

SOUTH CAROLINA COOPERATIVE FISH AND WILDLIFE RESEARCH UNIT



2011

Annual Report

The South Carolina Cooperative Fish and Wildlife Research Unit is growing and expanding its staff and research program. With the addition of a new Assistant Leader for Wildlife, we are forming new relationships with our cooperators and continuing to conduct scientific research to support the mission of addressing important natural resource issues in the state of South Carolina, as well as throughout the SE U.S. and internationally.

South Carolina Cooperative Fish and Wildlife Research Unit

2011 ANNUAL REPORT



G 27 Lehotsky Hall
Clemson University
Clemson, SC
29634

Phone: 864-656-0168

Fax: 864-656-1034

http://www.coopunits.org/South_Carolina/

Cooperators:

U. S. Geological Survey
Clemson University
South Carolina Department of Natural Resources
U. S. Fish and Wildlife Service
Wildlife Management Institute

Front Cover Photograph: Clemson graduate student Molly Giles with satellite tagged goose, Santee National Wildlife Refuge, South Carolina

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COOPERATORS AND PERSONNEL

COORDINATING COMMITTEE

United States Geological Survey

Byron Williams, Chief, Cooperative Research units, 12201 Sunrise Valley Drive, Reston, VA 20192

Jim Fleming, Southern Supervisor, Cooperative Research Units, Cookeville TN 38501

South Carolina State Department of Natural Resources

John Frampton, Director, South Carolina Department of Natural Resources, PO Box 167, Columbia, SC 29202

Derrell Shipes, Chief of Wildlife Statewide Projects, Department of Natural Resources, PO Box 167, Columbia, SC 29202

Clemson University

Tom Scott, Dean, College of Agriculture, Forest and Life Sciences, Clemson University 101 Barre Hall, Clemson, SC 29634

Patricia Layton, Director, School of Agriculture, Forest, and Environmental Science, Clemson University

Wildlife Management Institute

Steve Williams, President, Wildlife Management Institute, Gardners, PA 17324

UNIT PERSONNEL

Scientists

Patrick Jodice, Unit Leader, U.S. Geological Survey, and Associate Professor, School of Agriculture, Forest and Environmental Sciences



Katherine McFadden, Assistant Unit Leader-Wildlife, U.S. Geological Survey, and Assistant Professor, School of Agriculture, Forest and Environmental Sciences



Staff

Carolyn Wakefield, Administrative Assistant

Biography of New Assistant Unit Leader (Katherine McFadden)

Dr. Kate McFadden received her PhD from the Department of Ecology, Evolution, and Environmental Biology (E3B) at Columbia University in 2004. She completed two postdoctoral fellowships, one at the American Museum of Natural History and one in Washington DC working for the National Oceanic and Atmospheric Administration. She returned to teach at Columbia University from 2006 -2010 and then served as a United States Fulbright Scholar at the National University of Rwanda in 2011.

Her research interests include an array of topics in terrestrial and marine ecology, evolution and conservation, with a central focus on the conservation of large vertebrates such as carnivores and marine turtles. Her past research has examined the phylogenetic uniqueness, demographics, foraging ecology, and conservation of dwarf island carnivores and marine mammals. Current projects include population dynamic modeling, behavioral ecology, and foraging ecology of marine turtles at Palmyra Atoll in the Central Pacific Ocean. Other ongoing work includes examining how small mammal communities respond in forests with Sudden Oak Death. Dr. McFadden received an advanced certificate in environmental policy from Columbia University in 2003 and her environmental policy interests focus on ecosystem approaches to management on local, regional, and global scale.

Dr. McFadden's research program at the South Carolina Cooperative Research Unit and Clemson University will focus on a combination of field and lab-based ecological research that concentrates on both theoretical and applied questions in the areas of community ecology, population ecology, and conservation biology. Much of her work focuses on endangered and threatened species, and she seeks understand the role species play in structuring communities and in maintaining ecosystem function. In South Carolina, she seeks to examine the temporal and spatial variation in movement patterns, habitat selection, and population ecology of wildlife.



Kate McFadden with a servaline genet in Rwanda (2011)

COLLABORATORS

Clemson University:

Jeff Allen, Director, SC Water Resources Center, Strom Thurmond Institute
Robert Baldwin, School of Agriculture, Forest, and Environmental Sciences
William Bridges, Experimental Statistics
William Bowerman, School of Agriculture, Forest, and Environmental Sciences
William Conner, School of Agriculture, Forest, and Environmental Sciences
Joe Culin, Assoc. Dean, College of Agriculture, Forestry and Life Sciences
Patrick Gerard, Experimental Statistics
Laura Jodice, Parks, Recreation and Tourism Management
Drew Lanham, School of Agriculture, Forest, and Environmental Sciences
Robert Powell, Parks, Recreation and Tourism Management
John Rodgers, School of Agriculture, Forest, and Environmental Sciences
Greg Yarrow, School of Agriculture, Forest, and Environmental Sciences

South Carolina Department of Natural Resources Cooperators:

Breck Carmichael, Special Assistant to the Director
Jamie Dozier, Yawkey Wildlife Center
Du Bose Griffin, Marine Turtle Conservation Program
Dean Harrigal, Waterfowl Biologist
Felicia Sanders, Wildlife Biologist
Mark Scott, Fisheries Biologist
Mark Spinks, Wildlife Biologist
David Whittaker, Assistant Deputy Director, Marine Resources Division

Federal Agency Cooperators:

Laurel Barnhill, USFWS
Sarah Dawsey, USFWS Cape Romain Natural Wildlife Refuge
Scott Johnston, USFWS
Susan C. Loeb, Southern Research Station, USFS
Raye Nillius, USFWS Cape Romain Natural Wildlife Refuge
Daniel D. Roby, Oregon Cooperative Fish and Wildlife Research Unit
John Stanton, USFWS
Melanie Steinkamp, USFWS
Stacy Vander Pol, National Institute Standards and Technology
Craig Watson, USFWS Ecological Services, Charleston, SC
USFWS Region 4, Cape Romain Natural Wildlife Refuge
USFWS Region 4, Santee National Wildlife Refuge
USFWS Migratory Bird Management Office
USFWS Ecological Services
USFS Southern Forest Experiment Station
National Park Service, Congaree National Park

Private Sector Cooperators:

Avian Research Conservation Institute
Bahamas National Trust
BioDiversity Research Institute
Defenders of Wildlife
Georgia Sea Turtle Center
Low Country Institute
National Fish and Wildlife Foundation
Society for the Conservation and Study of Caribbean Birds
South Carolina State Ports Authority
St. Catherine's Island Wildlife Survival Center
U.S. Golf Association

Faculty Cooperators from other Colleges and Universities:

Jennifer Arnold, Penn State University
Peter Frederick, University of Florida
Will Mackin, University of North Carolina
Katie O'Reilly, University of Portland
Richard Philips, British Antarctic Survey
John Speakman, Aberdeen University
Robert Suryan, Oregon State University
Dick Veit, City College of New York

GRADUATE EDUCATION

CURRENT STUDENTS

Samantha Collins, M.S. Wildlife & Fisheries Biology (Advisor: Jodice)
Lisa Eggert, Ph.D. Wildlife & Fisheries Biology (Advisor: Jodice)
Elizabeth Zinsser, M.S. Wildlife & Fisheries Biology (Advisor: Jodice)

RECENT GRADUATES

Gillian Brooks, M.S. Wildlife & Fisheries Biology (Advisor: Jodice)
Molly Giles, M.S. Wildlife & Fisheries Biology (Advisor: Jodice)
Jessica Gorzo, M.S. Wildlife & Fisheries Biology (Advisor: Jodice)

COURSES TAUGHT

WFB 861, Wildlife Energetics, Fall 2010, 2 credits (Jodice)
WFB 861, Foundations of Ecology, Fall 2011, 3 credits (Jodice)
WFB 861, Reading in Ecology, Spring 2012, 1 credit (Jodice)
FNR 808, Graduate Student Seminar, Spring 2012, 1 credit (McFadden)

CURRENT PROJECTS

Movement patterns, habitat use and conservation assessment of stopover sites for migratory Canada geese

INVESTIGATORS: Patrick Jodice (SCCFWRU)
Dean Harrigal (SCDNR)
Marc Epstein (USFWS)

STUDENT: Molly Giles, M.S.

SPONSORS: South Carolina DNR
USFWS

DATES: January 2008 – December 2010



Information on local and flyway-scale space use is lacking for the cohort of migrant geese (*Branta canadensis interior*) that winter in and adjacent to the Santee National Wildlife Refuge in Summerton, South Carolina. We examined home range and habitat selection of Canada geese in this region. We deployed transmitters on 17 geese (9 VHF and 8 PTT) on wintering grounds at Santee NWR during the winter of 2009-2010. Estimates of fixed kernel home range size ranged from 214 to 263 ha for VHF-marked geese and 1190 to 1915 ha for PTT-marked geese. Home ranges of all birds were compact and mainly contained within the Bluff Unit of Santee NWR, although geese did make occasional forays to private agricultural fields within ca. 3 km of the refuge. Habitat selection analyses of VHF-marked geese showed that birds selected for corn, millet, and moist soil habitat during the winter of 2009-2010.

Geese departed Santee NWR between 5 and 7 March 2010 and arrived on the Atlantic Population (AP) breeding grounds on the eastern shore of the Hudson Bay by either 24 May 2010 or 9 June 2010 via two migration routes. Six PTT-marked geese followed an eastern route, stopping in northeastern North Carolina and western New York, with three of those birds completing a spring migration to AP breeding grounds. Geese following the eastern route had a mean distance between stopover sites of 417 ± 76 km, and a mean total migration distance of 2837 ± 345 km. Two geese followed a more western route, stopping in northeastern Ohio after departing Santee NWR.

A better understanding of local wintering space use and habitat selection of geese will inform land management on refuge lands, and aid in the conservation and management of goose populations in South Carolina. Information on flyway-scale movements and migration stopovers used by geese is beneficial to the understanding of migratory habitats, and better informs the timing of sport harvest seasons of Atlantic flyway goose populations. A manuscript focusing on the migration data is in preparation for submission to a peer-reviewed journal. The graduate student is currently employed by the PA Game Commission.

Nest success of Black Skimmers and Least Terns in Cape Romain National Wildlife Refuge

INVESTIGATORS: Patrick Jodice (SCFWRU)
Felicia Sanders (SCDNR)

STAFF: Gillian Brooks, M.S. Student

SPONSORS: U. S. Fish & Wildlife Service, SC DNR

DATES: January 2009-April 2011



Least Terns

Little is known about the reproductive success of Least Terns (*Sternula antillarum*) and Black Skimmers (*Rynchops niger*) along the coast of South Carolina. It appears reproductive success of both species may be limited by a variety of ecological stressors. To provide baseline measurements of reproductive success of Least Terns and Black Skimmers in South Carolina, and to assess factors which may influence nest success of both species, 257 Least Tern and 347 Black Skimmer nests were monitored at four colony sites within Cape Romain National Wildlife Refuge, 2009-2010. Nest success was highly variable among colony sites and years for both species. Apparent nest success ranged from 0 – 97% for Least Terns and 0 – 81% for Black Skimmers. Variation in daily nest survival of Least Terns was strongly related to colony site, year, and predation risk. For Black Skimmers, daily nest survival was best explained by a combination of various factors at multiple scales including tide height, predation risk, clutch size, and colony site. Predation and overwash were the principle causes of nest loss, collectively accounting for 65% of nest loss for both species. Nest predators included American mink (*Neovison vison*), Black Vulture (*Coragyps atratus*), Great Horned Owl (*Bubo virginianus*), and Laughing Gull (*Larus atricilla*). Estimates of productivity and age-specific survival are needed to determine if these highly variable rates of nest success of Least Terns and Black Skimmers can support local populations.

A manuscript focusing on reproductive success of Least Terns is in preparation for submission to a peer-reviewed journal. The graduate student is currently employed by Natural Resources Conservation Service working on the Sage Grouse Initiative.

Avian communities and landscape characteristics of golf courses within the Beaufort County sea island complex

INVESTIGATORS: Patrick Jodice (SCCFWRU)
Lauren Barnhill (SCDNR)
Chris Marsh (Low Country Institute)

STUDENTS: Jessica Gorzo, M.S.

SPONSORS: National Fish and Wildlife Foundation

DATES: January 2008- December 2011



Painted bunting nest

The native breeding bird community of Beaufort County, South Carolina is experiencing landscape alteration in several forms. A prevalent human land use in the coastal zone is golf course development. This study explored the relationship between golf course land cover (n=23) and avian community metrics. Each study site consisted of the in-play area of the golf course, surrounded by a 400 m zone. Landscape metrics were calculated for each study site, and served as independent variables. The dependent variables were the following avian community metrics: species richness, neotropical migrant richness, abundance, diversity, evenness, and mean Partners in Flight (PIF) score. Stepwise model selection produced multiple linear regression models for each avian community metric. Significant variables in the model were interpreted for ecological meaning. Avian species richness, abundance and diversity increased with the area of the landscape, while the interaction of interspersion/juxtaposition and patch richness had varying but significant effects on diversity, species richness and neotropical migrant richness. Mean patch fractal dimension of residential areas positively affected species richness and evenness, while mean patch fractal dimension of turf was opposite in relation to the mean shape index of turf in the evenness model. Evenness showed unique responses to metrics calculated for forested wetland and mixed upland forest. These results yield insight into avian community response to golf course landscape characteristics, and may aid in future management decisions in the region.

A manuscript focusing on the landscape relationships with avian community structure is in preparation for submission to a peer-reviewed journal. The graduate student is currently a PhD student at University of Wisconsin.

South Atlantic information resources: data search and literature synthesis for seabirds

INVESTIGATORS: Patrick Jodice (SCCFWRU)
Joe Tavano (Clemson University)

SPONSORS: Minerals Management Service/Bureau of Ocean Energy Mgmt.

DATES: Complete

This synthesis of information on the marine avifaunal communities of the South Atlantic Planning Area was prepared from a variety of sources including but not limited to published literature, gray literature, agency reports, and other written documents. Spatial data were collected from a variety of sources including state records, National Audubon Society online databases of Christmas Bird Count data and Important Bird Areas, The Conservation Biology Institute's database of protected areas, and the OBIS/SEAMAP marine mammals, birds, and turtles database.

It is clear from this synthesis that the marine bird community of the South Atlantic Planning Area has not received the level of research or conservation attention given to many other communities of marine birds throughout the U.S. The most recent range-wide assessments were published in the early 1980s. Other reviews, such a recent 2007 overview of pelagic seabirds in the South Atlantic Bight, provide brief accounts of occurrence but still a synthesis of all relevant information is lacking. Given recent environmental events such as the Deepwater Horizon oil spill in the Gulf of Mexico, and what appears to be a growing national interest in the development of marine-based alternative energy facilities, a comprehensive synthesis of seabird information for the region is warranted.

We synthesized the existing knowledge on distribution and ecology of seabirds in the South Atlantic Bight which includes coastal South Carolina and waters offshore of South Carolina. Data gaps were identified and areas for future research highlighted. This final report includes species accounts, location accounts, distribution maps, and summaries of research and survey efforts.

Movement patterns of seabird breeding in the Exuma Cays, Bahamas

INVESTIGATORS: Patrick Jodice (SCCFWRU)
Will Mackin (University of North Carolina)
Jennifer Arnold (Penn State University)
Richard Phillips (British Antarctic Survey)

SPONSORS: USFWS

DATES: January 2008 – December 2010



Audubon's Shearwater

During the period May – July 2008 we attached geolocators (GLSs) to 11 Audubon's Shearwaters and 13 White-tailed Tropicbirds. GLSs are small (2-3 g) devices that estimate location based on ambient light levels and also record salt-water immersion; hence time foraging at sea also can be estimated. The devices we used were provided by the British Antarctic Survey. These are the first efforts to deploy GLSs on these species or in this region. We recovered 2 GLSs from after 5 weeks during the 2008 breeding season. These birds engaged in a combination of long and short foraging trips as estimated from the proportion of time spent at-sea. Locations ranged from local use of the waters throughout the Exumas to periodic use of waters south of Cuba.

We revisited colonies during June 2009. We recovered 4 additional GLSs from Audubon's Shearwaters and 3 from White-tailed Tropicbirds. During the breeding season both species frequented the northern Bahamas but also were located south of Cuba. During winter, shearwaters dispersed along the coast as far north as the northeastern U.S. Tropicbirds dispersed north but also were frequently located east of Bermuda and in waters towards the mid-Atlantic ridge. These locations represent the first annual movement data collected from seabirds in the Bahamas. Our preliminary results indicate that the foraging range during chick-rearing and the wintering range of these two seabirds are far larger than previously thought. Furthermore, the birds we tracked appear to make use of a 'hot-spot' in the north Atlantic that supports a diverse assemblage of marine birds. This new information changes the perspective of managers and policy makers who are mandated to address marine ecosystem-based management and marine spatial planning. Additional devices were deployed in 2010 on shearwaters at Cay Sal Bank, the southwestern most group of islands in the Bahamas.

Enhancing productivity of American Oystercatchers in Cape Romain National Wildlife Refuge

INVESTIGATORS: Patrick Jodice (SCCFWRU)
Felicia Sanders (SCDNR)

STUDENT: Samantha Collins (M.S. Student)

SPONSORS: USFWS, SCDNR

DATES: January 2010 – present



Oystercatcher eggs

Cape Romain National Wildlife Refuge (CRNWR) supports abundant populations of nesting shorebirds and is a critical breeding and wintering region for the American Oystercatcher (*Haematopus palliatus*). The American Oystercatcher appears to be experiencing declines in nesting numbers throughout the southern portion of its range. The purpose of this study is to assess techniques that might enhance reproductive success of oystercatchers and identify factors that affect nest survival in oystercatchers.

During 2010 and 2011 we monitored nests of American Oystercatchers within three study areas in Cape Romain NWR, SC; Lighthouse Island, Southwest Bulls Bay (SWBB), and along the Atlantic Intercoastal Waterway (Waterway). These nests were monitored from April through July each year. Nests in SWBB and along the Waterway were assigned either to the ‘headstarting group’ or ‘control group’. Headstart nests had eggs removed for artificial incubation and eventual replacement at the nest site while control nests were not manipulated. In 2010 and 2011, behavior and attendance surveys were conducted for nests during the incubation and chick rearing stage along the Waterway and in SWBB. These surveys were typically one hour in duration and occurred during the low tide period.

Data are currently being managed and analyses are underway for a final report and thesis. The GRA presented an update of accomplishments and activities at the 2011 American Oystercatcher Working Group Meeting and at the 2011 Waterbird Society Annual Meeting.

The final report is expected to be complete by 30 May 2012.

Survival rates of seabirds in oiled areas of the Gulf of Mexico

INVESTIGATORS: Patrick Jodice (SCCFWRU)
Lisa Eggert (Clemson University)
Dave Evers (Biodiversity Research Institute)

SPONSORS: USFWS

DATES: Ongoing



Brown Pelican with Satellite Tag

his research is a component of the NRDA avian injury assessment at the Gulf of Mexico – *Deepwater Horizon Mississippi Canyon* oil spill and these data will serve as the primary measure of survival rates for the NRDA process for seabirds (pelicans, terns, skimmers) in the Gulf of Mexico. The primary objective is to determine the rate of mortality in sublethally oiled birds through the use of individual tracking studies. The primary species of interest are brown pelican (*Pelecanus occidentalis*) and black skimmer (*Rynchops niger*). The initial research area has included the coastal islands of Louisiana. Satellite tags with activity sensors and VHF tags with mortality switches were deployed to evaluate survival and movement of the focal species. Data collected will be used to estimate mortality rates of adult birds, determine movement patterns, and determine habitat use patterns. We also deployed satellite tags and VHF tags on reference (i.e., birds not impacted by oil) in South Carolina and Georgia. The data being collected also will improve our understanding of movement patterns and foraging habitat use of nearshore seabirds in the Gulf of Mexico and southeastern US which will benefit marine spatial planning and risk assessment for offshore energy development.

Field work is completed although analysis is still in the early stages of development. Preliminary results of movement data have been presented at scientific conferences. It is anticipated that this data set will yield several papers over the next 2 – 3 years.

South Carolina coastal bird monitoring

INVESTIGATORS: Lisa Eggert (Clemson University)
Patrick Jodice (SCCFWRU)
Dave Evers (Biodiversity Research Institute)
Felicia Sanders (SCDNR)



Black Skimmer

SPONSORS: Biodiversity Research Institute
USFWS
SCDNR
SC Audubon

DATES: January 2011 – December 2011

Reproductive success is a primary conservation concern for coastal birds breeding on South Carolina (SC) seabird nesting islands. Predation and human use are two factors limiting reproductive success at SC colonies, particularly for Black Skimmers (*Rynchops niger*). Determining how these factors affect reproductive success can provide opportunities for effective management.

Breeding status of Black Skimmers was recorded during visits to SC colonies over the course of the 2011 breeding season. Human use of nesting islands and signs of disturbance near colonies were tracked via colony perimeter walks, trail cameras, and opportunistic observations. Signs of predation and potential predators were recorded during all visits. All carcasses observed were recorded and a determination was made whether the mortality was caused by a predation event or the cause was unknown. An effort was made to monitor other species as time allowed.

The effect of predation and disturbance on reproductive success of Black Skimmers was intensively monitored on two nesting islands, Bird Key Stono River and Deveaux Bank, and allowed for identification of primary causes of individual and colony-wide reproductive failure. Eight trail cameras (Reconyx PC900) were deployed to record activity within the colonies every 15 seconds, 24 hours a day, and were programmed with a motion-sensor for additional coverage of disturbance events within proximity to each camera. Cameras were deployed on Bird Key from 27 May, 2011 to 23 July, 2011, and on Deveaux Bank from 24 May, 2011 to 18 July, 2011. Trail camera observations are based on preliminary review of images (approx. 3,225,000 photos). The perimeter of nesting areas for Black Skimmers and Least Terns (*Sternula antillarum*) were recorded with GPS track logs. Additional and more detailed analyses are being conducted.

A summary report is available through SC CRU.

Building international capacity for seabird science

INVESTIGATORS: Patrick Jodice (SCCFWRU)
Lisa Sorenson, Ann Sutton & Will Mackin (Society for
the Conservation and Study of Caribbean Birds)
Chris Haney (Defenders of Wildlife)
Jennifer Wheeler (US FWS)

SPONSORS: National Fish & Wildlife Foundation

DATES: January 2011 – December 2013



Caribbean seabirds are among the least studied of regional seabird populations with many pressing conservation needs, but the capacity to implement conservation measures is severely constrained. Lack of trained personnel, lack of knowledge of cost-effective methods to address threats and monitor effectiveness of measures, lack of funding for implementation combined with lack of awareness are limitations unique to regions like the Caribbean where the small sizes and small individual economies of its many nation-states simply do not allow for advances in seabird management to be easily made. In this region capacity is the fundamental obstacle to effective conservation. Increasing capacity is a fundamental approach to responding and mitigating the effects of the DWH oil spill.

The goal of this project is to compensate for lethal and sub lethal damages to Caribbean and Gulf of Mexico seabird meta-populations and their habitats caused by the DWH oil spill by building long-term, in-country capacity to address threats and effectively manage and conserve species and habitats. This project will promote immediate and long-term conservation at important sites throughout the region by (1) implementing immediate conservation projects at high-priority sites that also will serve as demonstration projects for a later capacity-building training workshop, (2) training key individuals (including protected area managers, scientists, and their partners who will themselves implement projects and act as trainers) during a multi-day capacity-building workshop, (3) supporting trained individuals by developing and implementing projects (to be supported by a small grants program) as well as long-term funding proposals. These activities will mitigate the effects of the DWH and permanently increase the capacity to address other short and long-term threats. The main activities will focus on assisting local practitioners to implement practical conservation activities addressing regional priority needs.

A summit workshop was held in summer 2011 in Freeport, Bahamas. Approximately 50 participants from throughout the Caribbean attended including scientists from Mexico, Cuba, and the U.S. The attendees contributed greatly to the development of ideas for training classes and materials and the break-out sessions allowed us to hone our ideas regarding the focus of the training and the locations of the training. The first training workshop is planned for June 2012 in San Salvador, Bahamas.

Nest success and habitat use of Wilson's Plovers in South Carolina

INVESTIGATORS: Patrick Jodice (SCCFWRU)
Felicia Sanders (SCNDR)

STUDENT: Elizabeth Zinsser (M.S. Student)

SPONSORS: SC DNR

DATES: January 2012 – December 2013



Wilson's Plover is a medium-sized plover associated strictly with coastal areas. The US Shorebird Conservation Plan list Wilson's Plover as a "species of high concern" in their prioritization of shorebird species according to relative conservation status and risk. Wilson's Plovers are listed as state threatened in South Carolina. SC DNR surveys from 2009 -2011 suggest approximately 300 pairs nest in SC and they are rare on beaches with development.

The major threat to the species in US appears to be loss of breeding habitat on beachfronts. On undeveloped barrier islands, human disturbance also appears to cause nest loss and abandonment of sites. Unfortunately little is known about most aspects of the life history of this species and therefore management and conservation efforts are limited in scope. Our goal is to examine the reproductive ecology of Wilson's Plovers in SC. The research will build upon similar successful projects with Brown Pelicans, Least Terns, Black Skimmers, and American Oystercatchers in the same region and therefore also contribute to an increasing in knowledge on reproductive ecology of this guild in the region. The primary study sites will be South and Sand Islands, Yawkey Wildlife Center, SC. Sites in Cape Romain NWR may be added if logistics permit. Our objectives are to (1) determine nesting chronology, (2) determine nest success and factors affecting reproductive loss, (3) determine habitat use of chicks, and (4) determine brood behavior in response to presence of humans. Research will be initiated April 2012.

Determining the movement patterns and habitat use of seabirds to support marine spatial planning along the Atlantic coast

INVESTIGATORS: Patrick Jodice (SCCFWRU)
Will Mackin (University of North Carolina)

SPONSORS: USFWS

DATES: January 2012 – December 2013



White-tailed Tropic Bird Chick

Although ship-based and aerial surveys are the standard methods used to measure abundance and distribution of birds at sea, each is a population-based survey that provides information without regard to the individual. While data from such surveys are sufficient for estimating abundance or distribution, additional data are needed to more fully understand the individual variability associated with the population use of an area and the impact that would have on marine spatial planning issues. We propose to use remote tracking devices to measure movement patterns of seabirds in the Northwest Atlantic and to focus these efforts on species and locations that will overlap with ongoing planning and research efforts. Data from individual tracking efforts will allow us to assess variability in movements and use patterns and to measure features such as residence or first-passage time, fidelity to specific marine locations, and the relationship between marine use areas and colony of origin (which allows for any marine impacts to be assessed in relation to breeding locations and population trends at the breeding grounds). Our objective is to deploy GLSs on Audubon’s Shearwaters (*Puffinus lherminieri*) and White-tailed Tropicbirds (*Phaethon lepturus*). Each species breeds throughout The Bahamas and Caribbean. These species were chosen because they are observed frequently enough during surveys offshore of the mid- and south Atlantic US coast to warrant the collection of more specific data on individual movement patterns. This research will build upon previous efforts although the range of colonies at which geolocators will be deployed will be greatly expanded, as will the sample size. Research will begin in summer 2012 and the PIs are currently in the process of choosing study colonies.

FUTURE RESEARCH DIRECTIONS

Modeling carnivore habitat use and range movement patterns

INVESTIGATORS: Kate McFadden (SCCFWRU)

SCDNR

PROJECT STATUS: Proposal in development

Within the last two decades, carnivores such as black bear and coyote in South Carolina have continued to increase in abundance, which has caused an expansion of their range southward. This range expansion has resulted in increased utilization of areas with higher human densities, and landscapes with a greater proportion of agriculture. Landscapes with high proportions of developed areas and open agricultural lands have potential to increase home range size of bears and may influence the movement patterns of carnivores, given the lower overall habitat quality on the landscape. I propose to investigate how an anthropogenically fragmented landscape influences the spatial ecology, movements, and habitat selection of carnivores in the southeastern United States. Data from GPS-collared carnivores will be used to determine how movements are defining home ranges in different habitats and with varying levels of anthropogenic and natural variation influences movement and range expansion of carnivores. I propose to incorporate habitat models into a spatially-explicit population model. Data for population parameters will be based on a combination of data sources including track survey data collected from SCDNR, camera trapping, and genotyping. Additionally, I will evaluate habitat selection and temporal variation in space use between carnivores near urban areas. This research will provide an understanding of how top predators move through landscapes to help in predicting where human-bear interactions may occur in the future.



Influence of wild hogs on habitat quality in the Clemson Experimental Forest

INVESTIGATORS: Kate McFadden (SCCFWRU)
Rob Baldwin (Clemson University)
Greg Yarrow (Clemson University)

PROJECT STATUS: Proposal submitted for funding (EPA)

Feral hogs negatively impact water quality through rooting and wallowing in and near water sources. Wallowing can also damage riparian areas and increase sedimentation, and defecation in and around the water may increase levels of nutrients and allow for transmission of up to five different agents known to be infectious to humans. This study will examine the impact feral hogs have on water quality of wetlands that drain into Lake Hartwell within the urban Seneca Watershed in the Piedmont Ecoregion of South Carolina. This project seeks to develop a monitoring protocol to identify water bodies that are physically or biologically damaged by invasive feral hog and develop predictive models to estimate the risk of disease transmission to humans from fecal contamination of water bodies.



Stock assessment of loggerhead sea turtle populations in foraging grounds off the coasts of South Carolina

INVESTIGATOR: Kate McFadden (SCCFWRU)

Mike Arendt (SCDNR)

PROJECT STATUS: Proposal in development

The loggerhead sea turtle is South Carolina's state reptile and is listed as threatened under the US Endangered Species Act. In collaboration with the SC DNR, this project will use at-sea survey data from the last 10 years to estimate the abundance and distribution of threatened loggerhead sea turtles along the South Carolina and Georgia coast. Extensive data has been collected by the SCDNR using tow surveys including the stage specific make up and spatial distribution of loggerheads in southeastern waters. This data can serve as the basis of population projection models to make predictions of how various abiotic factors (sea surface temperature, currents, chlorophyll levels, etc.) may impact the distribution and abundance of this species over time and space.



Gull predation rates in seabird colonies

INVESTIGATOR: Patrick Jodice (SCCFWRU)

Felicia Sanders (SC DNR)

PROJECT STATUS: Proposal in development

The SC CRU and SC DNR have collaborated on numerous projects focusing on the ecology of nearshore seabirds during the past 10 years. This proposed research would continue that collaboration and initiate new research based on findings of previous research. We are proposing to investigate the predation rates of Laughing Gulls on Brown Pelicans, Royal and Sandwich terns, and Black Skimmers at 2 – 3 colony sites in SC with varying levels of gull nesting. Currently SC supports breeding Laughing Gulls. Herring and Black-backed Gulls have yet to establish here, although they are established as breeders in NC and VA and in those states managers report substantial predation pressure on nearshore seabirds. If funded, this research would quantify predation pressure, determine if some individual gulls specialized in predating eggs and chicks of other seabirds (this appears to be the case in western seabird colonies), and establish a baseline of gull predation pressure prior to any establishment of the larger Herring and Black-backed gulls in the state. We are in the initial phases of idea development and plan on initiating contact with various funding sources (USFWS, USDA, NFWF, SC DNR) during the summer of 2012 with the plan to initiate work in 2013.



Eastern Brown Pelicans: Dispersal, seasonal movements and monitoring of PAHs and other contaminants among breeding colonies in the Gulf of Mexico

INVESTIGATOR: Patrick Jodice (SCCFWRU)
Kate McFadden (SCCFWRU)

PROJECT STATUS: Proposal submitted for funding (BOEM)

This study will focus on obtaining information about populations of brown pelicans across the northern Gulf of Mexico. Study objectives are to (1) document dispersal, seasonal and annual movements, seasonal home range, site fidelity, and short-term (≤ 4 years) survival of marked adult and immature brown pelicans among nesting colonies from the Gulf coast and (2) measure levels of contaminants in adult and nestling brown pelicans. Objective 1 will be addressed through satellite and VHF telemetry and objective 2 will be addressed through the acquisition of tissue samples (e.g. blood, feathers, eggs). The study will address information gaps relative to brown pelicans in the Gulf of Mexico and provide baseline ecological information. In particular, limited information is known regarding foraging behavior for this species and the general ecology of immature eastern brown pelicans in the northern Gulf of Mexico is also poorly understood. The project is not intended to be a post-spill study, but rather to address data gaps for the agency as it pertains to development of additional oil and gas projects in the Gulf. Research will build from and compliment previous and ongoing research efforts of the PI in the Gulf and in coastal SC. The project will begin in 2012 and run through 2015.



PUBLICATIONS

JOURNAL ARTICLES

- Eggert, L.M.F. *, P.G.R. Jodice, K.M. O'Reilly. 2010. Stress response of Brown Pelican nestlings to ectoparasite infestation. *General and Comparative Endocrinology*. 166: 33-38.
- Hand, C.*, F. Sanders, P.G.R. Jodice. 2010. Foraging proficiency during the nonbreeding season in a specialized forager: Are juvenile American Oystercatchers (*Haematopus palliatus*) 'bumble-beaks'* compared to adults? *Condor* 112:670-675.
- Jodice, P.G.R., and R.M. Suryan. 2010. The transboundary nature of seabird ecology. Pages 139-165 In *Landscape Scale Conservation Planning* (S. Trembulak and R. Baldwin, eds.). Springer.
- Jodice, P.G.R., L.C. Wickliffe*, E.B. Sachs*. 2011. Seabird use of discards from a nearshore shrimp fishery in the South Atlantic Bight, USA. *Marine Biology* 158:2289-2298.
- Meehan, K.*, P.G.R. Jodice. 2010. Landscape scale correlates of fox squirrel (*Sciurus niger*) presence on golf courses in coastal South Carolina. *Southeastern Naturalist* 9: 573-586.
- Thibault, J.*, F. Sanders, P.G.R. Jodice. 2010. Parental attendance and brood success in American Oystercatchers. *Waterbirds* 33:511-517.
- Wickliffe, L.C.*, P.G.R. Jodice. 2010. Abundance of nearshore seabirds at shrimp trawlers in South Carolina. *Marine Ornithology* 38: 31-39.

* indicates graduate student advisee

THESES AND DISSERTATIONS

- Jessica Gorzo, Dept. Forestry and Natural Resources, M.S. student, May 2009 – January 2012: Avian Communities and landscape characteristics of golf courses within the Beaufort County sea island complex
- Gillian Brooks, Dept. Forestry and Natural Resources, M.S. student, August 2008 – June 2011: Reproductive Success of Black Skimmers and Least Terns
- Molly Giles, Dept. Forestry and Natural Resources, M.S. student, January 2008 – December 2010: Habitat Use and Home Ranges of Migratory Canada Geese in the Santee-PeeDee System

ACTIVITIES

TECHNICAL ASSISTANCE

Peer reviewer, Florida Biological Status Report for Brown Pelican, Black Skimmer, and Fox Squirrel (Patrick Jodice)

Sponsor, Program MARK training workshop offered for SAFE's faculty and graduate students

TRAINING ATTENDED

Introduction to Structured Decision Making, Auckland, New Zealand (Kate McFadden)

Introduction to Program MARK (Patrick Jodice, Samantha Collins, Gillian Brooks, Lisa Eggert)

PRESENTATIONS AND SEMINARS

Invited Seminars

Jodice, P.G.R. 2011. The importance of understanding individual movement patterns in nearshore and pelagic seabirds of the western north Atlantic. Fort Johnson Marine Science Center, College of Charleston, South Carolina.

Invited Presentations

Wakefield, E.D., and 50 authors including P.G.R. Jodice. 2012. A newly described seabird diversity hotspot in the deep northwest Atlantic identified using individual movement data. Pacific Seabird Group Annual Meeting, Honolulu, Hawaii.

Eggert, L., D. Evers, P.G.R. Jodice, M. Yates, D. Yates, J. Goyette, and D. Meattey. 2011. Movements of Brown Pelicans and Black Skimmers from the Deepwater Horizon oil spill injury assessment. Waterbird Society Annual Meeting, Annapolis, Maryland

Evers, D., P.G.R. Jodice, P. Frederick. 2011. Assessing injury to colonial waterbirds from the Deepwater Horizon oil spill. Oil Spill Symposium, Waterbird Society Annual Meeting, Grand Island, Nebraska

Contributed Papers / Presentations / Posters

K. McFadden, E. Sterling, E. Bentley-Vintinner, A. Gomez, F. Arengo, and E. Sterling. 2011. Temporal and spatial variability in foraging habits of green sea turtles in the Central Pacific using stable isotope analyses. International Congress for Conservation Biology, Auckland, New Zealand.

Collins, S.*, P.G.R. Jodice, F. Sanders. 2011. Headstarting: An experimental study to improve nest success of American Oystercatchers. Waterbird Society Annual Meeting, Annapolis, Maryland

Eggert, L., D. Evers, J. Goyette, P.G.R. Jodice, D. Meattey, M. Yates. 2011. Regional differences in mercury exposure in Brown Pelicans and Black Skimmers. Waterbird Society Annual Meeting, Annapolis, Maryland [Poster]

Moore, L. W. Bowerman, W. Bridges, and P.G.R. Jodice. 2011. Changes in water quality affect the food supply of lesser flamingo's at Kamfers Dam, South Africa. Waterbird Society Annual Meeting, Annapolis, Maryland

Brooks, G.*, P.G.R. Jodice, F. Sanders. 2011. Nest success of beach-nesting birds in Cape Romain National Wildlife Refuge, South Carolina, USA. Waterbird Society Annual Meeting, Grand Island, Nebraska

Collins, S.*, P.G.R. Jodice, F. Sanders. 2011. Headstarting American Oystercatchers within Cape Romain National Wildlife Refuge, South Carolina. Waterbird Society Annual Meeting, Grand Island, Nebraska [Poster]

Giles, M.*, P.G.R. Jodice, J. Stanton, M. Epstein. 2011. Migratory pathways and migration chronology of Canada geese wintering at the Santee National Wildlife Refuge. Waterbird Society Annual Meeting, Grand Island, Nebraska

Sheehan, K.*, P.G.R. Jodice, W. Bowerman. 2011. Intestinal parasite assemblages of the Double-Crested Cormorant: a comparison of three lake colonies in Minnesota USA. Waterbird Society Annual Meeting, Grand Island, Nebraska

Gorzo, J.*, and P.G.R. Jodice. 2011. Bird Community Distribution on Golf Courses in Coastal Beaufort County, SC. Joint Annual Meeting Assoc. Field Ornithologists, Cooper Ornithological Society, Wilson Ornithological Society, Kearney, Nebraska [Poster]

Jodice, P.G.R., W. Mackin, J.A. Arnold, R. Phillips. 2010. Movement patterns of Audubon's Shearwaters and White-tailed Tropicbirds as determined by geolocators. First World Seabird Conference, Victoria, British Columbia, Canada [Poster]

Eggert, L.M.F.*, P.G.R. Jodice, F. Sanders, G. Brooks. 2010. Conservation challenges and successes for seabirds in South Carolina, USA: Importance of longterm monitoring and research partnerships. First World Seabird Conference, Victoria, British Columbia, Canada [Poster]

Eggert, L.M.F.*, P.G.R. Jodice. 2010. Intertidal habitat use and management of seabirds on a coastal island in South Carolina. Pacific Seabird Group Annual Meeting, Long Beach, California

* graduate student advisee

SERVICE

Patrick Jodice:

Chair, Pacific Seabird Group (Elected)
Executive Council, Waterbird Society (Elected)
Chair, Scientific Program, First World Seabird Conference
Member, International Steering Committee, First World Seabird Conference

Facilitator, Forestry and Natural Resources Seminar Series, Clemson University
Faculty Search Committee, Clemson University
Internal Reviewer, Promotion and Tenure Committee, Clemson University
Graduate Student Studies Committee, Department of Forestry and Natural Resources, Clemson University
External Reviewer, Promotion and Tenure, Oregon St. Univ.
External Reviewer, Promotion and Tenure, Virginia Tech.

Team Leader, Individual Tracking Studies, Atlantic Marine Bird Conservation Cooperative
Panelist, Marine Wind Power Workshop, BioDiversity Research Institute
Speaker and Panelist, South Carolina Ocean Planning Workgroup
Facilitation Team, Seabirds and Wind Workshop

Reviewer (2010-2011) Animal Conservation, Wilson Journal of Ornithology, Ecosphere, Revista Brasileira de Ornitologia, Marine Ecology Progress Series, Journal of Ethology, Journal of Comparative Biochemistry and Physiology, Southeastern Naturalist

Kate McFadden:

Member, South Carolina Wild Hog Task Force
Member, South Carolina Chapter, The Wildlife Society (Dec 2011- Present)
Reviewer, Acta Theriologica
Reviewer, Journal of Ecology
Reviewer, Oryx
Reviewer, Journal of Ocean Management