
SOUTH CAROLINA COOPERATIVE FISH & WILDLIFE RESEARCH UNIT



ANNUAL REPORT

2018

In 2018, the South Carolina Cooperative Fish & Wildlife Research Unit continued to engage our cooperators to address natural resource questions and issues. Unit scientists advised and mentored nine graduate students in both M.S. and Ph.D. programs, taught graduate classes, and provided technical assistance to cooperators.

South Carolina Cooperative Fish & Wildlife Research Unit



South Carolina sunset; Pelican and egrets in Alabama; Prairie-chicken survey route in Kansas; Loblolly pines in South Carolina

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Cooperators:

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

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COOPERATORS AND PERSONNEL

COORDINATING COMMITTEE

United States Geological Survey

John Organ, Chief, Cooperative Research Units, 12201 Sunrise Valley Drive, Reston, VA 20192

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Emily Cope, Deputy Director for Wildlife and Freshwater Fisheries, South Carolina Department of Natural Resources, PO Box 167, Columbia, SC 29202

Billy Dukes, Chief of Wildlife, South Carolina Department of Natural Resources, PO Box 167, Columbia, SC 29202

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Robert Boyles, Deputy Director for Marine Resources, South Carolina Department of Natural Resources, PO Box 12559, Charleston, SC 29422

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Clemson University

Keith Belli, Dean, College of Agriculture, Forestry and Life Sciences, Clemson University 101 Barre Hall, Clemson, SC 29634

Paula Agudelo, Associate Dean of Research, College of Agriculture, Forestry and Life Sciences, Clemson University 101 Barre Hall, Clemson, SC 29634

Greg Yarrow, Chair, Forestry and Environmental Conservation, Clemson University, 261 Lehotsky Hall, Clemson, SC 29634

Wildlife Management Institute

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

UNIT PERSONNEL

Patrick Jodice, Unit Leader, U.S. Geological Survey, and Professor, Department of Forestry and Environmental Conservation

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

Brenna Byler, Administrative Assistant, South Carolina Cooperative Fish & Wildlife Research Unit and Department of Forestry and Environmental Conservation

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

Yvan Satgé, Research Specialist, South Carolina Cooperative Fish & Wildlife Research Unit and Department of Forestry and Environmental Conservation

Hail & Farewell



Retirement & Recognition, Derrell Shipes, SC DNR

The SC Unit is grateful for the years of service that Derrell Shipes has provided to the scientists, students, and staff here. Derrell played an integral role in hiring scientists, identifying research that served the needs of the SC DNR and other cooperators, and guiding the Unit through his participation not only in our annual meetings but also throughout the year in his timely interactions with our scientists and students. We wish Derrell and his family the best in his well-deserved retirement years. Derrell will always be an integral member of the SC Cooperative Fish and Wildlife Research Unit. Thank you!



Welcome, Dr. Pamela Michael

The SC Unit is pleased to introduce our new Post-Doctoral Research Associate, Pamela Michael. Pam will be working with Dr. Jodice on the Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS). She will be responsible for taking the lead on all aspects of the data analysis for this extensive and complex survey of seabirds in the Gulf of Mexico. Pam recently completed her Ph.D. in Quantitative Marine Science at the University of Tasmania. She received her M.S. from Hawai'i Pacific University and her B.S. from University of Puget Sound. She brings with her an academic background in spatial and behavioral ecology, climate change impacts, ecosystem modeling, and marine fisheries interactions.

COLLABORATORS

Clemson University

Robert Baldwin, Department of Forestry and Environmental Conservation
Kyle Barrett, Department of Forestry and Environmental Conservation
William Bridges, Mathematical Sciences
Saara DeWalt, Biological Sciences
Troy Farmer, Department of Forestry and Environmental Conservation
Patrick Gerard, Mathematical Sciences
Cathy Jachowski, Department of Forestry and Environmental Conservation
David Jachowski, Department of Forestry and Environmental Conservation
Laura Jodice, Parks, Recreation and Tourism Management
Richard Kaminski, James C. Kennedy Waterfowl and Wetlands Conservation Center
Brandon Peoples, Department of Forestry and Environmental Conservation
Robert Powell, Parks, Recreation and Tourism Management
Thomas Rainwater, Department of Forestry and Environmental Conservation
John Rodgers, Department of Forestry and Environmental Conservation
Shari Rodriguez, Department of Forestry and Environmental Conservation

South Carolina Department of Natural Resources Cooperators

Jay Butfiloski, Wildlife Biologist
Jay Cantrell, Assistant Big Game Program Coordinator
Jamie Dozier, Tom Yawkey Wildlife Center
Andrew Grosse, Amphibian & Reptile Conservation
Christy Hand, Wildlife Biologist
Michael Hook, Small Game Program Coordinator
Mary Catherine Marin, Wildlife Biologist
Mark McAlister, Wildlife Biologist, Tom Yawkey Wildlife Center
Charles Ruth, Big Game Program Coordinator
Felicia Sanders, Wildlife Biologist
Derrell Shipes, Chief of Wildlife Statewide Projects (retired)
Mark Scott, Fisheries Biologist
Michael Small, Assistant Small Game Program Coordinator
Amy Tegeler, Bird Conservation Coordinator
Janet Thibault, Wildlife Biologist

Federal Agency Cooperators

Laurel Barnhill, USFWS
Sarah Dawsey, USFWS Cape Romain Natural Wildlife Refuge
Dean Demarest, USFWS

Deborah Epperson, USGS WARC
Lance Garrison, NOAA/NMFS
Jeff Gleason, USFWS
Rebecca Green, BOEM
Kristin Hart, USGS
David Haukos, USGS Kansas Cooperative Fish and Wildlife Research Unit
Mike Hooper, USGS
Scott Johnston, USFWS
Mona Kalil, USGS
Meg Lamont, USGS
Susan Loeb, Southern Research Station, USFS
Jim Lyons, USGS
Clint Moore, USGS Georgia Cooperative Fish and Wildlife Research Unit
Dave Moran, BOEM
David Shelly, National Parks Service
Emily Silverman, USFWS
John Stanton, USFWS
Melanie Steinkamp, USGS
Edward (Jerry) Tupacz, USFWS, Wildlife Biologist
Craig Watson, USFWS Ecological Services, Charleston, SC
Tim White, BOEM
Randy Wilson, USFWS
Bureau of Ocean Energy Management
USFWS Region 4, Cape Romain Natural Wildlife Refuge
USFWS Migratory Bird Program
USFWS Ecological Services
USFS Southern Forest Experiment Station
National Park Service, Congaree National Park
Smithsonian Migratory Bird Center

Private Sector Cooperators

Biodiversity Research Institute
International Crane Foundation
Jost Van Dyke Preservation Society
National Fish and Wildlife Foundation
Nemours Wildlife Foundation
Society for the Conservation and Study of Caribbean Birds
Terra Mar, LLC

Cooperating Scientists from other Colleges, Universities, and Institutes

John Dindo, Dauphin Island Sea Lab

Lisa Ferguson, Wetlands Institute

Auriel Fournier, Mississippi State University

Peter Frederick, University of Florida

Christian Hagen, Oregon State University

Chris Haney, Terra Mar, LLC

Autumn-Lynn Harrison, Smithsonian Institute

Mevin Hooten, Colorado State University

David Koons, Colorado State University

Anne Lacy, International Crane Foundation

Stacey Lance, University of Georgia

William Mackin, Terra Mar, LLC

Hannah Madden, Ecological Professionals, St. Eustatius National Parks

Adriana Mancada, El Colegio de la Frontera Sur Unidad Campeche, Mexico

Ken Meyer, Avian Research Conservation Institute

Darshan Narang, Environmental Management Authority, Trinidad & Tobago

Hannah Nevins & Brad Keitt, American Bird Conservancy

Ben Parrott, University of Georgia

Louis Perrotti, Roger Williams Park Zoo

James Pitman, Western Association of Fish and Wildlife Agencies

Daniel D. Roby, Oregon Cooperative Fish and Wildlife Research Unit

Adam Rosenblatt, University of North Florida

Ernst Rupp, Grupo Jaragua, the Dominican Republic

Melgar Tabasco, Fundación Pedro y Elena Hernandez, Mexico

Mark Woodrey, Mississippi State University

Susan Zaluski, Jost van Dyke Preservation Society, British Virgin Islands

Elise Zipkin, Michigan State University

GRADUATE EDUCATION

CURRENT STUDENTS

Sheldon Davis, M.S. Wildlife & Fisheries Biology (Advisor: Jodice & Loeb)
Sarah Kimpel, M.S. Wildlife & Fisheries Biology (Advisor: Jodice & Loeb)
Abigail Lawson, Ph. D. Wildlife & Fisheries Biology (Advisor: Jodice)
Alexander Schindler, M.S. Wildlife & Fisheries Biology (Advisor: Ross)
Rochelle Streker, M.S. Wildlife & Fisheries Biology (Advisors: Jodice & Lamb)
Bradley Wilkinson, Ph.D. Wildlife & Fisheries Biology (Advisor: Jodice)
Jesse Wood, M.S. Wildlife & Fisheries Biology (Advisor: Ross)

RECENT GRADUATES

Hannah Plumpton, M.S. Wildlife & Fisheries Biology (Advisor: Ross)
Hillary Thompson, M.S. Wildlife & Fisheries Biology (Advisor: Jodice)

CURRENT & RECENTLY COMPLETED RESEARCH

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

Investigators: Patrick Jodice (SC CRU), Derrell Shipes (SC DNR), Jay Butfiloski (SC DNR), and Clint Moore (GA CRU)

Student: Abby Lawson (Ph. D. Candidate, Clemson University)

Sponsors: SCDNR and USGS

Dates: 2013-2018

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

Investigators: Beth Ross (SC CRU), Amy Tegeler (SC DNR), and David Jachowski (Clemson University)

Student: Jesse Wood (M.S., Clemson University)

Sponsors: USDA NRCS

Dates: 2016-2018

A Multi Species Approach to Managing the Effects of Weather and Land Cover on Upland Game Birds

Investigators: Beth Ross (SC CRU), and David Haukos (KS CRU)

Student: Alexander Schindler (M.S., Clemson University)

Sponsors: Pheasants Forever, USDA NRCS, and Clemson University

Dates: 2017-2019

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

Investigators: Beth Ross (SC CRU), and Emily Silverman (USFWS)

Student: Hannah Plumpton (M.S., Clemson University)

Sponsors: USGS and Clemson University

Dates: 2016-2018

Nonbreeding Habitat Assessment of Whooping Cranes in a Reintroduced Population

Investigators: Patrick Jodice (SC CRU), and Anne Lacy (International Crane Foundation)

Student: Hillary Thompson (M.S., Clemson University)

Sponsors: Nemours Foundation

Dates: 2014-2018

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

Investigators: Susan Loeb (USFS), and Patrick Jodice (SC CRU)

Student: Sarah Kimpel (M.S., Clemson University)

Sponsors: National Park Service

Dates: 2015-2018

Potential Prescribed Fire Effects on Bat Roost and Foraging Habitat Use on Big South Fork National River and Recreation Area

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

Student: Sheldon Davis (M.S., Clemson University)

Sponsors: USFS

Dates: 2018-2019

Spatial & Disturbance Ecology of Eastern Brown Pelicans in the South Atlantic Bight

Investigators: Patrick Jodice (SC CRU)

Student: Bradley Wilkinson (Ph. D., Clemson University)

Sponsors: USGS and Bureau of Ocean Energy Management

Dates: 2017–2020

Seabird Colony Registry and Atlas for the Southeastern United States

Investigators: Patrick Jodice (SC CRU), Lisa Ferguson (Wetlands Institute), Yvan Satgé (Clemson University), and Joe Tavano (Clemson University)

Sponsors: US FWS, SC CRU

Dates: 2012-2018

Spatial and Reproductive Ecology of Brown Pelicans in the Gulf of Mexico

Investigators: Patrick Jodice (SC CRU) and Juliet Lamb (University of Rhode Island)

Student: Rochelle Streker (M.S., Clemson University)

Sponsors: Bureau of Ocean Energy Management and USGS

Dates: 2012-2018

Gulf of Mexico Marine Assessment Program for Protected Species

Investigators: Patrick Jodice (SC CRU), Jeff Gleason (USFWS), Chris Haney (Terra Mar LLC), Pamela Michael (Clemson University), and Yvan Satgé (Clemson University)

Sponsors: US FWS and Bureau of Ocean Energy Management

Dates: 2017-2021

Ecology and Conservation of the Endangered Black-capped Petrel

Investigators: Patrick Jodice (SC CRU), Yvan Satgé (Clemson University), and Ernst Rupp (Grupo Jaragua)

Sponsors: BirdsCaribbean, Neotropical Bird Club, SC CRU

Dates: 2018-2019

Habitat Use and Inter-Population Movements of the American Flamingo

Investigators: Patrick Jodice (SC CRU), Yvan Satgé (Clemson University), and Melgar Tabasco (Fundación Pedro y Elena Hernandez)

Sponsors: Fundación Pedro y Elena Hernandez

Dates: 2017-2019

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

The American Alligator (*Alligator mississippiensis*) is an iconic species in South Carolina, of 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 of alligator monitoring programs to best 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 to inform management decisions.

We concluded field work in 2017 for objectives 1 and 2, following three years of intensive nightlight survey efforts on the coastal plain and a single-year pilot study focused on inland habitats in Congaree National Park. In the last year, we have finalized our integrated population model that synthesizes a long-term mark-recapture dataset from the Tom Yawkey Wildlife Center (YWC) and the aforementioned

nightlight survey counts. The model will serve to determine the intensity of monitoring required to produce reliable population estimates (objective 1) and as the basis to evaluate population-level responses to management or harvest decisions (objective 2).

In Fall 2017 and Spring 2018, we collected prey and plant samples along a marine to freshwater gradient in the Santee Delta region. We are using stable isotope analysis to compare the habitat samples to previously collected alligator plasma from the YWC study, in order to evaluate individual variation in habitat-specific foraging patterns (objective 3). Additionally, in 2018 we also analyzed YWC whole blood samples to determine total mercury content and identify potential demographic and environmental drivers.



American Alligator equipped with a satellite transmitter. (A. Lawson 2017)

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

A primary focus of Farm Bill conservation incentive programs (like EQIP) is to promote habitat conservation for 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 programs on private lands. However, feedback on the success of Farm Bill incentive programs has largely been limited to anecdotal evidence and informal feedback from participants and partners. Objective 1 was to evaluate the effectiveness of Farm Bill programs at conserving forest habitat and wildlife in South Carolina. We identified the effects of Farm Bill practices on Loblolly Pine (*Pinus taeda*) stands and identified drivers of avian species richness and abundance in relation to management (burning, thinning, herbicide spray) and other habitat factors. Objective 2 was to assess the use of audio recorders as a tool for monitoring bird species of conservation concern on private lands.

Working with the Natural Resources Conservation Service and private landowners for permission, we conducted bird and vegetation surveys at 53 sites in 9 counties of the Piedmont to Midlands of South

Carolina. From May-July 2017 and 2018, we conducted 318 point-count surveys and deployed 8 audio recorders which captured 1332 GB of audio data from 59 sampling sessions. 1) We found that repeated burning shifted pine stands to more open woodlands conditions. Species richness was highest at sites with 3 or more prescribed burns, with lower basal area, and with greater mid-story complexity, but species responded differently in abundance. Ground foraging birds were more abundant in more open-canopy stands, while foliage-gleaning birds were more related to amount of habitat on the landscape scale (1-5km). 2) Although we detected similar lists of species with individual point counts as with individual acoustic surveys, we detected more species across all visits and seasons with the point count method. Findings provide guidance on improved monitoring effectiveness of incentive programs and habitat management, and insights into how such technology can be used to survey other areas of focus.



Survey location in a Loblolly Pine stand. (J. Wood 2018)

A Multi-Species Approach to Managing the Effects of Weather and Land Cover on Upland Game Birds

Incorporating the projected effects of climate and land use change into management actions is critical for ensuring the viability of future populations. As many species are affected by these changes, managing for multiple species rather than single species can maximize limited resources. Grasslands of the Great Plains provide an ideal opportunity to study the effects of changing weather and land cover on several species of management interest.

We are conducting a study to quantify the effects of weather and land cover on four species of upland game birds in Kansas: Ring-necked Pheasant (*Phasianus colchicus*), Northern Bobwhite (*Colinus virginianus*), Lesser Prairie-Chicken (*Tympanuchus pallidicinctus*), and Greater Prairie-Chicken (*Tympanuchus cupido*). We combined historic survey data with weather, land cover, and farm bill practice data in a hierarchical modeling framework. Variations of this model included threshold models, allowing us to estimate threshold points at which species respond to changes in land cover, as well as interaction models, allowing us to estimate the

interaction between weather and land cover on these populations on different spatial scales.

Initial results indicated both Lesser and Greater Prairie-Chicken, as well as Ring-necked Pheasant populations responded most to landscape variables, particularly grassland-to-cropland ratio and edge density. Northern Bobwhite populations did not exhibit a strong response to any weather or landscape variable. The populations of all four species also demonstrated significant threshold responses to grassland-to-cropland ratio and edge density (i.e., population initially had a positive, negative, or no response to the landscape variable, followed by a change in the response after a threshold value was reached), although the specific effect differed depending on individual species and spatial scale. We will next use our model results as inputs into decision-support software to select potential areas for future conservation focus in Kansas. Through our approach, we will better understand how to manage multiple species to optimize conservation and management efforts.



Prairie-Chicken survey route in Phillips County, Kansas. (A. Schindler 2017).

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

Sea ducks are a poorly understood species, and while populations are thought to be declining, developing an effective way 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.

We ran a Least Absolute Shrinkage and Selection Operator with broad and fine scale oceanographic and weather variables. The oceanographic variables bathymetry, ocean floor slope, and distance to shore

were found to have the greatest association with the distribution of Black Scoter. Additionally, our results suggest that oceanographic variables have a stronger relationship with Black Scoter distribution than weather variables. To quantify winter movement patterns of Black Scoters, we used satellite telemetry data from 2009 to 2012 that was provided by the Sea Duck Joint Venture. We used Mann-Whitney U-tests to quantify the differentiation between sex and geography. While there was no difference between sexes, average wintering site area and distance between wintering sites differed by geographic region. Southern wintering sites were larger and further apart than northern wintering sites. These results suggest that Black Scoter habitat use and movement patterns vary regionally.



Black Scoters (Kurt Hasselman 2010)

Nonbreeding Habitat Assessment of Whooping Cranes in a Reintroduced Population

In 2001, a reintroduced population of Whooping Cranes (*Grus americana*), known as the Eastern Migratory Population (EMP), was established in the eastern United States. The population had its breeding range in central Wisconsin, with a non-breeding range on the Florida Gulf coast. Between 2007 and 2018 the winter distribution the EMP expanded north to include areas as distant as southern Indiana. To date, there has been no assessment of habitat use of the EMP across the current winter distribution. The objectives of this study were to identify factors influencing daily home range sizes of wintering Whooping Cranes in the EMP, describe habitat characteristics of areas used by cranes, and assess behavior associations with habitat.

During Winters 2014-2015 and 2015-2016, we used radio-telemetry to track 20 and 23 groups of wintering Whooping Cranes, respectively, each for one full day. We recorded their location, behavior, and the habitat characteristics of their locations. Based on natural clustering, we grouped wintering sites into three regions: North (Illinois, Indiana, Kentucky), Central (Tennessee, Alabama), and South (Georgia, Florida, Louisiana). We showed that home ranges decreased in size from North ($4.9 \pm 2.8 \text{ km}^2$) to Central ($3.1 \pm 1.0 \text{ km}^2$) to South ($2.3 \pm 0.5 \text{ km}^2$).

Home ranges in the South were also comprised of the greatest proportion of wetlands compared to other regions. In the northern region, cranes selected agricultural areas, and used areas that were potentially seasonally inundated during winter. In the central region, cranes selected for both agriculture areas and wetlands compared to forests. Cranes wintering in the South did not select habitat characteristics out of proportion to their availability within their home ranges. In all regions, cranes used areas with water or vegetation below the tibiotarsal joint more often than areas with deep water or tall vegetation. Lastly, while Whooping Cranes in the North foraged more often in agricultural areas than in grasslands or wetlands, they foraged equally in all three habitats in the central region, and they foraged in either grasslands or wetlands in the South. Loafing behavior was more associated with wetlands than agricultural areas or grasslands in all three regions. The findings of this study are the first description of habitat characteristics of areas used by cranes wintering throughout the current and entire winter range of the EMP. Results from this study will inform land managers of wintering habitat use and can benefit conservation planning with respect to future reintroduction efforts of this endangered species.



Radio-tracked Whooping Crane in agricultural field (H. Thompson 2016)

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

The Southeastern Myotis (*Myotis austroriparius*) is a rare and sensitive species of bat that is associated with mature bottomland forests. Little is known about the ecology of this species, particularly its roosting habits. Furthermore, 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 its susceptibility to WNS. To this end, we are examining Southeastern Myotis torpor patterns, tree microclimates, roost selection, roost fidelity, and roost networks.

Since October 2016 we located 46 roosts of myotis through opportunistic cavity searches or radiotelemetry. We also conducted weekly netting at roost trees from November through March. Initial

results suggest that Southeastern Myotis selects winter roosts with larger cavity interior volumes than random tree cavities, in stands with higher percentage of surrounding basal area attributable to *Nyssa spp.* than random stands. We deployed temperature and relative humidity dataloggers into cavities in roost trees, reference trees, and at ambient points to investigate the difference in microclimate between roost and non-roost trees. We also conducted vegetation plot surveys to understand the effect of plant community structure on roost site selection.

During Winter 2016-2017 and May 2017, we collected tissue samples from Southeastern Myotis and Rafinesque's Big-Eared Bats (*Corynorhinus rafinesquii*), respectively for Jessi West, a Ph.D. student at Tennessee Tech University. West's research examines population genetics of bats throughout the Southeast.



Sarah Kimpel holds a Southeastern Myotis equipped with a radio-tag (P. Kimpel 2015)

Potential Prescribed Fire Effects on Bat Roost and Foraging Habitat Use on Big South Fork National River and Recreation Area

Prescribed fire is a management tool commonly used in ecosystem restoration and maintenance in North America, though little is known about how fire characteristics affect bat foraging habitat use, roost use, and roost selection. While many studies suggest that prescribed fire improves bat foraging habitat, more information is needed regarding effects of time since last burn and fire severity on the summer ecology of bats. Thus our objective is to use acoustic detectors to determine how summer occupancy of bats in Big South Fork National River and Recreation Area (BISO) is affected by time since last burn, fire severity, weather and forest type. Additionally, we are examining summer roost tree selection and roost habitat selection of Northern Long-eared Bats (*Myotis septentrionalis*), Indiana Bats (*M. sodalist*), Little Brown Bats (*M. lucifugus*), and Tri-colored Bats (*Perimyotis subflavus*) captured in BISO and radio-tracked during 2018 and 2019 mist net surveys. The results of this project will help revise the BISO Fire Management Plan to better support rare and endangered bats in forests managed with prescribed fire.

During May-August 2018, we collected acoustic data using Anabat SD2 detectors in 36 prescribed fire sites for 3 nights each with varying combinations of time since last burn (0-2, 3-4, 5-7, and >8 years), and burn severity (high, medium or low) using a stratified random design. Nightly temperature was recorded at each detector site, and forest structures such as basal area, canopy closure, and potential roost availability were determined. A total of 712 calls were recorded among these sites, and manually vetted for species identification. Preliminary results indicate that prescribed burns conducted at frequent intervals may provide good foraging habitat for Tri-colored Bats in BISO.

During our summer 2018 mist net surveys, we successfully tracked two Tri-colored Bats to roost and characterized roost trees and surrounding habitat using methods similar to those at detector sites. We will also compare these roosts to randomly selected trees within a radius equal to the distance traveled from the capture location and known roosts to determine if bats select for roost, habitat, or burn severity.



Tri-colored Bat captured in McCreary County, KY (S. Davis 2018)

Spatial & Disturbance Ecology of Eastern Brown Pelicans in the South Atlantic Bight

As a nearshore marine predator and species of conservation concern, Brown Pelicans (*Pelecanus occidentalis*) in the southeastern United States constitute a valuable study population for investigating coastal ecological systems. Despite occupying a highly visible and elevated trophic position in estuarine and oceanic ecosystems, movement parameters describing habitat use patterns, foraging behaviors, and migratory corridors are undeveloped at multiple spatial and temporal scales. This study aims to resolve these information gaps by outfitting adult pelicans breeding in South Carolina with high-resolution GPS satellite transmitters, which will provide accurate locational data throughout the annual life-history cycle.

In addition to habitat use patterns, both natural and anthropogenic disturbances will also be investigated to provide baseline risk assessments. These include

the impacts of large-scale meteorological events such as hurricanes, potential interactions with offshore energy development, oil spill risk assessment modeling, and the magnitude of influence on pelican nestlings posed by the local shrimp trawling fleet.

To date, 45 adult pelicans have been equipped with satellite transmitters breeding at four colonies in South Carolina. We expect to also deploy transmitters at locations in Georgia and northern Florida. Upon the completion of various life-history stages, maps will be generated showcasing breeding ranges, migratory pathways, wintering locations, and site fidelity at colonial, subpopulation, and population structures. This information will greatly expand our knowledge of this species in the Atlantic, and complement prior research recently conducted on Brown Pelicans in the Gulf of Mexico.



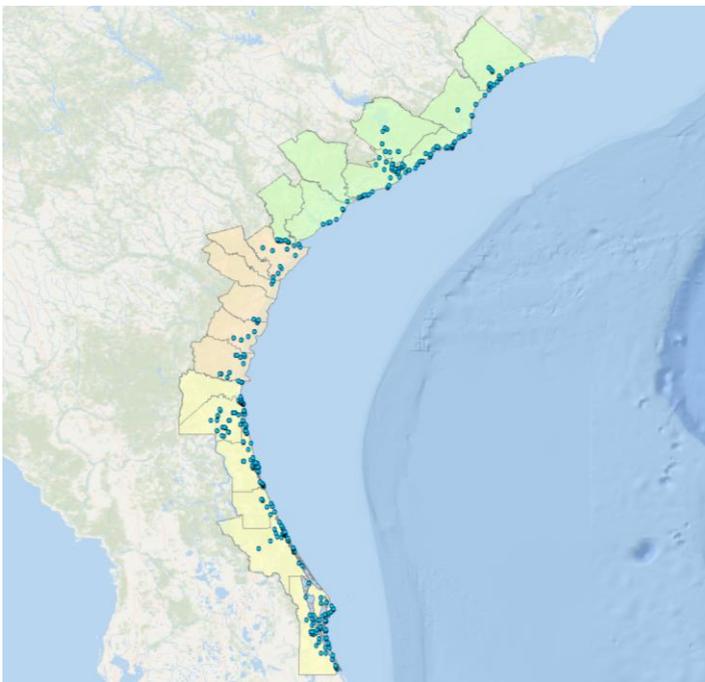
Bradley Wilkinson bands a captured Brown Pelican (B. Byler 2018)

Seabird Colony Registry and Atlas for the Southeastern United States

The coastal region of the South Atlantic Bight is characterized by sandy barrier and estuarine islands backed by extensive tidal marshes that host critical populations of nesting seabirds. Ten major rivers and numerous tidal creeks supply the coastal zone with ample nutrient and freshwater input, resulting in a region with productive fisheries that subsequently provision colonies of piscivorous seabirds. The most recent atlas of seabird nesting colonies for the eastern U.S. was published in 1978 and up-to-date information was required by state and federal biologists to efficiently manage seabird species in the region.

To aid in the conservation of seabird populations that utilize the coast, we created a Seabird Colony Registry and Atlas of the Southeastern United States to compile the locations and attributes of seabird colonies along the coasts of South Carolina, Georgia, and northeast Florida for 2003-2017. The purpose of

the Registry and Atlas is to provide an updated and integrated regional repository for seabird data, including a spatial inventory. The current Registry and Atlas is primarily intended for use by local, state, and federal resource managers. The atlas will aid in the development of regional conservation and management plans, enhance understanding of species phenology and distribution, and can be used to evaluate important bird use areas. Following the occurrence of a natural or anthropogenic stressor, such as a pollution event or hurricane, this product may serve as a reference for response teams. This product can also inform discussions and decisions related to coastal zone management (e.g., recreational use of and access to beaches, marine spatial planning, scheduling and siting of sand dredging and beach nourishment operations). Finally, the Atlas also may support the selection of study sites for research or the development of long-term monitoring plans.



Extent of the Seabird Colony Registry and Atlas for the Southeastern United States. (Y. Satgé 2018)

Spatial and Reproductive Ecology of Brown Pelicans in the Gulf of Mexico

This project focuses on providing baseline information about populations of Brown Pelicans (*Pelecanus occidentalis*) across the northern Gulf of Mexico. This study assesses aspects of the breeding biology of Brown Pelicans on Gaillard and Cat Islands in Mobile Bay, AL that can be used to inform restoration efforts within the Gulf of Mexico. Study objectives are to document (1) the relationship between environmental variables, nest site characteristics, and nestling survival, and (2) when productivity is lost during nestling maturation to fledging. This project's research builds from and compliments previous research efforts of the SC CRU across the northern Gulf of Mexico and coastal SC.

To date, habitat characteristics were measured and recorded at four separate intervals across the breeding season from 99 nests at both colonies in 2017 and 147 nests at the Gaillard colony only in 2018. We collected breeding data at each colony including chick survival from hatch to fledge, chick body condition, chick diet composition, and nestling provisioning rates. We have color-banded 305 pelican nestlings at the colonies during both years. These chicks, along with the 600 pelican nestlings previously banded by the SC CRU at colonies throughout the northern Gulf, are part of an ongoing citizen science effort to re-sight color bands and investigate the dispersal patterns of juveniles.



Brown Pelicans nesting on Gaillard Island, AL. (R. Streker 2018)

Gulf of Mexico Marine Assessment Program for Protected Species

The nearshore and offshore waters of the Gulf of Mexico are critically important breeding or non-breeding habitats for many species of seabirds from North America, the Caribbean, and Western Europe. Historically, limited information regarding the species composition, distribution, and abundance of seabirds has been available to inform planning decisions, policy analyses, or risk models in the region, hindering our ability to plan for or respond to data needs during oil and gas activities.

Starting in April 2017, we have conducted seabird surveys on 15 pelagic cruises in the northern Gulf of Mexico as part of the Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS), a federal partnership between the Bureau of Ocean Energy Management, the U.S. Fish and Wildlife Service, the U.S. Geological Survey, and the National Oceanic and Atmospheric Administration. The seabird component of GoMMAPPS is anticipated to be the most spatially and temporally extensive avian research effort conducted in the Gulf of Mexico. To date, using standard, transect-based methodology we have amassed ~ 5,700 detections of 36 seabird species

totaling ~25k seabirds. Preliminary results have shown high numbers of non-breeding Black Terns (*Chlidonias niger*) in the Mississippi River delta and Western Gulf; a widespread presence of Brown Booby (*Sula leucogaster*), a tropical species commonly associated with coastal environments, in pelagic waters; an extended presence of European-breeding Band-rumped Storm-petrel (*Oceanodroma castro*) in U.S. waters from March to September; and the regular occurrence of Black-capped Petrel (*Pterodroma hasitata*), a threatened Caribbean species currently petitioned for protection under the Endangered Species Act. Future data analysis will evaluate patterns in occurrence and abundance across space and time. We are also developing additional components that would, if fully funded, use telemetry to document movement patterns of seabirds from both the nearshore and pelagic environments. Collectively, these data will permit spatially-explicit modeling of seabird abundance and distribution across the Gulf and provide a critical basis for understanding and addressing potential impacting factors in the region.



Brown Booby during GoMMAPPS at-sea survey (C. Haney 2017)

Ecology and Conservation of the Endangered Black-capped Petrel

A gadfly petrel endemic to the Caribbean, the Black-capped Petrel (*Pterodroma hasitata*) has a fragmented and declining population, is considered Endangered throughout its range, and is under consideration for listing under the Endangered Species Act by the U.S. Fish and Wildlife Service. Population estimates based on at-sea observations range from 2,000 to 4,000 individuals, with a fragmented breeding population estimated at 500 to 1,000 pairs. While historical records and recent surveys suggest possible nesting populations in Cuba and Dominica, the only confirmed breeding areas are located on Hispaniola. The expansive marine range of the species exposes it to many conservation threats at sea including fisheries activity, offshore energy development, marine pollution including mercury bioaccumulation, and climate change. The current lack of information on the foraging ecology of the species, however, limits our understanding of its marine habitat preferences and associated conservation threats. Therefore, we partnered with the Dominican NGO Grupo Jaragua to (1) gather fine-scale data on individual movements of Black-capped Petrels breeding in the Sierra de Bahoruco, Dominican

Republic, and (2) study their diet through a molecular analysis of fecal DNA.

In Spring 2018 we used GPS tracking technology to record the foraging movements of three chick-rearing adults during a provisioning trip for 8-11 days in April 2018. Tracked petrels travelled between 2,000 and 4,000 km in the Caribbean Sea and the Northwest Atlantic Ocean and foraged 34.5% of the time. Foraging areas appeared to be associated with physical processes such as the Guajira upwelling, and climatological fronts in the outer continental shelf of the South Atlantic Bight. These two areas were also characterized with the highest fishing effort for the commercial longline fishery, a conservation concern for the species. We also collected fecal samples from 11 chick-rearing adults and are planning on performing the genetic sequencing of prey DNA in Winter 2018-2019. Further conservation actions include developing a habitat suitability model to predict suitable nesting areas of Black-capped Petrel in the region, and a plan to use satellite-tracking technology to record the movements of adult petrels from their U.S. non-breeding areas to unknown breeding grounds in the Caribbean.



Adult Black-capped Petrel ready to be equipped with a GPS tracker. (Y. Satgé 2018)

Habitat Use and Inter-Population Movements of the American Flamingo

The American Flamingo (*Phoenicopterus ruber*) is distributed along coastal wetlands of eastern Mexico and the Caribbean. Despite its widespread regional distribution, baseline data on population size and movements within and between populations are lacking. In Mexico, the Yucatan population is censused annually by the Mexican Department of Protected Areas and the Fundación Pedro y Elena Hernández. Breeding censuses and post-breeding aerial surveys along the coast of Yucatan have shown that a significant portion of the population leaves the region after breeding but the location of the post-breeding and wintering sites are unknown. The Fundación Pedro y Elena Hernández proposed to use satellite tracking of non-breeding adult flamingos to inform conservation actions for the species in eastern Mexico and the western Caribbean.

We are assisting the Fundación Pedro y Elena Hernández in implementing satellite tracking

technology for American Flamingos breeding in northern Yucatan. In October 2017, we collaborated with the Roger Williams Park Zoo, RI to test attachment methods of satellite transmitters on captive flamingos. Then, in November 2017, we trained biologists of the Fundación Pedro y Elena Hernández and the Mexican Department of Protected Areas to (1) capture and outfit American Flamingo with satellite transmitters using these adapted methods, and (2) use best practices for the management of tracking data. To date, 11 adult flamingos have been equipped with satellite transmitters. The information obtained from this study will be used to understand year-round movements (including post-breeding dispersal, migratory routes, and non-breeding distribution) and habitat use of American Flamingos in eastern Mexico.



American Flamingos in foraging habitat in Northern Yucatan, Mexico. (M. Tabasco 2018)

PUBLICATIONS

JOURNAL ARTICLES 2017-2018

* = graduate student author

- Barzen, J.A., A.E. Lacy, H.L. Thompson*, and A.P. Gossens. 2018. Assessing habitat use for the reintroduced Eastern Migratory Population of Whooping Cranes. *In The Biology and Conservation of the Whooping Crane (Grus americana)*. Eds S.J. Converse and J. French.
- Fallon, J.A., E.P. Smith, N. Shoch, J.D. Paruk, E.A. Adams, D.C. Evers, P.G.R. Jodice, C. Perkins, S. Shulte, W.A. Hopkins. 2018. Hematological indices of physiological injury to lightly oiled birds from the Deepwater Horizon oil spill. *Environmental Toxicology and Chemistry* 37:451-461.
- Jodice, P.G.R., E.M. Adams, J.S. Lamb*, Y.G. Satgé. In Press. Gulf of Mexico Avian Monitoring Network Strategic Monitoring Plan: Seabirds. In Lyons et al. (eds.). *Gulf of Mexico Avian Monitoring Network Strategic Monitoring Plans*.
- Lamb, J.S.*, Y.G. Satgé, and P.G.R. Jodice. 2017. Diet composition and provisioning rates of nestlings determine reproductive success in a subtropical seabird. *Marine Ecology Progress Series* 581: 149-164.
- Lamb, J. S.*, C. V. Fiorello, Y.G. Satgé, K. Mills, M. Ziccardi, and P.G.R. Jodice. 2018. Movement patterns of California brown pelicans (*Pelecanus occidentalis californicus*) following oiling and rehabilitation. *Marine Pollution Bulletin* 131: 22–31.
- Lamb, J. S.*, D.J. Newstead, L.M. Koczur, B.M. Ballard, M.C. Green, and P.G.R. Jodice. 2018. A bridge between oceans: overland migration of marine birds in a wind energy corridor. *Journal of Avian Biology* 49
- Lawson, A.J.*, J.S. Sedinger, and E.J. Taylor. 2017. Identifying demographic and environmental drivers of recruitment and population growth in a cavity nesting sea duck population. *Journal of Avian Biology* 48: 1394-1405.
- Lawson, A.J.*, B.A. Strickland, and A.R. Rosenblatt. 2018. Patterns, drivers and effects of alligator movement behavior and habitat use. *In American Alligators: Habitats, Behaviors, and Threats*. Eds S.E. Henke and C.B. Eversole. Nova Science Publishers, Hauppauge, NY, USA.
- Lawson, A.J.*, C.T. Moore, T.R. Rainwater, P.M. Wilkinson, F.M. Nilsen, L.J. Guillette Jr., R.H. Lowers, K.W. McFadden, and P.G.R. Jodice. *In review*. Minimum age predicts non-linear mercury bioaccumulation patterns in adult American alligators. *Science of the Total Environment*.

- Loeb, S.C., P.G.R. Jodice. 2018. Activity of southeastern bats along sandstone cliffs used for rock climbing. *Journal of Fish and Wildlife Management* 9: 255-265.
- Ross, B.E., D. Haukos, C. Hagen, and J. Pitman. 2018. Combining multiple sources of data to inform conservation of Lesser Prairie-Chicken populations. *Auk* 135(2): 228-239.
- Ross, B.E., D. Haukos, and P. Walther. 2018. Quantifying changes and influences on Mottled Duck density in Texas. *Journal of Wildlife Management* 82: 374-382.
- Wilkinson, B.P.*, J. Jahncke, P. Warzybok, R.W. Bradley, and S.A. Shaffer. 2018. Variable utilization of shelf-break associated habitats by chick-brooding Rhinoceros Auklets in the California Current System. *Marine Ecology Progress Series* 590: 211-226.

THESES AND DISSERTATIONS 2017-2018

- Hannah Plumpton, Department of Forestry and Environmental Conservation, M.S., August 2018: *Black Scoter (Melanitta americana) Winter Habitat Use and Movement Patterns Along the Atlantic Coast of the United States*
- Hillary Thompson, Department of Forestry and Environmental Conservation, M.S., May 2018: *Characteristics of Whooping Crane Home Ranges During the Nonbreeding Season in the Eastern Migratory Population*

REPORTS & DATA RELEASES

- Ferguson, L.M., Y.G. Satgé, J. Tavano, and P.G.R. Jodice. 2018. Seabird colony registry and atlas for the Southeastern United States. Final Report for U.S. Fish and Wildlife Service. South Carolina Cooperative Fish and Wildlife Research Unit, Clemson, South Carolina.
- Lamb, J.S., Y.G. Satgé, and P.G.R. Jodice. 2017. Foraging ecology of Brown Pelican in the northern Gulf of Mexico (2013-2015): U.S. Geological Survey data release, <https://doi.org/10.5066/F7R78D6J>.
- Lamb J.S., Y.G. Satgé, and P.G.R. Jodice. 2017. Data from: Influence of density-dependent competition on foraging and migratory behavior of a subtropical colonial seabird. Movebank Data Repository. doi:10.5441/001/1.7856r086
- Satgé, Y.G. and P.G.R. Jodice. 2018. Testing attachment techniques for the deployment of a long-term satellite tracking device on wild American Flamingos. Final Report. South Carolina Cooperative Research Unit, Clemson, USA.

ACTIVITIES

TEACHING

- B. Ross, Spatial Ecology and Conservation, co-taught, Fall 2017.
- P. Jodice, Conservation Physiology (on campus), Fall 2018.
- P. Jodice, Conservation Physiology (online), Fall 2018.

TRAINING

- J. Wood led an interactive workshop for SC DNR and USDA-NRCS biologists on using acoustic recording units to inventory wildlife.
- J. Wood attended workshops at the 2018 North American Congress for Conservation Biology about using Google tools for conservation, and informing policy for concrete conservation outcomes.
- A. Lawson led a Science Communication and Social Media course for the Graduate Seminar in Forestry and Natural Resources at Clemson University.
- Y. Satgé trained Mexican biologists of Fundación Pedro y Elena Hernandez and of Comisión Nacional de Áreas Naturales Protegidas on techniques to outfit American Flamingo with satellite transmitters and best practices for the management of tracking data. Y. Satgé also trained Dominican biologists and technicians of Grupo Jaragua in processing and outfitting Black-capped Petrel with GPS trackers.
- Y. Satgé led workshops on USGS-compliant data releases.

PRESENTATIONS AND SEMINARS

Invited presentations

- Jodice, P.G.R., M.S. Woodrey, and A. Fournier. 2018. Movement ecology of seabirds: Multi-scale and multi-taxa approaches to addressing conservation needs in the Gulf of Mexico. Southeastern Association of Fish and Wildlife Agencies, Mobile, Alabama.
- Jodice, P.G.R., J.S. Lamb*, Y.G. Satgé, and C. Poli*. 2017. Spatial ecology of seabirds in the Gulf of Mexico. Bureau of Ocean Energy Management Information Transfer Meeting, New Orleans, Louisiana.
- Lamb, J.S. *, Y.G. Satgé, and P.G.R. Jodice. 2018. Evaluating year-round seabird habitat needs in the Gulf of Mexico to improve oil pollution risk assessment and mitigation. University of Florida Seminar Series, Gainesville, FL.
- Lamb, J.S. *, Y.G. Satgé, and P.G.R. Jodice. 2018. Brown Pelican ecology: Using GPS technology to study the movements of Brown Pelicans and understand key habitat needs and risk factors. Coastal Discovery Museum, Hilton Head, SC.
- Lawson, A.J.* 2018. South Carolina alligator population ecology: abundance estimation and monitoring. Natural Resource Measurements, Clemson University, Clemson, SC.
- Wilkinson, B.P.*, and P.G.R. Jodice. 2018. Spatial analytics of contrasting seabird species across multiple temporal scales: different drivers of animal movement. Wake Forest University Biology Seminar Series, Winston-Salem, NC.

Contributed papers / Presentations / Posters

- Fiorello, C., J.S. Lamb*, Y.G. Satgé, K. Mills-Parker, and M. Ziccardi. 2018. Post-release survival and movement of oiled and rehabilitated Brown Pelicans (*Pelecanus occidentalis*) affected by the 2015 Refugio oil spill in California. International Wildlife Disease Association Conference, St. Augustine, Florida.
- Gleason J.S., R.R. Wilson, P.G.R. Jodice, J.E. Lyons, E.F. Zipkin, and E.D. Silverman. 2018. Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS): a Nexus to Regulatory Decision-Making. American Ornithological Society, Tucson, Arizona.
- Lamb, J.S. *, C.V. Fiorello, Y.G. Satgé, K. Mills, M. Ziccardi, and P.G.R. Jodice. 2018. Movement patterns of California Brown Pelicans (*Pelecanus occidentalis carolinensis*) following oiling and rehabilitation. Pacific Seabird Group Annual Meeting, La Paz, Mexico.
- Lawson, A.J.*, C.T. Moore, and P.G.R. Jodice. 2018. Synthesizing multiple data streams to estimate abundance and detection probability in a highly wary, long-lived apex predator: an integrated modeling approach. The Wildlife Society, Cleveland, Ohio.
- Lawson, A.J.*, C.T. Moore, and P.G.R. Jodice. 2018. Synthesizing multiple data streams to estimate abundance and detection probability in a highly wary, long-lived apex predator: an integrated modeling approach. International Statistical Ecology Conference, St. Andrews, Scotland.
- Mills, K., D. Jacques, J.S. Lamb*, C. Fiorello, Y.G. Satgé, P.G.R. Jodice, and M. Ziccardi. 2018. The Big Picture: Habitat Use, Behavior, Movement Patterns, Body Condition, Breeding Propensity, and Survival of Brown Pelicans Following Oiling and Rehabilitation from the 2015 California Refugio Oil Spill. Effects of Oil on Wildlife Conference. Baltimore, Maryland.
- Ross, B.E., D.S. Sullins, D.A. Haukos. 2018. Using an individual-based model to assess monitoring for lesser prairie-chicken population growth rates. International Grouse Symposium, Logan, Utah. Oral presentation
- Ross, B.E. and M. Weegman. 2018. Quantifying the power to detect trends in vital rates using integrated population models. International Statistical Ecology Conference, St. Andrews, Scotland, UK. Oral presentation
- Ross, B.E., D.S. Sullins, D.A. Haukos. 2018. Using an individual-based model to assess monitoring for lesser prairie-chicken population growth rates. Kansas Natural Resource Conference, Manhattan, Kansas. Oral presentation
- Ross, B.E., D. Haukos, and P. Walther. 2017. Quantifying changes and drivers of mottled duck density in Texas. The Wildlife Society. Albuquerque, New Mexico. Oral presentation
- Schindler, A.R.*, B.E. Ross, and D.A. Haukos. 2018. A multi-species approach to managing the effects of weather and land cover on upland game birds. Kansas Natural Resources Conference, Manhattan, Kansas. *Poster*
- Streker, R.*, J.S. Lamb, and P. G. R. Jodice. 2018. Reproductive Ecology of Brown Pelicans (*Pelecanus occidentalis carolinensis*) in the Mobile Bay Complex, AL. Joint Meeting of the Association of Field Ornithologists and the Wilson Ornithological Society, Chattanooga, Tennessee. *Poster*
- Wilkinson, B.P.*, Y.G. Satgé, J.S. Lamb, and P.G.R. Jodice. 2018. Behavioral responses of eastern Brown Pelicans to the passage of Hurricane Irma along the Atlantic coast. Pacific Seabird Group Annual Meeting, La Paz, Mexico.
- Wood, J.M.*, A.K. Tegeler, and B.E. Ross. 2018. The effects of US Farm Bill cost-share conservation practices and private lands management on avian communities in South Carolina, USA. North American Congress for Conservation Biology. Toronto, Canada.

SERVICE

B. Ross, Kennedy Center Advisory Council.

B. Ross, committee member, Department Chair Search, Dept. of Forestry and Environmental Conservation.

B. Ross, Board Member (elections), The Wildlife Society, Biometrics Working Group.
 B. Ross, Associate Editor, Wildlife Society Bulletin.
 B. Ross, Associate Editor, The Condor.

P. Jodice, Chair, World Seabird Union. 2015 – 2020.
 P. Jodice, Steering Committee Member, Gulf of Mexico Avian Monitoring Network.
 P. Jodice, Steering Committee Member, Atlantic Marine Bird Cooperative.

A. Lawson, Ecology and Natural Resources Speaker Series Coordinator, Clemson University. 2018-2019.
 A. Lawson, IUCN SSC Crocodile Specialist Group. Ongoing.
 J. Wood, Natural Resources Graduate Student Association, Vice President, Clemson University. 2017-2018.
 B. Wilkinson, Natural Resources Graduate Student Association, President, Clemson University. 2018-2019.

AWARDS AND HONORS

B. Ross, The Wildlife Society Leadership Institute Class of 2017.
 P. Jodice, USGS Annual Performance Award, 2018.

A. Lawson, Research Grant, Greenville Zoo Conservation Fund, 2018.
 A. Lawson, Student Travel Grant, The Wildlife Society Biometrics Working Group, 2018.
 A. Lawson, Clemson University Professional Enrichment Grant, 2018.
 A. Lawson, Wade Stackhouse Fellowship, 2018.
 A. Schindler, Clemson University Professional Enrichment Grant, 2017.
 Y. Satgé, BirdsCaribbean David Lee Fund for the Conservation of Caribbean Birds, 2018.
 Y. Satgé, Neotropical Bird Club Conservation Award, 2018.
 A. Wood, Clemson University Professional Enrichment Grants, 2018.
 S. Kimpel, Marion Bailey Assistantship for Research in National Parks, 2017.

PRESS / PUBLIC OUTREACH

Outreach: Project Pelican Presentation. Buccaneer Yacht Club, Mobile AL. R. Streker*. June 2018.

Outreach: Conversation on the Future of Conservation in America: Drs. G. Machlis, R. Baldwin, and J.D. Lanham, J.M. Wood*, and J. Robelot. March 2018.

Press: Clemson researchers seek public's help in spotting Gulf pelicans. Clemson University Press Release. S. Bradley. 2017.

Press: Clemson University's Project Pelican tracks banded birds along Gulf Coast. Pensacola News Journal. A. Delaney. 2018.

Press: Alligator's comeback offers lessons as conservation law faces criticism: Saving the Southern Wild. Nola.com/The Times Picayune. S. Sneath. 2018.

Press: Tracking device lost on Hilton Head takes 1,100-mile road trip – without its pelican. The Island Packet. L. Wilson. 2018.

