision north of Centralia Road in Hernando Co., as well as Forest Road 11 in Ocala National Forest, Marion Co. Two drift-fence arrays with four 30-m-long arms of silt fencing were installed in sandhill habitat in Riverside Island and Salt Springs Island, Ocala National Forest, as part of a survey for upland snake species proposed for federal listing, including the short-tailed snake (Enge 2013). Each array
had a large center box snake trap, eight single-opening funnel traps, and eight 5-gallon pitfall traps. Traps were checked twice weekly from 1 April through 30 June.

Captive snakes were initially maintained in a 10-gallon aquarium with sand, leaf litter, a piece of pine bark, and a small water bowl. In mid-May, snakes were switched to another 10-gallon aquarium in which the substrate consisted of a 15-cm-thick section of soil and associated leaf litter removed intact from sandhill habitat. The soil retained its subsurface structure and provided a more naturalistic microhabitat. A depression was dug in one corner of the aquarium and filled with damp sphagnum moss to provide an oviposition site. This end of the terrarium was sprayed with water approximately weekly. Snakes were maintained at ambient temperatures and humidity in an insulated metal building with box fans in the open windows to facilitate air exchange and prevent overheating. Crowned snakes and ground skinks were released into the aquarium as potential prey items. Periodically, short-tailed snakes were individually housed overnight with a crowned snake in a small plastic container with a thin layer of soil to facilitate feeding.

RESULTS

Specimen Collection. From 14 April through 22 May, seven live and three dead short-tailed snakes were found (Table 1). An adult female (457 mm SVL, 495 mm TL, 9.6 g) was caught in Hernando Co. on 15 April after a heavy rain (Fig. 1). It is possible that she had already bred in the wild, but she showed no signs of being gravid. A young male (259 mm SVL, 286 mm TL, 5.6 g) caught in Marion Co. on 24 April was put in the cage with the female. This male was released after larger males were caught. An adult male (450 mm SVL, 495 mm TL, 8.2 g) caught in Hernando Co. on 30 April was retained for the breeding program (Fig. 2). When found at 0945 hr, it was being attacked by a fish crow (Corvus ossifragus). An adult male (454 mm SVL, 495 mm TL, 11.8 g) incidentally found on a road in scrub habitat in Ocala National Forest on 18 May by an FWC bear biologist was added to the terrarium on 18 May (Fig. 3). An adult male with a slightly stubbed tail (405 mm SVL, 432 mm TL, 7.3 g) captured in a funnel trap in Riverside Island, Ocala National Forest, on 22 May was released (Table 1). The sex of snakes was initially determined based upon the length and taper of their tails, and their sex was confirmed by applying pressure to the tails of live snakes and everting the hemipenes of males. The female and two largest males kept in captivity had approximately equal total lengths but weighed 8.2–11.8 g on 30 April, with the female having the intermediate mass (9.6 g). When weighed again on 4 June, the female had gained 1.6 g, whereas the males had each lost 0.3–0.4 g. Specimens from Hernando and Marion counties could be differentiated by their patterns. The Hernando Co. animals had at least 20 more dorsal blotches on the bodies than did Marion Co. animals.

Behavior. When first captured, short-tailed snakes often exhibit defensive behaviors that I believe mimic the dusky pygmy rattlesnake (Sistrurus miliarius barbouri), which it somewhat resembles in coloration and pattern except for its extremely slender body and small head. A short-tailed snake may cock its head sharply upwards (Fig. 2) and quickly twitch it laterally numerous times while moving its tail spastically. The pygmy rattlesnake also twitches its head but seldom rattles defensively because its diminutive rattle is readily shed and produces barely audible rattling sounds when intact (Rowe et al. 2002). Juvenile pygmy rattlesnakes twitch and curl their brightly colored tails to mimic insect larvae and lure anurans and lizards within striking distance.
distance, but the more dull-colored tails of adults are seldom used for prey luring (Jackson and Martin 1980, Rabatsky and Farrell 1996, Rabatsky and Waterman 2005). The defensive tail vibration of most snakes is rapid and continuous, and it is thought to deflect attention of a predator away from the more vulnerable head (Greene 1988). Defensive short-tailed snakes do not rapidly vibrate their tails but may instead slowly waggle and curl their tails spasmodically in motions that resemble caudal luring by pygmy rattlesnakes. Woolfenden (1962) mentioned the

Table 1. Data on short-tailed snakes collected in April–May 2014.

<table>
<thead>
<tr>
<th>Date</th>
<th>Latitude</th>
<th>Longitude</th>
<th>County</th>
<th>Sex</th>
<th>SVL (mm)</th>
<th>Capture Method</th>
<th>Collector</th>
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<tr>
<td>4/14</td>
<td>28.6281</td>
<td>-82.3014</td>
<td>Hernando</td>
<td>M</td>
<td>445</td>
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<td>K. Wood</td>
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<td>F</td>
<td>457</td>
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<td>G. Craft</td>
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<tr>
<td>4/24</td>
<td>29.4526</td>
<td>-81.8093</td>
<td>Marion</td>
<td>F</td>
<td>500</td>
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<td>J. Schmitt</td>
</tr>
<tr>
<td>4/24</td>
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<td>-81.8086</td>
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<td>M</td>
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</tr>
<tr>
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<td>-82.5060</td>
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<td>450</td>
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<tr>
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<td>-82.4942</td>
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<td>M</td>
<td>454</td>
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<tr>
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<td>-81.7929</td>
<td>Marion</td>
<td>M</td>
<td>405</td>
<td>In drift-fence trap</td>
<td>C. Godwin</td>
</tr>
</tbody>
</table>

Figure 1. Adult female caught on 15 April 2014 in Hernando Co. and used in the breeding program. 
Figure 2. Adult male caught on 30 April 2014 in Hernando Co. and used in the breeding program. It is exhibiting defensive behavior, as indicated by the sharply cocked head (the underside of the head is facing the observer).

Figure 3. Adult male caught on 18 May 2014 in Marion Co. and used in the breeding program.
distinctive head-twitching behavior in an excited captive short-tailed snake that would occasionally hold its head vertically and jerk it repeatedly to the side. He speculated that this behavior was related to its fossorial habits, because a short-tailed snake burrows into sand by pressing its nose to the substrate and moving its head up and down. However, the speed and orientation of these two movements differ, whereas the head motions are virtually identical to those of pygmy rattlesnakes. Captive snakes in this study seldom exhibited this behavior, but I observed this behavior while photographing snakes shortly after capture, and Garrett Craft and Jordan Schmitt have filmed this behavior while capturing snakes on roads. Short-tailed snakes may also strike repeatedly and attempt to bite, but their small mouths are usually unable to grip a finger, and the teeth cannot penetrate the skin. When found on roads, short-tailed snakes typically remained motionless, but the one being attacked by the crow quickly crawled away and immediately became defensive when its escape was interrupted (G. Craft, pers. comm.).

In the terrarium, individuals tended to inhabit different microhabitats. The Marion Co. male usually remained on the surface in or on top of the oak leaf litter, whereas the Hernando Co. animals usually were buried in the sand, particularly the female. The Marion Co. male was found in scrub habitat, whereas the Hernando Co. animals came from sandhill habitat, but it is unknown if this was a factor in their microhabitat selection. They did not appear to be efficient at detecting and preying upon crowned snakes, because crowned snakes typically lasted for at least a month after being introduced to the terrarium containing three short-tailed snakes. Predation on crowned snakes was never observed in the terrarium, but the female and Marion Co. male each fed once while confined to a small container overnight with a crowned snake. The female ate a crowned snake on 10 May. One predation attempt by the female was observed in the terrarium, but the crowned snake escaped. The male was observed constricting a crowned snake in the small container but released it when disturbed during a photographic attempt. Other observers have noted crowned snakes escaping while being constricted, even after over two hours of being held by the short-tailed snake, which usually swallows its prey live (Mushinsky1984, Rossi and Rossi 1993). Ground skinks and one mole skink (Plestiodon egregius) in the terrarium eventually disappeared, but they could have died instead of being eaten.

**Reproduction.** The female did not appear to be gravid in May–July when most oviparous snake species in Florida lay their eggs. Dr. Natalie Lamneck radiographed her on June 9 and 27. On the first X-ray image, there appear to be two faint, small clusters of ovarian follicles present (Fig. 4), and there is an oval, solid-looking object resembling a small egg in the second X-ray image (Fig. 5). Dr. Elliott Jacobson, an eminent reptile veterinarian at the University of Florida, examined the radiographs and could not interpret them. He suggested taking an ultrasound image, which can detect soft tissue. An ultrasound conducted at Santa Fe College on 28 July detected no eggs, although there was a flat, unidentified object that may have corresponded to the “egg.” The objects detected by the first radiograph may not have been ovarian follicles; if they were, they were subsequently resorbed. The small follicular size at such a late date would suggest that oviposition occurs in late summer or fall, indicating sperm storage if breeding occurs in March–April. Some snake species, such as pygmy rattlesnakes and cottonmouths (Agkistrodon piscivorus), can breed in spring or fall (Ernst and Ernst 2003). Considering the high degree of surface activity exhibited by short-tailed snakes in fall, it is possible that they also can breed in fall.
Figure 4. Radiograph taken on 9 June 2014 of the female showing what appears to be two clusters of small ovarian follicles in the section of the body between overlapping coils.

Figure 5. Radiograph of the female (left) and Hernando Co. male (right) taken on 27 June 2014, showing an oval object towards the posterior of the female.
FUTURE RESEARCH

This study was unsuccessful at collecting reproductive information on short-tailed snakes, despite finding an adult female in spring. If ovarian follicles were present, she might have resorbed them due to inadequate nutrition or environmental conditions. All short-tailed snakes maintained in captivity during this study either failed to feed or fed sporadically, despite keeping them in a naturalistic setting with minimal disturbance and offering them at least a dozen crowned snakes and several small skinks. The female had low body weight when captured and gained 1.6 g in a little over one month, but she remained noticeably more slender than the Marion Co. male. The PI is considering maintaining the female and Marion Co. male until next year to try breeding them again. He is also going to examine all adult female specimens at FLMNH, regardless of collection date, to see if eggs can be detected. If possible, he will obtain permission to dissect those females that have not already been dissected to look for eggs.

ACKNOWLEDGMENTS

We wish to thank Cody Godwin for assistance in collecting specimens. Cody Godwin, Jonathan Mays, and Paul Moler collected crowned snakes. Travis Thomas and Eric Suarez assisted in getting radiographs and ultrasound imaging, which were performed by Dr. Natalie Lamneck and Lila Decubelas. Paul Moler reviewed this report.

LITERATURE CITED


