Final Performance Report
South Carolina State Wildlife Grant F09AF00159 (T-51-R)
South Carolina Department of Natural Resources
October 1, 2009 -September 30, 2011

Project Title: Ecology and Impacts of Coyotes on Loggerhead Sea Turtles, Least Terns and Other Wildlife: Implications for Management

Objective 1
To develop a reliable and cost-effective method for estimating coyote densities in coastal and barrier island communities in South Carolina.

Objective 2
To examine home range, habitat use and diets of coyotes on the TYWCHP to better understand ecology and impacts on other species in coastal and barrier island communities in South Carolina.

Objective 3
To determine the extent and impacts of coyote predation on loggerhead sea turtle and least tern nests on TYWCHP.

Objective 4
Based upon the results of the study, develop recommendations for managing coyotes in coastal and barrier island communities in South Carolina, especially as it relates to coyote impacts on sensitive species. This would include an efficient coyote monitoring program, a means of estimating current and future coyote impacts, and an effective management strategy for controlling depredating coyotes on the TYWCHP and other coastal and barrier islands communities in South Carolina.

C**oyote trapping and radiotelemetry**
After the failed 2010 coyote telemetry attempt using unreliable AVM equipment, three more coyotes were fitted with new, reliable Telonics radiocollars over the course of a cumulated three months of trapping. One of these coyotes was captured on South Island, while the other two were collared on Cat Island. Relocating coyotes with the new Telonics collars proved just as difficult as with the AVM collars—routinely over 60 hours of cumulative telemetry work was required to relocate a single animal. Even then, the coyote captured on South Island could only be relocated on one spot on the beach on certain nights, but was never relocated in any other location. One coyote captured on Cat Island was occasionally relocated, but only around the hammock area of South Island—where she was also recaptured on two other occasions and her collar appeared to be functioning correctly. The last coyote collared on Cat Island was only relocated one other time, despite large amounts of search time.

Two collared coyotes were lethally removed from the beach during regular trapping activities in December 2010. Both of these animals were originally collared on South Island, one the first animal collared with AVM equipment and the other the first collared with Telonics equipment who had occasionally been relocated on the beach. In the late summer of 2011 a coyote fitted with a Telonics collar started appearing on game cameras situated on loggerhead turtle nests.

This coyote must have been collared on Cat Island, however renewed efforts to locate or identify the animal with telemetry also failed.

If radiotelemetry is pursued with coyotes on the Yawkey Wildlife Center, we highly recommend investigators to consider testing satellite collars. Several observations of field technicians lead us to believe that coyotes on the YWC are particularly skittish, sometimes going underground after they detected field workers. Some of these collared coyotes might also be transient animals with much larger than expected home ranges. This would explain the virtual disappearance of the last collared male coyote only to reappear on Cat Island with an exceptionally strong telemetry signal. Satellite collars would likely allow for adequate data collection despite these issues.

Raccoon trapping

Eight more raccoons were collared with Telonics equipment with the aid of a volunteer veterinarian working at a private practice in Murrel's Inlet. One raccoon collared with AVM equipment in 2010 showed significant neck abrasions presumably caused by the collar holding moisture against the animal's skin. The old collar was removed, the wound cleaned and the animal released. Additional efforts to target previously collared raccoons resulted in the recapture of only one other animal which showed similar injury to the neck.

Relocation efforts of newly collared raccoons worked especially well as none of the animals collared travelled off the island or appeared to change their behavior due to the presence of researchers. Over 1,000 raccoon locations were obtained on eight raccoons in 2011. Each of these raccoons were used to test raccoon response to an artificial increase in coyote area use. Raccoon home ranges were closely monitored (4 locations/day) for a period of seven days as a control period. Coyote urine was then liberally applied to specific areas inside the raccoon home ranges and raccoon locations were taken for seven more days. Raccoon locations pre- and post-treatment with coyote urine will be compared to determine raccoon response to a potential increase in predation threat. Preliminary analysis suggests that raccoons did not significantly change their space use after the coyote urine was applied, suggesting that raccoons do not view coyotes as a predatory threat. However, more detailed analysis including habitat variables is being conducted.

Data was also collected on raccoon activity patterns, with activity levels recorded for each raccoon at least five times for every hour block (0-23 hours). This data is also currently being analyzed.

DNA and diet analysis

Over 400 samples have been collected for dietary analysis thus far. Approximately 50% of these scat samples contain feathers of some kind. While most of these feathers are downy breast feathers and therefore will not be identifiable, all unique or distinctive feathers are being checked for possible identification with reference materials. Hair removed from the samples is proving to be the most reliable method for identifying mammalian prey, although identification with skull or teeth fragments is possible in some cases. Seeds are also being identified with both identification books and with a reference collection. Some of the items identified in scat analysis thus far are listed in Appendix 1.

Two undergraduate students at Clemson are now processing these scat samples as the focus of their Creative Inquiry project.

DNA analysis on approximately 40 fresh scat samples is continuing at the Clemson University Genomics Institute with Dr. Alison Starr. However, so far scat samples have failed to yield usable amounts of DNA with currently used laboratory techniques. Once adequate DNA extractions are achieved, identifications from fecal DNA will be tested against known coyote blood and fecal samples provided by Dr. Julie Young at the Millville Predator Research Facility in Millville, Utah.

Field technicians, student interns and projects

Since May of 2009 ten undergraduate student interns have worked in some capacity on the coyote project (one in Summer 2009, five in Summer 2010, and four in 2011). Seven of these are Clemson students while the other three are affiliated with other universities. These students received housing, but were not monetarily compensated for their work. Seven have received some sort of academic credit through their home institutions, and two took the results of their individual research projects to the National Conference of Undergraduate Research in Ithaca, New York in April 2011. Three more students will take their project results to the same conference in Ogen, Utah in March 2012.

Two field technicians have also volunteered their time to the project thus far. Each have received housing, rabies vaccinations and a $250/month food stipend. Skyler Hackley came from Richmond, VA, worked from January to March 2010, and then left the project for a better paying field job elsewhere. Stephanie Miller from Tallahassee, FL, joined the project in October 2010 and left in March 2011 due to lack of adequate funding.

Caity Brig from Carlisle, Pennsylvania joined the project without a food stipend in March 2011 and continued until field work ended. She is now enrolled as a graduate student at Clemson and plans to get her Masters working with loggerhead sea turtles on the YWC.

Outreach

Two classes aimed at continuing education for South Carolina science and agricultural education teachers have been conducted on the island and highlighted the research project. Approximately thirty teachers participated in two week long courses, during July 2009 and 2010.

The promotional video project has been suspended due to lack of funding.

Final products

Data is currently being analyzed and at least two journal articles are being targeted for publication in the Journal of Wildlife Management. All published products related to this project, including a full copy of the doctoral dissertation, will be provided to the SCDNR upon their completion.

Significant Deviations: None other than those described in the text above.

Estimated Total Federal Expenditure: $34,965

Appendix 1. Items identified so far in coyote scat

Small mammals

Voles	*Microtus sp.*
Eastern harvest mouse	*Reithrodontomys humulis*
Rice rat	*Orzyzomys palustris*
Hispid cotton rat	*Sigmodon hispidus*
Eastern woodrat	*Neotoma floridana*
Squirrels	*Sciurus sp.*

Midsized mammals

Raccoon	*Procyon lotor*
Virginia opossum	*Didelphis virginiana*
Rabbits	*Sylvilagus sp.*

Large mammals

Wild hog	*Sus scrofa*

Other animals

- Unidentified lizards
- Unidentified turtles
- Unidentified fish

Vegetation and seeds

- Persimmon
- Blackberry
- Acorns
- Various grasses