
SOUTH CAROLINA COOPERATIVE FISH & WILDLIFE RESEARCH UNIT



ANNUAL REPORT 2016

In 2016, the South Carolina Cooperative Fish & Wildlife Research Unit continued to engage our cooperators to address emerging natural resource issues in the State of South Carolina and throughout the United States. Unit scientists continued to advise and mentor graduate students in both MS and PhD programs, and to provide technical assistance to cooperators.

South Carolina Cooperative Fish & Wildlife Research Unit

2016 ANNUAL REPORT



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

Image: Spawning Horseshoe Crabs on Cape Romain, SC – F. Takahashi, 2016

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COOPERATORS AND PERSONNEL

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Beth Ross, Assistant Unit Leader-Wildlife, U.S. Geological Survey, and Assistant Professor, Department of Forestry and Environmental Conservation

Juliet Lamb, Post-Doctoral Research Associate, South Carolina Cooperative Fish & Wildlife Research Unit and Department of Forestry and Environmental Conservation

Staff

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COLLABORATORS

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South Carolina Department of Natural Resources Cooperators:

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Jamie Dozier, Tom Yawkey Wildlife Center
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Du Bose Griffin, Marine Turtle Conservation Program
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Felicia Sanders, Wildlife Biologist
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USFWS Migratory Bird Management Office
USFWS Ecological Services
USFS Southern Forest Experiment Station
USFS, Daniel Boone National Forest
USFS Nantahala National Forest
USFS Northern Research Station
National Park Service, Congaree National Park
National Park Service, Big South Fork National River & Recreation Area
National Park Service, Obed Wild and Scenic River
National Park Service, Fire Effects Team, Great Smoky Mountains

Private Sector Cooperators:

Bahamas National Trust
Biodiversity Research Institute
Georgia Sea Turtle Center
International Crane Foundation
National Fish and Wildlife Foundation
The Nature Conservancy
Nemours Wildlife Foundation
Society for the Conservation and Study of Caribbean Birds
St. Catherine's Island Wildlife Survival Center

Cooperating Scientists from other Colleges, Universities, and Institutes:

Evan Adams, BioDiversity Research Institute
Dave Evers, BioDiversity Research Institute
Lisa Ferguson, Wetlands Institute
Christine Fiorello, Oiled Wildlife Care Network
Peter Frederick, University of Florida
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Katie O'Reilly, University of Portland

Ben Parrott, University of Georgia
James Pitman, Western Association of Fish and Wildlife Agencies
Richard Philips, British Antarctic Survey
Daniel D. Roby, Oregon Cooperative Fish and Wildlife Research Unit
Rob Ronconi, Acadia University
Ernst Rupp, Grupo Jaragua
John Speakman, Aberdeen University
Robert Suryan, Oregon State University
Richard Veit, City College of New York
George Wallace, American Bird Conservancy
Susan Zaluski, Jost van Dyke Preservation Society, BVI
Michael Ziccardi, Oiled Wildlife Care Network

GRADUATE EDUCATION

CURRENT STUDENTS

Leanne Burns, M.S. Wildlife & Fisheries Biology (Advisors: Jodice & Loeb)
Sarah Kimpel, M.S. Wildlife & Fisheries Biology (Advisors: Jodice & Loeb)
Abigail Lawson, Ph. D. Wildlife & Fisheries Biology (Advisor: McFadden & Jodice)
Brian Leo, Ph. D. Wildlife & Fisheries Biology (Advisor: Jodice)
Hannah Madden, M.S. Natural Resources, University West Indies (Advisor: Jodice)
Hannah Plumptre, M.S. Wildlife & Fisheries Biology (Advisor: Ross)
Rochelle Streker, M.S. Wildlife & Fisheries Biology (Advisor: Jodice & Lamb)
Fumika Takahashi, M.S. Wildlife & Fisheries Biology (Advisor: Jodice)
Hillary Thompson, M.S. Wildlife & Fisheries Biology (Advisor: Jodice)
Jesse Wood, M.S. Wildlife & Fisheries Biology (Advisor: Ross)

RECENT GRADUATES

Shefali Azad, M.S. Wildlife & Fisheries Biology (Advisors: McFadden & Jachowski)
Jonathan Brooks, M.S. Wildlife & Fisheries Biology (Advisors: Jodice & Loeb)
Juliet Lamb, Ph. D. Wildlife & Fisheries Biology (Advisor: Jodice)
Susan Sullivan, M.S. Wildlife & Fisheries Biology (Advisor: McFadden & Jodice)

RESEARCH

COMPLETED PROJECTS

Population Modeling of Black Bears in Northwestern South Carolina

INVESTIGATORS:

Kate McFadden (SC
CRU),
David Jachowski
(Clemson University),
Patrick Jodice (SC
CRU)

STUDENT:

Shefali Azad (M.S.,
Clemson University)

SPONSORS:

SCDNR

DATES:

2014 - 2016



Black Bears (*Ursus americanus*) are managed as a game species in the northwestern region of South Carolina. Although harvest, roadkills, and bear sightings have been increasing over the past few decades, no formal research study in the state has examined their long-term population trends. Additionally, while state agencies regularly conduct bait-station surveys and acorn mast surveys, the usefulness of these data as population indices had not been evaluated.

This project developed and investigated the performance of a number of population models based on multiple data streams, applied to Black Bears in the northwestern region of South Carolina. The various data streams used to develop the models included 1) sex-specific age-at-harvest matrices derived from harvest records, 2) capture-recapture matrices from genetic analysis of hair snares, 3) bait station visitation by bears, 4) acorn mast indices for the region of interest, and 5) human-bear interactions.

A population reconstruction model using the Downing method was developed to establish long-term abundance trends. An extended working model that could incorporate future harvest data was also delivered to SCDNR. Capture-recapture population models using both spatial and non-spatial approaches in a maximum-likelihood framework were developed to establish a current baseline density for the Black Bear population in the region. Finally, the usefulness of bait station and acorn mast indices to predict population growth rates and human-bear interactions was investigated. While acorn mast trends significantly predicted growth rates and interactions, bait station indices did not. It was recommended that SCDNR develop a focused study into the viability of increasing resources to improve the statistical power of the bait station surveys.

Image: Black Bear – R. Small, 2013

Effect of Forest Opening Landscape Characteristics, Prey Availability, and Environmental Factors on Bat Activity in the Southern Appalachians

INVESTIGATORS:

Susan Loeb (USFS),
Patrick Jodice (SC
CRU)

STUDENT:

Jonathan Brooks (M.S.,
Clemson University)

SPONSORS:

USFS, USDA

DATES:

2014–2016



Early successional habitat (ESH) is important for many wildlife species. Over the past century, land use changes have caused ESH to decline in eastern hardwood forests. Bats, which utilize ESH for foraging, are also a conservation concern, however little information is available on how ESH restoration affects bats. Our objective was to determine how opening size, presence of edge, prey abundance, vegetation structure, and environmental factors affect bat activity in forest openings.

In June–August 2014 and May–August 2015, we placed Anabat SD2 bat detectors, Townes-style Malaise insect traps, and iButton temperature loggers at the interior and edge of small (0.2–1.6 ha), medium (2.1–5.6 ha), and large (6.2–18.5 ha) forest openings in the Nantahala National Forest, North Carolina. Recorded call files were identified to species and insect specimens were counted and identified to order. Mean nightly temperature was also determined and vegetation surveys were conducted to quantify vegetation structure.

Opening size and presence of edge did not affect total insect abundance, however there was a positive effect of live and dead tree basal area and mean nightly temperature. Overall bat activity was significantly higher at opening edges compared to opening interiors, was positively related to mean nightly temperature, and was negatively related to vegetation structure. Activity of open-adapted species was also negatively related to vegetation structure. These results suggest that in the southern Appalachian Mountains opening vegetation structure and environmental factors are important for determining bat activity. Open-adapted bats may select foraging patches with less vegetation structure because they can forage more efficiently in these environments, whereas clutter-adapted bats can forage efficiently in both cluttered and open environments. When creating ESH, land managers should maintain an open vegetation structure to benefit open-adapted bat species, focus on creating openings at lower elevations, and configure openings to maximize edge relative to opening area.

Image: Sampling early successional habitat – J. Brooks, 2016

Modeling Use of Obed Wild and Scenic River Sport Climbing Areas by Rare and Sensitive Bats

INVESTIGATORS:

Susan Loeb (USFS),
Patrick Jodice (SC
CRU)

SPONSORS:

National Park Service

DATES:

2015 –2016



Sport climbing is a rapidly growing sport in the US and elsewhere.

Although several species of bats commonly roost in cliffs, the potential for impacts of climbers on bats has not been examined. We initiated a pilot study on the potential impacts of sport climbing on bats in Obed Wild and Scenic River, TN to: 1) determine if Small-footed Bats (*Myotis leibii*) avoid climbed cliffs for roosting, and 2) determine if overall bat foraging and commuting activity varies between climbed and unclimbed areas.

We used radio-telemetry to track Small-footed Bats to day roosts, and Anabat SD2 detectors to compare bat activity between climbed and unclimbed areas of regularly climbed cliff faces, and between climbed and unclimbed cliffs. Four adult male Small-footed Bats were tracked to nine day roosts, all of which were in various types of crevices including five cliff face roosts (three on climbed and two on unclimbed faces). Other roosts were in boulders in the river and between upright boards in a barn. Overall bat activity was significantly higher along climbed cliffs than unclimbed cliffs although species richness did not differ between climbed and unclimbed cliffs. Lower activity along unclimbed cliffs may have been related to lower cliff heights and more clutter along these cliff faces. Our data suggest that cliffs are important foraging and commuting habitats for bats in Obed Wild and Scenic River and may also be important roosting areas. Cliffs may provide abundant food resources, protection from predators, and navigational aids for bats.

Image: Climbing area in the Obed – A. Melton, 2006

CURRENT PROJECTS

Lesser Prairie-Chicken Response to Environmental Change in Kansas

INVESTIGATORS:

Beth Ross (SC CRU, KS CRU),
David Haukos (KS CRU),
Christian Hagen (Oregon State University),
Jim Pitman (WAFWA)

SPONSORS:

USDA NRCS

DATES:

2013-2016



Significant numbers of Lesser Prairie-chickens of Kansas and Colorado are associated with former croplands that have been enrolled in a U.S. Department of Agriculture conservation programs/practices, principally the Conservation Reserve Program (CRP) and Environmental Quality Incentive Program (EQIP). At a broad-scale CRP has reduced habitat fragmentation and assisted in connecting extant and expanding populations. Additionally, conservation practices with CRP fields that may be affecting these populations include vegetation species composition, development of supplemental water areas, mid-term management practices, and emergency haying/grazing declarations. Use of CRP may also be related to juxtaposition of CRP, cropland, and other land uses.

In addition, the overall population response by Lesser Prairie-chickens to conservation programs needs to be assessed in regard to demography of the population to model future population trends. Concurrent with CRP and land use practices, more information is needed on the response of Lesser Prairie-chickens to changes in climate. The Great Plains region is predicted to experience increasing drought conditions, which could negatively affect Lesser Prairie-chickens in the future. A better understanding of the interaction between land use and climate change on Lesser Prairie-chicken population demographics is important for future management practices.

Our results thus far indicate that extreme values of Palmer Drought Severity Index (both low and high, or dry and wet conditions) during the spring breeding season were the best predictors of changes in Lesser Prairie-chicken abundance, though neither had a significant effect on male Lesser Prairie-chicken abundance on leks. Abundance on leks was highest during the mid-1980s, followed by low population abundance in the 1990s. The population has remained relatively stable since the late 1990s. Additionally, increasing the ratio of cropland to grassland in a given area (i.e., moving towards more cropland) reduces the resilience of Lesser Prairie-chickens to extreme drought conditions. Using an integrated population model, we found that juvenile survival is likely most impacted by extreme drought causing the shifts in population abundance.

Image: Banding Lesser Prairie-chicken chicks – B. Ross, 2016

Spatial-temporal Overlap of Horseshoe Crab (*Limulus polyphemus*) Eggs and Foraging Shorebirds in the Cape Romain Region

INVESTIGATORS:

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CRU),
Felicia Sanders
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STUDENT:

Fumika Takahashi
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University)

SPONSORS:

SCDNR, USFWS

DATES:

2015–2016



American Horseshoe Crab (*Limulus polyphemus*) eggs provide migratory shorebirds with an abundant food source at stopover sites, allowing the birds to rapidly gain weight for their long migration to arctic breeding grounds. Shorebird utilization of Horseshoe Crab eggs has been well documented at northeastern stopover sites such as the Delaware Bay. However this relationship has not been well studied in the southeast, specifically in South Carolina. The purpose of this study is to determine if there is a correlation between density of Horseshoe Crab eggs and abundance of foraging shorebirds during spring migration at Cape Romain National Wildlife Refuge.

To accomplish this, we monitored 10-12 study plots between March and June 2015-2016 at predicted Horseshoe Crab spawning sites throughout the refuge. We conducted weekly shorebird surveys and sampled plots twice a month for densities of Horseshoe Crab eggs. Across both years, we collected 1,081 Horseshoe Crab egg samples and conducted 325 shorebird surveys. Additionally, we coordinated refuge-wide Horseshoe Crab spawning surveys on the evenings of 2 June 2015, and 22-24 May 2016. We used a linear regression to compare the density of eggs in each plot with the number of foraging shorebirds. Our results show a positive correlation between foraging shorebirds and Horseshoe Crab eggs for both years.

Additional analyses will further explore this relationship by conducting a dietary analysis of shorebird fecal samples. We will also investigate the relationship between sand grain size and the presence of shorebirds and Horseshoe Crab eggs across our study site beaches. The results of our study will help to provide a better understanding of Cape Romain NWR as a stopover site for shorebirds and enable us to compare densities of Horseshoe Crab eggs and spawning adults with other stopover sites along the Atlantic coast.

Image: Shorebirds foraging on Horseshoe Crab eggs, Cape Romain – F. Takahashi, 2016

Nonbreeding Habitat Assessment of Whooping Cranes in a Reintroduced Population

INVESTIGATORS:

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CRU),
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STUDENT:

Hillary Thompson
(M.S., Clemson
University)

SPONSORS:

Nemours Foundation,
Clemson University,
International Crane
Foundation

DATES:

2014 –2016



In the late 1940s, the endangered wild population of Whooping Cranes (*Grus americana*) numbered ca. 15 individuals which nested in northern Canada and wintered in coastal Texas. To safeguard this species from extinction, an Eastern Migratory Population (EMP) of 100 individuals was reintroduced in 2001 at breeding grounds in Wisconsin. Initially the population wintered along the Florida Gulf coast but beginning in 2007, the winter range expanded north to include areas from Florida to southern Indiana. While a general understanding of migratory routes and wintering sites has been obtained for the EMP, a thorough assessment of wintering habitat use has not been conducted.

Field work was conducted during the 2015-16 winter season. We focused on assessment of local scale habitat data for wintering Whooping Cranes across the southeastern United States. We collected data from 23 groups of cranes in 8 states. Preliminary analysis suggests that presence of a nearby protected area was an important variable predicting use. Additional analyses will focus on including a measure of soil wetness or potential to be inundated to assess use of flooded agricultural areas. Daily movement patterns and home range sizes are also being assessed.

We also are investigating landscape scale habitat use during migration. We are using satellite telemetry data to examine migration route fidelity among years and stopover habitat use. Preliminary analyses suggest that Whooping Cranes are not using the exact routes learned during first year migration (i.e., when led by the ultralight plane), but instead are ranging ca. 90-120 km from the original learned route. Preliminary results also suggest that Whooping Cranes are using stopover areas that are protected sites and sites characterized as either agriculture or wetlands. Project completion is anticipated by December 2016. This research will aid in the understanding of the ecology and management of non-breeding Whooping Cranes, the management of wintering and stopover sites, and eventually in the recovery of this endangered species.

Image: Wintering Whooping Crane – H. Thompson, 2016

Modeling Bat Assemblages and Habitat Use Across Big South Fork National River and Recreation Area: Potential Effects of Prescribed Fire

INVESTIGATORS:

Susan Loeb (USFS),
Patrick Jodice (SC
CRU)

STUDENT:

Leanne Burns (M.S.,
Clemson University)

SPONSORS:

USGS

DATES:

2014 –2016



As the practice of prescribed burning becomes more common for the management of eastern forests, understanding if, and how, foraging bats respond to structural changes generated by fire is of increasing importance. As the Big South Fork National River and Recreation Area (BISO) Fire Management Plan is revised, this project aims to provide data on seasonal bat use and habitat associations that will enhance the plans' ability to safely and productively manage forests with prescribed fire for rare and endangered bats occupying the area.

To date, all summer and winter sampling has been completed. Acoustic detectors were used to assess bat presence and activity throughout the annual cycle on BISO by simultaneously monitoring activity levels in forest sites with varying burn histories and adjacent unburned sites. Meteorological data were collected and vegetation surveys were conducted at each site to quantify environmental and structural characteristics. A total of 9,209 bat passes at 164 sites were recorded during the summer of 2014 and 2015, and a total of 2,739 bat passes at 9 sites were recorded during the 2014-2015 winter season with 6 species/species groups identified. Analysis of 2015-2016 winter season data is ongoing.

Models that estimate detection probability and site occupancy are currently being fit to evaluate *a priori* hypotheses concerning habitat and landscape factors affecting bat presence and activity. Data indicate measures of structure (e.g., tree density and basal area) are significantly lower in burned than unburned sites and bat occupancy is most strongly associated with lower vegetative structure, higher elevation, and a history of burning in open stand types. Our results suggest that the lower vegetative structure associated with prescribed fire may increase foraging suitability for bats in mixed forests of the Cumberland Plateau.

Image: Recently burned site adjacent to unburned site – L. Burns, 2016

South Carolina Alligator Adaptive Management Strategies: Population Dynamics, Habitat Utilization, and Conservation Threats

INVESTIGATORS:

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Derrell Shipes & Jay Butfiloski (SCDNR),
Clint Moore (GA CRU),
Patrick Jodice (SC CRU)

STUDENT:

Abby Lawson (Ph.D.,
Clemson University)

SPONSORS:

SCDNR, USGS

DATES:

2013 – 2017



The American Alligator (*Alligator mississippiensis*) is an iconic species in South Carolina and has substantial ecological and economic importance. This study is investigating alligator population ecology using multiple analytical methods to establish an adaptive management framework for harvest decision-making. The primary study objectives are to (1) improve the study design for alligator monitoring programs to better reflect annual variation in alligator size class-specific abundance, (2) identify factors that influence said variation, and (3) evaluate the influence of alligator habitat use patterns on management decisions.

Spring 2016 marked the final field season of a three-year study aimed at estimating seasonal alligator abundance and evaluating the influence of survey design on abundance estimation precision and accuracy (objectives 1 and 2). Evaluating seasonal patterns in abundance and detection probability will allow us to determine how varying survey design components (e.g., replicate number, season) influence these estimates and in turn, management decisions.

This spring we also continued the movement ecology study, aimed at evaluating male alligator movement patterns and habitat use (objective 3), and relating said patterns to variation in seasonal abundance in surveyed areas. In 2015 we deployed 24 transmitters, 21 of which remained attached and functioning as of April 2016. This year, we tagged five additional adult male alligators at the Tom Yawkey Wildlife Center. Both the survey and movement data indicate that seasonal habitat-specific alligator abundance is highly variable, and likely driven by water-level manipulation in impounded wetlands.

Image: Satellite-tracked alligators – A. Lawson, 2016

Eastern Brown Pelicans: Movement Patterns, Habitat Characteristics, Demographics, and Contaminant Exposure in the Northern Gulf of Mexico

INVESTIGATORS:

Patrick Jodice (SC
CRU)

STUDENT:

Juliet Lamb (Ph.D.,
Clemson University),
Rochelle Streker (M.S.,
Clemson University)

SPONSORS:

Bureau of Ocean
Energy Management,
USGS

DATES:

2012 – 2018



This study focuses on obtaining information about populations of Brown Pelican (*Pelecanus occidentalis*) across the northern Gulf of Mexico. Study objectives are to (1) document dispersal, seasonal and annual movements, seasonal home range, and site fidelity of marked adult Brown Pelicans among nesting colonies from the Gulf coast, (2) compare contaminant exposure risk, contaminant levels, and health parameters in adult and nestling Brown Pelicans from various colony sites, and (3) document the relationship of local environmental and nest site characteristics to nestling survival and recruitment.

The study addresses information gaps relative to Brown Pelicans in the Gulf of Mexico and provides 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 management agencies as it pertains to development of additional oil and gas projects in the Gulf. Research builds from and complements previous and ongoing research efforts of the PI in the Gulf and in coastal SC.

To date, we have deployed 93 remote-downloading GPS tags on adult pelicans in the northern Gulf: 25 tags in Florida, 5 in Alabama, 32 in Louisiana, and 31 in Texas. We have used tracking data to analyze preferred marine habitat characteristics and analyze individual and colony-wide variation in home ranges, habitat characteristics, and migratory patterns. We have also collected breeding data from each colony including chick survival from hatch to fledge, chick body condition, chick stress levels, chick diet composition, and nestling provisioning rates. To date, we have color-banded 600 pelican nestlings and are conducting an ongoing citizen science effort to re-sight color bands and investigate the dispersal patterns of juveniles during their first winter.

Future analysis will focus on comparing health, contaminant loads, and stress across colony sites, determining genetic correlates of migratory behavior, and investigating drivers of local-scale variation in nesting success and chick survival.

Image: Eastern Brown Pelican colony in Florida – J. Lamb, 2015

Movement Patterns and Survival of Rehabilitated California Brown Pelicans Following the Refugio Oil Spill

INVESTIGATORS:

Patrick Jodice (SC
CRU),
Christine Fiorello &
Michael Ziccardi
(OWCN)

STUDENT:

Juliet Lamb (Ph.D.,
Clemson University)

SPONSORS:
OWCN**DATES:**
2015 – 2016

In June of 2015, we began collaborating with a research group at the University of California Davis on a project tracking post-release survival and movements of rehabilitated Brown Pelicans along the California Coast. Initiated and funded by the Oiled Wildlife Care Network (OWCN), this study seeks to compare both movements and mortality rates of non-oiled control pelicans to those observed in pelicans that were rescued, cleaned, and eventually released following the *Refugio* Oil Spill in Santa Barbara, California.

During the initial phase of the project, we determined appropriate transmitter specifications and procured transmitters on short notice. Juliet Lamb provided training to OWCN staff members and rehabilitators at their Los Angeles facility, including a demonstration of harness attachment techniques. In all, twelve GPS transmitters were deployed on rehabilitated pelicans, with an additional eight transmitters on wild-caught control birds.

Since deployment of tags we have continued to assist with data management and provided data summaries and support as needed. In 2016-17 we will work with OWCN to analyze and publish the movement data resulting from this effort.

Image: Juliet Lamb demonstrates harness attachment – J. Cox, 2015

Creative Inquiry: Using Computing Engineering to Improve Seabird Conservation (FNR 4700 010)

INVESTIGATORS:

Patrick Jodice & Yvan
Satgé (SC CRU),
Jacob Sorber (Clemson
University)

SPONSORS:

Clemson University

DATES:

2015 –2016



Pelagic seabirds, which travel through expansive and distant marine regions for foraging, are one of the most threatened groups of birds globally and present unique conservation challenges. Informing assessments of threats requires defining spatial and temporal use areas at sea through the deployment of tracking loggers. Thanks to advances in miniaturization, such devices are now able to archive daily locations of smaller species of seabirds over several years. Use of this technology, however, is restricted by the fact that such archival loggers must be recovered to allow access to tracking data. Current methods used to recover loggers are time-consuming or require expensive infrastructure, and are inefficient for monitoring seabirds in extremely remote locations.

In collaboration with Dr. Jacob Sorber (Clemson University School of Computing), PIs created this Creative Inquiry as a research and development branch to the TRACS projects. Nine undergraduate students enrolled in the course and designed an automated computing device using low-power, low-cost components to record when tracked birds use their nesting sites. The PIs and their collaborators in the field can also be alerted over the Internet via satellite when the birds they study return from migration. Additionally, this device can be used to monitor nest attendance (an important factor for the study of breeding biology) among multiple bird species. There are plans to use the device to help with the recovery of archival loggers from Caribbean seabirds, and to study the nest attendance patterns of endangered Black-capped Petrels and Peruvian Diving-petrels.

Image: Adult Red-billed Tropicbirds and chick, St Eustatius –Y. Satgé, 2016

Tracking Atlantic and Caribbean Seabirds (TRACS)

INVESTIGATORS:

Patrick Jodice (SC
CRU)

PRIMARY SPONSORS:

USFWS, USGS,
American Bird
Conservancy,
Avian Research &
Conservation Institute,
Jost Van Dyke
Preservation Society,
National Fish and
Wildlife Foundation

DATES:

2012 – 2017



Many species of seabirds breeding in the Caribbean occupy waters off the Atlantic and Gulf coasts of the US during some portion of the annual cycle. As marine spatial planning becomes a pressing issue in the region, data are needed to enhance our understanding of the seabird community in the South Atlantic Bight and the Gulf of Mexico. Although current 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 individual variability or colony of origin. We are deploying tracking devices to measure movement patterns of seabirds in the Caribbean, Gulf of Mexico, and Northwest Atlantic. Data from individual tracking efforts will allow us to assess variability in movements and use patterns, fidelity to specific marine locations, and the relationship between marine use areas and breeding locations and population trends at the breeding grounds. To date, we have collected tracking data from six species of pelagic seabirds in Mexico, Jamaica, the Dominican Republic, The Bahamas, British Virgin Islands, St Eustatius and Tobago in collaboration with federal agencies, and local Universities and NGOs.

Our research builds upon tracking work we initiated in the Bahamas in 2008-2010 and also takes advantage of the Capacity Building project we initiated in the Caribbean. As such, we are closely collaborating with the University of the West Indies in advising M.S. student Hannah Madden in St Eustatius for the study of the breeding biology and spatial ecology of the local population of vulnerable Red-billed Tropicbird (*Phaethon aethereus*). In April of 2016, we conducted a pilot study to deploy GPS loggers on breeding adults; based on this effort we will be able to improve our tracking effort during the winter of 2017. These data will complement our earlier studies on the connectivity of Caribbean seabird species.

Details on each project, including a complete list of sponsors and collaborators, can be found at www.atlanticseabirds.org

Image: Black-capped Petrel with PTT – R. Ronconi, 2014

Assessment for the Potential for White Nose Syndrome in Bats of Congaree National Park

INVESTIGATORS:

Susan Loeb (USFS),
Patrick Jodice (SC
CRU)

STUDENT:

Sarah Kimpel (M.S.,
Clemson University)

SPONSORS:

National Park Service

DATES:

2015 –2017



The Southeastern Myotis (*Myotis austroriparius*) is a rare and sensitive species that is associated with mature bottomland forests. Little is known about the ecology of this species, particularly its roosting habits. Further, White Nose Syndrome (WNS), a disease caused by the fungal pathogen, *Pseudogymnoascus destructans* which kills bats during their winter hibernation period, was recently found in Richland County, home of Congaree National Park. Thus, our objective is to determine the roosting habits of Southeastern Myotis in Congaree National Park and to assess their susceptibility to WNS. To this end, we are examining Southeastern Myotis torpor patterns, tree microclimates, roost selection, roost fidelity, and roost networks.

Since January 2015 we located 73 roosts through opportunistic cavity searches or radiotelemetry. Forty roosts were found during winter months, and 33 during summer months. We also conducted weekly netting of roost trees throughout winter and summer. Initial results suggest that Southeastern Myotis use multiple roosts over the course of a season, and that they utilize “hub trees,” which are used more frequently, for longer periods of time, and by more bats than other roosts. We are investigating the difference in microclimate between roost and non-roost trees by deploying temperature and relative humidity loggers into cavities in roost trees, reference trees, and at ambient points. We are also conducting vegetation plot surveys to understand the effect of plant community structure on roost site selection.

During winter 2015-2016, we collaborated with Dr. Daniel Lindner, U.S. Forest Service, Northern Research Station to test whether bats in Congaree National Park and surrounding areas are carrying *P. destructans* and thus may be susceptible to WNS. To date, all samples have tested negative.

Image: Fieldwork in Congaree National Park – S. Kimpel, 2016

NEW PROJECTS

Innovative Approaches to Monitoring Success of Farm Bill Incentive Programs in Conserving Avian Wildlife on Private Lands

INVESTIGATORS:

Beth Ross (SC CRU),
Amy Tegeler (SCDNR),
David Jachowski
(Clemson University)

STUDENT:

Jesse Wood (M.S.,
Clemson University)

SPONSORS:

USDA NRCS

DATES:

2016-2018

A primary focus of Farm Bill conservation incentive programs is to promote habitat conservation of at-risk species. Given that over 77% of land in South Carolina is under private ownership, conservation of the many at-risk bird species in the state requires effective design and implementation of habitat conservation incentive programs on private lands. However, feedback on whether Farm Bill habitat conservation incentive programs such as EQIP have been successful has largely been limited to anecdotal evidence and informal feedback from program participants and partners.

We are initiating a new research project in Spring of 2017 to assess the conservation impact of Farm Bill programs in SC. The objectives of this project are to 1) evaluate the effectiveness of Farm Bill programs (e.g., EQIP) at conserving habitat and wildlife, and 2) assess the use of audio recorders as a tool for monitoring bird species of conservation concern on private lands. Findings will not only provide guidance on improved monitoring effectiveness of incentive programs, but provide unique insights into how such technology can be used to identify areas of future focus.



Image: Bachman's sparrow – National Audubon, 2016

Habitat Use and Species Distribution of Black Scoters in the Atlantic Flyway

INVESTIGATORS:

Beth Ross (SC CRU)
(SCCFWRU)

STUDENT:

Hannah Plumpton
(M.S., Clemson
University)

SPONSORS:

USGS, Clemson
University

DATES:

2016 - 2018

Sea ducks are a poorly understood avian group, and while populations are thought to be declining, developing effective means to track abundance and long-term trends has remained a challenge. Currently, the best information on sea duck abundance is based on aerial surveys conducted by the U.S. Fish and Wildlife Service during the 2008-2012 winters along the Atlantic Flyway.

The goal of this project is to quantify habitat use and species distribution of Black Scoters (*Melanitta americana*) in the Atlantic Flyway during winter using existing aerial survey data from U.S. Fish and Wildlife Service. The results of the project will enhance our understanding of the ecology of Black Scoters, be used to develop future aerial surveys for sea ducks, and may be used to evaluate how off-shore wind energy development may affect Black Scoter populations. The project began in August 2016.



Image: Black scoter – National Audubon, 2016

Spatial Ecology, Movement Patterns, and At-sea Habitat Use of Nearshore Seabirds in the South Atlantic Bight

INVESTIGATORS:

Patrick Jodice (SC
CRU)

STUDENT:

Brian Leo (Ph.D.,
Clemson University)

SPONSORS:

USGS, BOEM

DATES:

2016-2019



The Eastern Brown Pelican is a species of conservation concern that breeds and winters throughout the southeastern US. Our understanding, however, of daily and annual movements in this region is limited. Given the interest in development of offshore wind energy and the potential for oil & gas leasing in offshore habitats, data are needed to assess potential interactions with seabirds.

This study will assess at-sea habitat use, movement patterns, and migration paths of adult Brown Pelicans throughout the southeastern US and throughout the annual cycle. We propose to capture ca. 100 adults at nesting colonies in SC, GA, and north FL, and to deploy GPS satellite transmitters. Seasonal home range maps will be developed for each individual and core use areas also will be mapped for the population. All of the above data will be used to determine high, moderate, and low use areas at sea throughout the year. Movement and use data will be layered with available marine habitat data to provide environmentally based risk assessments for each species.

The research effort is led by the USGS Cooperative Research Unit in South Carolina with collaboration from USFWS, SC DNR, GA DNR, FL FWC, NC Wildlife Resources Commission, and Clemson University.

Data will support NEPA analyses and research needs identified at the BOEM sponsored Atlantic Wind Energy Workshop 2011, the BOEM Studies Development Plans for FY13-15, and avifauna chapter of the information synthesis developed for BOEM for the South Atlantic Planning area (authored by the PI).

Image: Eastern Brown pelican – P. Jodice, 2006

PUBLICATIONS

JOURNAL ARTICLES 2015-2016

- Barzen, J.A., A.E. Lacy, H.L. Thompson*, and A.P. Gossens. In Review. Assessing habitat use for the reintroduced Eastern Migratory Population of Whooping Cranes. *The Biology and Conservation of the Whooping Crane (Grus americana)*.
- Collins, S.A.*, F.J. Sanders, P.G.R. Jodice. In Press. Assessing conservation tools for an at-risk shorebird: Feasibility of headstarting for American Oystercatchers. *Bird Conservation International*.
- Jodice, P.G.R., R.A. Ronconi, E. Rupp, G.E. Wallace, and Y. Satgé. 2015. First satellite tracks of the endangered Black-capped Petrel. *Endangered Species Research* 29:23-33.
- Lamb, J.S.* 2015. Review of vegetation management in breeding colonies of North Atlantic terns. *Conservation Evidence* 12: 53-59.
- Lamb, J.S.*, P.G.R. Jodice, and Y.G. Satgé. In review. Evidence for density dependence in foraging and migratory behavior of a nearshore seabird. *Functional Ecology*.
- Lamb, J.S.*, Y.G. Satgé, C.V. Fiorello, and P.G.R. Jodice. In review. Behavioral and reproductive effects of GPS transmitter attachment on Brown Pelicans (*Pelecanus occidentalis*) on three temporal scales. *Journal of Ornithology*.
- Lamb, J.S.*, K.M. O'Reilly, and P.G.R. Jodice. In review. Physical condition and stress levels during early development reflect nutrition and predict nestling survival in a nearshore seabird. *Conservation Physiology*.
- Lamb, J.S.*, D. Newstead, L. Koczur, B. Ballard, M.C. Green, and P.G.R. Jodice. In review. Marine birds over land: Use of the Tehuantepec Isthmus by migratory waterbirds during non-breeding. *Diversity and Distributions*.
- Lawson, A.J.*, J.S. Sedinger, and E.J. Taylor. In review. Life history patterns, individual heterogeneity, and density dependence in breeding common goldeneyes of the northern boreal forest. *Journal of Avian Biology*.
- Lucas, J.S.*, S.C. Loeb, P.G.R. Jodice. 2015. Roost selection by Rafinesque's big-eared bats (*Corynorhinus rafinesquii*) in optimal habitat. *Acta Chiropterologica* 17:131-141.
- Ross, B.E., D. Haukos, C. Hagen, and J. Pitman. 2016. The relative contribution of variation in climate to changes in lesser prairie-chicken abundance. *Ecosphere* 7:e01323.
- Ross, B.E., D. Haukos, C. Hagen, and J. Pitman. 2016. Landscape composition creates a threshold influencing Lesser Prairie-Chicken population resilience to extreme drought. *Global Ecology and Conservation* 6:179-188.
- Thompson, H.L.*, and A.E. Lacy. In Press. Detailed Winter and Migratory Habitat Use of Six Eastern Greater Sandhill Cranes. *Proceedings of the Thirteenth North American Crane Workshop*.

* indicates graduate student advisee

THESES AND DISSERTATIONS 2015-16

Jonathan Brooks, Department of Forestry and Environmental Conservation, M.S., August 2016: *Effect of forest opening landscape characteristics, prey availability, and environmental factors on bat activity in the Southern Appalachians* (Co-advised by Dr. S Loeb, USFS)

Juliet Lamb, Department of Forestry and Environmental Conservation, Ph.D., May 2016: *Ecological Drivers of Brown Pelican Movement Patterns and Reproductive Success in the Gulf of Mexico*

Susan Sullivan, Department of Forestry and Environmental Conservation, M.S., December 2015: *Innovative Approaches to Manage and Reduce Wild Hog Damage in South Carolina* (Co-advised by Drs. Kate McFadden and Greg Yarrow)

ACTIVITIES

TECHNICAL ASSISTANCE

Y. Satgé trained Sint Eustatius National Park biologists to deploy, recover and analyze data from GPS tracking devices on local Red-billed Tropicbirds.

TRAINING DELIVERED

B. Ross participated in teaching an “Introduction to R” workshop at The Wildlife Society Conference in 2015. The workshop reached a wide audience including state and federal biologists as well as NGO employees.

TRAINING ATTENDED

S. Kimpel attended Conservation Leaders for Tomorrow, in Mansfield, Georgia.

J. Lamb attended *Marxan* and *Marxan* with Zones (Pac-MARA) workshops in St. John’s, Newfoundland.

A. Lawson attended Applied Hierarchical Modeling in Ecology Workshop, Patuxent Wildlife Research Center in Laurel, MD; Spatial Capture-Recapture Workshop in Athens, Georgia; and Analyses of Wildlife Telemetry Data with the *rhr* Package for R, the Wildlife Society Annual Conference in Winnipeg, Manitoba.

F. Takahashi attended SCDNR’s Shorebird/Seabird Workshop in Charleston, SC.

H. Thompson attended the workshops Improving GIS-based Wildlife Habitat Models, North American Ornithological Conference in Washington D.C.; Hierarchical Models Made Easy, and Species Distribution Modeling in R from Start to Finish, North American Congress for Conservation Biology, in Madison, WI; and Exploring the application radar for inundation mapping: how new radar datasets can enhance remotely sensed monitoring, Society For Conservation GIS Annual Meeting in Monterey, CA.

PRESENTATIONS AND SEMINARS

Invited Presentations

Haney, J.C., R.H. Clarke, D.C. Evers, B.D. Hardesty, P.G.R. Jodice, and W.A. Montevecchi. 2015. Challenges to assessing oil spill impacts to seabirds in the deep ocean. World Seabird Conference, Cape Town, South Africa.

Jodice, P.G.R., W. Mackin, A-L. Harrison, R. Ronconi, J. Lamb, C. Poli, Y. Satgé. Tracking Atlantic and Caribbean Seabirds. World Seabird Conference, Cape Town, South Africa.

Lamb, J.S.* 2016. Estimating survival of nestling pelicans from physiological measurements. Quantitative Ecology, Clemson University, Clemson, SC.

Lamb, J.S.* and P.G.R. Jodice. 2016 Ecological drivers of Brown Pelicans movement patterns and reproductive success in the Gulf of Mexico. Bureau of Ocean Energy Management, New Orleans, LA.

Contributed Papers / Presentations / Posters

Brooks, J.D.*, P.D. Gerard, and S.C. Loeb. 2015. Bat use of forest openings in relation to landscape characteristics and prey abundance. Georgia Bat Working Group Meeting, Athens, GA; 11th Annual Meeting of the Tennessee Bat Working Group, Knoxville, TN; 45th Annual North Symposium on Bat Research. North American Society for Bat Research, Monterey, CA

Brooks, J.D.*, P.D. Gerard, and S.C. Loeb. 2016. Effect of forest opening landscape characteristics, prey abundance, and vegetation structure on bat activity. 96th Annual Meeting of the American Society of Mammalogists. Minneapolis, MN; 26th Annual Colloquium on the Conservation of Mammals in the Southeastern U.S. Guntersville, AL.

Burns, L*, S. Loeb, W. Bridges, and P.G.R. Jodice. 2015. Winter Activity Patterns of Bats of the Big South Fork National River and Recreation Area. Tennessee Bat Working Group Annual Meeting, Knoxville, TN.

Burns, L*, S. Loeb, W. Bridges, and P.G.R. Jodice. 2016. How Do Bats of the Cumberland Plateau Respond to Post-Fire Habitats? Southeastern Bat Diversity Network Annual Meeting and Mammal Colloquium. Guntersville, AL.

Burns, L*, S. Loeb, W. Bridges, and P.G.R. Jodice. 2016. Prescribed Burning and Bats of Big South Fork National River and Recreation Area. Big South Fork National Park Science Symposium, Rugby, TN.

Burns, L*, S. Loeb, and P.G.R. Jodice. 2016. Following the flames? Bat Occupancy in Cumberland Plateau Forests Managed by Fire. North American Bat Research Symposium, San Antonio, TX.

Devenport M., S. Luo, O. Mayar, W. Mohr, A. Tomberg, J. Wilder, Y.G. Satgé, J. Sorber, and P.G.R. Jodice. 2016. Using computing engineering to improve the recovery of archival loggers. Focus On Creative Inquiry, Clemson, SC.

Haynes-Sutton, A, W. Mackin, J.C. Haney, J. Wheeler, L. Sorenson, P.G.R. Jodice. 2015. An integrated approach to building capacity for seabird conservation in the Caribbean - a success story. 2nd World Seabird Conference, Cape Town, South Africa.

- Kimpel, S. P.*, S.C. Loeb, and P.G.R. Jodice. 2015. Roosting Habits of Southeastern *Myotis* in an Old-Growth Bottomland Hardwood Forest. North American Symposium on Bat Research. Monterey, CA.
- Lamb, J.S.* and P.G.R. Jodice. 2015. Sex, death, and oil: Conservation implications of individual variation in Brown Pelican movement patterns. World Seabird Conference, Cape Town, South Africa.
- Lamb, J.S.* and P.G.R. Jodice. 2016. Spatial distribution and behavior mediate surface pollutant exposure risk in a nearshore seabird. International Marine Conservation Congress, St. John's, NL, Canada.
- Lamb, J.S.*, K.M. O'Reilly, and P.G.R. Jodice. 2016. Long-term physiological responses of nestling seabirds to variation in prey availability and nest conditions. Annual Meeting of the Society for Integrative and Comparative Biology, Portland, OR.
- Lawson, A.J.*, P.G.R. Jodice, and K.W. McFadden. 2015. Does harvest pressure influence body size class composition in American alligator populations? The Wildlife Society Annual Conference. Winnipeg, MB, Canada.
- Lawson, A.J.*, P.G.R. Jodice, C.T. Moore. 2015. Using abundance patterns to improve monitoring programs and conservation decision-making: an American alligator example. 69th Annual Conference of the Southeastern Association of Fish and Wildlife Agencies. Asheville, NC.
- Lawson, A.J.*, P.G.R. Jodice, T.R. Rainwater, M.P. Guillette, K.W. McFadden, and P.M. Wilkinson. 2016. American alligator home range and movement patterns in coastal South Carolina. Crocodile Specialist Working Group Meeting. Skukuza, South Africa; The Palmetto Alligator Research Symposium. Georgetown, SC; South Carolina Chapter of The Wildlife Society Annual Conference. Georgetown, SC.
- Loeb, S.C. and P.G.R. Jodice. 2015. Are Bats and Sport Climbing Compatible? A Pilot Study. North American Symposium on Bat Research, Monterey, CA.
- Loeb, S.C. and P.G.R. Jodice. 2016. The importance of cliffs in the roosting and foraging ecology of eastern bats. American Society of Mammalogists Annual Meeting, Minneapolis, MN.
- Poli, C., A-L. Harrison, P.G.R. Jodice. 2015. Evidence for multi-scale foraging behavior of Masked Boobies (*Sula dactylatra*) in the Gulf of Mexico. 2nd World Seabird Conference, Cape Town, South Africa
- Ross, B.E., D. Haukos, C. Hagen, and J. Pitman. 2015. The relative influence of climate variability and landscape change on Lesser Prairie-Chicken populations. The Wildlife Society. Winnipeg, MB, Canada.
- Ross, B.E., D. Haukos, and P. Walther. 2016. Drivers of mottled duck pairs on the Upper Texas Gulf Coast. 7th North American Duck Symposium. Annapolis, MD.
- Satgé, Y.G., J.S. Lamb*, and P.G.R. Jodice. 2016. Diet composition and provisioning rates determine reproductive success in a nearshore seabird. 2nd World Seabird Twitter Conference.
- Satgé, Y.G. and P.G.R. Jodice. 2016. Using computing engineering to improve the recovery of archival loggers. 2nd World Seabird Twitter Conference.
- Takahashi, F.*, Jodice, P.G.R., and F. Sanders. 2016. Spatio-temporal overlap of foraging shorebirds and horseshoe crab (*Limulus polyphemus*) eggs at Cape Romain National Wildlife Refuge, SC. Clemson Biological Sciences Annual Student Symposium, Clemson, SC.

Thompson, H.L.*, P.G.R. Jodice, and A. E. Lacy. 2016. A day in the life of a Whooping Crane: habitat use and movements on the wintering grounds. North American Ornithological Conference, Washington D.C.

Thompson, H.L.*, P.G.R. Jodice, and A. E. Lacy. 2016. Habitat use and movements of migrating Whooping Cranes in a reintroduced population. North American Congress for Conservation Biology, Madison, WI.

Thompson, H.L.*, P.G.R. Jodice, and A. E. Lacy. 2016. Daily movements and local scale habitat characteristics of areas used by wintering Whooping Cranes. Society for Conservation GIS annual meeting, Monterey, CA.

Wheeler, J., A. Brown, J. Goetz, A. Jean, P.G.R. Jodice, M. McKown, E. Rupp, G. Wallace. 2015. Advances in Scientific Understanding and Conservation of the Black-capped Petrel. World Seabird Conference, Cape Town, South Africa.

* graduate student advisee

SERVICE

- P. Jodice, Chair (Elected), World Seabird Union (2015-2020)
- P. Jodice, USGS Research Grade Evaluation, Panel Chair
- P. Jodice, Steering Committee Member, Gulf of Mexico Avian Monitoring Team
- P. Jodice, Steering Committee Member, Atlantic Marine Bird Cooperative
- B. Ross, Kennedy Center Advisory Council

STUDENTS

- J. Brooks, Contributor, National White-nose Syndrome Recovery Plan
- L. Burns, Senator, Graduate Student Government, Clemson University. 2014-2016
- L. Burns, Dean Graduate Student Advisory Board, CAFLS, Clemson University. 2015-2016
- L. Burns, Board Member, North American Society for Bat Research. 2015-2017
- L. Burns, Committee Member/Team Leader, Southeastern Bat Diversity Network Bat Blitz, 2015-2016
- S. Kimpel, Graduate Representative, Student Disability Services Advisory Board, Clemson University.
- J. Lamb, Executive Council member, Waterbird Society. 2015-2019
- J. Lamb, Co-Chair, Student Affairs Committee, and Member, Diversity Committee, Waterbird Society.
- J. Lamb, Speaker Series Seminar Coordinator, Clemson University. 2015-2016
- J. Lamb, Gulf of Mexico Avian Monitoring Network, Seabird Group.
- A. Lawson, Speaker Series Seminar Committee, Clemson University. 2016-2017
- A. Lawson, Membership Chair, Alpha Epsilon Lambda, Clemson University. 2016-2017
- A. Lawson. Director of Communications, Graduate Student Government Executive Cabinet, Clemson University. 2015-2016
- A. Lawson. Lead Organizer, symposium Applications of Decisions Analysis in Wildlife Population Management, Wildlife Society Annual Conference. 2016
- A. Lawson. Student Liaison, Statistical Ecology Section, Ecological Society of America. 2015-2016
- A. Lawson. IUCN Crocodile Specialist Working Group; Future Leaders Working Group. 2016

AWARDS AND HONORS

P. Jodice, USGS Annual Performance Award, November 2015

STUDENTS

L. Burns, Clemson University Professional Enrichment Grants, 2016

J. Lamb, Publication Award for Outstanding Contribution to Conservation, Waterbird Society, 2016.

J. Lamb, Clemson University Professional Enrichment Grants, 2016

J. Lamb, Selected Delegate to National Communicating Science Workshop, Cambridge, MA. 2016.

A. Lawson, Clemson University Professional Enrichment Grants, 2016

A. Lawson (co-author), T. Rainwater (lead PI), Hobcaw Barony Research Grant. 2016

Y. Satgé and J. Lamb, Best Presentation, World Seabird Twitter Conference, World Seabird Union, 2016.

F. Takahashi, 3rd place graduate student poster, Clemson Annual Biological Student Symposium, 2016.

H. Thompson, Clemson University Professional Enrichment Grants, 2016

PRESS/PUBLIC OUTREACH

Outreach: “Re:Wild” biweekly column on wildlife, JSTOR Daily Online Magazine. J. Lamb, ongoing.

Outreach: Something dangerous may be lurking in the South Carolina flood waters. Tech Insider, A. Lawson, 2015.

Outreach: Host of Biotweeps (@Biotweeps), a rotating-curator, biology-focused Twitter account for science communication. A. Lawson, 2016.

Outreach: How Nile Crocodiles are bigger and badder than alligators. National Geographic, A. Lawson, 2016.

Outreach: Bats of Congaree National Park. Congaree National Park Lunch’n’Learn Series. S.C. Loeb and S. Kimpel. 2016

Press: Tracking Alligator Movements in South Carolina to Understand Population Trends. Wildlife Management Institute: Cooperative Research Unit Corner. A. Lawson, 2015.

Press: Bat Scientists from across the country flock to study Alabama Bats. Alabama Media Group, AL. 2016.

Press: Closing in on the alligator: Public hunt applications open as survey continues. Charleston Post and Courier Newspaper, SC, 2016.

Media: Surveying for gators in order to protect the population during hunting season. WCIV-TV ABC New 4, Charleston, SC, 2015.

Twitter:

SC CRU: @SCCoopUnit

Y. Satgé and J. Lamb: @project_pelican

B. Ross: @betheros

H. Thompson: @HillLThompson

A. Lawson: @AbsLawson

