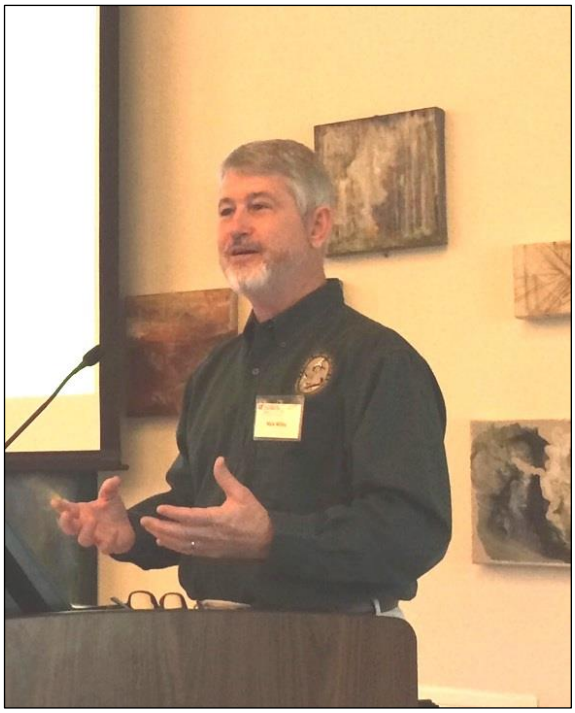
ANNUAL REPORT JANUARY – DECEMBER 2017

THE 2017 ANNUAL REPORT IS DEDICATED TO

Nick Wiley

As former Executive Director of the Florida Fish and Wildlife Conservation Commission, Nick Wiley has been a long-term supporter and friend of the Florida Cooperative Fish and Wildlife Research Unit. Nick and former Florida Coop Unit Leader Franklin Percival met when Nick was in graduate school. It had to do with a Brittany spaniel, the bloodline of which Nick still maintains. There must be a story there (*ask both of them, then compare notes…*). Later Nick played a role in the formative years of the Florida Alligator Research Team (F.A.R.T), which included the Coop Unit. He was a constant colleague, cooperator, and supporter of both the Florida and national Unit program. His personal engagement in a variety of Unit and FWC collaborative projects was profound: he helped better the alligator, Objective Based Vegetative Management, bobwhite quail, and snail kite projects. Nick excitedly and productively involved himself in Percival's graduate course on administrative techniques. He was instrumental in making our annual meeting's poster sessions successful by competing for beverage tickets against Jack Payne, and together they always made the students very comfortable interacting with top administrators. The students and our cooperators were lucky. The Unit will miss his leadership and commitment as FWC Executive Director, member of our Coordinating Committee, and friend. Our Unit caps are tipped to you, Nick, in your new leadership position in Ducks Unlimited.



COOPERATING AGENCIES

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
UNIVERSITY OF FLORIDA
U.S. FISH & WILDLIFE SERVICE
U.S. GEOLOGICAL SURVEY
WILDLIFE MANAGEMENT INSTITUTE

RESEARCH MISSION STATEMENT

2017 Photo Contest Winner, Sarah Dudek, MS student, “Trust Your Parents”

The mission of the Florida Cooperative Fish and Wildlife Research Unit is to conduct detailed investigations of wetlands and their component fish and wildlife resources, emphasizing the linkages with both aquatic and terrestrial ecosystems. This charge will include research at a range of levels including populations, community, and ecosystems, and will emphasize the interaction of biological populations with features of their habitat, both natural and those impacted by human activities.

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FLORIDA COOPERATIVE
FISH AND WILDLIFE RESEARCH UNIT

FLORIDA COOPERATIVE FISH AND WILDLIFE
RESEARCH UNIT INTRODUCTION

The Florida Cooperative Fish and Wildlife Research Unit was established in 1979 as one of the first combined units. The purpose of the Florida Unit is to provide for active cooperation in the advancement, organization, and conduct of scholarly research and training in the field of fish and wildlife sciences, principally through graduate education and research at the University of Florida. The Florida Unit has the mission to study wetland ecosystems within the state. Florida is a low relief, sub-tropical peninsula that is ecologically fragile. Though abundant, Florida's water resources are under increasing pressure from a burgeoning human population. Domestic, recreational, and development needs threaten Florida's water / wetland resources. In following its program directive, the Florida Unit has developed a research program that addresses management issues with approaches spanning species to ecosystem perspectives. Specifically, this Unit conducts detailed investigations of aquatic-terrestrial ecosystem interfaces and their component fish and wildlife resources.

Between 1979 and 2017, over 358 projects totaling more than $57 million were funded through the Unit. These projects covered a wide variety of fish, wildlife, and ecosystem subjects and have involved over 50 line, affiliate, and adjunct faculty members as principal and co-principal investigators. Projects associated with the Unit have resulted in over 400 publications, 125 technical reports, 100 theses and dissertations, and 175 presentations. Cooperation has been the Florida Unit's strength. As a Cooperative Research Unit of the U.S. Geological Survey, it serves as a bridge among the principal cooperators, such as the University of Florida, the Florida Fish and Wildlife Conservation Commission (FFWCC), the U.S. Geological Survey (USGS), the U.S. Fish and Wildlife Service (FWS) and the community of state and federal conservation agencies and non-governmental organizations. Evidence of this role is the Unit's funding which has included contributions from FFWCC, 12 BRD research labs and centers, 12 offices within the USFWS Southeast Region, the University of Florida, U.S. Army Corps of Engineers, U.S. Navy, U.S. Department of Agriculture, U.S. Air Force, U.S. National Park Service, Environmental Protection Agency, St. Johns River Water Management District, South Florida Water Management District, U.S. AID, World Wildlife Fund, The Nature Conservancy, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, BRD, Florida Wildlife Federation, National Audubon Society, Florida Alligator Farmers' Association, American Alligator Farmers' Association, Florida Fur Trappers' Association, and other private contributions. Many Unit projects involve multiple investigators from several agencies. This cooperative interaction stimulates continuing involvement of funding sources, provides for student contacts with potential employers and agency perspectives, and directs transfer and application of research results.

UNIT COORDINATING COMMITTEE

Jack Payne	Vice President for Agriculture and Natural Resources, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, Florida.
Eric Sutton	Executive Director, Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida.
Barry Grand	Supervisor, Cooperative Research Units, U.S. Geological Survey, Auburn, AL.
Cynthia Dohner	Regional Director, U.S. Fish and Wildlife Service Southeast Region, Atlanta, Georgia.
Steven Williams	President, Wildlife Management Institute, Gardners, Pennsylvania.
David Viker	Regional Refuge Chief, U.S. Fish and Wildlife Service Southeast Region, Atlanta, Georgia

BIOGRAPHICAL PROFILES OF UNIT SCIENTISTS

Abby Powell – Unit Leader, Courtesy Professor, Department of Wildlife Ecology and Conservation and College of Natural Resources and the Environment at the University of Florida. Dr. Powell is an avian ecologist, with special interest in species of conservation concern, wetland-associated species, and migratory connectivity.

Raymond R. Carthy – Assistant Unit Leader, Courtesy Assistant Professor, Department of Wildlife Ecology and Conservation and College of Natural Resources and the Environment at the University of Florida. His research centers on ecology of endangered species. His research interests involve reproductive ecology and physiology of coastal and wetland herpetofauna, with a focus on marine and freshwater turtles. He is also involved in research on threatened upland species, conservation management, and Unmanned Aircraft Systems.

COOPERATIVE UNIT PERSONNEL

M. Gay Hale, BA – Administrative Services Specialist II, Florida Cooperative Fish and Wildlife Research Unit, Department of Wildlife Ecology and Conservation, University of Florida. Responsible for administrative details of $4.92 M annual research program as well as supervision of staff; student activities, personnel, budgets, research work orders, contracts and grants within University, fiscal reports, travel, purchasing, payables, vehicles (State/Federal), website, and other related functions.

Lisa Burnett – Administrative Support Assistant, Florida Cooperative Fish and Wildlife Research Unit. She is primarily responsible for purchasing card and travel processes within the University financial system, and the tracking and recording of spent funds on all grants and state funds. She also handles federal vehicles and helps with general office procedures.

COOPERATORS

University of Florida

Robert Ahrens	Mendy Allen	Michael S. Allen	Karen A. Bjorndal
Alan B. Bolten	Rena Borkhataria	Cameron Carter	Matthew J. Cohen
Bon A. Dewitt	Catherine Eastman	Robert Fletcher	Tom Frazer
Peter. C. Frederick	Ikuko Fujisaki	Bill Guiliano	Eric Hellgren
Mark Hostetler	Peter G. Ifju	Susan Jacobson	Steven Johnson
Frank Mazzotti	Robert McCleery	Debbie Miller	Martha Monroe
Holly Ober	Madan Oli	Elizabeth Pienaar	William (Bill) Pine
Carrie Reinhart-Adams	Christina Romagosa	J. Perran Ross	Maria Sgambati
Scott E. Smith	Taylor Stein	Benjamin Wilkinson	Blair Witherington (Disney)

Florida Fish and Wildlife Conservation Commission

Britany Bankovich	Tyler Beck	Robin Boughton	Curtis Brown
Janell Brush	William Caton	Matt Chopp	Andrew Cox
Patrick Delaney	Jason Dotson	Harry J. Dutton	Gregg Eason
Kevin Enge	Carolyn Enloe	Anna Farmer	Catherine Kennedy
Tim O'Meara	Erin Ragheb	Scott Sanders	Amy Schwarzer
Zach Welch	Nick Wiley	Allan R. Woodward	

U.S. Geological Survey

Kristen Hart	James Hines	Fred Johnson	Meg Lamont
Julien Martin	James D. Nichols	Bruce Quirk	Kenneth G. Rice
Ken Sulak			

U.S. Fish and Wildlife Service

Daniel Barrand	Laura Brandt	Kathleen Burchett	Victor Doig
Andrew Gude	Layne Hamilton	Stan Howarter	Patty Kelly
Joyce Kleen	Mike Legare	Joyce Palmer	Paul Tritaik
Larry Woodward			

U.S. Army Corps of Engineers

Deberay Carmichael
Gina Ralph

U.S. Air Force

Bruce Hagedorn

South Florida Water Management District

Christa Zweig

Others

Russell Hall

National Park Service

Leonard Pearlstine

RESEARCH PERSONNEL

(Names in red are supervised by Powell and/or Carthy)

Post-Doctoral Associates:

Matthew Burgess, PhD
Supervisor: Ray Carthy
Research: Integration, validation and fusion of small unmanned aircraft system multimodal data

Dan Gwinn, PhD
Supervisor: Mike Allen
Research: Climate change impacts on Florida freshwater fisheries

Nahid Jafari, PhD
Supervisor: Christina Romagosa
Research: Integrating Science and Management for Optimal Prevention and Control of Aquatic Invasive Species in the Everglades

Jennifer Seavey, PhD
Supervisor: Robert Fletcher and Bill Pine
Research: Climate change, sea-level rise, and biodiversity

Ellen Robertson, PhD
Supervisor: Robert Fletcher
Research: Snail kite monitoring of population demographics; exploring senescence and other aspects of survival.

Research Associates:

Mike Cherkiss, MS
Position: Wildlife Biologist/ Crocodile and Python Project Manager
Research: American alligator and crocodile monitoring and assessment program, (MAP). IFAS, Fort Lauderdale Research and Education Center

Brian Jeffrey, MS
Position: Wildlife Biologist/Alligator Project Manager
Research: Endangered snail kites

Brian Smith, MS
Position: Research associate
Research: Burmese pythons in the Everglades

Thomas Selby, MS
Position: Research associate
Research: Burmese pythons in the Everglades

Graduate Students:

Nichole Bishop
Degree: PhD, Interdisciplinary Ecology
Graduation Date: May 2019
Research: Nutritional ecology of sea turtles
Advisor: Ray Carthy

Alexis Cardas
Degree: MS, Wildlife Ecology & Conservation
Graduation Date: December 2019
Research: Impacts of translocation on a cooperatively breeding bird in the Ocala National Forest
Advisor: Abby Powell

Natalie Claunch
Degree: PhD, School of Natural Resources and the Environment
Graduation Date: May 2021
Research: Invasive reptile physiology and management
Advisor: Christina Romagosa

Sarah Dudek
Degree: MS, Wildlife Ecology and Conservation
Graduation Date: May 2018
Research: Snail kite ecology
Advisor: Robert Fletcher

Scott Eastman
Degree: MS, School of Natural Resources and the Environment
Graduation Date: May 2019
Research: Evaluating the effects of climate change and coastal management adaption strategies on the reproductive success of marine turtles
Advisor: Ray Carthy

Daniel Evans
Degree: PhD, Wildlife Ecology and Conservation
Graduation Date: May 2018
Research: Elucidation of sea turtle developmental, foraging and reproductive migrations using satellite telemetry
Advisor: Ray Carthy

Kodiak Hengstebeck
Degree: MS, Wildlife Ecology and Conservation
Graduation Date: December 2016
Research: Assessing impacts of invasive pythons on gopher tortoises in Florida
Advisor: Christina Romagosa

Richard Herren
Degree: PhD, Wildlife Ecology and Conservation
Graduation Date: May 2020
Research: Composition, distribution and ecology of Nature Coast sea turtle assemblage
Advisor: Ray Carthy

Tomo Hirama
Degree: PhD, Wildlife Ecology and Conservation
Graduation Date: May 2019
Research: Standardized measurements of loggerhead sea turtle hatchling orientation: Quantifying effects of artificial light and light mitigation programs
Advisor: Ray Carthy

Brian Jeffery
Degree: PhD, Wildlife Ecology and Conservation
Graduation Date: TBD
Research: Impacts of climate on Snail Kite demography
Advisor: Rob Fletcher

Jame McCray
Degree: PhD, Wildlife Ecology and Conservation
Graduation Date: August 2018
Research: Wildlife legislation and management in Florida: Sea turtles, a test case for creating effective policy
Advisor: Susan Jacobson and Ray Carthy

Caroline Poli
Degree: PhD, School of Natural Resources and the Environment
Graduation Date: August 2019
Research: Spatial Ecology and Population Biology of Snail Kites
Advisor: Robert Fletcher

Molly Tuma
Degree: MS, Wildlife Ecology and Conservation
Graduation Date: December 2019
Research: Survival, Habitat Use and Distribution of Two Federally-listed Shorebird Species in Florida
Advisor: Abby Powell

Brad Udell
Degree: PhD, Wildlife Ecology and Conservation
Graduation Date: August 2019
Research: Aquatic and invasive species
Advisor: Christina Romagosa

Nicholas Vitale
Degree: MS, Wildlife Ecology and Conservation
Graduation Date: August 2019
Research: Productivity of American oystercatchers
Advisor: Abby Powell

Tyler Ward
Degree: PhD, Mechanical and Aerospace Engineering
Graduation Date: May 2018
Research: UAS payload construction and data processing of digital imagery
Advisor: Peter Ifju

Travis Whitley
Degree: PhD, Mechanical and Aerospace Engineering
Graduation Date: May 2018
Research: UAS Autopilot development
Advisor: Peter Ifju

Yun Ye
Degree: PhD, School of Forest Resources and Conservation, Geomatics
Graduation Date: May 2018
Research: Computer recognition algorithms for UAS imagery
Advisor: Scot Smith

CURRENT RESEARCH PROJECTS

Productivity of American Oystercatchers Nesting on Spoil Islands
Investigators: Abby Powell, Janell Brush
Student: Nicholas Vitale, MS, Wildlife Ecology and Conservation
Duration: September 2016-December 2018
Funding Agency: UF Nature Coast Biological Station; USGS RWO 299
In-Kind Support: FFWCC

Because oystercatchers are a species of high conservation concern in the U.S. Shorebird conservation Plan, there is a strong desire to better manage for these birds. However, we must first have a better understanding of what limits productivity at this site to make better management choices. The objectives of this study are to determine factors limiting Oystercatcher productivity and develop management suggestions to improve breeding success. In addition we will look at how changing habitat may influence breeding over time. During the 2017 field season, we intensively monitored nesting oystercatcher both through direct observation as well remotely, to determine how reproductive success and document causes of failure. We also conducted human disturbance surveys and collected data on predators and habitat characteristics of nest sites. During the 2018 field season, we will repeat these same methods as well as begin to track chicks to better determine cause of late-season failures; we demonstrated that at the barge sites late-season chick survival was poor and the major period for failures in 2017. Data suggest predation as the major cause but additional information is needed to positively identify the predator(s). In Cedar Key, low elevation of nesting islands resulted in frequent inundation and therefore failure of nests before hatching. Initial surveys suggest that these islands may be eroding away and becoming less suitable with time. This research will inform us how to better manage important nesting sites in Florida for oystercatchers and other shorebirds.

Impacts of Translocation on a Cooperatively Breeding Bird in the Ocala National Forest
Investigators: Abby Powell, Karl Miller
Student: Alexis Cardas, MS, Wildlife Ecology and Conservation
Duration: August 2017-December 2019
Funding Agency: FFWCC
In-Kind Support: Personnel provided by FFWCC and FWRI

Translocation has been considered as a conservation tool to increase the population numbers of Florida scrub-jays, especially in areas that have been recently restored, and where small, isolated populations reside and are unlikely to increase naturally through dispersal. The majority of translocation research has focused on the success at recipient sites, while the impacts associated with the donor population have not been monitored. Ocala National Forest is home to the largest remaining population of Florida scrub-jays and is currently the donor site for translocations. As the goal of any translocation is to have a positive impact on the species population, it is imperative that the costs to the donor population are minimized to the greatest extent possible. This study intends to focus on the impacts that translocation could place on the donor population through monitoring of nesting success and productivity. During two field seasons, January-July of 2018 and 2019, a subset of helpers will be removed from groups for translocation. Nests will be monitored within three categories of family groups: (1) no helpers, (2) helpers, (3) helpers removed. Data will be collected on productivity, nest success, weight of nestlings, time spent provisioning, and breeder persistence. Monitoring nests in groups with and without helpers will increase the understanding of how this cooperative breeder benefits from the presence of non-breeding individuals. If data show evidence that helpers do not increase productivity or nest success, then future translocations can focus on removing helpers as opposed to entire family groups.

Demographic, Movement and Habitat of the Endangered Snail Kite in Response to Operational Plans in Water Conservation Area 3A
Investigator: Robert Fletcher
Student: Sarah Dudek, MS, School of Natural Resource & the Environment
Duration: September 2014-June 2018
Funding Agency: Army Corps of Engineers, FFWCC

Our goal is to provide reliable information on population size and trends, including key demographic, habitat, and foraging information of relevance to the recovery of this species. Demographic analyses revealed that snail kite abundance drastically declined between 1999-2008, with the population approximately halving from 2000 to 2002 and again from 2006 to 2008. Each of these two periods of population decline coincided, in part, with drought conditions throughout the southern portion of the kites' range. By coupling the vital rates measured over this time period with the changes in population size (using a Life Table Response Experiment), it became apparent that the primary demographic factors contributing to this decline were changes in adult fertility (the product of young fledged per adult and juvenile survival). Because demographic parameters are heavily influenced by bird behavior, movement studies constitute the other major aspect of the research. Snail kites were monitored by band-resight surveys in various wetlands. Environmental data were recorded at each nest along with nest status. Morphological data were recorded for each nestling. Once the nestlings reached an age of ~24 days, they were marked with unique bands. Nesting was lower in 2017 compared to 2016 due to a drought in the breeding season. Hurricane Irma also destroyed 55 nests in September 2017. A total of 213 active nests with known fates were detected. Of those 70 were successful. We banded 161 nestlings and 141 were observed to have fledged. Overall apparent nest success was 36 (± 2)%, (down from 44% last year). Since the snail kite population is critically endangered and because adult fertility plays an overwhelming role in population growth rate, it is critical to identify and attempt to limit factors that negatively affect reproduction and juvenile survival. Long-term monitoring allows us to quantify these vital rates and link them to potential critical variables that may be limiting the population.

Identifying the Role of Hydrology and Prey for a Key Bottleneck in the Recovery of Snail Kites in the Greater Everglades
Investigator: Robert Fletcher
Student: Caroline Poli, PhD, Interdisciplinary Ecology
Duration: September 2016-April 2019
Funding Agency: Greater Everglades Priority Ecosystem Science, RWO 297

Survival of Snail Kites during the first year post-fledging is important to population growth, but monitoring data indicate that it varies among years. Young Snail Kites remain near the nest site for the first 30-60 days after fledging and the risk of mortality is highest within 45 days of fledging, thus it is likely that variability in first-year survival is driven by attributes of the natal site, including hydrology and prey availability. Fine-scale (daily, hourly) tracking information that links movement patterns of Snail Kites with hydrology and prey availability at each occupied site will allow us to develop effective management guidelines to promote first-year survival. Our objectives are to: a) quantify post-fledgling movements and first-year survival across the Greater Everglades Ecosystem; b) link movements and survival to variation in hydrology and measures of prey resources, and c) develop models that help determine key targets for water management in the Greater Everglades Ecosystem. In 2016 and 2017 we deployed GPS tracking devices on Snail Kites that were close to fledging age. Tags recorded 12 locations per day for up to 1 year and downloaded data remotely through cellular networks. We plan to estimate movement trajectories using hidden Markov models, and to predict switching of behavioral states using covariates related to snail density (measured through in-situ sampling) and hydrology (extracted from online databases such as EDEN). In 2018 we plan to deploy additional tags. Preliminary data confirm that birds spend the first 30-60 days post-fledging within 1 km of the nest site. Birds that dispersed from the nest site made looping foray flights lasting 1-5 days each, then returned to the original nest site. Analysis of movement trajectories in relation to hydrology and prey is ongoing.

Survival, Habitat Use, and Distribution of Two Federally-listed Shorebird Species in Florida
Investigator: Abby Powell
Student: Molly Tuma, MS, Wildlife Ecology & Conservation
Duration: September 2017-December 2019
Funding Agency: FFWCC

Florida hosts substantial nonbreeding populations of the federally-listed Piping Plover (*Charadrius melodus*) and the *rufa* subspecies of Red Knot (*Calidris canutus rufa*); however, there is little information on their ecology in the state. As a result, there are few to no measures in place to protect these populations from threats, such as human and habitat disturbance. Shorebirds can spend up to 75% of their annual lifecycle migrating or on their wintering grounds, and conditions in these areas can have carry-over effects that drive population trends. Understanding the population conditions of Piping Plovers and Red Knots in Florida will help to determine effective management actions for the Florida populations and contribute to range-wide conservation. The objective of this study is to estimate baseline ecological parameters for Piping Plovers and Red Knots in Florida. We will estimate survival and habitat selection for Piping Plovers in the Panhandle, and create a state-wide distribution map and analyze movement data for Red Knots. Resight data for Piping plovers have been collected by U.S. Fish and Wildlife Service and Florida Audubon biologists since 2011, and Red Knot data have been collected by various research projects and birders since 2008. We plan to analyze these data to determine what variables drive survival rates and habitat use in Piping Plovers, and gain an understanding of Red Knot distribution across the state. We expect results to show a negative effect of human and predator presence on Piping Plover survival and habitat use and to see local movement and some cross-state movement in Red Knots. Without reliable research addressing trends and disturbance in the nonbreeding population of Piping Plovers in Florida, management actions cannot be effectively implemented in the state. From 2011 to present, the Panhandle has hosted birds from all three Piping Plover breeding populations: the threatened Great Plains and Atlantic populations, and the endangered Great Lakes population (preliminary data). This research will add to the knowledge of this delicate species, and allow for more holistic, range-wide management efforts.

Green Turtle Spatial Distribution, Abundance and Habitat Models on Florida's Nature Coast
Investigator: Ray Carthy
Student: Rick Herren, PhD, Wildlife Ecology & Conservation
Duration: September 2016-June 2020
Funding Agency: UF Nature Coast Biological Station
In-Kind Support: Sea Turtle Conservancy

Florida's Nature Coast contains the second largest seagrass ecosystem in the Gulf of Mexico. Juvenile green turtles are thought to move from the open ocean into these shallow waters at approximately 3 – 5 years of age. Remarkably little research has been done in this area since Dr. Archie Carr first described the Cedar Key turtle fishery in the 1950s and few studies have used habitat models to understand the spatial and temporal distribution of green turtles. Federal green turtle recovery plans in the U.S. have emphasized the need for demographic data on juvenile life stages and the identification of critical habitat necessary for their survival. The goal of this project is to: 1) describe the distribution and abundance of juvenile green turtles in shallow seagrass beds using vessel and small Unmanned Aerial System (sUAS) surveys; and 2) randomly select sites with high and low juvenile green turtle abundance and use predictive habitat use models to determine the abiotic and biotic factors driving their distributions. Standardized vessel and sUAS surveys will be used to characterize the green turtle distribution and abundance. In a select number of high abundance sites (i.e. hotspots) turtles will be captured to describe their size, diet, sex, health and genetic makeup. Water quality and benthic factors will be measured seasonally in high and low turtle abundance sites to determine correlations with abundance. A smaller sample of turtles will be fitted with GPS transmitters to determine their home range and seasonal movements. Comparisons will be made between vessel surveys and drone surveys to determine method efficacy and whether turtle behavior/sightability is affected by the survey platform. Multiple trips have been made to reconnoiter the study area and to assess and refine survey methodologies.Data collection will begin in late spring and continue through 2020. The Sea Turtle Conservancy has partnered with Carolina Skiff for the creation of a custom sea turtle survey vessel for use in this study (pictured above). The vessel is in the process of being outfitted with state of the art equipment and a tower with a second driving station. It is expected to be operational in May 2018.

Population Ecology of the Diamondback Terrapin in the Big Bend Region of Florida
Investigators: Steve Johnson, Mike Allen
Student: Travis Thomas, PhD, Wildlife Ecology & Conservation
Duration: September 2016-December 2019
Funding Agency: FFWCC
In-Kind Support: UF Nature Coast Biological Station

The Diamondback Terrapin is the only turtle species found in the coastal marshes of North America and plays a vital ecological role in the salt marsh ecosystem. They have experienced population declines throughout their range due to loss of habitat and bycatch mortality from drowning in crab traps. These are long-lived animals with low reproductive rates, which makes them particularly vulnerable to human-induced mortality sources. Florida is important to this species' conservation, and represents 20% of this turtle's range. Several studies in Florida have characterized local populations; however, to date no population estimates are available for the Big Bend Region of Florida. In 2016–2017, we used satellite imagery to characterize barrier islands in the Suwannee River Estuary. Variables such as island size and distance to shore were calculated. In 2017, we surveyed 18 coastal islands multiple times to estimate the population abundance. Turtles were hand captured by walking the tidal wrack line. Captured turtles were measured, weighed, marked, and released. Tissue samples were collected from captured terrapins for future genetic analysis. All capture points will be marked with GPS and entered into a database. Data on vegetation, elevation, substrate and wrack composition for the islands surveyed will also be measured. Turtle surveys produced a total of 6 captures from 2 islands. All captured turtles were female. Research is ongoing; however, early observations reveal that Diamondback Terrapins may utilize smaller barrier islands that meet a specific habitat requirement. In 2018, we plan to continue measuring island habitat variables and conduct more turtle surveys beginning in March to help identify these critical island types and how they influence turtle abundance and occupancy on barrier islands.

A Nutritional Ecology Study of *Dermatemys mawii,* a Critically Endangered Species of Freshwater Turtle Endemic to Central America
Investigators: Karen Bjorndal, Ray Carthy
Student: Nichole Bishop PhD, School of Natural Resources and Environment
Duration: December 2014-May 2019
Funding Agency: USGS
In-Kind Support: Belize Foundation for Research and Environmental Education; Jacksonville Zoo and Gardens

Dermatemys mawii is a critically endangered fresh-water turtle endemic to Central America. Captive breeding programs have been identified as an important component of conservation efforts for *D. mawii*, but relatively little is known about their biology and ecology. Diet is a primary means by which an organism interacts with its environment and is essential in understanding an organism's ecology. I am using a nutritional ecology framework to examine *D. mawii's* digestive physiology, gut morphology and microbial endosymbiont community in an effort to elucidate their dietary adaptations and subsequent implications for captive and wild management. The objectives are to: 1) describe and quantify the natural diet composition of *D. mawii*; 2) describe and compare age-specific differences in the digestive performance of *D. mawii* between yearlings and adults; and 3) characterize the gut microflora of *D. mawii* hatchlings, juveniles, and adults. The objectives were addressed by: 1) using a dataset from specimens that identifies and quantifies stomach contents of 78 *D. mawii* of various age/size, sex, and habitats; 2) conduct feeding trials with yearlings and adult *D. mawii* to determine differences in digestive performance among age classes; and 3) continue to collect fecal samples from all age groups of *D. mawii*. I will then isolate microbial communities and identify them using 16S rRNA-based pyrosequencing according to the methods in Hong *et al.* (2011). My preliminary results indicate that *D. mawii* are herbivorous throughout their lives. Therefore, I anticipate that the relationships between digestion and retention time, food quality, gut capacity, and rate of intake will be unique among *D. mawii*. Knowledge gained from this study will address the long-term conservation goals by informing husbandry practices and captive breeding protocols for *D. mawii*.

The Path Most Travelled: Leatherback and Cheloniid Sea Turtle Migration Movements and Foraging Areas

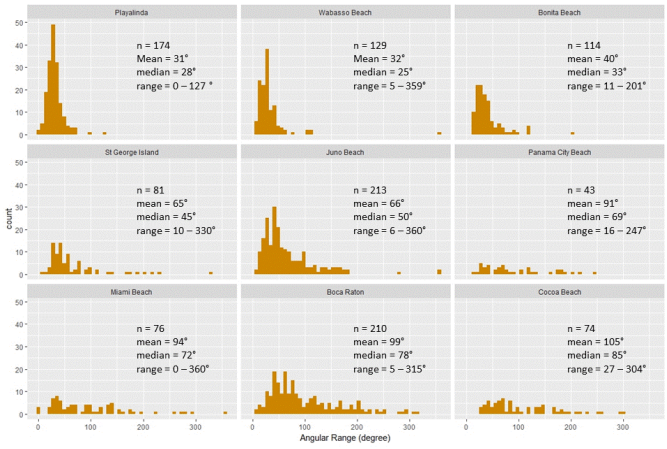
Major Advisor: Ray Carthy
Student: Daniel R Evans, PhD, Wildlife Ecology & Conservation
Duration: January 2014-May 2018
Funding Agency: Sea Turtle Conservancy

Foraging in the marine environment is difficult as a result of the patchiness of food, often due to oceanic features. In order to reduce migration energy costs, sea turtle foraging areas need to be predictable and persistent over time. By connecting oceanic features and animal movements, it is possible to identify foraging areas and migration pathways and the associated environmental factors of these areas in the seascape. Research objectives are 1) to identify ocean features that characterize foraging areas in the Atlantic basin used by post-nesting female leatherback sea turtles from a nesting population on the Caribbean coast of Panama to see if these areas are geographically stable, 2) to model the migration movements of leatherbacks and three Cheloniid sea turtle species (green, loggerhead, and hawksbill) from nesting populations in Panama, Florida, Costa Rica and Nevis, and 3) to overlay identified sea turtle foraging areas and migration corridors among the 4 species and with known Marine Protected Areas. A switching space-state model (SSSM) was used to determine changes in behavior of leatherback turtles and 3 Cheloniidae species to identify foraging areas, migration pathways, spatial overlap among the 4 species, and the use of MPAs by the tracked turtles. Seven environmental variables were extracted from remote sensing imagery at each sea turtle satellite telemetry location to compare the characteristics of different behaviors and different foraging regions. Results suggest that leatherbacks may not just be bimodal (migration or foraging) in their movement behavior, but that a third, intermediate behavior is taking place. This third behavior appears to be different for leatherbacks foraging in the Gulf of Mexico compared to those foraging in the North Atlantic Ocean, with a searching compared to a wandering behavior, respectively. Searching behavior overlapped with restricted area foraging, while the wandering behavior was spatially separate from both migration and restricted area foraging behaviors. Loggerhead turtle residential and core foraging areas were significantly larger than green and hawksbill turtle residential and core foraging areas. Primary core foraging areas environmental characteristic were different among species, mostly a result of each species having different diet regimes. Results from this study varied when compared to other studies, suggesting turtles from different nesting beaches have different foraging behaviors. Tracked turtles either foraged or migrated through 153 different Marine protected Areas (MPAs), nearly 10% of available MPAs, but several identified foraging areas and migration corridors were not within existing MPAs. This research helped elucidate different sea turtle behaviors allowing the identification of core foraging areas and different foraging behavioral styles in both leatherback and loggerhead turtles. The research also provided insight into the use of MPAs by sea turtles, the overlap among and within species, and the possible role of nesting departure date in determining foraging region.

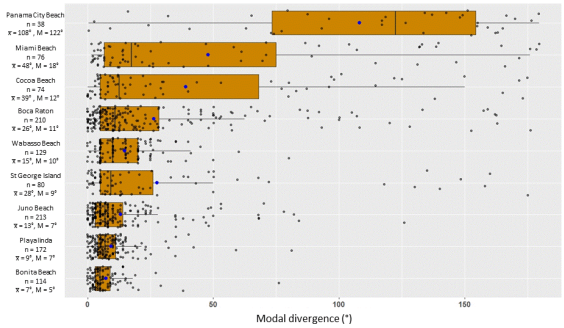
Standardized Measurements of Loggerhead Sea Turtle Hatchling Orientation: Quantifying Effects of Artificial Light and Light Mitigation Programs
Investigators : Robert Hardy, Morgan Young, Ray Carthy, and Blair Witherington
Student: Shigetomo Hirama, PhD, Wildlife Ecology & Conservation
Duration: 2015-present
Funding Agency: FFWCC Disney Conservation program
In-Kind Support: Florida Sea Turtle Nesting Survey Permit Holders

Artificial lighting disorients sea turtle hatchlings and reduces their chances of survival. The recovery plan for northwest Atlantic loggerhead sea turtles lists light pollution among the most important mortality factors. Light management as a means of reducing that mortality is under way, but there are no reliable measures for assessing progress and effectively guiding management. The current project provides information on sea turtle hatchling orientation on the Florida beaches along the Gulf of Mexico and Atlantic Ocean. Standardized measurements will be used to map the severity of disorientation caused by artificial lighting. The results will directly inform management agencies to reduce artificial lighting so that the number of hatchlings that enter the ocean can be increased.
Project objectives are to collect data on light intensity and hatchling orientation and to identify the degree of disorientation such that spatial and temporal trends may be assessed. Detail in

hatchling orientation measurement would inform beach lighting management strategies for reducing disorientation of hatchlings. We measured light intensity on the beach using a photometer at Wabasso Beach, Cocoa Beach, Bonita Beach, Boca Raton, and Miami Beach. Along with light intensity, we measured two parameters that describe the accuracy of hatchling orientation, angular range and modal divergence from the ocean at 17 beaches throughout Florida. The angular range describes the spread of tracks that hatchlings leave in the sand; it is the absolute value of the difference in bearings between the two most widely separated tracks. The results of two parameters that showed sea turtle hatchling orientation from the selected beaches are shown below.



Angular range (0 – 360°) of loggerhead hatchling tracks from nine beaches of Florida; Playalinda with the minimum amount artificial lighting serves as the baseline data. Angular range shows spread of hatchling tracks: a smaller value indicates better accuracy of hatchling orientation.



Modal divergence from ocean direction (0 – 180°), an indicator of accuracy of hatchling orientation. This parameter shows divergence of modal direction (most frequent direction that hatchlings traveled) from ocean direction. Same as angular range, a smaller value indicates better accuracy of hatchling orientation (x̄ = mean, M = medians)

The Long-term Spatiotemporal Patterns, Nesting Success and Hatching Success of Marine Turtles on an Undeveloped Beach in Northeast Florida

Investigator(s): Todd Osborne, Raymond Carthy

Student: Scott Eastman, MS, School of Natural Resources & the Environment

Duration: September 2014-December 2019

Funding Agency: UF Whitney Laboratory for Marine Bioscience.

In-Kind Support: Personnel provided by the Guana Tolomato Matanzas National Estuarine Research Reserve, Florida DEP.

Sea level rise, increasing rates of coastal erosion, and the current coastal management response of coastal armoring is resulting in large stretches of seawalls being constructed in northeast Florida. The rate and extent of the coastline that is armored, and the effect this is having on the availability of suitable areas for nesting sea turtles is relatively unknown. The current paradigm in coastal management is focused on protection of property though coastal armoring. Roughly 25 percent of Florida's coastal shorelines were recorded as being armored in 1998. These trends in coastal armoring and the effects on sea turtles and their nesting habitats have yet to be fully understood. Our research objectives will take multiple approaches in identifying descriptive and causal inference for the effects of coastal armoring on available sea turtle nesting habitat and reproductive behaviors: a descriptive approach identifying the spatiotemporal trends in the availability of habitat due to coastal armoring, and a comparative model of sea turtle nesting behaviors and reproductive success associated with natural beaches and armored shorelines. To address this issue, we will take two approaches: we will conduct an analysis of the spatiotemporal patterns of coastal armoring in northeast Florida, utilizing remote sensing techniques, historical FDEP permitting records, and high accuracy survey data collected on armoring structures. We will then compare the long-term nesting behaviors, and reproductive success on natural beaches (control) and armored beaches (treatment) within close geographic proximity, with a before and after control and impacted (BACI) design. Currently, digital permitting records of coastal armoring have been acquired from the Florida Department of Environmental Protection and high precision ground truthing and survey efforts are underway. Historical records on sea turtle nesting for both the natural and armored areas have been acquired. The current management responses to rising seas and coastal erosion make understanding coastal armoring effects on the availability of suitable areas for nesting sea turtles and impacts to nesting behaviors critical for adaptive management practices, and can provide critical inputs to compliment a holistic framework for decision-making, ultimately resulting in greater species protection.

Effects of Coastal Dynamics and Climate on Loggerhead Turtle Nest Success and Management: An Assessment of Sea Turtle Nesting Beaches in St. John's County Florida
Investigator: Raymond Carthy
Student: Nichole Bishop, PhD, School of Natural Resources & the Environment
Duration: December 2014-July 2018
Funding Agency: USGS, RWO285
In-Kind Support: UF Whitney Laboratory for Marine Bioscience

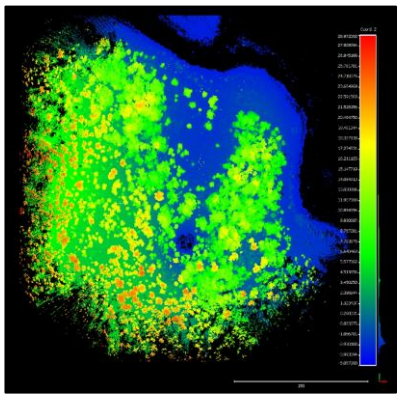
St. John's county beaches are popular nesting sites for sea turtles; these same beaches are also popular places for people and range in development from dense residential properties to protected, undeveloped reserve. Beach slope is an important factor in sea turtle nesting preference and is a result of multiple factors including erosion and accretion catalyzed by human activities. Although continued monitoring was conducted at all sites, special focus was given to the Archie Carr property given its potential to become the first sea turtle conservation easement. Baseline monitoring is necessary to establish changes to beach morphodynamics given their varied anthropogenic usage, potential impacts from climate change and most recently, Hurricane Matthew of 2016. Our objectives are to characterize the Guana Tolomato Matanzas National Estuarine Research Reserve (GTMNERR) beach, Crescent Beach (CB) and the Archie Carr beach property in Summer Haven (SH) by: 1) monitoring beach slope, 2) measuring sand grain size and 3) surveying flora. To monitor beach slope, students and graduate mentor conducted three transects at each beach annually from June 2014 to the present. Transects were run from the vegetation line at the base of the fore-dune to the low tide line. Sand samples were collected at the base of the dune, the middle of the dune and the swash zone. Each sample was passed through a sieving column and composition (e.g. shell, plant/organic material, sand, charcoal, etc) of each fraction was recorded according to the Udden-Wentworth grain-size classification scheme. To survey the flora, three belt transects extended from the vegetation line on the fore-dune to the water line in the estuary. At 5m intervals $1m^2$ quadrats were sampled, and plant species and percent coverage for each species were recorded. For GTMNERR: slope is staying consistent, but beach is eroding. For CB: it was highly variable; erosion and accretion and changes in slope occurred throughout the beach. For SH: It has experienced depletion of vegetation due to salt water inundation (Matthew storm surge) and sand deposition. Severe erosion along beach and slope incline is increasing.

Foraging Ecology and Diet of the Florida Bonneted Bat
Investigator: Holly Ober
Student: Elysia Webb, MS, Wildlife Ecology & Conservation
Duration: August 2016-December 2019
Funding Agency: FFWCC

The Florida bonneted bat, *Eumops floridanus*, is a federally endangered bat species endemic to southern Florida. Virtually nothing is currently known about its foraging ecology or diet, which hinders the development of conservation recommendations. We are (1) examining foraging habitat selection patterns, and (2) characterizing diet. Specific topics we are investigating include the distance bats fly each night while foraging, the number of foraging trips they make per night, the habitat they prefer to forage in, which insects are consumed, the extent of seasonal variation of diet in a single bat population, and the difference in diet between populations from the northern and southern extent of the species range during a single season. Recently, GPS satellite tags capable of logging animal positions have been developed in a size suitable for large bats. We applied GPS units to 24 bats in Babcock-Webb Wildlife Management Area and were able to use this new technology to track foraging paths of 18 individual bats. In addition, we collected bat guano so that we can assess two aspects of variation in bat diets. First, we collected bat guano one night each month for a full year beneath bat roosts to assess seasonal variation in the insects the bats are consuming. Second, we captured free-flying bats at the northern and southern extent of the species range during a 6 week period and will use this data to assess geographic variation in diet. On average, adult female bats traveled farther distances per night than male bats. Also, bats generally travelled longer distances in December than in April or August. We will begin lab work to analyze diet during spring 2018. Understanding the typical distances bats travel from roosts to forage and which vegetation communities the bats prefer to forage in will enable development of habitat management strategies. Also, knowledge of which insects the bats consume will facilitate strategies that can foster conservation of the bats through enhancement or augmentation of preferred insects, or restrictions on pesticide use in areas that foster these insects.

Integration, Validation, and Fusion of Small Unmanned Aircraft System Multimodal Sensor Data in Support of USGS
Investigators: Raymond R. Carthy, Peter G. Ifju, Benjamin E. Wilkinson, Scot E. Smith and Matthew Burgess
Students: Travis J. Whitley, PhD, Mechanical and Aerospace Engineering; H. Andrew Lassiter, PhD, Geomatics Department; Chad S. Tripp and Jeroen J. Poelstra, Undergraduates, Mechanical and Aerospace Engineering; and Andrew E. Ortega, Undergraduate, Computer Science and Engineering.
Duration: August 2016- August 2019
Funding Agency: USGS RWO300
In-Kind Support: Temporary loan of a small LiDAR unit by the UF Geomatics Department until the dedicated product purchased by the USGS arrives.

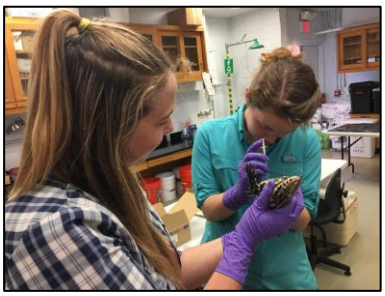
Small unmanned aircraft systems (sUAS) are increasingly popular data collection platforms in natural resources-based scientific studies. Sensor suites for use aboard sUAS can be limited by factors such as size, weight, and cost. Until recently, Light Detection and Ranging (LiDAR) sensors had been unfeasible for sUAS. The University of Florida Unmanned Aircraft Systems Research Program (UFUASRP) has been tasked with incorporating a small yet affordable LiDAR sensor to a rotary-wing octocopter sUAS platform. Through technological advances, the generation of high-accuracy terrain maps and other valuable three-dimensional (3D) remotely-sensed data products using a LiDAR sensor are now a realistic possibility from sUAS platforms. The combination of high-resolution two-dimensional (2D) imagery collected via existing sUAS sensors with 3D LiDAR-generated point clouds provides a multitude of new opportunities for researchers to create stunning models of target areas suitable for scientific analyses.
The objectives of this study include: 1) modifications to an octocopter sUAS platform and payload bay to house and permit unobstructed use of the LiDAR sensor; 2) development of a calibration methodology and correction algorithms to standardize the LiDAR data produced with the new sensor; 3) integration of the sUAS-collected 3D LiDAR data with existing 2D sUAS sensor data (e.g. visual, thermal, hyperspectral, etc.); and 4) creation of a structured workflow for post-processing the data collected by the multimodal sensor suite into user-friendly products for analyses.
In the laboratory, the various payload sensor inputs and outputs were determined, schematics of potential sensor configurations within the payload bay were drawn up, and the physical integration (co-mounting) and wiring of the sensors was completed. An innovative 3D ground control target was designed, fabricated, and distributed throughout several experimental flight areas to facilitate high-accuracy calibration of the sUAS LiDAR data. Initial flights with the multimodal payload were utilized for comprehensive data collection and analysis, modifications to sUAS flight operations, and thorough tuning of all sensor suite components. Recent flights have produced data suited for rigorous multimodal data fusion methods which are being implemented to synthesize the calibrated data products from all sensors, and a post-processing workflow was devised and is being further refined to produce end-products ready for subsequent analyses.The addition of the 3D LiDAR sensor to the existing sUAS sensor suite is extremely valuable, and further supports the UFUASRP theory that sUAS can be utilized as scientific remote sensing platforms. The ability to create 3D digital point cloud models as framework structures onto which high-resolution 2D imagery collected by existing sUAS sensors can be draped upon facilitates a host of new natural resource-based sUAS applications. The desire to integrate a LiDAR sensor as a payload component for civilian sUASs has been requested by researchers for over a decade. The UFUASRP has been able to successfully incorporate a LiDAR unit as an available option to their multimodal payload suite. The systematic integration of calibrated LiDAR data capable of generating 3D point clouds from a sUAS is a landmark step in the utility of sUAS as tools for scientific data collection.



Burmese Pythons in the Greater Everglades: Movement, Habitat Use, Impacts and Control Tools
Investigator: Christina Romagosa
Student: Brian Smith, MS, Wildlife Ecology & Conservation
Duration: Aug 2014-August 2017
Funding Agency: USGS (RWO 291)

The Burmese python population is expanding outside of the southern Everglades and poses a major threat to native wildlife. This study addresses two issues in python management: (1) understanding fine-scale activity patterns, and (2) understanding diet and habitat-use across the landscape. Previous python tracking studies have yielded broad-scale information, but information on daily activity and fine-scale habitat-use is limited. Stable isotope analysis adds to current knowledge on python diet and habitat-use of pythons, and how those factors differ temporally and spatially. Our first objective is to refine use of GPS tracking and understand fine-scale activity patterns to optimize removal efforts. For this, we surgically implanted GPS tags into 13 pythons in 2 seasons in Everglades National Park. We used these data to identify strengths and weakness of GPS technology and identify patterns of python road crossings. The second objective is to understand variability of python resource use (diet and habitat) across the landscape of southern Florida. For this, muscle tissue samples were taken from 425 pythons from across the landscape and we analyzed the samples for carbon and nitrogen stable isotope ratios. We then estimated the size and location of the isotopic niche of pythons from 6 regions of southern Florida. First objective results showed that GPS tags are heavily influenced by habitat factors such as canopy cover, but python movement bouts are captured well by the tags. Preliminary analyses suggest that pythons are most active near 25 °C, and that pythons may be crossing roads more frequently than expected. Second objective results showed pythons have an extremely broad isotopic niche, indicating that they can use both terrestrial- and marine-derived food resources and feed across a variety of trophic levels. Python movements are likely related to specific environmental conditions, and timing removal efforts with these optimal conditions will improve their efficiency. Pythons are also likely to cause trophic cascades and influence the ecosystem through both predation and competition.

Experiential Learning Through Wildlife research and Management of Invasive Reptiles
Investigator: Christina Romagosa
Student(s): Natalie Claunch, PhD, School of Natural Resources & Environment; also supports Diego Juarez, MS, Wildlife Ecology & Conservation
Duration: July 2014 -Aug 2018
Funding Agency: USGS (RWO 292)
In-Kind Support: Graduate Stipend for N. Claunch through UF Graduate School Fellowship



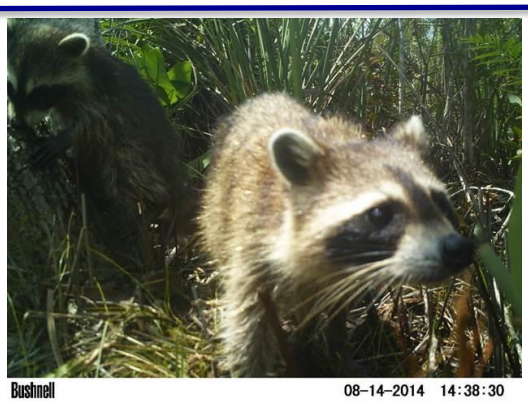
University programs in wildlife ecology and/or management are crucial for the conservation and management of natural resources. Graduates from these programs most often go into academic or natural resource management agency sectors. Students must have a working knowledge of many topics, such as natural history, management, ecology, critical thinking, decision-making, effective communication, research design, as well as technological/field techniques. While some of these topics are taught in the classroom, some are best learned by experiential learning. The most effective graduates from wildlife programs are those that can link across concepts and understand how to connect research with management, regardless of whether they are on the research or management side. Florida has more nonnative species than any state, which creates unique needs for wildlife professionals. USGS & UF work with several agencies on invasive reptile research focusing on the biology, ecology, and development of control tools for these species. These projects largely depend on in-the-field work, and provide an opportunity by which interns can participate in research and management on invasive species. The multi-agency approach to these projects educates students on bridging the research-management implementation gap, while giving them field experience necessary to excel in their field. Our objectives are: a) to provide experiential learning opportunities with invasive reptiles to undergraduate and graduate students; b) provide labor through internships to attain research goals for existing USGS/UF invasive reptile research projects, (tegu movements and demography, python diet and Invasive reptile physiology (Claunch PhD project)) and c) increase research collaboration and opportunities between USGS and UF. To date, twenty seven interns have worked/are working on the cooperative projects. These interns have gone on to other technician jobs, graduate school, or permanent positions with agencies (USGS, NPS). As nonnative species introductions increase across the United States, so will the need for wildlife ecologists that are trained to address this complex issue.

Integrating Science and Management for Optimal Prevention and Control of Aquatic Invasive species in the Everglades
Investigator: Christina Romagosa
Student(s): Brad Udell, PhD, Wildlife Ecology & Conservation; Mathieu Bonneau, Postdoc; Nahid Jafari, Postdoc; Brian Smith, MS also contributed
Duration: August 2015-September 2020
Funding Agency: USGS (RWO 295)

Working closely with regulatory agencies, we are developing decision support tools that identify the optimal allocation of resources needed to meet management objectives regarding two invasive species: tegus and melaleuca. More specifically, we pair dynamic models of population growth and spread, with multiple sources of information, and decision analytic approaches to predict the outcome of potential management actions, and to identify optimal management strategies. For the Tegu project, we are working closely with USGS, NPS, SFWMD, NC State and UF partners to develop an optimal trapping framework, with hopes to ultimately implement it as part of an adaptive management program. This will help determine how to allocate trapping effort between eradication, containment, and monitoring efforts, and also between multiple locations in order to best meet targets for the least cost possible. We are also leading two related projects to estimate the parameters of this framework for the tegu population in South Florida. The first is estimating abundance of tegus and capture rates from removal data in each location. The second is using tegu movement data and habitat data to analyze tegu habitat selection and landscape resistance to movement, with the goal of estimating the probability of movement between each location. We hope to have a prototype of the tegu framework ready by this summer. We will have a workshop with managers this July to further these efforts. For the Melaleuca project, we are working with SFWMD, NPS, USFWS, and partners at USGS and USF to develop predictive models of melaleuca growth in spread in different habitats, and under different management actions (i.e. biocontrol). We parameterize this model using multiple sources of information, such as melaleuca distribution history and management history in the study area, as well as information from individual based models. Using this model, we can then project the effects of management of the future growth and spread of melaleuca, allowing managers to evaluate potential management strategies in a spatial context. Finally, we pair this model with a decision analytic framework and optimization techniques in order to determine the most efficient management strategies to minimize melaleuca abundance in the landscape for a set budget. For the melaleuca, we are also in the process of gathering data sources and preliminary analysis. Development of the spatiotemporal dynamics model and the optimization framework are under way. The first draft of the EDRR screening tool has been completed, and is being validated. We expect the tool to be operation by June 2018. Work related to this has led to the funding of a National Socio-Environmental Synthesis Center (SESYNC) working group on linking trade, biology, and pet owner decisions to the risk of vertebrate invasions in the US.

Assessing Impact of Invasive Pythons on gopher tortoises in Florida
Investigator: Christina Romagosa
Student: Kodiak Hengstebeck, MS, Wildlife Ecology & Conservation
Duration: August 2015-December 2017
Funding Agency: USGS (RWO 296)

The Burmese python population is expanding from the core population in the southern Everglades. As pythons invade upland habitats, they are documented to also use gopher tortoise burrows. As these interactions increase, there will be as-yet-unknown effects on the gopher tortoise and the suite of burrow-commensal vertebrates. The gopher tortoise is a species of special concern in Florida, and pythons could affect their management. Pythons could also potentially use gopher tortoise burrows as winter refugia north of their current range if burrow microclimates in those northern ranges are suitable. The study objectives are: (1) determine python occupancy of gopher tortoise burrows in the occupied range, (2) assess burrow selection by pythons based on burrow and habitat characteristics, (3) assess burrow microhabitat as a suitable refuge for pythons north of their current range. Pythons in burrows were captured using a modified tortoise trap. We are currently collecting habitat and microhabitat data on burrows north of the current python range to compare to python-occupied burrows in SW FL. Preliminary surveys indicated that pythons are using burrows, particularly in winter months. Pythons were also found to co-occupy burrows with gopher tortoises, although the potential impacts on tortoises are as-of-yet unknown. Python occupancy of tortoise burrows could affect the resident gopher tortoises, who are considered to be an ecosystem engineer. If burrow microclimate north of current python range is compatible, then pythons could expand their range and overwinter in tortoise burrows.



Changes in Mammal Communities Across the Greater Everglades
Investigator: Robert McCleery
Student(s): Brain Reichert (Post Doc), Wildlife Ecology & Conservation
Duration: June 2014-August 2018
Funding Agency: USGS (RWO 288)
In-Kind Support: NA

Invasive Burmese pythons (*Python molurus bivittatus*) may be causing declines in medium- to large-sized mammals throughout the Greater Everglades Ecosystem (GEE); however, other factors such as urbanization, habitat changes and drastic alteration in water flow may also be influential in structuring mammal communities. The loss of mammals in the Greater Everglades is likely causing drastic losses in the ecological functioning of the system. The cause of decline must be understood as well as what makes some mammals more vulnerable to declines than others so we can focus our conservation efforts on them. The aim of this study was to gain an understanding of what environmental features and traits of mammals make populations vulnerable to decline from invasive pythons. We used data from trail cameras and scat searches with a hierarchical community model that accounts for undetected species to determine the relative influence of introduced Burmese pythons and environmental features on mammalian species and their different behavioral and morphometric traits. Python density had significant negative effects on all species except armadillo. Despite these negative effects, occurrence of some generalist species increased significantly near urban areas. At the community level, pythons had the greatest impact on species richness, while turnover was greatest along the urbanization gradient where communities were increasingly similar as distance to urbanization decreased. Mammals that were large, fecund and/or occupy a number of habitat were more resilient to pressure from increase numbers of pythons. Python-induced changes to mammal communities may be mediated near urban development, but elsewhere in the GEE, pythons are likely causing a fundamental restructuring of the food web, declines in ecosystem function, and creating complex and unpredictable cascading effects. These effects will have clear implications for the management of wildlife and ecological function.

Evaluating Effectiveness of Using an Integrated Outreach and Trapping Program to Remove Invasive Wildlife in South Florida
Investigator: Frank J. Mazzotti
Student(s): Jenna Cole, MS, Wildlife Ecology & Conservation, Sarah Cooke, MS, School of Natural Resources & the Environment
Duration: August 2016-September 2017
Funding Agency: USGS (RWO 301)
In-Kind Support: Analytical support provided by USFWS

Gold and Argentine black and white tegus are established in and around conservation lands in Miami-Dade County and threaten natural resources through predation and competition. We designed and implemented a surveillance and removal program to characterize distribution and abundance of tegus in Miami-Dade County; developed a trapping program specifically for gold tegus in Miami-Dade County; and provide science and outreach support to disseminate research results. Tegu surveillance included camera and live trapping, visual surveys, and outreach to landowners, agricultural workers, local herpetologists, and government and utility employees. We conducted 55 surveys and observed six tegus (including opportunistic sightings): two in Homestead; one on Card Sound Road; and three near traps in Redland Rock Pit. We captured 13 tegus in traps at Redland Rock Pit. Camera traps detected tegus near L-31N and C-111, and in several county-owned properties. We conducted outreach through presentations, booths, briefings, and fliers at 15 events and through a Miami Herald article. We conducted 55 surveys totaling 103.6 person hours and 1131.4 km. Our catch per unit effort was 0.019 tegus/hour or 0.002 tegus/km. We did not detect gold tegus in Miami-Dade County but responded to reports in Broward County. We set camera and live traps and confirmed their presence but did not capture any prior to brumation. Tegus seen on camera along the L-31 show a distribution more widespread than previously known. Sightings in county-owned properties will guide future trapping locations. Gold tegus in Broward County represent a new threat worthy of a dedicated effort.

Using Models to Assess Gulf Sturgeon Population Viability

Investigator(s): Bill Pine and Rob Ahrens
Student(s): Merrill Rudd, PhD, University of Washington; Krystan Wilkinson, PhD, University of FL
Duration: August 2016-June 2018
Funding Agency: NOAA-Fisheries (RWO 298)
In-Kind Support: School of Natural Resources & the Environment

Gulf sturgeon, a large anadromous fish species currently listed as "threatened" under the Endangered Species Act are of conservation concern in the Gulf of Mexico because of their long-life span and slow population recovery rate. We are working with NOAA and USFWS resource managers to develop two tools to inform management actions designed to promote Gulf sturgeon population recovery. We are designing two population models for use in prioritizing management actions for Gulf sturgeon. The first is a stochastic population viability model (PVA) that allows managers to assess extinction risk for Gulf sturgeon with very small population sizes that have been subjected to frequent high mortality events including oil spills and large hurricanes. The second model is an age-structured population model that is useful for evaluation tradeoffs in management actions directed at different life-history stages. These models for Gulf sturgeon are based on earlier published efforts for similar species. The PVA model is based on an approach described in Pine et al. (2013) based on a series of workshops with USGS and USFWS cooperators. The age-structured model follows a common framework used for many fish populations and was originally developed for commercial fisheries applications. We have provided a draft of a manuscript using the PVA model to USFWS and NOAA cooperators and requested feedback on scenarios evaluated in the model. We have completed a draft of the user's guide for the age-structured model and agency cooperators are deciding whether or not to include a workshop using this age-structured model as a breakout group in the upcoming Gulf Sturgeon working group meeting. We have a call in early February 2018 where the agency leads will decide. Gulf sturgeon resource managers are currently developing plans for new management actions such as improved access to spawning grounds, spawning habitat enhancement, or efforts to reduce adult mortality using funds from the Natural Resource Damage Assessment. These models are helping to inform those planning efforts.

Ecology, Physiology & Control of Invasive Reptiles in Florida

Investigator: Christina Romagosa
Student: Natalie Claunch, PhD, School of Natural Resources & the Environment
Duration: August 2017-July 2022
Funding Agency: USGS (RWO 302)
In-Kind Support:

Invasive species are considered to be a leading cause of animal extinctions worldwide and can have complex ecological and evolutionary impacts via predation, competition, and disease spillover. As nonnative species introductions increase across the United States, so will the need for wildlife ecologists that are trained to address this complex issue. Florida has more nonnative plants and animals than any state other than Hawaii, which creates a unique set of needs for training of wildlife researchers and professionals. Florida provides an experiential-learning opportunity for students to gain field experience, and learn about resource management, and the science to inform invasive species management. The U.S. Geological Survey is working with several federal and Florida state agencies, NGOs, and universities on invasive reptile research focusing on the biology, ecology, and development of control tools. The problem of invasive reptiles will only increase over time, as more than 50 species have already established breeding populations within Florida. Efforts to detect and remove individuals of nonnative reptile species, before they establish additional breeding populations, are of highest priority. Even with the current research efforts, there is still limited information on the biology and ecology of invasive reptiles in Florida, their impacts, and the tools available for control are either lacking or need development. Also, relatively few studies aim to address how mechanisms, such as physiological processes, influence the success of an invasive species and how this information relates to ecological impacts and current control efforts. These projects, as well as specific invasive species undergraduate and graduate courses that are offered at UF, provide a necessary knowledge base for students. Interns who have participated in larger research projects associated with our USGS-UF collaborations, have successfully gone on to attend graduate school and/or obtained positions within government agencies. The multi-agency, cross-cutting approach to these projects can help educate undergraduate and graduate students on how to bridge the research-management implementation gap, while giving them the invaluable field experience necessary to excel in their field.

Doris Duke Scholars Program

Investigator(s): Ray Carthy, Christina Romagosa, Rena Borkhataria

Student(s): Nichole Bishop, PhD, Wes Boone, PhD, Brian Smith, MS

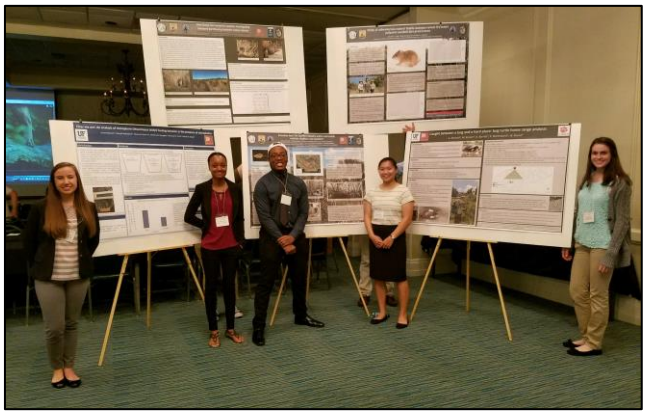
Duration: September 2013-September 2019

Funding Agency: Doris Duke Conservation Scholars Program Partnership with University of Florida

The annual goals of the Doris Duke Conservation Scholars Program include providing students with a better understanding of the research process, exposing them to a variety of research and field techniques, and helping to develop a deeper understanding of and appreciation for a topic of their interest through independent projects. We believe that we were successful in meeting these goals during the 2017 field season. Students were involved in a variety of research activities that included observational and experimental studies. Individual research projects allowed students to work through all phases of the research process from developing a research question to designing a study to analyzing the data they collected. These individual projects also allowed students to explore a topic in depth, and provided opportunities for students to use a variety of techniques and equipment. Students had several opportunities throughout the summer that allowed them to meet visiting scientists and work on additional projects that exposed them to novel field techniques. Students at the Whitney Lab volunteered to assist with a PhD student's work in which they collected quadrant data related to biodiversity. Students also continued collecting data relating to biodiversity at UF's "Archie Carr" property in St. John's County and beach profile surveys on sea turtle nesting beaches in the same region. As a result of this work, the first sea turtle conservation easement was established at the UF property. Additionally, impacts from Hurricane Matthew (October 2016) were evident and are still being assessed.

While doing research on Sanibel Island, some students captures and processed small mammals in mangrove, fresh water and button wood communities. Students investigated temporal and spatial partitioning of native and non-native rodents.

One measures of program effectiveness is a student's ability to communicate the results of their independent research with the scientific community. In previous years, we have had success with students presenting their research as a poster at the Ecological Society of America's (ESA) annual conference: the Summer 2017 cohort have taken pride and ownership of their work as they too look forward to sharing the results of their research at ESA 2018. Four of the five



2017 cohort also presented their work as posters at The Florida Wildlife Society's spring meeting. Joelle Carbonell won the award for best student poster presentation titled "Paradise lost? Do Sanibel Island's native and exotic rodents displace one another?"!

Interns:

Year 1:
- Alex Cronin
- Nadia Kemal
- Jaclyn Selden
- Adreenah Wynn
- Xue "Jackie" Zhang

Year 2:
- Jeanette Brisbane
- Megan Ely
- Charmaine Pedrozo
- Monica Quintiliani
- Sharmin Siddiqui

Year 3:
- Modeline Celestin
- Camille DeJesus
- Hanna Innocent
- Elizabeth Sherr

Year 4:
- Amy Almond
- Joelle Carbonell-Bierbaum
- Tre'nard Morgan
- Marcela Mulholland
- Camya Robinson

PUBLICATIONS

Peer-Reviewed Publications

Bishop, N**.**, R. Hudson, J. Marlin, T. Pop, T., Rainwater, S. Boylan, B. Atkinson, and R. Carthy. Utilizing growth rates to estimate age and size at sexual maturity in the critically endangered Central American river turtle, *Dermatemys mawii*. ***In review*** Chelonian Conservation and Biology.

Bjorndal, K.A., Bolten, A.B., Chaloupka, M., Saba, V.S., Bellini, C., Marcovaldi, M.A.G., Santos, A.J.B., Bortolon, L.F.W., Meylan, A.B., Meylan, P.A., Gray, J., Hardy, R., Brost, B., Bresette, M., Gorham, J.C., Connett, S., Crouchley, B.V.S., Dawson, M., Hayes, D., Diez, C.E., van Dam, R.P., Willis, S., Nava, M., Hart, K.M., Cherkiss, M.S., Crowder, A.G., Pollock, C., Hillis-Starr, Z., Muñoz Tenería, F.A., Herrera-Pavón, R., Labrada-Martagón, V., Lorences, A., Negrete-Philippe, A., Lamont, M.M., Foley, A.M., Bailey, R., Carthy, R.R., Scarpino, R., McMichael, E., Provancha, J.A., Brooks, A., Jardim, A., López-Mendilaharsu, M., González-Paredes, D., Estrades, A., Fallabrino, A., Martínez-Souza, G., Vélez-Rubio, G.M., Boulon Jr., R.H., Collazo, J.A., Wershoven, R., Guzmán Hernández, V., Stringell, T.B., Sanghera, A., Richardson, P.B., Broderick, A.C., Phillips, Q., Calosso, M., Claydon, J.A.B., Metz, T.L., Gordon, A.L., Landry Jr., A.M., Shaver, D.J., Blumenthal, J., Collyer, L., Godley, B.J., McGowan, A., Witt, M.J., Campbell, C.L., Lagueux, C.J., Bethel, T.L., and Kenyon, L., 2017, Ecological regime shift drives declining growth rates of sea turtles throughout the West Atlantic: Global Change Biology, 23(11):4556-4568.

Bonneau, M., F.A. Johnson, B.J. Smith, C. M. Romagosa, J. Martin and F.J. Mazzotti. 2017. Optimal control of an invasive species using a reaction diffusion model and linear programming. Ecosphere 8: e01979. 10.1002/ecs2.1979

Cattau, C.E., R.J. Fletcher, Jr., C.W. Miller, R.T. Kimball, and W.M. Kitchens. 2018. Rapid morphological change of a top predator with the invasion of a novel prey. Nature Ecology and Evolution 2:108-115.

Carthy, R. R. 2016. The leatherback turtle: Biology and Conservation. Herpetological Review, 47(4):703-705. Edwards, J.R., J. Ketterlin Eckles, M.R. Rochford, R. Irwin, K.L. Krysko, J.G. Duquesnel, F.J. Mazzotti, and R.N. Reed. 2017. The Gold Tegu, *Tupinambis teguixin* (Linnaeus, 1758) *sensu lato* (Squamata: Teiidae): evidence for an established population in Florida. BioInvasions Records 6(4):407-410.

Churchwell, R. T., S. Kendall, S. C. Brown, A. L. Blanchard, T. E. Hollmen, and A. N. Powell. 2017. The first hop: use of Beaufort Sea Deltas by hatch-year Semipalmated Sandpipers. Estuaries and Coasts. DOI 10.1007/s12237-017-0272-8.

Gallaway, B. J. ,W. J. Gazey, C. W. Caillouet, Jr., P. T. Plotkin, D. J. Shaver, F. A. Abreu Grobois, A. M. Amos, P.M. Burchfield, R. R. Carthy, M. A. Castro Martínez, J. G. Cole, A. T. Coleman, M. Cook, S. DiMarco, S. P. Epperly, A. M. Foley, M. Fujiwara, D. Gomez Gamez, G. L. Graham, W. L. Griffin, S. S. Heppell, F. Illescas Martínez, J. Isaacs, M. M. Lamont, R. L. Lewison, K. J. Lohmann, J. M. Nance, J. Pitchford, N. F. Putman, S. W. Raborn, J. K. Rester, .J. J. Rudloe, L. Sarti Martínez, M. Schexnayder, J. R. Schmid, C. Slay, M. Tumlin, T. Wibbels and B. M. Zapata Najera. 2017. Development of a Kemp's Ridley Sea Turtle Stock Assessment Model. Gulf of Mexico Science. 33(2)138-157.

Johnson, F.A., B.J. Smith, M. Bonneau, J. Martin, C.M. Romagosa, F.J. Mazzotti, H. Waddle, R.N. Reed, J.K. Eckles, and L.J. Vitt. 2017. Expert elicitation, uncertainty, and the value of information in controlling invasive species. Ecological Economics 137: 83-90

McFarland, H. R., S. Kendall, and A. N. Powell. Nest-site selection and nest success of an arctic-breeding passerine, Smith's Longspurs, in a changing climate. The Condor: Ecological Applications 119:85-97.

Olsoy, P.J., L.A. Shipley, J.L. Rachlow, J.S. Forbey, N.F. Glenn, M.A. Burgess, and D.H. Thornton. 2018. Unmanned aerial systems measure structural habitat features for wildlife across multiple scales. Methods in Ecology and Evolution. 9: 594-604.

Phillips, A.C.N., J. Coutou, S. Rajh, N. Stewart, A. Watson, A. Jehu, H.Asmath, F. Dziva, C. Unakal R.B. Holder, and R.R. Carthy. 2017. Temporospatial dynamic and public health significance of bacterial flora identified on a major leatherback turtle (*Dermochelys coriacea*) nesting beach in the Southern Caribbean. Marine Ecology. 15pp. https://doi.org/10.1111/maec.

Reichert, B.E., A.R. Sovie, B.J. Udell, K.M. Hart, R.R. Borkhataria, M. Bonneau, R. Reed and R.A. McCleery. 2017. Urbanization may limit impacts of an invasive predator on native mammal diversity. Diversity and Distributions: DOI: 10.1111/ddi.12531

Robertson, E.P., R.J. Fletcher, Jr., and J.D. Austin. ***In press.*** Microsatellite polymorphism in the endangered snail kite reveals a panmictic, low diversity population. *Conservation Genetics*.

Robertson**,** E.P., R.J. Fletcher, Jr**.,** and J. D. Austin. 2017. The causes of dispersal and the cost of carryover effects for an endangered bird in a dynamic wetland landscape. Journal of Animal Ecology 86:857-865.

Sovie, A.R., R.A. McCleery, R.J., Fletcher, and K.M. Hart. 2016. Invasive pythons, not anthropogenic stressors, explain the distribution of a keystone species. Biological Invasions 18:3309-3318.

Theses/Dissertations

Burgess, Matthew A. 2017. Small unmanned aircraft systems and their payloads as aerial data collection platforms for natural resource-based applications. Doctoral Dissertation, University of Florida.

Robertson, Ellen. 2017. The roles of dispersal and post-dispersal reproduction for connectivity across a dynamic wetland landscape. Doctoral Dissertation, University of Florida.

PRESENTATIONS

Ahrens, R.N.M, W.E. Pine, and S.K. Bolten 2017. Informing gulf sturgeon (*Acipenser oxyrinchus desotoi*) recovery goals based on historical population size and extant habitat. NOAA Protected Resources Symposium. Seattle, Washington

Bentzen, R. L., A. N. Powell, and R. Suydam. 2017. Migration trends for king and common eiders past Point Barrow, Alaska. 6th International Seaduck Conference, San Francisco, California, 9 February, 2017.

Bentzen, R. L., A. N. Powell, and R. S. Suydam. 2017. Migration trends for king and common eiders past Point Barrow, Alaska. Coastal Marine Institute Annual Studies Review, Alaska Marine Science Symposium, Anchorage, Alaska, 27 January, 2017.

Bishop, N.D., Pop, T., Rainwater, T.R., Marlin, J., Bjorndal, K.A., Carthy, R.R. 2017. Is coprophagy an important management consideration for the captive breeding of herbivorous turtles? The effects of adult fecal matter consumption in hatchling *Dermatemys mawii* (Central American River Turtle). Paper presented at the 15th Annual Symposium on the Conservation and Biology of Tortoises and Freshwater Turtles. Charleston, South Carolina.

Bonneau, M., F. Johnson, B.J. Smith, C.M. Romagosa, J. Martin, and F. Mazzotti. 2017. Optimal control of an invasive using reaction diffusion model and linear programming. GEER Conference, Coral Springs, Florida. Organized Session on Integrating Science and Management for Controlling Invasive Species. April 2017

Burgess, M. A., R. R. Carthy, P. G. Ifju, H. A. Lassiter, A. E. Ortega, S. E. Smith, C. S. Tripp, B. E. Wilkinson, and T. J. Whitley. 2017. University of Florida Unmanned Aircraft Systems Research Program. NASA Ames Research Center, Moffett Field, California March 2017. (Invited Oral).

Burgess, M.A. 2017. Utilization of small unmanned aircraft systems to address terrestrial applications in natural resources. U.S. National Park Service—Training on the Use of Unmanned Aircraft Systems for Natural and Cultural Resource Science and Stewardship, Fort Collins, Colorado. May 2017.

Burgess, M.A. 2017. Selecting a small unmanned aircraft system platform and payload combination: it all depends on the question. U.S. National Park Service—Training on the Use of Unmanned Aircraft Systems for Natural and Cultural Resource Science and Stewardship. Fort Collins, Colorado. May 2017.

Burgess, M.A. 2017. Small unmanned aircraft systems and their payloads as aerial data collection platforms for natural resource-based applications. Monthly U.S. Department of the Interior—Unmanned Aircraft Systems User National Webinar. May 2017.

Carthy, R.R., M.A. Burgess, P.G. Ifju, T.J. Whitley, C.S. Tripp, A.E. Ortega, and J.J. Poelstra. 2017. The University of Florida Unmanned Aircraft Systems Research Program: monitoring 2017 bay scallop fisheries in State waters off Taylor County, Florida. 2017 Public Scallop Seminar, Steinhatchee, Florida. (Invited Oral)

Carthy, R. R., M. A. Burgess, P. G. Ifju, H. A. Lassiter, A. E. Ortega, S. E. Smith, C. S. Tripp, B. E. Wilkinson, and T. J. Whitley. 2017. Small Unmanned aircraft Systems (sUAS) used by the University of Florida UAS Research Program and and overview of current US UAS legislation. 37th International Symposium on Sea Turtle Biology and Conservation, Las Vegas, Nevada (Invited Workshop Presentation).

Celestin, M. H. Innocent, N.D. Bishop, C.M. Romagosa, R.R.Carthy, and W.W. Boone. 2017. Investigating the influence of environmental covariates on marsh rabbit occupancy in southwest Florida. Ecological Society of America, Portland, Oregon. (Contributed Poster), June 2017.

Claunch, N., and C. Romagosa. Do reptilian invaders shed armor to conquer new lands? Joint meeting of ichthyologists and herpetologists, Austin, TX, July 2017. (Lightning Talk)

DeJesus, C., W.W. Boone, R.R. Carthy, C.M. Romagosa, and N.D. Bishop. 2017. The vulture restaurant is OPEN: Comparative feeding ethology of black and turkey vultures. Ecological Society of America, Portland, Oregon. (Contributed Poster)

Dudek, S., R.J. Fletcher, and S. Onate. 2017. Mapping the distribution of an exotic prey species across the geographic range of an endangered predator: An example with snail kites on Lake Okeechobee. Florida Ornithological Society Meeting. November 11, Gainesville, Florida.

Innocent, H. M. Celestin, N.D. Bishop, C. M. Romagosa, R.R. Carthy, W.W. Boone. 2017. Shrub encroachment in a south Florida grassland: implications for mammalian inhabitants. Ecological Society of America, Portland, Oregon. (Contributed Poster)

Hengstebeck, K.H., C.M. Romagosa, P.T. Andreadis, and I.A. Bartoszek. 2017. Trapping large constrictors from underground refugia. Joint Meeting of Ichthyologists and Herpetologists. Austin, Texas. July 2017.

Hengstebeck, K.H., C.M. Romagosa, P.T. Andreadis, and I.A. Bartoszek. 2017. Potential impacts of Burmese pythons on gopher tortoises. Gopher Tortoise Council Annual Meeting. Aiken, South Carolina. October 2017.

Hengstebeck, K.H., C.M. Romagosa, P.T. Andreadis, and I.A. Bartoszek. 2017. A growing problem: how far north can invasive Burmese pythons really go? Wild Futures in Conservation and Climate Conference. Gainesville, Florida. November 2017.

Hirama, Shigetomo. 2017. FWRI-ISM Beachfront Lighting Research. Florida Fish and Wildlife Conservation Commission Meeting. Gainesville, FL. October 4, 2017. Oral Presentation.

Ifju, P.G., M.A. Burgess, R.R. Carthy, T.J. Whitley, H.A. Lassiter, B.E. Wilkinson, and S.E. Smith. 2017. University of Florida Unmanned Aircraft Systems Research Program. The 2017 Federal Users Workshop on Unmanned Aircraft Systems (UAS). NASA Ames Research Center, Moffett Field, Mountain View, California, March 2017.

Jeffery, B.M., R.J. Fletcher, E.P. Robertson, S.J. Dudek, and C. Poli. 2017. Hurricane impacts on snail kite demography. Florida Ornithological Society Meeting. November 11, 2017. Gainesville, Florida.

Jeffery, B.M., R.J. Fletcher, E.P. Robertson, S.J. Dudek, and C. Poli. 2017. Hurricane impacts on snail kite demography. Florida Climate Institute Meeting. November 9, 2017. Gainesville, Florida.

Lassiter, H.A., R. Wang, and B.E. Wilkinson. 2017. Development of algorithms for automated, single-tree parameter estimation from LiDAR and photogrammetric point cloud data. 2017 American Society for Photogrammetry and Remote Sensing Annual Conference. March, Baltimore, Maryland, March 2017.

Lassiter, H.A., B.E. Wilkinson, M.A. Burgess, R.R. Carthy, P.G. Ifju, S.E. Smith, C.S. Tripp, and T.J. Whitley. 2017. Visible, infrared, and hyperspectral vertical frame imagery from small UAS. The 2017 Federal Users Workshop on Unmanned Aircraft Systems (UAS). NASA Ames Research Center, March, Moffett Field, Mountain View, California, March 2017. (Invited Oral).

Mazzotti, F.J., J.R. Dalaba, M.R. Rochford, and J.K. Ketterlin. 2017. Everglades invasive reptile and amphibian monitoring program (EIRAMP). Florida Fish and Wildlife Conservation Commission Meeting, Gainesville, Florida. December 5-7, 2017. Poster presentation.

McCleery, R. A. 2017. Impacts of pythons on South Florida's mammals. State of Florida's Annual mammal planning meeting. Gainesville, Florida.

McCleery, R.A., B.E. Reichert, A.R. Sovie, K. Hart, R.R. Borkhataria, M. Bonneau, R. Reed 2017. Burmese pythons and urbanization shape meso-mammal community in the Everglades. Greater Everglades Ecosystem Restoration Conference. Coral Springs, Florida.

Pine, W.E., K.A. Wilkinson, M. Rudd, and R.N.M. Ahrens. 2017. Resolving persistent uncertainty in Gulf of Mexico sturgeon movement and mortality. American Fisheries Society Annual Meeting. Tampa, Florida.

Poli, C., R.J.R. Fletcher, and K. Meyer. 2017. Movement patterns of post-fledging Snail Kites improve understanding of a key bottleneck in recovery of the species. Florida Ornithological Society Meeting. November 11, 2017. Gainesville, Florida. Oral presentation.

Powell, A. N. 2017. The challenges of restoring populations of artic-breeding eiders. Special session, Planning Restoration and Recovery of Sea Ducks Injured in Coastal Oil Spills. 6th International Sea Duck Conference, 7 February, Tiburon, California (Invited Oral)

Powell, A. N. 2017. Conservation of arctic birds: filling in the missing pieces. Invited Seminar, Clemson University, South Carolina.

Robinson, B., L. Phillips, and A. Powell. 2017. Accelerated energy intake increases survival rates of Black Oystercatcher broods. Annual Meeting, Pacific Seabird Group, Tacoma, Washington. (Contributed Oral)

Rochford, M.R., J. Ketterlin Eckles, and F.J. Mazzotti. 2017. UF reptile research & monitoring. Everglades Cooperative Invasive Species Management Area Summit, Davie, Florida. July 26, 2017. Oral presentation.

Rochford, M.R., J. Ketterlin Eckles, and F.J. Mazzotti. 2017. Relationships between invasive wildlife and ecosystem restoration in the Florida Everglades. Greater Everglades Ecosystem Restoration (GEER) Conference, Coral Springs, Florida. April 17-21, 2017. Oral presentation.

Sherr, E., W.W. Boone, C. M. Romagosa, R.R. Carthy and N.D. Bishop. 2017. Interactions between ctenophores (*Mnemiopsis leidyi*) and microplastic beads within ecologically relevant parameters. Ecological Society of America, Portland, Oregon. (Contributed Poster)

Udell, B.J., Bonneau, M., Martin, J., Johnson, F.A., Romagosa, C.M. 2017. Decision Analysis for the optimal control on Melaleuca. GEER Conference 2017, Coral Springs, Florida. Organized Session on Integrating Science and Management for Controlling Invasive Species. April 2017.

Vitale, N.. 2017. Reproductive success of American Oystercatchers in Florida's Big Bend. Florida Ornithological Society Meeting. November 11, 2017. Gainesville, Florida. Poster presentation.

Webb, E. 2017. Foraging Movements of an Endangered Florida Bat. Florida Fish and Wildlife Conservation Commission Meeting, December, Gainesville, Florida. Poster presentation.

Wilkinson, B.E., A.H. Abd-Elrahman, M.A. Burgess, R.R. Carthy, P.G. Ifju, H.A. Lassiter, A.E. Ortega, S.E. Smith, C.S. Tripp, and T.J. Whitley. 2017. Small UAS laser scanning: calibration and precision assessment. Florida Chapter of the American Society for Photogrammetry and Remote Sensing LiDAR Workshop. Gainesville, Florida.

Wilkinson, B.E. 2017. LiDAR fundamentals/UAS LiDAR processing. 'GatorEye' Workshop. Gainesville, Florida. July 2017.

HONORS AND AWARDS

Work related to Invasive Species on RWO 295 has led to the funding of a National Socio-Environmental Synthesis Center (SESYNC) working group on linking trade, biology, and pet owner decisions to the risk of vertebrate invasions in the US.

Brad Udell (PhD student on RWO 295) received a 2016-17 UF Grinter Graduate School Fellowship ($2500)

Kodiak Hengstebeck (MS student on RWO 296) received a 2017 Jennings Scholarship from the Department of Wildlife Ecology and Conservation. February 2017.

Nichole Bishop (PhD student on RWO 285) received a Turtle Conservation Fund grant Fall 2016 $2500 and was awarded $5000 for Research Abroad for Doctoral Students. As a result of the monitoring, the .65 acre property in Summer Haven has become the first sea turtle conservation easement.

Nichole Bishop was honored as "Faces of the Turtle Survival Alliance" by the Turtle Survival Alliance for June 2017 http://www.turtlesurvival.org/blog/1-blog/476-faces-of-the-tsa-vol-5#.WabZHaI8aLU and
she was honored as "Hicatee Hero" by the Belize Foundation for Research and Environmental Education (September 28, 2017) https://www.facebook.com/BfreeBelize/posts/1669151273126588.

COMPLETED PROJECTS

Burmese Pythons in the Greater Everglades: Movement, Habitat Use, Impacts and Control Tools.
Investigator(s): Christina Romagosa
Completion Date: August 2017
Funding Agency: USGS RWO 291

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