FINAL PERFORMANCE REPORT
South Carolina Project T-15-P
Amended
South Carolina Endangered Species Program
South Carolina Department of Natural Resources
October 1, 2005 – September 30, 2007

Job 1. Gopher Tortoise Management

Objectives:

1. Develop a plan to recover and enhance the gopher tortoise population at Aiken Gopher Tortoise Heritage Preserve in Aiken County to include the re-stocking of tortoises from the surrounding habitat and from other sites in South Carolina.

Accomplishments:
During the previous Interim Report Period, October 1, 2005 – September 30, 2006, we reported on the progress to establish three pens (each 1 ha in size) on the Aiken Gopher Tortoise Heritage Preserve. Nine waif tortoises were put in Pen 1 during Autumn 2006 (19 October 2006). The 9 tortoises originated from different places within the Southeast U.S. Several had been long-term captives, after having been confiscated by authorities at an earlier time. Several were obtained during the summer of 2006 from other agencies who were given the tortoises that were found wandering in downtown streets or along interstate highways. Agencies that provided waif tortoises for this project include U.S. Geological Survey, North Carolina Wildlife Dept, SREL, and Georgia DNR. These gopher tortoises were numbered #1- #9 using a marking scheme that used a series of notches on the carapace marginal scutes.

Pen 1: Waif Tortoises

During the current project period, an additional nine (9) adults and eight (8) hatchling gopher tortoises were obtained for the waif tortoise Pen 1. One female (#1) from the original introduction of 9 tortoises died in March 2007 from unknown causes. However, it was noted that she did not dig a very deep burrow before winter. All indications are that the other 8 original tortoises are doing well, as several new burrows have been constructed during summer 2007. Therefore, the total number of gopher tortoises residing in Pen 1 at the end of this project period is now 25. The sex ratio is 8 females, 8 males, 1 subadult female, and 8 hatchlings. The sources of the tortoises added during this project period include the following:

Adults/Sub-adult in Pen 1

#10 Female- found in downtown Atlanta, GA
#11 Juvenile female—found in Spartanburg, SC
#12, 13, 100, 214, 14—5 individuals (3 females, 2 males) all from an earlier waif collection maintained at Webb Center
#118 Male—originally from SRS population, but had emigrated to near Windsor and was captured.
#15 Female—found in Aiken, SC

Hatchlings in Pen 1

8 hatchlings from captive tortoises in Hilda, SC. These hatchlings are offspring of two Florida gopher tortoises that were brought to SC in the 1950s and continue to exist in the town of Hilda. (These hatchlings will be released on 29 October 2007 and will be confined under a hatchling "cage" (see description and photo under Pen 3 report).

The vegetation in Pen 1 shows no signs of being overgrazed, and the grasses and forbs are increasing, as result of the very effective growing season fire conducted by the preserve manager, Brett Moule.

Pen 1 after growing season burn, Spring 2007.

Tortoise #214 at burrow in Pen 1

Pen 2: AGTHP resident tortoises

During the current project period, efforts were made to trap all known tortoises existing sporadically on the AGTHP and on adjacent private property. This effort resulted in the capture of six (6) adult and subadult tortoises. The locations of an additional two adults (or subadults) and 2-3 juveniles are known on peripheral areas of the AGTHP. Trapping efforts were unsuccessful at capturing these remaining animals. These 4-5 burrows will again be targeted with trapping in Spring 2008. However, the 6 captured tortoises (2 females, 2 males, 2 juvenile females) were added to Pen 2 (designated for native AGTHP and vicinity tortoises):

Adults/Sub-adult in Pen 2

#140 (JF), 141 JF, 142 (F), 143 (F), 144 (M), and HIMPQ (M). Note that the coding system for HIMPQ indicates that this tortoise was previously captured during a survey of the AGTHP conducted by University of Georgia students in 1999.

In addition, aprons of AGTHP tortoises were excavated during Summer of 2007 by Tracey Tuberville and Kurt Buhlmann. One gopher tortoise nest containing two eggs was found. One of the eggs hatched, the other was infertile. That hatchling is small and is currently being maintained at SREL and the intention is to add it to the Pen 2 population in Spring 2008.

a.

b.

a. One of the burrows trapped to obtain tortoises for Pen 2.
b. Tracey Tuberville excavating a tortoise burrow apron for eggs on AGTHP.

Brett Moule using burrow camera to check for tortoises on the AGTHP.

<u>Pen 3: South Carolina tortoises (from areas other than AGTHP)</u>

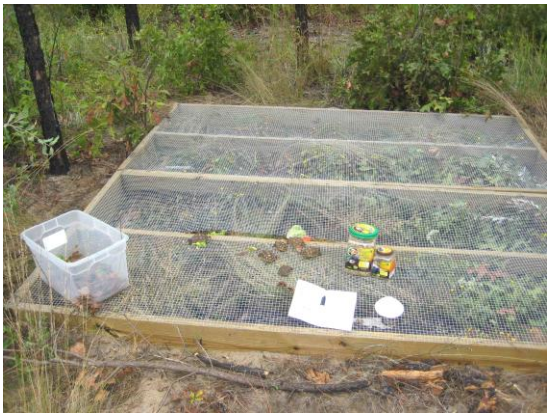
During the current project period, 12 gopher tortoises (3 males, 1 juvenile female, 3 yearlings, and 5 hatchlings) were obtained from a private property owner near the town of Grays, SC. Surveys conducted of the site indicate that perhaps 18 total tortoises may exist there. Trapping efforts will resume with the arrival of warm weather in Spring 2008.

The 12 tortoises from Grays, SC are as follows:
#300 (M), 301 (J), 302 (J), 303 (J), 304 (M), 305 (JF), 306 (M) and 5 hatchlings (unmarked as of this report and not yet added).
In addition, two separate introductions of hatchling tortoises were made to Pen 3 during the Project period. Six (6) hatchlings from laboratory-hatched eggs from the Tillman Sand Ridge Heriege Preserve were released into Pen 3 with starter burrows during Summer 2007. An additional six (6) hatchlings (also form Tillman Sand Ridge HP) were released into Pen 3 but covered under an 8 ft x 8 ft wire mesh cage in Autumn 2007. The intention of the cage is to

prevent predation by coyotes, crows, or raccoons. To date, the hatchlings seem to be surviving under the cages. Additional cages are under construction and will be used for all future hatchling releases.
Therefore the total number of gopher tortoises added to Pen 3 during this project period:
12 tortoises from Grays, SC: (3 males, 1 juvenile female, 3 yearlings, and 5 hatchlings)
12 tortoises from Tillman Sand Ridge, SC: (12 hatchlings)
Total = 24

The hatchling cage in Pen 3 just after construction.

An adult tortoise in Pen 3.



Hatchlings being released into the Hatchling cage within Pen 3, Autumn 2007.

Project Summary for Objective 3

All tortoises are measured, marked, and had blood samples taken (by Tracey Tuberville) for further genetic analyses. The complete total for tortoises released at the AGTHP:

Pen 1: 25 (8 F, 8 M, 1 JF, 0 Y, 8 H) (subtracts one known death, original total = 26
Pen 2: 7 (2 F, 2 M, 2 JF, 0 Y, 1 H) (includes one hatchling not yet released) Pen 3:
Pen 3: 24 (0 F, 3 M, 1 JF, 3 Y,17 H)
TOTAL = 56

Significant Deviations: None

Job 2. Diamondback Rattlesnake

Objectives

1. Determine the feasibility of managing rattlesnake populations by translocating eastern diamondback rattlesnakes to sites with appropriate habitat within the historic range of the species. Develop a model for eastern diamondback rattlesnake demography, to include population size, survivorship, mortality, growth patterns, age classes and sex ratio.

Accomplishments:
The study was initiated in 2006, encompassing 4 study areas in the South Carolina Coastal Plain, i.e., Hoover Plantation (Jasper County), Nemours Wildlife Foundation (Beaufort County), Cheehaw Combahee Plantation (Colleton County), and Donnelly Wildlife Management Area (DWMA; Colleton County). In 2007, we added another study site, Okeetee Plantation (Jasper County), and discontinued efforts to monitor the EDB at DWMA. The study areas comprised varying degrees of upland pine savanna, and thus harbored eastern diamondback rattlesnakes.

In March, 2007, we translocated all of the study animals that were telemetered in 2006 to the Webb Wildlife Center. We captured four new rattlesnakes this year (Nemours, N=1; Cheehaw Combahee Plantation, N = 3), which will be translocated in March, 2008.

All telemetered rattlesnakes were located weekly. We will quantify movement patterns using data collected in 2007 following November ingress. We will begin our analysis comparing pre- and post-translocation movements using the individuals that were captured in 2006.

Significant Deviations: None

2.Conduct research and monitoring at the Webb Wildlife Center (continuation of ongoing monitoring) and at least three other public properties in the S.C. coastal plain that support longleaf pine habitat. Determine the potential distribution of longleaf pine habitat on public properties in the S.C. coastal plain using a qualitative vector GIS model.

Accomplishments:

Donnelly Wildlife Management Area: The majority of our spring surveys were conducted at DWMA. We were unable to locate eastern diamondbacks on the property.

Webb Wildlife Center
Multiple surveys were conducted at the Webb Center between March and September 2006. The surveys yielded 14 snakes, including four eastern diamondback rattlesnakes.

Cheehaw Combahee Plantation
We surveyed Cheehaw Combahee Plantation in March, 2007. We captured four adults (3 females and 1 male), three of which were used in the telemetry study. Two other rattlesnakes were observed during routine field visits to the study area to locate the telemetered rattlesnakes. These two individuals were not captured because they were in close proximity to, or breeding with, telemetered snakes.

Hoover Plantation
Numerous surveys were conducted at Hoover Plantation in March, 2007. We did not capture any new individuals.

Nemours Wildlife Foundation
Two surveys were conducted at the study site in March, 2007, yielding one adult eastern diamondback.

Okeetee Plantation
No surveys were conducted at Okeetee Plantation during Spring, 2007.

Significant Deviations: None

Job 3. Timber Rattlesnake Surveys

Objectives:

1. Determine the distribution of the montane phase and the coastal plain phase of this species in the region.

Accomplishments:
Our study primarily focuses on timber rattlesnake populations in upstate South Carolina. Specifically, our main study location is Table Rock State Park. Of the current 15 snakes captured, 4 of them are classified as the coastal plain phase and exhibit light coloration and the remaining 11 are classified as the montane phase with subsequent dark coloration. Moreover, of the 11 montane phase individuals, 3 of these are further classified as being the yellow coloration of the montane phase. Currently, there appears to be no elevation, habitat, or sex differences in either phase of the upstate timber rattlesnake.

Significant Deviations. None

2. Develop a management strategy for the timber rattlesnake on public lands in South Carolina; Determine the population size and demography at selected sites to include: population structure, sex ratios, mortality, reproductive success, survivorship and

mortality. Determine home range size, habitat use and seasonal activity patterns for both "forms" of this species, in this region, using radio telemetry.

Accomplishments:
In late September 2006, 3 timber rattlesnakes were captured and implanted with radio transmitters. All three were males and represented 2 phases (2 montane, 1 coastal) of the species. These three snakes were monitored throughout the fall and tracked to their place of hibernation. Two snakes hibernated in areas of rocks and boulders, while the third snake overwintered in the bank of a small creek. Last activity for two of them was at the end of November and the other was on December 18th, 2006. All three began to move again in late March 2007.

Two of the snakes emerged from hibernation fine and are currently being tracked. One snake, however, made one movement in early spring and went under a set of rocks whereupon a few weeks later the radio transmitter was found on the surface. This rattlesnake was not sighted during its single spring movement. The transmitter had bite marks and it and it is presumed the rattlesnake perished underground and a rodent carried the transmitter out. No signs of skin or bone were found. It should be noted, this snake was one that was found trailside in the park and it had been reported that people were throwing rocks/sticks at it. During the surgical implantation of the transmitter, a wound was found on the snake where the ventral meets the side. This wound was debrided of skin and dirt but there could have been internal damage that was not visually detectable. It is thought that this injury combined with a late freeze in April may have contributed to the snake's death as this snake spent the longest time above ground (last sighting Dec. 18th) before going underground for winter. The time above ground could have been used to gain heat to assist in repairing the injured area. Although it is possible there could have been problems associated with the transmitter surgery, no post-op complications were observed and the other two snakes that were implanted with transmitters during the same time have had no problems.

In the spring/summer/fall of 2007, 12 new snakes were captured and implanted with radio transmitters. There were 5 males and 7 females. Most of the snakes were randomly encountered but a few were found in the course of tracking radio transmittered snakes. Two females were found a month apart being courted by the same radio transmittered male. Moreover, one of these females was found mating with a new male about a month later.

Mating and courting were observed in the fall with all observations (3 courting, 1 mating) taking place in September and October. Three of the females in the study (not ones that were captured courting/mating) gave birth in late August/early September. One litter yielded at least 5 young. The number of young in the other two litters is unknown as only one snake was found from one and no babies were observed at the third probable birthing. However, with the latter, the female

lost weight and baby timber rattlesnake shed skins were found at the area she occupied shortly after her observed weight loss.

Movements for males appear greater than females but no statistical analysis has been preformed yet. Both males and females seem to have an affinity for wooded areas and are often found in the vicinity of fallen logs and branches. Two females captured at a rocky outcrop stayed in the vicinity of the outcrop the majority of the time, however, both females were ones that gave birth. Another female (non-pregnant) and two males that were captured in rocky outcrop areas spent very little time in the rocky outcrop area post surgery release. All of the other captured rattlesnakes were found in wooded areas.

Of the 12 new snakes captured in spring/summer/fall of 2007, one death was observed. This mortality was of one of the females that had given birth in late August/early September but the mortality was not due to birthing or a natural predator. Unfortunately, this snake was most likely killed by humans. This female was very site specific and had extreme preference to a rocky outcrop area where there were numerous crevices. The area was off the main trail and most hikers (probably all) would miss this area as they would hike along the trail. However, a group decided to camp illegally (no camping allowed in park along trails) and have a campfire (also unlawful) near this area. Hatchet marks were found on a fallen log less than 10 feet from a crevice this snake was fond of using and less than 2 days after the group had been there, the snake was found dead and missing the head and tail. It is very unlikely a natural predator would eat only the head and tail and leave the rest of the body intact. Instead, it is much more likely that a human used their hatchet to take care of the head and keep the rattle as a souvenir. No other mortalities of radio tagged animals were observed. (Note: Three additional timber rattlesnakes were found dead during part of this study. None of these animals had been marked, and all were human related mortalities. One was found trailside with no head or tail near a popular bathing place in the creek. The other two were road-kills of which one was deliberate according to the park staff member who witnessed the event. The other one was not witnessed and therefore we cannot determine whether it was deliberate or accidental.)

Significant Deviations: None

Job 4. Seepage slope Salamanders

Objectives:

1. Develop a predictive model for coastal plain seepage slope habitat as a means of identifying potential habitat for the southern dusky salamander and Chamberlain's dwarf salamander. Survey potential habitat for presence absence of the target species. Collect specimens of the southern dusky salamander, when present, for genetic analysis to determine if there are "cryptic' species of this complex found in South Carolina.

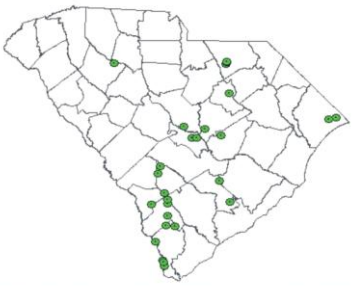
Accomplishments:
Two additional seep study sites were added to the water quality, hydrology and salamander-monitoring portion of this study during FY 07. Each new site comprises two seeps, bringing the total number of seeps monitored to eight. Water sampling wells and cover-board transects were

placed at the new seeps following the same protocols used for the original seeps. One new site is located on Beidler Forest approximately five miles from the original Beidler study site. The other new site is located in Calhoun County, on private property, approximately five miles from the original Calhoun County site.

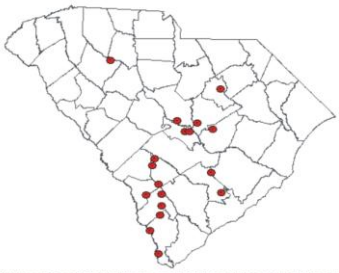
Water quality and hydrology sampling was conducted at all seeps quarterly during the reporting period. Salamanders were only sampled at these sites on three occasions, due to a focus on locating new, or historic *Desmognathus* populations for comparative sampling purposes. The cover-board arrays have not been removed and sampling will begin again at these sites in FY08.

During FY07 we initiated a molecular phylogeny study involving the two focal species of this project *Desmognathus auriculatus* and *Eurycea chamberlainii*. The goal of this study is to resolve the phylogenetic, and eventually the taxonomic status of these two species and their "closest" relatives in South Carolina. We have contracted with East Carolina University for assistance with this portion of the project.

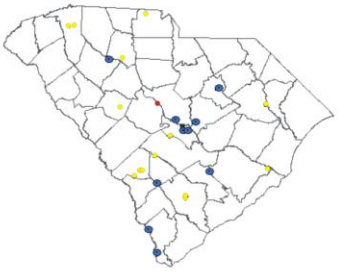
During FY07 SCDNR staff surveyed 26 sites for Plethodontid salamanders. Some of these sites were historic locations for *Desmognathus* and others were new sites selected due to their hydrologic and topographic characteristics. Salamander species in the family Plethodontidae were collected at 18 of these sites, *Eurycea chamberlainii* at 2 sites and *Desmognathus auriculatus* at 9 sites. One additional site in the Piedmont was sampled and a *Desmognathus* was collected there. No more than six individuals of each species of *Eurycea* and *Desmognathus* were taken from each site for the molecular phylogeny study. Dave Beamer of East Carolina University and Scott Pfaff of Riverbanks Zoo contributed fourteen additional samples of *Desmognathus* for analysis.



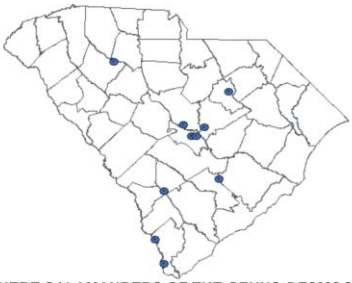
SITES SAMPLED FOR SALAMANDERS BY SCDNR STAFF IN FY07



SITES WHERE PLETHODONTID SALAMANDERS,*DESMOGNATHUS, EURYCEA, PSEUDOTRITON* WERE COLLECTED IN FY07



ALL S.C. SITES FROM WHICH *DESMOGNATHUS* SAMPLES WERE TAKEN FOR MOLECULAR PHYLOGENY STUDY



SITES WHERE SALAMANDERS OF THE GENUS *DESMOGNATHUS* WERE COLLECTED BY SCDNR STAFF IN FY07

Preliminary results from the molecular phylogeny study indicate that the "focal" species *Desmognathus auriculatus,* southern dusky salamander does not occur in South Carolina. To date this analysis has identified 4 separate lineages of *Desmognathus* in the Coastal Plain and Piedmont of South Carolina, none of which is closely aligned with *D. auriculatus.*

Significant Deviations: None