Managing Florida's Coastal Resources

Florida Chapter of The Wildlife Society

2018 Spring Meeting

April 11-13, 2018

FLORIDA CHAPTER

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Volunteers/Student Coordination: Monica Folk

Agenda Summary

Wednesday, April 11

10:00am Scavenger hunt starting at the gazebo on the back lawn (this event is free, but you must pre-register; prizes will be awarded to the top student-professional teams)

11:00am Registration, Poster setup (Pine Room)

1:00pm Symposium: Coastal Conservation in Florida (Magnolia Room)

3:30pm Break

4:00pm FLTWS Chapter Business Meeting

5:30pm Networking Social / Raffle

Thursday, April 12

Breakfast on your own

8:30am Plenary: Managing Florida's Coastal Resources (Magnolia Room)

10:00am Break

10:15am Concurrent Sessions: Student Papers, Technical Papers (Sable Rooms)

Noon Lunch on your own

1:30pm Concurrent Sessions: Student Papers, Technical Papers (Sable Rooms)

2:50pm Break

3:20pm Concurrent Sessions: Student Papers, Technical Papers (Sable Rooms)

5:30pm Poster Session Social / Silent Auction (Pine Room)

7:00pm Banquet and Awards Ceremony (Palm & Oak Room)

Friday, April 13

Breakfast on your own

8:30am Concurrent workshop & field trips (all are free, but you must pre-register)

- Field trip to Citrus Tract of the Withlacoochee State Forest
- Field trip to Crystal River Preserve State Park
- Workshop on 3D Printing for Scientists (Sable Room A)

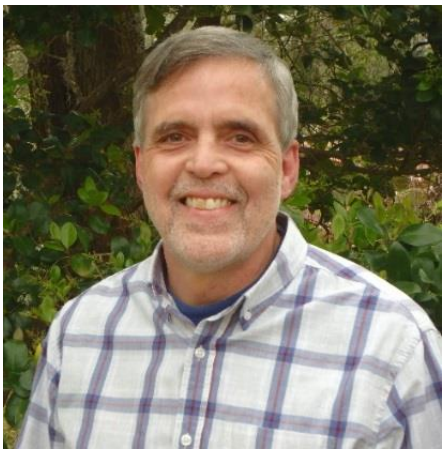
Noon Adjourn

Coastal Conservation in Florida

Welcome Address: Mark Ausley, *President-Elect of the Florida Chapter of The Wildlife Society*

1:00-1:25 CHALLENGES FOR BEACH MOUSE CONSERVATION IN A CHANGING ENVIRONMENT

Terry J. Doonan, *Florida Fish and Wildlife Conservation Commission, Terry.Doonan@MyFWC.com, 386-758-0525*



Abstract: Beach mice are subspecies of the old field mouse, *Peromyscus polionotus*. They occur exclusively in the coastal dune ecosystems of Florida and Alabama. Of the 7 extant beach mouse subspecies, Florida is home to 6: 2 subspecies are resident on the Atlantic coast and 4 along the panhandle coast. Historically on the Atlantic coast, beach mice ranged from near Jacksonville south to at least Palm Beach County. In the panhandle, beach mice historically ranged from Perdido Key at the Alabama border east to Cape San Blas, near Apalachicola. Today, 5 of the 6 subspecies are federally listed and all face significant conservation challenges. Viable beach mouse populations exist almost exclusively on public conservation lands. A concern for conservation is that populations can become isolated, with little movement of individuals between them, which can leave populations vulnerable to declines. Thus, for successful beach mouse conservation, monitoring is essential. FWC biologists have conducted regular track monitoring, a cost-efficient approach that can detect changes in the areas occupied by mice, determine population trends, and identify areas where conservation actions may be needed. Unfortunately, funding for beach mouse monitoring has been limited and inconsistent, which handicaps conservation efforts for these species. We know that catastrophic impacts from hurricanes can rapidly alter the availability or quality of dune habitats and decimate beach mouse populations. But, when conditions are favorable, beach mouse populations can rebound rapidly. To successfully conserve beach mouse populations in Florida, we must maintain good quality habitat conditions on conservation lands, preserve corridors of appropriate habitat that enable beach mice to move successfully among sites, and sustain monitoring. Maintaining conditions that enable populations to flourish will preserve their resilience so that when hurricanes or other impacts cause major losses, these hardy species will be able to rebound successfully.

Bio: Terry J. Doonan is the Mammal Conservation Coordinator for the Florida Fish and Wildlife Conservation Commission (FWC). Terry earned his M.S. from the University of Central Florida and Ph.D. from The University of Kansas. He has over 25 years of experience studying the ecology of vertebrate populations, with an emphasis on mammal populations and communities, and the effects of varying habitat conditions on them. As Mammal Conservation Coordinator for FWC, Terry is responsible for developing sound

conservation strategies for imperiled mammal species. He also serves as FWC's lead for White-nose Syndrome response activities. Further, Terry works with other staff members and partners to put together conservation projects that benefit imperiled and other important mammal species. Current and recent mammal conservation projects have focused on bat species, beach mice, the Florida mouse, and spotted skunks.

1:25-1:50 MANAGING FLORIDA'S COASTAL SHOREBIRDS: A FLORIDA PANHANDLE CASE STUDY

Raya Pruner, *Florida Fish & Wildlife Conservation Commission,* *Raya.Pruner@MyFWC.com*

Co-author: MARVIN FRIEL, Florida Fish & Wildlife Conservation Commission, *Marvin.Friel@MyFWC.com*

Abstract*:* Coastal habitats are naturally dynamic environments that are severely stressed globally by ongoing human population growth and climate change, leading to increases in direct pressures to coastal environments and coastal-dependent species. Consequently, there is little undeveloped beach habitat remaining, and what does remain is often degraded to the detriment of coastal species, such as beach-nesting shorebirds. Shorebirds in Florida face a suite of challenges that impact population stability and growth, however management of recreational and predator pressures is arguably the most obtainable. Focusing on two state imperiled beach-nesting shorebird species, Snowy Plover (*Charadrius nivosus*) and Least Tern (*Sternula antillarum*), we discuss effective habitat management actions using an adaptive framework that focuses on impacts from human disturbance and predator pressures, look at population trends for both species at coastal State Parks in the Florida panhandle, address uncertainties, and discuss strategies for state-wide management.

Bio: Raya Pruner has been conducting research in support of wildlife management in Florida since 2006, with an emphasis on beach-nesting shorebirds and migratory shorebirds and terns. She is currently an Assistant Research Scientist with the Florida Fish and Wildlife Research Institute. She received her M.S. from the University of Florida in 2010 for a project focusing on Snowy Plover habitat selection and reproductive performance in the Florida panhandle. From 2010 to 2017 she managed various research projects designed to improve management for nesting and wintering shorebirds at the Florida Park Service coastal parks while working as a District Biologist at the Florida Park Service - District 1 Administration office. Her studies have focused on factors affecting populations of species of conservation concern, including habitat quality, predators, and human disturbance. Ms. Pruner has worked with the Oregon Heritage Foundation through Oregon State University surveying and monitoring for the Western Snowy Plover. In

addition, she has worked for the Florida Fish and Wildlife Conservation Commission monitoring Snowy Plovers under the 2006 state-wide population re-assessment project and for the Bear River Migratory Bird Refuge (USFWS) monitoring inland Snowy Plover populations in Utah.

1:50-2:15 ONTOGENY OF ORIENTATION RESPONSES IN DEVELOPING SEA TURTLE EMBRYOS

Raymond R. Carthy, *U. S. Geological Survey, Florida Cooperative Fish and Wildlife Research Unit, University of Florida, ngosi@ufl.edu*

Co-authors: J. Roger Brothers, University of North Carolina, brother@live.unc.edu; Vanessa Bézy, University of North Carolina, Vanessa.bezy@gmail.com; Kenneth J. Lohmann, University of North Carolina, Klohmann@email.unc.edu; Margaret M. Lamont, U. S. Geological Survey- W.A.R. C., mlamont@usgs.gov

Abstract: When they emerge from their nests, hatchling sea turtles are prepared to use a suite of environmental cues to guide their movements across the beach to the sea and, from there, to the open ocean. Among the orientation cues used by hatchlings during sea-finding and the offshore migration are visual cues, the direction of ocean waves, and Earth's magnetic field. Little is known, however, about when orientation abilities first arise during embryonic development or whether such processes might play a role in natal beach imprinting or other events that shape subsequent behavior. To investigate these possibilities, we studied the orientation of late-stage embryos in eggs collected from an east-coast Florida beach. The results revealed a striking bimodal alignment: the embryos overwhelmingly faced to the north or south but not to the east or west. Although the environmental cue used by turtles to align non-randomly is not yet known with certainty, an interesting possibility is that embryos might align their bodies relative to Earth's magnetic field, one of the few sources of directional information present in an underground nest chamber. In a preliminary experiment, a clutch of loggerhead eggs was incubated inside a magnetic coil system that was used to rotate Earth's field by 90 degrees. The orientation of embryos was aligned with the new north-south magnetic axis within the coil, providing initial evidence consistent with the hypothesis that the alignment of sea turtle embryos is mediated by detection of Earth's magnetic field. Although additional experiments are needed, the initial findings suggest that the ability to detect magnetic fields may develop before embryos emerge from their eggs, and might be critical to sea turtles' navigational abilities at later life stages. Perturbation of the coastal magnetic environment by development and placement of electrical/metallic/magnetic structures may potentially affect this navigational "calibration" stage.

Bio: Raymond Carthy is the Assistant Unit Leader at the U.S. Geological Survey Florida Cooperative Fish and Wildlife Research Unit, and a Special Courtesy Assistant Professor

in the Department of Wildlife Ecology and Conservation at the University of Florida. His research centers on coastal ecosystems and threatened and endangered species, with a focus on marine turtles. Ray and his graduate students study nesting ecology, in-water movements, behavior, habitats, and anthropogenic threats to sea turtles in the coastal zone. He is a past President and Board member of the International Sea Turtle Society, and also serves as the Program Director and Wildlife Lead of the University of Florida Unmanned Aircraft Systems Research Program.

2:15-2:40 MANAGING FOR WILDLIFE AND HABITAT WHILE WORKING A CONSTRUCTION PROJECT

Lorraine Margeson, *donlocomm@aol.com, 727-415-4804*

Abstract: 3D Spoil Island is a working island in Hillsborough Bay, Florida, used by the US Army Corps of Engineers to deposit dredged material from Port Tampa and navigational channel dredging. It is currently 384 acres. I have worked there for various projects both construction and dredging as a sub-contracted bird monitor since 2014. I found unique opportunities for habitat management. This presentation will define that process and those opportunities.

Bio: Lorraine Margeson is a long-time, high-profile environmental activist in addition to her extensive history as a professional and volunteer shorebird surveyor and shorebird/seabird nesting manager. This management history includes gravel rooftop management for least terns and black skimmers in a highly urban setting. She has been instrumental in establishing preservation areas for wildlife and habitat across the government spectrum partnering with elected officials as well as government staff as a volunteer. She is a certified U.S. Army Corps of Engineers avian monitor and nest manager for federal construction projects as a sub-contractor. The work on 3D Spoil Island, the subject of her talk, comes under this work history. Lorraine is a long-time volunteer for the Florida Shorebird Alliance under the Florida Wildlife Commission umbrella as a surveyor for the Florida Shorebird Database, a bird steward, a nesting site manager, and a bird banding team participant.

2:40-3:05 THE MARINE SCIENCE CENTER – PRESERVING OUR MARINE WILDLIFE

Michael M. Brothers, *Marine Science Center, Ponce Inlet, FL, mbrothers@Volusia.org, 386-304-5543*

Abstract: The Marine Science Center in Ponce Inlet, Volusia County, Florida is a sea turtle hospital, a seabird hospital, and an environmental learning center with exhibits, aquariums, and a wide array of educational programs. The goal of the Marine Science Center is to rescue, rehabilitate, and release sick and injured sea turtles and sea birds. In addition, through our exhibits and programs the Center strives to educate the public on the marine environments of our region and create a bond between our visitors and our marine environments to encourage people to be better stewards of our planet. The Marine Science Center (MSC) has hosted over 1 million visitors since it opened in 2002. With about 100,000 visitors each year, we have the opportunity to teach thousands of school students, adults, and families. Our stingray touch pool and invertebrate touch pool provide hands-on opportunities for the public to engage with wildlife. All of our exhibits focus on the wildlife found in our immediate area, allowing visitors to experience the diversity that surrounds them right here. Our glove-trained birds of prey present another chance to engage the public about the issues surrounding raptors and their environment. Our sea turtle hospital has treated over 20,000 sea turtles since we opened. Our bird hospital has treated over 17,000 birds representing over 195 species. These medical facilities provide a unique opportunity for the public to see our medical staff actually working on sea turtles. Our bird hospital showcases a variety of bird habitats that provide home for some individuals that have injuries that prevent their release. All the efforts of the MSC are directed at improving our local marine environments through rehabilitated sick and injured wildlife or educating the public.

Bio: Michael Brothers is currently the Director of the Marine Science Center in Ponce Inlet, Florida, where he has worked since 2004. He is the former director of museums in Florida and Georgia and has worked as a professional interpretive naturalist for over 40 years. He has been studying Florida birds for the last 45 years and has extensive natural resource and natural science interpretive experience including specializations in the bird life and flora of Central Florida, as well as leading birding tours throughout Florida, the Okefenokee Swamp, the Galapagos Islands, Kenya, Machu Picchu, and the Amazon. Mr. Brothers' research specialty is in the coastal and oceanic birds of Florida. He is the Florida editor for the journal "North American Birds." He is also a former member of the Florida Ornithological Society Records Committee, which evaluates reports of birds recorded in the wild in Florida and is responsible for updating the scientific record of Florida's avifauna. He is currently conducting a research project on lesser black-backed gulls to discover the unknown breeding location of the birds we see in North America.

3:05-3:30 CHALLENGES AND OPPORTUNITIES FOR IMPROVED MANAGEMENT OF FLORIDA'S ESTUARINE RESOURCES

Franklin Percival, *Special Projects Coordinator, IFAS Nature Coast Biological Station, University of Florida, percivaf@ufl.edu*

Abstract: Florida's estuaries support tremendous natural resources, including the world's most valuable fisheries, and abundant wildlife. Threats to our coastal systems include sea level rise, climate change, altered hydrology, and urban development. Perhaps the greatest of these threats for Florida systems are changes in freshwater flow to estuaries via human water withdrawals and changes in precipitation due to climate change. For example, four of the six most severe droughts in the Suwannee River over the past 80 years have occurred within the last 15 years. Severe floods and droughts threaten aquatic habitat (oyster reefs, sea grass, create algae blooms), and thus threaten fish and wildlife resources. Integrated research and public education programs are going to be required to address these threats, and an example of such an effort is the new UF/IFAS Nature Coast Biological Station in Cedar Key. Collaboration among universities and state and federal agency partners will be essential to address these challenges, and I will highlight examples of ongoing work seeking to improve the management and conservation of natural resources.

Bio: H. Franklin Percival, BS, University of South Carolina, MS, PhD Clemson University. He worked as a wildlife research biologist in the US Fish and Wildlife Service and US Geological Survey for 42 years. He was Assistant Unit Leader and Unit Leader, FL Cooperative Fish and Wildlife Research Unit 1981-2016. He worked with a number of species and issues, mostly in teams of researchers.

Managing Florida's Coastal Resources

Welcome Address: Holly Ober *President of the Florida Chapter of The Wildlife Society*

8:35-9:05 FLORIDA'S COASTS - CONSERVATION CHALLENGES, FUTURE TRENDS, AND NATURE'S ROLE

Anne Birch

Abstract: We've heard the news and know the facts. With an estimated 20+ million people, Florida is now the third most populated state, edging out New York behind California and Texas. By 2045 Florida's population projection is expected to increase to over 27M people. Florida has the most coastline of any continental state, with more than two-thirds of its residents living in the coastal counties. As our coastal urban areas expand, we are also experiencing effects from sea level rise and increasing intensity and frequency of storms that expose a rising number of people to flooding, erosion, and other impacts from climate and development. Our coastal habitats and cities are affected by the actions of people and nature, each influencing the other in a fierce cycle. A challenge we face is how to translate this information into meaningful conservation actions that prepare the built and natural environments to adapt to future conditions. Nature can be resilient to short and long-term changes, if allowed, but given the rapidly changing environmental and social conditions we must understand and accept that nature's new normal will not be the same as the old. People are also resilient, but we need to accept that we cannot, nor should we, build our way out of danger. Future management should focus on being more nimble in decision making to capture opportunities for learning while simultaneously promoting the evolution and adaption of our natural and human communities to changing conditions. Our collective responsibility is to turn up the volume and take action to advance science, research, restoration, and policy in ways that embrace nature as a solution to the growing economic, environmental, and social equity challenges facing our coastal areas.

Bio: Anne Birch has been involved in marine conservation work in Florida for over 30 years. She has Bachelor and Master's degrees in Biology and Marine Ecology. As TNC's Florida Marine Program Manager she's responsible for guiding the Chapter's work on restoring and managing our coastal systems. This includes protection and restoration of habitats such as oyster and coral reefs and assessing how natural habitats can help protect our communities. She advocates for restoration and management of oyster habitat as an essential element of our estuarine systems, and manages oyster restoration projects in the Pensacola area and Charlotte Harbor Estuary, where TNC is a partner in coastal resilience planning and oyster restoration, and development of the first estuary-wide oyster restoration plan in the state. Anne facilitated community-based watershed planning across the Panhandle and Springs Coast to identify environmental issues and solutions for Deepwater Horizon funding opportunities. Establishment of EPA's new

Estuary Program in Perdido/Pensacola Bays is a direct result of this effort. Anne serves on the Florida Oceans Alliance Board of Directors, Indian River Lagoon National Estuary Program's Science Technical Engineering and Modeling Advisory Committee, Northeast Florida Ecosystem Restoration Steering Committee, and co-leads the Southwest Florida Oyster Restoration Working Group.

9:05-9:35 MANAGING FLORIDA'S COASTAL RESOURCES: PROMOTING RESILIENCE TO KEEP FROM TIPPING OVER

Bill Pine

Abstract: Many resource management practices appear to be based on the assumption that critical properties of ecosystems such as climate or stock-recruit relationships have statistical properties (e.g., means and variances) that are relatively constant over time. But what happens when this isn't the case? In this situation it may be possible that time-tested methods useful for managing or restoring coastal systems may no longer be effective. Instead, management in a non-stationary world will likely have to evolve into an active, highly adaptive framework for determining where management actions will have the best possible outcomes using approaches that promote resilience and allow for adaptation in ecosystems and human communities. Management success in this highly uncertain environment will likely require (1) fostering dialogue and trust among scientists, managers, and stakeholders; (2) a commitment to learning based on good monitoring data, analyses, estimation, and prediction that (3) inform new governance approaches from local to ecosystem scales to inform coastal restoration and management.

Bio: Bill Pine is a Professor at the University of Florida in the Department of Wildlife Ecology and Conservation. He received his BS from Auburn University, MS from the University of Florida, and a PhD from NC State University. Since joining the UF faculty in 2005, Bill has worked collaboratively with resource management agencies across the US to assess how riverine and estuarine ecosystems respond to changes in freshwater discharge. He has worked in a variety of large river systems in the US, including the Colorado, Gila, Rio Grande, Apalachicola, St. Johns, Chassahowitzka, Neuse, and Cape Fear river basins. He has published more than 70 manuscripts and supervised 13 graduate students during this time, with research efforts focusing on native fish population responses to dam operations, status and trends in Gulf sturgeon populations, and assessments of oyster populations in Apalachicola and Suwannee Sound, Florida. He also teaches a variety of undergraduate and graduate courses including Quantitative Wildlife Ecology, Field Ecology of Aquatic Organisms, and Management of Exploited Populations.

9:35-9:55 MANAGING MANATEES AND PEOPLE AT THREE SISTERS SPRINGS, CRYSTAL RIVER NATIONAL WILDLIFE REFUGE (NWR)

Joyce Palmer

Co-authors: JOYCE KLEEN, Crystal River National Wildlife Refuge, USFWS, Joyce_kleen@fws.gov, 325-436-7156; DANIEL SLONE, U.S. Geological Survey Wetland and Aquatic Research Center, 352-264-3551; SUSAN BUTLER, U.S. Geological Survey Wetland and Aquatic Research Center, 352-264-3557; JIM REID, U.S. Geological Survey Wetland and Aquatic Research Center, 352-264-3546; and CATHERINE G. HAASE, U.S. Geological Survey Wetland and Aquatic Research Center.

Abstract: The Crystal River NWR manages one of the most important natural warm-water refugia for manatees at Three Sisters Springs. The refuge is challenged to protect warm water habitat at Three Sisters Springs for manatees when they need to be there to survive while maintaining public access. Dramatic increases in manatee ecotourism in Kings Bay coupled with increases in the overall manatee population has led the refuge to evaluate human and manatee interactions within the springs and to develop and implement science-based management protocols to protect manatees. Initially, the refuge closed portions of the springs to human activity, restricted use of paddlecraft during manatee season, and required commercial guides to escort their visitors into the springs. The refuge has employed the U.S. Geological Survey (USGS) Sirenia Project to analyze movements of telemetry-tagged manatees monitored by satellite in combination with environmental information such as water temperature and level in the Gulf, Crystal, and Salt rivers, and local springs to provide valuable insight into their habitat use patterns relative to measurable ambient conditions. Manatees showed the expected pattern of more occurrences in the springs when Gulf temperatures were relatively cold (i.e., less than 20 °C). A detailed look at manatee GPS locations revealed that when Gulf water temperatures at Shell Island were colder than 17 °C, manatee habitat use patterns shift from the Gulf to higher occurrences in Three Sisters Springs and the adjacent springs known as Idiot's Delight. Thus, the Service now closes Three Sisters Springs to all human activity when Gulf temperatures at Shell Island drop to 17 °C and the springs will remain closed until temperatures rise above 17 °C for 24 hours or longer

Bio: Joyce Palmer is the Manager of the Crystal River National Wildlife Refuge Complex, which includes 5 refuges: Crystal River, Chassahowitzka, Egmont Key, Pinellas, and Passage Key.

She manages a multi-disciplinary staff and oversees daily operations for a heavily visited refuge complex, with a large volunteer corps, and an active and influential Friends group. Joyce has worked for the U.S. Fish and Wildlife Service for 18 years in various positions. Throughout her career, she has worked cooperatively with numerous local, state and

federal agencies while working on coastal Louisiana restoration and endangered species management with the Lafayette Ecological Services Office, on Comprehensive Everglades Restoration Plan projects with the South Florida Ecological Services Office, and while working at multiple refuges in Florida.

Joyce earned her Bachelor of Science degree in Wildlife Ecology and Management at the University of Florida (Go Gators!) and her master's degree at the University of Missouri. Her professional interests and expertise focus on wetland habitats in freshwater, coastal and marine environments, and their associated fish and wildlife resources. In her free time, Joyce enjoys traveling, birdwatching, and spending time outdoors with her husband and three children. She and her family were thrilled to move to Citrus County and enjoy exploring the Nature Coast.

CEUs

How to obtain CEUs (Contact Hours) during the FLTWS Spring Conference:

1. Attend Meeting Sessions that have been approved by TWS for Contact Hours (see below).
2. Record the actual time spent attending sessions, workshops, etc. in your Personal Activity Record (at the end of the conference, round the overall number to the nearest half).
3. Sessions missed, workshops not attended, etc. may not be recorded as Contact Hours.

Wednesday, April 11		CEU's Available
1:00pm	Symposium – *Coastal Conservation in Florida*	2.5
4:00pm	Business Meeting (all encouraged to attend—Prizes!!)	1.5

Thursday, April 12		
8:30am	Plenary Session – *Managing Florida's Coastal Resources*	1.5
10:15am	Concurrent Sessions (Technical Papers)	1.5
1:30pm	Concurrent Sessions (Technical Papers)	1.5
3:20pm	Concurrent Sessions (Technical Papers)	1.5

Friday, April 13		
8:30am	Workshop – 3D Printing for Scientists	*3.0
8:00am	Fieldtrip – Crystal River Preserve	*1.5
8:00am	Fieldtrip – Citrus Tract of the Withlacoochee State Forest	*1.5
Noon	Adjourn	

The conference has a maximum of 13.0 Category I Contact Hours available if the workshop is attended, or 11.5 if a fieldtrip is attended.

*An attendee can only earn Contact Hours on either the workshop or one of the post-meeting field trips, as they are simultaneous.

Session I A: 10:15-11:55 (Student) – *Sable A*

Abstracts – pages 20-23

10:15—10:35 Daily re-assessment of microhabitat by wading birds. J. O. Grisales Jimenez and D. E. Gawlik

10:35—10:55 Wild turkey (*Meleagris gallopavo)* nest recess behavior effect on nest success in Florida. B. G. Carpenter, K. Sieving, T. Terhune, R. Fletcher, and H. Pittman

10:55—11:15 Seasonal movements of wood storks at the landscape scale and potential implications for Everglades restoration. S. Picardi, R. R. Borkhataria, P. C. Frederick, M. Basille

11:15—11:35 Modeling wading bird foraging habitat in coastal ecosystems. M. T. Martinez, D. E. Gawlik, E. R. Kohler, and S. S. Romañach

11:35—11:55 Is Sanibel Island's least known inhabitant one of its most noteworthy? Genetics of a true native: *Sigmodon hispidus insulicola*. W. W. Boone IV, R. A. McCleery, and J. D. Austin

Session I B: 10:15-11:55 (Nonstudent) – *Sable B*

Abstracts – pages 23-26

10:15—10:35 What's in your toolbox? Using partnerships to manage invasive species more efficiently. E. P. Myers

10:35—10:55 Tolerance for the Florida panther in exurban Southwest Florida. P. D. Rodgers and E. Pienaar

10:55—11:15 Multi-stakeholder collaborations to conserve some of Florida's most endangered coastal small mammals. D. U. Greene, J. A. Gore, M. V. Cove, J. D. Austin, M. T. Mengak, and S. B. Castleberry

11:15—11:35 Using the Florida Master Naturalist Program to expand environmental education in Florida. S. A. Johnson and M. Main

11:35—11:55 Survival of wild turkey (*Meleagris gallopavo)* under variable harvest regulatory frameworks in Florida. H. T. Pittman, R. Shields, and J. Wood

Session II A: 1:30-2:10 (Student) – *Sable A*

Abstracts – pages 27-29

1:30—1:50 Smelly fruits and how big bats help them grow! S. Jayadi and H. Ober

1:50—2:10 Florida residents' tolerance for coyotes and preferred management strategies. K. Anderson and E. Pienaar

2:10—2:30 Spatiotemporal patterns of human-panther conflicts in a human-dominated landscape. M. Prat-Guitart, D.P. Onorato, J.E. Hines, M.K. Oli.

2:30—2:50 Understanding stakeholders' and public preferences for non-native pet trade management in Florida. D. J. Episcopio-Sturgeon and E. F. Pienaar

Session II B: 1:30-2:10 (Nonstudent) – *Sable B*

Abstracts – pages 29-32

1:30—1:50 An evolving view of food-limitation in wading birds: Differing implications of prey and habitat. D. E. Gawlik, J. A. Klassen, and B. A. Evans

1:50—2:10 Diamondback terrapin status assessment. T. D. Castellón

2:10—2:30 A range-wide assessment of the status and distribution of the striped newt (*Notophthalmus perstriatus*). A. L. Farmer, K. M. Enge, J. B. Jensen, D. J. Stevenson, and L. L. Smith

2:30—2:50 Techniques and preliminary results for studying elusive salt marsh mink in a coastal environment. L. M. Smith and C. Winchester

Session III A: 3:20-4:40 (Student* / Nonstudent) – *Sable A*

Abstracts – pages 32-35

3:20—3:40 Python-induced mammal declines in south Florida may influence zoonotic disease risk. A. A. Loggins*, R. A. McCleery, I. Hoyer, E. Blosser, C. Acevedo, and N. Burkett-Cadena

3:40—4:00 Vampire bat bite surveillance in Arizona, New Mexico, Texas, and Florida. D. Bergman, M. Bodenchuk, R. Chipman, and B. Haley.

4:00—4:20 Using remote cameras to identify optimal bridge construction to facilitate movement of Florida panther, Florida black bear, and other wildlife. J. M. Korn, B. Setchell, and N. Monies.

4:20—4:40 Restoration of a Valued Ecosystem Component, *Vallisneria americana*, in the Caloosahatchee River and Estuary. D. W. Ceilley, E. M. Everham III, J. Douglas, C. E Henne, and J. F. Anderson

Session III B: 3:20-4:40 (Nonstudent) – *Sable B*

Abstracts – pages 35-37

3:20—3:40 Factors influencing nest survival of salt marsh songbirds in northeast Florida. A. C. Schwarzer, W. A. Cox, and B. Tornwall

3:40—4:00 Testing assumptions about Florida scrub-jay translocation. K. E. Miller, A. Cardas, J. Garcia, R. Risch, P. Lammardo, J. Bishop, and J. DePue

4:00—4:20 Snail kite utilization of restoration areas on Lake Okeechobee. B. Bachelder and T. Beck

4:20—4:40 Crayfishes of the Florida netherworld. P. E. Moler

Poster Session

Thursday 5:30-7:00pm – *Pine Room*

Abstracts – pages 38-45

Caught between a bog and a hard place: Bog turtle home range analysis. A. Almond, M. Knoerr, K. Barrett, R. Borkhataria (STUDENT)

Movements and survivorship of translocated nuisance American crocodiles. A. M. Brunell, V. Deem, and F. Mazzotti

Paradise lost? Do Sanibel Island's invasive and native rodents displace one another? J. Carbonell, T. Morgan, C. M. Romagosa, and W. W. Boone IV (STUDENT)

Population genetics of Florida seaside sparrows (*Ammodramus maritimus*) Using ddRADseq. C. Enloe, A. Pandey, R. Kimball, and W.A. Cox. (STUDENT)

Range and status of the spotted turtle (*Clemmys guttata*) in Florida. J. D. Mays and A. H. Greene

Dinner for two: Do Sanibel Island's native rodents partition food resources temporally? T. Morgan, J. Carbonell, C. M. Romagosa, W. W. Boone IV (STUDENT)

Mobile acoustic survey duration, seasonality, and repetition influence inferences on bat activity and species richness. H. K. Ober, S. A. Johnson, S. Friedl

Comparing the differences in stormwater filtration, temperature, and relative humidity in pine flatwoods vs. solar array. R. Parada, S. Swarts, A. Huynh, J. Williams, and B. Butterfield (STUDENT)

The effect of microplastic beads on the clearance rate of ctenophores (*Mnemiopsis leidyi)*. C. Robinson, M. Mulholland, W. W. Boone IV, C. M. Romagosa, N. D. Bishop (STUDENT)

Using stable isotope ratios to evaluate seasonal dietary breadth in the Sanibel Island rice rat. A. Seelig, W. Boone, and R. McCleery (STUDENT)

Why should we care about nonbreeding shorebirds in Florida? M. Tuma, P. Kelly, R. Pruner, and A. Powell (STUDENT)

It's no day at the beach: Changing nesting habitats for least terns in Florida. R. Zambrano and T. N. Warraich

Field Trip I

Friday 8:30am – 12:00pm

Crystal River Preserve

Take a tour with a Park Service biologist and a SWFWMD biologist. Participants will go to the office of Crystal River Preserve where they will see an overview video of the Preserve. After that, a one hour boat tour will allow the group to see the estuarine and marsh resources including abundant wildlife. The third part of the tour will involve a driving/walking tour that will introduce participants to the challenges and solutions involved with the management of fire, exotic species, and other coastal resources in Crystal River. The final stop will be Three Sisters Spring Park where we will hear from a SWFWMD biologist about the completed and ongoing restoration work on the area. [limited to 23 participants]

Field Trip II

Friday 8:30am – 12:00pm

Citrus Tract of the Withlacoochee State Forest

Tour and talk about fire history and management and about the RCWs. This is a unique opportunity to tour the largest remaining block of sandhill and one of the largest RCW populations in peninsular Florida. [limited to 25 participants]

Workshop

Friday 8:30am – 12:00pm – *Sable A*

3D Printing for Scientists
Instructed by: *Andrew Marx*

Abstract: Participants will be introduced to the methodology needed to create lab or field supplies through 3D printing. Participants will learn how to create 3D projects using two different approaches, artistic (sculpture) or engineering (CAD). Andrew will also share information on free public access to 3D printers. Participants will need to bring a laptop and mouse. [limited to 25 participants]

Paper Abstracts

Technical Session I A: 10:15—11:55

POSSIBLE EVIDENCE FOR A DAILY RE-ASSESSMENT OF MICROHABITAT BY WADING BIRDS

JOSE O. GRISALES JIMENEZ, Florida Atlantic University, jgrisales2015@fau.edu, 561-536-8073; DALE E. GAWLIK, Florida Atlantic University, dgawlik@fau.edu, 561-297-3333

The ability to track fluctuating resources is a prominent feature in the evolution of many species and communities, particularly in dynamic ecosystems. In the Florida Everglades, foraging patches are formed as the marsh dries and prey are concentrated into shallow pools. Thus, under normal drying conditions, new foraging patches always occur at lower elevations than at previous foraging patches, and birds are assured of finding suitable foraging habitat in the general proximity of a previous day's foraging site without "prospecting". However, prey species are mobile, so we hypothesized that at small spatial scales wading birds must prospect daily to find high quality sites. We tested this hypothesis by quantifying the movement patterns from 555 observations of eight species of free-ranging wading birds (White Ibis, *Eudocimus albus*; Wood Stork, *Mycteria americana*; Snowy Egret, *Egretta thula*; Glossy Ibis, *Plegadis falcinellus*; Great Egret, *Ardea alba*; Tricolored Heron, *E. tricolor*; Great Blue Heron, *A. herodias*; and Little Blue Heron, *E. caerulea*) as they arrived each morning for 12 days at an experimental foraging site in Palm Beach County, Florida, 1997. If birds relied on knowledge of foraging conditions from the previous day but resampled habitat at small spatial scales each morning, we expected to see their movement rate follow a quadratic pattern with time since sunrise. We also tested for a positive linear movement response, suggesting that birds returned to a foraging site and did not prospect until prey were depleted in their initial foraging patch. We tested for a negative linear response suggesting that birds prospected each morning without regard to previous foraging conditions. The number of birds moving among the individual ponds (0.2-ha each) within the experimental site was recorded at one-minute intervals with measurements from 36 to 109 minutes after sunrise. The movement pattern was tested with a negative binomial zero inflation model with mixed effects. Models were evaluated using Akaike's information criterion (AICc). Results supported the quadratic model as the best fit to wading bird movements, suggesting that birds used both previous knowledge of foraging conditions and small-scale sampling of the habitat daily.

WILD TURKEY (*MELEAGRIS GALLOPAVO)* NEST RECESS BEHAVIOR EFFECT ON NEST SUCCESS IN FLORIDA

BOBBI G. CARPENTER, University of Florida, bobbicarp@ufl.edu; KATIE SIEVING, University of Florida, chucao@ufl.edu, 352-846-0569; ROBERT FLETCHER, University of Florida, robert.fletcher@ufl.edu, 352-846-0632; THERON TERHUNE, Tall Timbers Research Station, tterhune@talltimbers.org, 850-893-4153; HENRY PITTMAN, Florida Fish and Wildlife Conservation Commission, Henry.Pittman@myfwc.com, 352-334-4205.

Female wild turkey (hens hereafter) must assess the costs and benefits of nest attendance versus recess behavior in which they forage for required daily resources to sustain prolonged nest incubation. This results in natural trade-offs between acquiring resources, incubating a clutch, and vulnerability of themselves and their nest to predators. Our objective was to determine the effect of incubation recess behavior on nest success. Specifically, we examined the effects of recess frequency and time of day they occurred on nest survival. Habitat features were included; they likely influence recess behavior. We captured and fitted 66 hens with GPS transmitters that collected locations every 30 minutes during the nesting season. We used these locations to determine recess frequency and the time of day. A recess was recorded when one or more data points were away from the nest site. We collected habitat variables that may be representative of necessary resources during incubation such as distance to water, distance to hardwood habitat, distance to road, and management of habitat in nesting site area (e. g, time since burned, thinning or clear cut). We compiled recess behavior and habitat variables for 74 individual nest attempts for use in the Program Mark Nest-Survival Model and estimated nest survival rates. We predict hens that recess less frequently and closer to midday will have higher nest success than those that recess frequently and closer to dawn and dusk. Additionally, we believe habitat variables will influence recess frequency and when hens recess, thus influencing nest survival.

SEASONAL MOVEMENTS OF WOOD STORKS AT THE LANDSCAPE SCALE AND POTENTIAL IMPLICATIONS FOR EVERGLADES RESTORATION

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Wood storks (*Mycteria americana*) are an important indicator species for Everglades restoration. Their extreme sensitivity to hydrology dynamics strictly ties their reproductive success to ecosystem functioning. However, there are still uncertainties about possible limitations to the practical use of wood storks as indicators. Wood stork population trends may not accurately reflect local ecosystem functioning if they are simultaneously affected by conditions outside of the Everglades. Extreme mobility and large-scale movements in response to spatio-temporal heterogeneity of environmental conditions are typical features of wading birds. Thus, it is reasonable to expect that variations of conditions across the landscape all contribute in driving wading bird population trends. A better understanding of the extent to which wood stork population performance is affected by conditions in the Everglades versus elsewhere would help to refine constraints to their use as indicators. We used GPS tracking to quantify wood stork seasonal movement behavior at the landscape scale. We analyzed the movement trajectories of 85 storks tracked during 2004-2018, corresponding to 474 individual seasons. Using Migratory Range Shift Analysis, we detected seasonal range shifts within individual trajectories. We identified 344 shifts, 97 direct and 247

including a stopover. We described the wood stork population as partially migratory, including both individuals that seasonally commute between separate ranges and others that remain in one range year-round. We hypothesize that the coexistence of different migratory behaviors buffers hard-to-predict fluctuations in suitability of local nesting conditions, with migration and residency being alternative choices in the context of a bet-hedging strategy. We suggest that the absolute number of storks present in the Everglades or the number of nesting attempts, per se, would not be direct metrics of local ecosystem functioning, as they might be substantially affected by conditions in other parts of the landscape. On the other hand, the fledging rate from colonies in the Everglades each year should isolate local effects and provide an unbiased measure of the ability of the ecosystem to support the population. We suggest that this distinction is taken into account for future use of wood stork population metrics as indicators for Everglades restoration.

MODELING WADING BIRD FORAGING HABITAT IN COASTAL ECOSYSTEMS

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Our understanding of the mechanistic processes underlying resource availability and habitat selection by wading birds in intertidal ecosystems is critically lacking. Since wading birds are limited to foraging in water depths relative to their leg length, they are strongly influenced by daily tidal cycles that restrict when and where they can feed. Wading birds in intertidal areas may be better at tracking short-term changes in resource availability than wading birds in non-tidal areas due to the highly fluctuating availability of foraging habitat. We performed 19 surveys at Great White Heron National Wildlife Refuge (GWHR) and 33 surveys at Florida Bay from February to July 2017 to locate foraging little blue herons (*Egretta caerulea*). Mean bird density (birds/km^2) was higher at Florida Bay (10 birds/km^2) than GWHR (4 birds/km^2). At GWHR, mean bird density was not significantly different between sites Water Keys (5 birds/km^2) and Howe Key (4 birds/km^2; $p = 0.37$). In Florida Bay, bird density differed significantly by site ($p < 0.01$, $R^2 = 0.2687$, df = 29). Mean bird density was significantly higher at Sandy Key (28 birds/km^2) than at Snake Bight (6 birds/km^2; $p < 0.05$) and Frank and Murray Keys (3 birds/km^2; $p < 0.01$). During the peak of the nesting period (May to June), bird density was highest at Howe Key and Sandy Key, areas that are near nesting colonies. Selecting foraging sites near the colony reduces energetic costs by minimizing flight time and maximizes the possible number of food deliveries to nestlings. The selection for foraging sites close to the nest colony may be especially strong in intertidal systems where availability of foraging habitat is temporally restricted by the tidal cycle. We will use a resource selection function to determine if distance to colony and other physical, hydrologic, and environmental parameters influence little blue heron habitat selection. Results from wading bird habitat selection models in intertidal systems can be used to monitor high-use wading bird foraging areas, assess inter- and intra-annual fluctuations in resources based on real-time conditions, and evaluate outcomes of hydrologic restoration regimes and sea level rise scenarios on wading bird populations.

IS SANIBEL ISLAND'S LEAST KNOWN INHABITANT ONE OF ITS MOST NOTEWORTHY? GENETICS OF A TRUE NATIVE: *SIGMODON HISPIDUS INSULICOLA.*

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Listing of endemic subspecies under the Endangered Species Act implies evolutionary or ecological uniqueness. The insular cotton rat (*Sigmodon hispidus insulicola*) is one such candidate for listing. Despite the taxonomic distinction between the island (restricted to Sanibel and Pine islands, Florida) and mainland subspecies (*S. h. hispidus*), we do not know the degree of isolation of, nor the relative genetic status of, the insular form. We asked, what is the degree of divergence among island and between island and mainland populations of cotton rats? Does the level of inferred gene flow reflect long-term isolation, and is gene flow between island and mainland forms symmetric? To address these questions, we genotyped 248 cotton rats at 13 loci, and sequenced the cytochrome *b* mitochondrial gene for 166 of these. We tested alternative gene flow models between mainland and island populations using Bayes factor analysis based on migration estimated using Migrate-n, and explored patterns of divergence among mainland and insular populations. *Sigmodon hispidus insulicola* from Sanibel Island were differentiated at mitochondrial haplotypes (no shared haplotypes with mainland or Pine Island *S. h. insulicola*) and nuclear DNA reflecting a combination of population bottleneck (i.e., low diversity on island relative to mainland) and long-term isolation (monophyletic haplotypes and unique genotypes in multivariate space). Pine Island cotton rats were also distinct in their multi-locus nuclear profiles, but were not monophyletic in mtDNA and shared one common haplotype with mainland cotton rats. This pattern may reflect more recent isolation of Pine Island (which is closer to the mainland), a larger matrilineal Ne, or more recent matrilineal gene flow (the latter supported by Bayes factor analysis of mtDNA gene flow, Prob = 1.0). Pine and Sanibel islands were as differentiated from one another as either was to the mainland. There is a clear genetic demarcation between Sanibel and mainland *Sigmodon*, suggesting an independent evolutionary history. Pine Island appears to have had a more recent, or repeated genetic introgression from mainland sources (based on mtDNA), but is still isolated enough to have a similarly distinct microsatellite profile.

Technical Session I B: 10:15—11:55

WHAT'S IN YOUR TOOLBOX? USING PARTNERSHIPS TO MANAGE INVASIVE SPECIES MORE EFFICIENTLY.

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Invasive species are named as a contributing factor in many imperiled species listings, can increase the severity of wildfires, impede water flow, make areas inaccessible to wildlife, and can cause economic harm to working lands. Unfortunately, control of invasive species has become exceedingly difficult, due to the costs associated with effective management. Agencies and organizations have been struggling over the past 40 years to find more efficient tools that can slow invasions. Land managers— recognizing that invasive species are not contained by political boundaries— have long understood the need to collaborate on management efforts. In recent years, however, the need for interagency cooperation has taken on new importance as several high profile, potentially harmful organisms have invaded the native landscape. Combining national and state tools such as policy changes affecting plant and animal importation laws, the buying and selling of large constrictors, and hunting regulations for feral animals, with collaborative efforts at the local level are leading to increased success on long term, landscape-level control of invasive species. Learn about invasive species partnerships in your area, and innovative approaches to raising awareness and supporting local collaboration.

TOLERANCE FOR THE FLORIDA PANTHER IN EXURBAN SOUTHWEST FLORIDA

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Human tolerance for negative interactions with the Florida panther (*Puma concolor coryi*) is an important component of panther conservation efforts. Residents' tolerance for interactions with Florida panthers in exurban areas has not been explicitly studied, even though the highest number of documented human-panther interactions has occurred in a single exurban community in Florida (i.e., Golden Gate Estates). We implemented a mail-based survey in Golden Gate Estates in 2015 to investigate community members' level of tolerance for the panther. Golden Gate Estates provides a case study for future conservation efforts as panthers recolonize their historical range, and the panther comes into contact with more exurban and residential communities. Based on regression analysis of survey data, we found that individuals with ecocentric value orientations, individuals who were aware of panthers' presence in Florida prior to moving to Golden Gate Estates, and individuals who believe that proper animal care protects domestic animals from panthers were more tolerant of the panther. Age, livestock ownership, panther depredation of domestic animals, and risk concern were significant negative determinants of panther tolerance. The majority of respondents were willing to collaborate with neighbors and the Florida Fish and Wildlife Conservation Commission (FWC) to manage panther-related risks. Our research provides

insights into how tolerance for the Florida panther in exurban and residential communities may be secured or improved.

MULTI-STAKEHOLDER COLLABORATIONS TO CONSERVE SOME OF FLORIDA'S MOST ENDANGERED COASTAL SMALL MAMMALS

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Wildlife along Florida's coastal areas and on islands are among the most imperiled in the state. Continued habitat loss and fragmentation are among the primary causes for the loss of biodiversity and changes in ecosystem processes within these areas. Additionally, these areas are vulnerable to the effects of climate change, including increasing frequency and intensity of storm surges and other flooding events. Today, many species within these areas have a listing of threatened or endangered due to small population sizes, which are often disjunct. Some of these species, especially small mammals, are extremely vulnerable to extinction and local extirpations, requiring frequent monitoring and often human intervention. However, efforts to conserve and monitor their populations are laborious, expensive, and generally not feasible for one entity to conduct independently. To mitigate continuing threats and prevent local or range-wide extinction of these species, multi-stakeholder collaborations are necessary. Therefore, to achieve recovery efforts, we have developed and initiated long-term monitoring protocols for many small mammal species, especially those on Key Largo and along the Gulf and Atlantic coasts of Florida. Additionally, to reestablish extirpated populations, augment a population threatened with extinction, and to restore ecosystem function within coastal and island communities, we have conducted two reintroductions (Perdido Key and Choctawhatchee beach mice) and one experimental introduction (Key Largo woodrat) using captive-born and wild-born individuals. Through collaborative efforts and pooling data sets from ongoing monitoring efforts, we have been able to evaluate the effectiveness of reintroductions, increase our knowledge of how rodent communities are structured, and provide vital information on baseline conditions, including seasonal and annual population dynamics. Collectively, these efforts have addressed numerous information gaps that will continue to aid in the species' recovery.

USING THE FLORIDA MASTER NATURALIST PROGRAM TO EXPAND ENVIRONMENTAL EDUCATION IN FLORIDA

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The Florida Master Naturalist Program (FMNP) is a statewide environmental education

program with the mission to promote awareness, understanding, and respect of Florida's natural world among Florida's citizens and visitors. FMNP is a science-based UF/IFAS Extension program that can be used to benefit the mission of your organization in several ways. 1) Use FMNP as continuing education. FMNP includes 3 core courses on Florida natural history (Coastal, Freshwater, and Uplands Systems) and 5 courses on applied special topics (Wildlife Monitoring, Habitat Evaluation, Conservation Science, Environmental Interpretation, and Coastal Shoreline Restoration). All courses include classroom and experiential learning; arrangements can be made for CE Credits. 2) Become an Instructor. FMNP is currently taught by a network of more than 150 formal and non-formal educators representing dozens of government, non-profit, and private organizations throughout Florida. FMNP provides teaching materials, registration support, evaluation tools, instructor mentoring, and a fee-based structure to make the program self-sustaining. FMNP curricula can also be integrated into formal college courses with graduates becoming a “Certified Master Naturalist” upon completion. 3) Expand the outreach of your organization. During 2001-17, FMNP issued 13,000 course certificates to 7500 persons. Over 80% of FMNP instructors use course projects to benefit their organization’s mission and obtain new volunteers for ongoing projects; 90% of graduates state they are motivated to continue learning, educating, and volunteering. For additional information on using FMNP to expand environmental education in Florida and to benefit the mission of your organization, go to www.MasterNaturalist.org.

SURVIVAL OF WILD TURKEY (*MELEAGRIS GALLOPAVO)* UNDER VARIABLE HARVEST REGULATORY FRAMEWORKS IN FLORIDA.

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Wild turkeys (*Meleagris gallopavo*) are popular gamebirds across their range, making the pursuit and harvest of male wild turkey a favorite recreational activity of residents and non-residents of Florida. The desire to pursue and harvest wild turkeys in Florida creates a need to manage the harvest and harvest pressure applied to populations of wild turkey. We initiated a study in 2016 to investigate the relationship between harvest pressure on wild turkey populations and their survival. We captured and fitted 114 male wild turkey from 2016 to 2018 with VHF radio-transmitters (here after “marked turkeys”) to monitor their survival and causes of mortality, natural and harvest. We monitored these marked turkeys weekly for survival throughout the non-harvest season (May-February) and monitored them daily during the harvest season (March-April). We also documented movements and the number of hunter days each marked turkey was exposed during the harvest season. Apparent survival of wild turkey was lower during the harvest season than during the non-harvest season, and harvest was the most common cause of mortality. Natural mortality was higher among sub-adult marked turkeys, whereas harvest mortality was higher among adult marked turkeys. Marked turkeys located in areas of high harvest pressure (areas that result in more days an individual is exposed to hunting) had higher harvest mortality (90% harvest mortality) than marked turkeys located in areas of low harvest pressure. Our findings indicate that harvest is the

leading cause of mortality among adult wild turkeys and wild turkeys in areas of higher hunting pressure have lower overall survival than wild turkey in areas of lower harvest pressure.

Technical Session II A: 1:30—2:50

SMELLY FRUITS AND HOW BIG BATS HELP THEM GROW!

SHEHERAZADE JAYADI, Department of Wildlife Ecology and Conservation, University of Florida, sheherazade12@ufl.edu; HOLLY OBER, Department of Wildlife Ecology and Conservation, University of Florida, holly.ober@ufl.edu

Flying foxes, the large Old-World frugivorous bats, have potential roles as pollinators for the production of important cash crops, including durian. Well-known for its pungent odor and creamy texture, durian is economically substantial for local livelihoods in Indonesia. Our study aims to investigate the flying fox pollination services for durian using pollination exclusion experiments, camera traps, and fruit set counts. We conducted our study in a famous durian village in West Sulawesi, Indonesia, in October 2017-January 2018. Under the pollination exclusion experiment, durian flowers that were left open to all potential visitors had a significantly larger number of fruit sets compared to durian flowers that were completely inaccessible to any animals, or to those that only could be visited by bees and moths. This finding suggested that durian flowers could not self-pollinate, and thus relied on vertebrate pollinators to have successful fruit production. We deployed camera traps in front of durian flowers that were left accessible to all vertebrates and invertebrates to determine which organisms visited the flowers. We found that nocturnal visitors were the main factors that determined the production of durian fruits. Small fruit bats, *Eonycteris spelaea*, had the highest mean duration of visits [116.9 sec/visit] compared to the flying foxes, *Pteropus alecto* (11.1 sec/visit) and *Acerodon celebensis* (11.6 sec/visit). Given the high fruit sets generated by the durian flowers visited by bats, we confirmed they were the legitimate durian pollinators. In addition, the average number of durian fruit sets was higher on flowers that were visited by both small bats and flying foxes (Day 20: 8; Day 60: 4) compared to flowers that were only visited by the small bats (Day 20: 5; Day 60: 1). Flying foxes are presumably more effective pollinators because they can deposit large amounts of pollen and move it over longer distances. These findings link the role of bats, particularly flying foxes, to the local economy. This research provides essential information to increase durian production and impact positively the Indonesian agriculture sector, while enforcing the government prioritization of bat conservation.

FLORIDA RESIDENTS' TOLERANCE FOR COYOTES AND PREFERRED MANAGEMENT STRATEGIES

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ELIZABETH PIENAAR Department of Wildlife Ecology and Conservation, Institute of Food and Agricultural Sciences, University of Florida, efpienaar@ufl.edu, 352-846-0630

Evaluating human tolerance for wildlife and people's support for wildlife management actions is critical to designing management and outreach strategies that promote co-existence between people and wildlife. We examined Florida residents' and hunters' tolerance for coyotes, and how they would prefer the coyote population in Florida to be managed. Coyotes are found in every county of Florida, and would appear to be increasingly interacting with people. We administered a web-based survey to 2,777 Florida residents and hunters in 2017 to: 1) measure respondents' tolerance for coyotes; 2) identify their preferred management actions; and 3) identify key determinants of respondents' tolerance and management preferences. Based on both regression and t-test analyses, we found that larger landowners, hunters, and people living in rural areas have lower tolerance for coyotes in Florida, whereas pet owners and urban residents have higher tolerance for the coyote. Core beliefs about the ecological value of coyotes, whether coyotes are native to Florida, and threats associated with coyotes (i.e., perceived risks to humans, pets, livestock, and game populations) were significant determinants of tolerance. Respondents' willingness to take appropriate actions to mitigate conflicts with coyotes was correlated with their tolerance for coyotes, perceived threats of living with coyotes, and sociodemographic characteristics (gender, age, and education). These variables also determined the likelihood that respondents would assign management responsibility for the coyote to the Florida Fish and Wildlife Conservation Commission, rather than taking independent action to mitigate conflicts with coyotes. Our results provide guidance for structuring management and outreach strategies to promote coexistence between humans and coyotes in Florida.

SPATIOTEMPORAL PATTERNS OF HUMAN-PANTHER CONFLICTS IN A HUMAN-DOMINATED LANDSCAPE

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The growth of the endangered Florida panther (*Puma concolor coryi*) population within the anthropogenically altered landscape of southern Florida has increased opportunities for human-panther conflicts. In addition, the number of Florida panther vehicle collisions has increased, potentially threatening both human safety and the long-term persistence of the panther in the wild. Using a long-term dataset (2006-2017) of documented depredations and human-panther encounters, we analyzed the spatiotemporal patterns and ecological and anthropogenic factors driving these conflicts. The total number of human-panther conflicts increased during the study period, with depredations being the most frequent. Probability of a depredation or human-panther encounter was higher at sites that had higher fragmentation and close habitat patches, which could be providing suitable cover for panthers to rest and stalk prey. In addition, the probability of extinction of these depredations and human-panther

encounters decreased as the panther population increased in size. We also analyzed Florida panther deaths and injuries due to vehicle collision to assess the risk to panthers in southern Florida. The number of vehicle collisions increased during the study period, with larger risks to panthers in areas where habitat was more contiguous. However, sites with wildlife crossings and roads with wider shoulders had higher vehicle collision extinction probabilities. Future management efforts to mitigate and prevent depredations, human-panther encounters, and vehicle collisions should be targeted to those areas with the highest risk. The successful resolution of conflicts will be necessary to promote human-panther coexistence and the long-term persistence and recovery of the Florida panther.

UNDERSTANDING STAKEHOLDERS' AND PUBLIC PREFERENCES FOR NON-NATIVE PET TRADE MANAGEMENT IN FLORIDA

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There is growing recognition in the science community of the link between the non-native pet trade and the introduction and establishment of invasive species, owing to the deliberate release and accidental escape of non-native pets. Successful mitigation of the invasion risk posed by the non-native pet trade requires stakeholder participation and public support for appropriate management actions. We conducted both qualitative and quantitative studies in 2017 to measure stakeholder and public preferences for non-native pet trade management in Florida, and determinants of this support. We conducted 29 semi-structured interviews with non-native pet trade stakeholders, and we received 1,619 completed surveys from members of the Florida public and individuals who are involved in the pet trade. We found that 82% of survey respondents recognized the link between the pet trade and invasion risks. Respondents indicated the highest level of support for a law requiring non-native pet owners to microchip and register their pets, and least support for the euthanasia of all non-native animals that are captured in the wild. Respondents' opinions on the effectiveness of management actions depended on the feasibility of these actions. They identified the following barriers to effective management of invasion risks: lack of institutional trust; the existence of an adversarial relationship between stakeholder groups; and ethical concerns about destroying non-native and invasive species. The majority of respondents (85%) stated that they would vote in favor of a mandatory added payment on the sale of every non-native animal in Florida.

Technical Session II B: 1:30—2:50

AN EVOLVING VIEW OF FOOD-LIMITATION IN WADING BIRDS: DIFFERING IMPLICATIONS OF PREY AND HABITAT

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Several wading bird populations are reportedly food-limited. However, this limitation is best viewed as dynamic because wading birds are adapting to different degrees to the rapid anthropogenic changes occurring to many wetlands. We quantified the influence of one anthropogenic change, the introduction of non-native aquatic fauna, on the prey selection of the wood stork (*Mycteria americana*), tricolored heron (*Egretta tricolor*), snowy egret (*Egretta thula*), and little blue heron (*Egretta caerulea*) in the Florida Everglades, USA, 2012-2014. Tricolored heron and snowy egret prey composition was statistically similar across years, with the majority of prey biomass coming from large native marsh fish. Little blue herons also consumed native marsh fish, but they differed from the other two herons in that they consumed more invertebrates and non-native fish species. Wood stork prey composition differed from the small heron diets, composed of sunfish and non-native fish species. Whereas small herons are restricted in foraging because of their specialization on marsh fishes, their short nesting cycles allows for the phenological flexibility to delay nesting within a dry season until foraging conditions are optimal. Conversely, wood storks with longer nesting cycles are more temporally constrained, but appear to have greater flexibility in prey species, foraging range, and foraging habitat. An increase in the proportion of non-native species in the diets of storks suggests that storks, more so than small herons, are exploiting and may be affected by the changing species composition of aquatic fauna in South Florida.

DIAMONDBACK TERRAPIN STATUS ASSESSMENT: RESEARCH PLAN AND REQUEST FOR SAMPLES

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Conservation stakeholders are concerned about perceived declines in Florida's diamondback terrapin (*Malaclemys terrapin*) populations, but few data are available to assess their status. Florida is home to 5 recognized subspecies of diamondback terrapin, 3 of which are endemic. Although terrapins are abundant in a few locations, much of the state has not been surveyed. Nonetheless, at least one known population is thought to have declined substantially in recent decades, and detection of a range-wide genetic bottleneck suggests a severe population contraction. The Florida Fish and Wildlife Research Institute is conducting a status assessment of the diamondback terrapin in Florida that includes the following: 1) collection of sighting data from partners to map the current known distribution, 2) mark-recapture population assessments of 3 significant populations, and support of smaller-scale investigations by partners wherever possible, 3) development of a spatial habitat model to

quantify habitat availability, 4) a literature review to assess recent and projected future habitat losses, and 5) work with partners to collect genetic samples from populations statewide to validate subspecies taxonomy, assess population bottlenecks, and estimate effective population sizes. The project is still in the initial stages but we have developed numerous partnerships, mapped > 9,000 individual sightings, selected study sites, and collected >140 tissue samples for genetic analysis. We are seeking additional partnerships to obtain sighting data, collect tissue samples, and conduct local-scale assessments wherever possible.

A RANGE-WIDE ASSESSMENT OF THE STATUS AND DISTRIBUTION OF THE STRIPED NEWT (*NOTOPHTHALMUS PERSTRIATUS*)

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The striped newt (*Notophthalmus perstriatus*) is endemic to the xeric uplands of southern Georgia and northern Florida. The U.S. Fish and Wildlife Service designated the species as a candidate for federal protection under the Endangered Species Act in 2011 but determined its listing priority to be low relative to that of other candidate species. To assess the current status and distribution of the species, we conducted surveys of known and suitable breeding ponds, solicited sightings from qualified individuals, and obtained records by searching databases, the literature, and U.S. museum collections. In Florida, 13 counties had recent records (2000–2016) from 106 breeding ponds. However, recent unexplained extirpations in the panhandle suggest that the species faces imminent threats even on protected lands. In Georgia, six counties had recent records from nine breeding ponds. In the last five years, striped Newts from the western evolutionarily significant unit (ESU) have been found in only two ponds in Georgia and five ponds in Florida. Remaining Georgia populations are widely separated by predominantly unsuitable habitat, which may jeopardize their long-term viability. Our status assessment supports the determination by the U.S. Fish and Wildlife Service that this species warrants federal protection as a threatened species and suggests that striped newt populations are not necessarily secure on public lands. Further research is needed to determine the cause of recent declines of populations in the Florida panhandle and southwestern Georgia. Additional conservation measures may be necessary to ensure the long-term viability of western populations.

TECHNIQUES AND PRELIMINARY RESULTS FOR STUDYING ELUSIVE SALT MARSH MINK IN A COASTAL ENVIRONMENT

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Florida is home to four subspecies of mink (*Neovison vison*), including two subspecies residing exclusively in salt marsh. These subspecies are naturally rare in Florida, have restricted ranges, and are at risk of extirpation from the state. Little is known about the current range, population size, or life history, and their elusive and cryptic nature makes them difficult to study. In order to address these information gaps, we developed several survey methods to determine occupancy, diet, and genetic analysis in a tidal environment. First, we evaluated the area of occupancy and population size using floating camera traps and spotlight surveys to identify the optimal method for surveying salt marsh mink. We detected mink within 13 sample units on 2 transects for a naïve estimate of site occupancy of 0.09. Camera traps detected mink within 15 sample units at 50 camera sites for a naïve estimate of site occupancy of 0.31. Overall, camera traps were more effective for determining mink occupancy and distribution. The floating camera design was then adapted to evaluate diet using scat collected from floating platforms. Crustaceans were the dominant prey item in the scat, followed by fish, shrimp, and birds. No mammal prey was documented. The floating platform design was again adapted to accommodate live trapping efforts. Live trapping is necessary to confirm subspecies designation, which is currently based on morphology of a limited number of specimens. While trapping is currently underway, preliminary analysis supports subspecies designation. Salt marsh mink are a difficult species to study in a challenging tidal environment, but by using methods that fluctuate with the tide we can begin to effectively address many of the questions surrounding the species in Florida. The data obtained from this process can guide management efforts to aid in the persistence of these rare subspecies in Florida salt marshes.

Technical Session III A: 3:20—4:20

PYTHON-INDUCED MAMMAL DECLINES IN SOUTH FLORIDA MAY INFLUENCE ZOONOTIC DISEASE RISK

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Invasive species, particularly invasive predators, can have cascading negative effects on ecosystems. While many of these ecological impacts are well-studied, less is known about how invasive species influence disease ecology. A highly successful invasive species in south Florida, Burmese pythons (*Python bivittatus*), have contributed to large-scale declines of medium- and large-sized mammal populations. These mammal declines may alter pathogen transmission in the Greater Everglades by changing the relative abundances of hosts for pathogen vectors. Several rodent species are reservoir hosts for the Everglades virus, a zoonotic mosquito-borne pathogen, whereas most mammals do not support virus replication. If non-reservoir mammals are absent, vector mosquitoes (*Culex cedecei*) likely feed at higher rates on reservoir hosts, which may ultimately increase the prevalence of the virus in python-

impacted areas. We compared the diversity and relative abundance of reservoir rodents and non-reservoir mammal species sampled across a gradient of expected python impact in three natural areas (Big Cypress National Preserve, python-impacted; Fakahatchee Strand State Park, adjacent to python impacts; Florida Panther National Wildlife Refuge, python-free). While non-reservoir abundance and diversity were substantially lower in python-impacted areas (4 species compared with 8-10 species), the diversity of reservoir rodents (cotton mice, *Peromyscus gossypinus*; cotton rats, *Sigmodon hispidus*; black rats, *Rattus rattus*) was similar across sites. Opossums (*Didelphis viriginiana*), marsh rabbits (*Sylvilagus palustris*), and white-tailed deer (*Odocoileus virginianus*) were notably absent in python-impacted sites, though highly abundant in python-free areas. PCR-based analyses of mosquito blood meals from these locations reflect similar patterns of diversity and abundance. Blood meal host diversity was lowest in python-impacted areas (7 species), with the majority of blood meals (82 %) coming from reservoir species. By contrast, blood meals from one python-free site ranged across 13 mammal species, with non-reservoir species constituting 49 %. By exploring how invasive predators influence disease ecology, our study highlights important avenues of research into the far-reaching effects of invasive species on ecosystem processes and wildlife communities.

VAMPIRE BAT BITE SURVEILLANCE IN ARIZONA, NEW MEXICO, TEXAS, AND FLORIDA

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Common vampire bats (*Desmodus rotundus*) occur from northern Mexico south through most of South America. Recent ecological niche models suggest future range expansion into southern Texas and southern Florida. Vampire bats pose a significant rabies threat to livestock and people throughout their range. In recent years, vampire bat vectored rabies has been documented within 50 km of the state of Texas. As a result, surveillance efforts in targeted US-Mexico border areas are warranted to provide a systematic approach for early detection of vampire bats and vampire bat rabies within the U.S. The USDA, Animal and Plant Health Inspection Service, Wildlife Services, National Rabies Management Program (NRMP) developed a pilot surveillance project in 2016 to explore cost effective and efficient options for enhancing early vampire bat detection. The pilot program to enhance vampire bat surveillance includes targeted distribution of rabies outreach materials to livestock producers and agriculture agencies as well as surveying cattle for evidence of vampire bat bites at livestock sales barns, dairy barns, and feedlots. The NRMP works closely with WS State Programs in Texas, Arizona, New Mexico, and Florida to implement the program. Early detection strategies and an associated communication plan regarding the potential rabies threat associated with vampire bat range expansion into the U.S. are critical preparatory steps in reducing impacts to public and animal health.

USING REMOTE CAMERAS TO IDENTIFY OPTIMAL BRIDGE CONSTRUCTION TO FACILIATE MOVEMENT OF FLORIDA PANTHER, FLORIDA BLACK BEAR AND OTHER WILDLIFE.

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The main cause of mortality for Florida panther (*Puma concolor coryi*) and Florida black bear (*Ursus americanus floridanus*) is death by vehicle. Previous studies have shown these species benefit from the availability of specifically constructed wildlife underpasses. Currently most of the wildlife underpasses/crossings in Florida are located south of the Caloosahatchee River. With the recent discovery of two female panthers north of the Caloosahatchee River and evidence of breeding, it is increasingly important to ensure the protection of wildlife corridors and to mitigate for road mortality as the population expands. One objective of our study was to determine if existing bridges not built to be a wildlife crossing also facilitate safe passage for large mammals, including important prey items like white-tailed deer (*Odocoileus virginianus*) and feral hog (*Sus scrofa*). A second objective was to attempt to identify if specific bridge design attributes resulted in more use by large mammals or, conversely, resulted in avoidance. We examined photographs obtained by remote cameras and analyzed presence/absence of species by various attributes of bridge construction (ex: height, walkable paths) and surrounding areas (ex: fencing, habitat type). This information is vital in determining optimal construction of future wildlife crossings, in addition to finding cost effective ways to enhance existing bridges with shelves and fencing. Results from this study will in part aid the Florida Department of Transportation in determining location and bridge design for future crossings on Interstate 4 (I-4). I-4 is a multi-lane divided highway that spans between Tampa and Orlando and has 3 recorded panther road mortalities and has been a barrier to at least one radio-collared black bear (M34). To date we have recorded use by panther and black bear at wildlife underpasses but not regular bridges. Both underpasses and bridges have recorded bobcat (*Lynx rufus*), coyote (*Canis latrans*), white-tailed deer, feral hog, and multiple mesocarnivores. Density of panthers is much lower north of the Caloosahatchee River, so data from south of the River may need to be extrapolated to these areas or bobcat use may be used as an indicator of potential large predator preference.

RESTORATION OF A VALUED ECOSYSTEM COMPONENT, *VALLISNERIA AMERICANA*, IN THE CALOOSAHATCHEE RIVER AND ESTUARY

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Historic water management practices (Lake Okeechobee and S-79 releases), prolonged drought, high salinities, and the loss of sediment seed bank have contributed to the loss of approximately 2,000 acres of submerged aquatic vegetation, specifically *Vallisneria americana* in the Caloosahatchee River and estuary. *V. americana* was identified as a Valued

Ecosystem Component (VEC) for establishing minimum flows and levels (MFL) in the Caloosahatchee in 2001. The loss of these expansive submerged grass beds has cascading negative impacts on the entire ecosystem. Early restoration efforts in 2002-03 found that herbivory was a regulating factor preventing *V. americana* beds from recovering in the tidal portions of the Caloosahatchee. This same phenomenon has been documented by others in the Crystal River, Florida, and also in Chesapeake Bay. Known grazers include turtles, waterfowl, fishes, crustaceans, West Indian manatees, and more recently non-native apple snails (*Pomacea maculata*). Together, these grazers are limiting the growth and maturation of *V. americana* plants and thus prevent flower production. Current restoration efforts are underway using small, circular, wire mesh exclosures that are planted with *V. americana* to assess flower production, growth rates, and expansion outside exclosures. This Phase I study is funded through 2018 by the South Florida Water Management District and Lee County. The Phase II restoration project includes scaling up efforts to establish 20-acres of founder colonies of *V. americana* within the estuary to restore the seed bank for recovery of historic distribution and density of *V. americana*. To quantify aquatic communities and habitat value, fish and macroinvertebrate communities will be evaluated continuously within restored and established *V. americana* beds, and within the adjacent un-vegetated habitats for comparison. Sediment transport and sedimentation rates within and outside of grass beds will be quantified using acoustic and light refractive instruments to measure particle size distribution and volume concentration. Nutrient removal efficiency of *V. americana* will be quantified by monitoring biomass and sediment concentrations of carbon, nitrogen, and phosphorus within and outside grass beds. The Phase II restoration project represents a partnership between the State, the Snook and Gamefish Foundation, Florida Gulf Coast University, Sea and Shoreline, and Johnson Engineering.

Technical Session III B: 3:20—4:20

FACTORS INFLUENCING NEST SURVIVAL OF SALT MARSH SONGBIRDS IN NORTHEAST FLORIDA

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Salt marshes in northeast Florida have contracted over the past century, due both to mangrove encroachment and human activity. Consequently, the ranges of the Worthington's marsh wren (*Cistohorus palustris griseus*, hereafter wren) and the MacGillivray's seaside sparrow (*Ammodramus maritimus macgillivraii*, hereafter sparrow), two subspecies which rely completely on salt marshes in this area, have also contracted. Recent studies have shown that the current range for the two subspecies have seemingly stabilized, but questions remained about the baseline demographic rates of the subspecies and the habitat features which influenced them. From 2015 to 2017, we monitored 996 wren nests and 123 sparrow

nests to determine which habitat and nest features affected nest survival rates. Though the two subspecies demonstrate different nest building strategies, with wrens building much higher in the vegetation, daily high tide height was the strongest influence on nest survival for both subspecies, with higher high tides corresponding to lower daily nest survival probabilities. This was despite a lack of evidence of nest flooding for the vast majority of nests of either species, indicating that another mechanism such as extreme high tide concentration of predators in the higher elevation nesting areas of the marsh might be at play. Wren daily nest survival was also negatively related to the amount of *Juncus roemerianus* at both the nest and the larger landscape level, the amount of short form *Spartina alterniflora* at the landscape level, precipitation, elevation, and level of nest concealment. Sparrow daily nest survival was positively related to nest height.

TESTING ASSUMPTIONS ABOUT FLORIDA SCRUB-JAY TRANSLOCATION

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Translocation of the threatened Florida scrub-jay (*Aphelocoma coerulescens;* hereafter FLSJ) has been proposed as a strategy to maintain landscape connectivity, to assist populations in growing and recolonizing suitable habitat, and to preserve genetic diversity. The few translocations that have occurred to date mostly have involved small, nonviable populations located on private lands with federal incidental take permits. We are conducting research to evaluate assumptions about FLSJ translocation on conservation lands and its impact on source populations and recipient populations. During January 2017 - February 2018, we translocated a total of 26 individuals from Ocala National Forest, including 8 family groups (18 individuals) translocated to Seminole State Forest and 8 nonbreeding individuals to Rock Springs Run State Reserve. We found no evidence that “soft” release (i.e., housing the birds in an acclimation cage for 1-2 days at the recipient site before their release) offered any short-term or long-term benefits over “hard” release (i.e., directly releasing the birds without an acclimation period). We had a 100% success rate with translocation of family groups, as all settled near their release site and quickly established breeding territories. In addition, some of the nonbreeding “helpers” that we moved paired up and established territories despite their lack of previous breeding experience. Many of these findings contradict previous assumptions about FLSJ translocations, which were based on limited data. Intensive monitoring pre- and post-translocation at our study sites will determine the longer-term impacts of these manipulations on both the donor and recipient populations. In addition to providing conservation benefits at priority FLSJ populations, this project addresses critical information needed before establishing an interagency partnership to implement a statewide translocation program for FLSJs. Our translocation experiments planned for 2019-2020 include genetic augmentation of priority populations in southern Florida.

ENHANCE IT AND THEY WILL COME – EVERGLADE SNAIL KITE UTILIZATION OF HABITAT MANAGEMENT AREAS ON LAKE OKEECHOBEE

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Lake Okeechobee is considered critical foraging and breeding habitat for the Federally Endangered Everglade snail kite (*Rostrhamus sociabilis plumbeus*). Snail kite utilization is concentrated within the approximately 81,000 ha near shore and littoral zones of Lake Okeechobee. However, snail kite activity patterns within Lake Okeechobee are highly dynamic and shift within and between years due to varying water levels, prey availability, and marsh vegetation patterns. Vegetation patterns – composition, distribution, and structure – in Lake Okeechobee's littoral zone marsh create challenges for successful snail kite utilization. Over the past 15 years the Florida Fish and Wildlife Conservation Commission and partner agencies have implemented various management strategies across approximately 16,000 ha of marsh, many with the goal to improve snail kite habitat. These vegetation management activities include: chemical herbicide treatment, prescribed fire, and organic sediment removal. Historically, Moonshine Bay was an approximately 4,000 ha spikerush *(Eleocharis cellulosa*) marsh and an important nesting area for snail kites. Over the past 40 years Moonshine Bay has transitioned into a densely vegetated cattail (*Typha* sp.) marsh as a result of eutrophication, water level stabilization, and reduction of fire frequency. Due to this transition, snail kite nesting has greatly reduced in the area since 1989. The objective of habitat management in Moonshine Bay is to reduce coverage of dense monotypic cattail stands and increase the coverage of spikerush. The targeted conditions provide improved snail kite foraging habitat which in turn should result in increased likelihood of successful nesting opportunities. In 2015, herbicide treatments and prescribed fire were conducted across thousands of acres in Moonshine Bay to increase spikerush coverage in the marsh. The 2016 snail kite nesting season on Okeechobee was possibly the most successful on record. Approximately 70% of all 2016 Lake Okeechobee nesting effort, more than 160 nests, with a preliminary success rate of 66% – was associated with 2015 vegetation treatments. Snail kite nesting in Moonshine Bay during 2016 appears to be a response to habitat management activities. The response of Snail Kites to habitat management efforts on Lake Okeechobee shows the value of conducting active management for endangered species and basing management decisions on historic site conditions.

CRAYFISHES OF THE FLORIDA NETHERWORLD

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Florida is home to 15 currently recognized taxa of cave crayfishes, more than any other state, and all but 2 are endemic to Florida. One species is found in Miami-Dade County and one in the Panhandle west of the Apalachicola River. The remaining 13 taxa are found in the region from Orlando north to the Georgia line and west to Tallahassee. Genetic data indicate that this fauna is derived from at least 4 separate invasions of Florida's cave and spring systems.

Poster Abstracts

CAUGHT BETWEEN A BOG AND A HARD PLACE: BOG TURTLE HOME RANGE ANALYSIS

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Radio telemetry has been widely used to monitor movement and behavior of a variety of wildlife species; however, little research has been done to analyze movements of the bog turtle (*Glyptemys muhlenbergii*). This critically endangered species has been declining because of urban development and invasive plant growth. However, evaluating movement and habitat preferences of bog turtles may lead to a solution to their decline and aid in conservation of other species suffering from similar issues. We used radio telemetry to track movements of 13 female bog turtles across three mountain bog sites in western North Carolina before, during, and after nesting to compare movement and home ranges across each of the sites. We calculated home range sizes as minimum convex polygons around telemetry points using ArcGIS. We used a non-parametric Kruskal Wallace test to investigate differences among turtles and among sites. The number of points per turtle ranged from 12 to 30 (mean = 20.846, SD = 5.771, median = 20). Home ranges varied in size from 797 m^2 to 9,060.5 m^2. Average home range size across the three sites was 3151.885 +/- 2653.199 m^2. Home range sizes were 4,931.7 m^2 +/- 3,680.854 m^2 (n = 5, median = 2,491.5 m^2), 1,965.083 m^2 +/- 929.2491 m^2 (n = 6, median = 1,708.25 m^2), and 2,262.75 m^2 +/- 300.8739 m^2 (n = 2, median = 2,262.75 m^2) for sites A, B, and C respectively. Home range sizes did not vary significantly among sites (x2 = 2.93, 2 DF, p = 0.23), though one site was dominated by pasture and the other two by scrub/shrub and woody wetlands. Our home range sizes were comparable to those from studies in Virginia and North Carolina, but much smaller than in Pennsylvania. In site A, one turtle attempted to cross a road but was killed by a vehicle, a result of habitat fragmentation. Two other turtles crossed roads and luckily survived. Understanding how and when bog turtles move may lessen the negative impact of urban development on this endangered species.

MOVEMENTS AND SURVIVORSHIP OF TRANSLOCATED NUISANCE AMERICAN CROCODILES (*CROCODYLUS ACUTUS*)

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The American crocodile (*Crocodylus acutus*) is one of only two native crocodilians in Florida (along with the American alligator) and is federally listed as threatened. Because of its intolerance of colder weather, its range is restricted to coastal areas in the southernmost parts of the state. Despite this limited range, crocodile populations have increased over the past decade, and the number of human/crocodile conflicts has increased considerably. To address these conflicts, the Florida Fish and Wildlife Conservation Commission (FWC) implemented a crocodile-human interaction response plan that allows for the translocation of nuisance crocodiles in some situations. However, the effectiveness of translocations has been questioned because some crocodiles return to their original capture site, requiring additional translocations. Also, the fate of translocated crocodiles that do not return is often not known. Managers want to know whether translocation is an effective means of managing the nuisance crocodile problem and whether it exposes crocodiles to factors that increase mortality. This study is designed to use satellite/GPS telemetry to compare the movements and survival of translocated nuisance crocodiles to non-nuisance reference crocodiles at recipient sites and other remote locations. Transmitters will be equipped with mortality signaling capabilities, which will help to identify the timing, locations, and sources of mortality. We will also compare habitat use, movements, and physical condition between translocated and non-translocated reference crocodiles. FWC managers will use this information to develop management strategies that minimize risks to translocated crocodiles and resident crocodiles in recipient sites, and reduce the probability of return.

PARADISE LOST? DO SANIBEL ISLAND'S INVASIVE AND NATIVE RODENTS DISPLACE ONE ANOTHER?

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The invasion of islands by non-native rodents is a leading cause of extinction among native species worldwide. Rice rat (*Oryzomys palustris sanibeli*) populations on Sanibel Island are in decline. Their conservation status is likely due to anthropogenic changes including fire suppression and altered hydrology. However, the introduction of exotic black rats (*Rattus rattus*) may also negatively affect rice rats. Additionally, hispid cotton rats (*Sigmodon hispidus insulicola*), a native sympatric species that is more than double the size of rice rats, may also alter rice rats' distributions. To understand how these species may be interacting, it is important to consider their ecological differences. Cotton rats are almost exclusively found in Sanibel's grasslands and occasionally in buttonwood forests, whereas black rats are more frequently encountered in mangrove and buttonwood forests. Rice rats are found in all three plant communities. Because their ranges overlap, and because both native species are candidates for listing under the Endangered Species Act, it is important to determine if these species are competing. To monitor distributions of each species, Sherman live-traps were set at 25 points on 36 grids. Grids were run for four consecutive nights in the summer and winter for three years starting summer 2015. We used an occupancy modeling framework to

determine if the presence of black rats or cotton rats influenced the occupancy probability of rice rats. Our analysis revealed that rice rats were not affected by cotton rat (phi confidence interval: -2.69 – 0.49) or black rat (phi confidence interval: -1.081 – 1.624) occupancy, as both confidence intervals contained zero. While these results indicate that cotton rats and black rats may not influence the spatial distribution of rice rats on Sanibel Island, these results do not address the potential for competition to influence spatio-temporal partitioning of limited resources. Future analyses will address this topic.

POPULATION GENETICS OF FLORIDA SEASIDE SPARROWS USING DDRADSEQ

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A central problem in conservation biology is properly identifying “at risk” populations to effectively preserve biodiversity and maintain a species’ ability to cope with changing environmental conditions. Taxonomic uncertainties can have serious ramifications on conservation prioritization, listing status, and in turn funding allocation that may be crucial to species survival. Currently, five recognized subspecies of seaside sparrow (*Ammodramus maritimus*) are resident in the marshes of Florida. Genetics studies in the late 1980’s revealed significant phylogenetic differences between gulf and Atlantic populations. However, relationships between Florida Gulf Coast subspecies of seaside sparrow are poorly understood and are currently based on distribution and weak morphological differences that have often been contradicted by molecular-based subspecies designations. In 2016, FWC initiated a genetics study to re-examine currently accepted subspecies delineations using modern high throughput sequencing techniques and to identify low variability, at risk subpopulations of seaside sparrow in Florida. We used the ddRADseq, a form of restriction site associated DNA sequencing to test the hypothesis that subspecies, currently based on traditional methods, do not correspond with sub-specific taxa formed by distinct evolutionary lineages from molecular analysis within the state of Florida. Preliminary data analysis from samples collected in 2016 suggest support of this hypothesis. Additional samples collected in summer 2017 will further clarify these relationships.

RANGE AND STATUS OF THE SPOTTED TURTLE (*CLEMMYS GUTTATA*) IN FLORIDA

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The spotted turtle (*Clemmys guttata*) is a Species of Greatest Conservation Need in Florida, where it reaches the southern periphery of its range. A 2015 report by the Endangered Species Coalition listed the spotted turtle among 10 U.S. species most threatened by habitat fragmentation, and in 2013 this species was petitioned for listing under the U.S. Endangered

Species Act. Spotted turtles have been documented from 15 counties in Florida, with most records limited to single specimens found on roads during March—May. The majority of documented sightings in Florida are from isolated wetlands within the St. John's River watershed, with scattered records south to Polk County and west to Wakulla County. Spotted turtles in Florida are both uncommon and cryptic, favoring a highly aquatic lifestyle, rarely basking or spending time upland. Since 2014, we have been using various survey methodologies (e.g., trapping, visual encounter surveys) and mark-recapture techniques at two North Florida sites. At site 1 we have marked 16 turtles and recaptured 18, and at site 2, we've marked 42 turtles with 26 recaptures. We are currently working with partners from Georgia to Maine incorporating standardized surveys to better understand the species' status and inform better conservation and management. We'll continue to collect demography data at our initial study sites in Florida, but we'll also initiate rapid assessments at historic or potential sites throughout the state. Have you seen a spotted turtle? Please report your sighting to spotted.turtle@myfwc.com.

DINNER FOR TWO: DO SANIBEL ISLAND'S NATIVE RODENTS PARTITION FOOD RESOURCES TEMPORALLY

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We examined the potential for interspecific competition by investigating spatial partitioning of two species native to Sanibel Island; the Sanibel Island rice rat (*Oryzomys palustris sanibeli*) and insular hispid cotton rat (*Sigmodon hispidus insulicola*). Cotton rat densities on Sanibel Island are a degree of magnitude greater than rice rat densities. The size of cotton rats may give them a competitive advantage over rice rats. However, the omnivorous habits of rice rats, as opposed to the herbivorous habits of cotton rats, may minimize niche overlap. Additionally, the semiaquatic nature of rice rats may result in minimal interference between these species. We placed two baited camera traps at each of 18 locations in freshwater wetlands dominated by sand cord grass (*Spartina bakeri*) to determine activity periods of each species. Cameras were active for four day periods during summer and winter of 2015. We extracted species, date, and time information from these photos for further analysis. We calculated time-to-encounter between the species and compared them to randomly assigned encounter times to determine if they deviated from a random distribution. This allowed us to investigate spatio-temporal avoidance. We did not find evidence of spatio-temporal avoidance ($p = 0.52$) during the first year of this study. However, due to lower than expected rice rat detection rates (observed at four of 18 locations in season one, and zero locations in season two) these results correspond to just a few individuals and may not represent the entire Sanibel Island rice rat population. To provide further insight into population-level spatio-temporal partitioning, we are currently processing and analyzing two additional years of data (four seasons). However, the sympatric nature of rice rats and cotton rats throughout their ranges may mean that they have developed other ways to minimize competition, including dietary changes.

MOBILE ACOUSTIC SURVEY DURATION, SEASONALITY, AND REPETITION INFLUENCE INFERENCES ON BAT ACTIVITY AND SPECIES RICHNESS

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Mobile acoustic surveys are commonly used to monitor trends in bat occurrence and activity over time. We set up an experiment to investigate 3 issues that may cause biases in data collected at a local scale through this survey approach: survey duration, season, and starting point repetition. Our objectives were to determine for our study area whether inferences on bat activity and species richness would vary according to the duration of our mobile surveys, the time of year we conducted them, or the starting location. We used Anabat II echolocation detectors coupled with ZCAIMs to record bat activity, with high mount microphones attached to the roofs of two vehicles. Each survey night, both vehicles surveyed the same 60 mile circular route, beginning simultaneously from one of two locations along the route (i.e., one vehicle always began the route at mile marker 0 and the other at mile marker 30). Both vehicles simultaneously surveyed the circular transect 3 nights/week in April, June, and August, which corresponds to peaks of pregnancy, lactation, and volant young in the area. We then used Kaleidoscope Pro software to objectively classify each high quality sequence of recorded echolocation calls to species. We detected most species expected in the region: *Eptesicus fuscus*, *Lasiurus borealis*, *Lasiurus intermedius*, *Lasiurus seminolus*, *Nycticeius humeralis*, *Perimyotis subflavus*, *Tadarida brasiliensis*. Activity levels of each species peaked at different times of night and varied among seasons. Number of species detected varied according to number of nights surveyed as well as starting location. Survey efficiency could be maximized by (1) limiting survey duration to the period extending from 30 min past sunset to 2 hrs past sunset, (2) surveying during peak lactation, and (3) varying survey transect start points. Overall, results suggest that survey duration, season, starting point repetition strongly influence inferences drawn from mobile acoustic surveys at the local scale, and highlight the importance of careful advance planning when designing long-term monitoring plans that expect to reliably estimate bat occurrence and activity through mobile surveys.

COMPARING THE DIFFERENCES IN STORMWATER FILTRATION, TEMPERATURE, AND RELATIVE HUMIDITY IN PINE FLATWOODS VS. SOLAR ARRAY

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The University of Central Florida (UCF) is proposing development of a forty-acre solar array within an actively managed, fire dependent mesic flatwoods ecosystem on the UCF Orlando campus. Functioning mesic flatwood ecosystems provide critical stormwater management

services to both UCF and the surrounding communities. The installation of the proposed solar array could alter the stormwater ecosystem services in this site through the removal of vegetation and compaction of soils. This study aims to compare the potential impacts to stormwater ecosystem services, with the benefits of the proposed solar array. Variables measured in this study will include stormwater filtration rates, evapotranspiration rates, temperature, and relative humidity. These variables will be measured in four sites of equal size on campus. Site treatments include (1) flatwoods burned in the previous six months, (2) flatwoods burned in the previous two years, (3) flatwoods with no fire, and (4) an existing solar array. Temperature and relative humidity will be measured using randomly placed data loggers at each site; field filtration rates will be measured using an infiltrometer and verified using the program iTree, which will also be used to calculate evapotranspiration at each site. It is expected that all variables will differ between the flatwoods sites and the solar array site, however they are not expected to differ among the flatwood sites. Benefits of solar energy have been studied extensively, but few studies have compared the associated costs of installation and maintenance of solar arrays to the impacts of habitat removal on ecosystem services.

THE EFFECT OF MICROPLASTIC BEADS ON THE CLEARANCE RATE OF CTENOPHORES (*MNEMIOPSIS LEIDYI*)

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Microplastics (>5 mm) are increasing in marine ecosystems and may pose threats to marine organisms, especially when ingested. *Mnemiopsis leidyi,* a species of ctenophore, is a key component of the marine food chain and a vital source of nutrition for larger organisms. We investigated the effect of microplastic beads (250-300 µm) on the clearance rate—the volume of water cleared of particles per unit time—by ctenophores. We set up three aquaria, each with 15L of filtered seawater, with the following: 1) control tank with prey only, 2) control tank with ctenophores (n=10) and prey, and 3) experimental tank with ctenophores (n=10), prey, and microplastic beads. This experiment was replicated four times. Prey (300 zooplankton/L) and microplastic bead (30 MpB/L) densities were both at ecologically relevant levels. We calculated the difference in clearance rates (by ctenophore volume) by comparing the control tank with ctenophores and prey to the experimental tank with ctenophores, prey, and microplastic beads. A Student's t-test was used to analyze the data. We also observed ctenophores ingesting and egesting microplastic beads throughout the experiment. The mean clearance rate of ctenophores exposed to prey and microplastic beads (38.4 mL [seawater] mL [ctenophore]$^{-1}$ hr^{-1} ± 11.83 SD) was significantly lower compared to those exposed to prey only (71.5 mL [seawater] mL [ctenophore]$^{-1}$ hr^{-1}± 14.95 SD) ($t[6]= 3.466$, $p = 0.013$). The mean clearance rate of ctenophores exposed to prey and microplastic beads was 46% lower than those exposed only to prey. The results of this study demonstrate the potential for

microplastics to negatively impact the total intake of food by ctenophores, thereby potentially decreasing nutrient intake. As important primary predators, ctenophores occupy a space towards the bottom of many marine food webs. Decreased food intake may reduce their nutritional value to consumers, resulting in increased levels of ctenophore consumption or decreased nutrient availability. Additionally, ctenophores that are consumed with ingested microplastic beads could contaminate larger marine organisms through bioaccumulation.

USING STABLE ISOTOPE RATIOS TO EVALUATE SEASONAL DIETARY BREADTH IN THE SANIBEL ISLAND RICE RAT

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The Sanibel Island rice rat (SIRR; *Oryzomys palustris sanibeli*) is a subspecies of marsh rice rat endemic to Sanibel Island, and is currently listed as a Species of Special Concern by the Florida Fish and Wildlife Conservation Commission. Rice rats inhabit Sanibel's interior freshwater marshes and exterior mangrove swamps, and seasonal movement between these areas is presumed. I examined stable isotope ratios ($^{13}C/^{12}C$ and $^{15}N/^{14}N$) of SIRR guard hair samples and samples of potential diet items to determine the influence of seasonality (summer or winter) and habitat utilization on trophic level and niche breadth. I used Levene's test for homogeneity of variance to test hypotheses regarding whether SIRR dietary niche breadth varied seasonally. Analysis showed that dietary niche breadth partially varied between summer and winter samples ($^{13}C/^{12}C$ p=0.068, $^{15}N/^{14}N$ p=0.018), showing that SIRR diet was more diverse during summer flood periods than during dry winter periods. Their dietary isotopic ratios were found to partly overlap with that of an animal prey base ($^{13}C/^{12}C$ p=0.065,$^{15}N/^{14}N$ p=0.042), but showed no overlap with a plant food base ($^{13}C/^{12}C$ p=0.001, $^{15}N/^{14}N$ p=0.01). These findings increase SIRR rank within the food web above that of primary consumers, and indicate that rice rats either (a) have more food sources during wet periods, or (b) greater movement during wet periods results in an increased dietary niche breadth, or both.

WHY SHOULD WE CARE ABOUT NONBREEDING SHOREBIRDS IN FLORIDA?

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Florida's coastal habitats are an essential stopover and wintering location for many migratory shorebird species. However, these populations face a suite of threats ranging from human disturbance to habitat loss. Little research has been conducted in Florida to understand the

effects of these threats on nonbreeding populations of shorebirds. Subsequently, few effective management actions are in place to protect these populations. As the human population of coastal Florida continues to grow and shorelines are threatened by sea-level rise, research into the migratory species that rely on these coastal areas is essential for informing management actions to address these evolving threats. Using two existing sight/resight datasets, we will estimate population parameters for piping plovers (*Charadrius melodus*) and the *rufa* subspecies of red knot (*Calidris canutus rufa*), two federally-listed shorebird species that occur along Florida coasts during their nonbreeding season. These species can spend only a few days at a stopover location or up to 75% of their year wintering in Florida. First, we will estimate survival and habitat use of piping plovers in the Florida Panhandle with respect to human use, habitat disturbance, and predator presence, using a sight/resight dataset collected by the U.S. Fish and Wildlife Service and the Florida Audubon Society during 2011-2017. Second, we will map *rufa* red knot distribution and movement patterns for greater Florida, using data collected across Florida by biologists and citizen scientists during 2008-2017. Florida's coastlines are a dynamic and increasingly threatened system that is relied on by migratory shorebirds for a few days to replenish energy stores, or for months of winter residence. Once concluded, this research will add to the knowledge of the threats that migratory shorebirds face in Florida, and allow for effective state-level management, and more holistic range-wide conservation efforts.

IT'S NO DAY AT THE BEACH: CHANGING NESTING HABITATS FOR LEAST TERNS IN FLORIDA

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Least terns have nested on flat tar-and-gravel roofs in Florida and other regions of the United States since the early 1950s. Habitat disturbance and loss has been implicated as the primary reason for this shift from the ground to roofs. It is estimated that currently about half of the nesting population of least terns in Florida are on gravel roofs. However, gravel roofs are being phased out in favor of newer materials which are not suitable for nesting. Simultaneously, the least tern's traditional nesting habitats continue to face pressure from human development and recreation. Possibly as a result, least terns have started nesting in non-traditional natural habitats, which are far removed from the Florida coastline or are exploiting artificial habitats such as abandoned bridges, gravel roads, and construction zones. Least terns have successfully nested and fledged young in all of these new types of habitats. The least tern's penchant for utilizing new habitats may prevent its extirpation in Florida and could provide wildlife managers more options to protect and recover the species. Nesting platforms, rafts, artificially created islands and spoil mounds are increasingly being used as alternate habitat for least terns.

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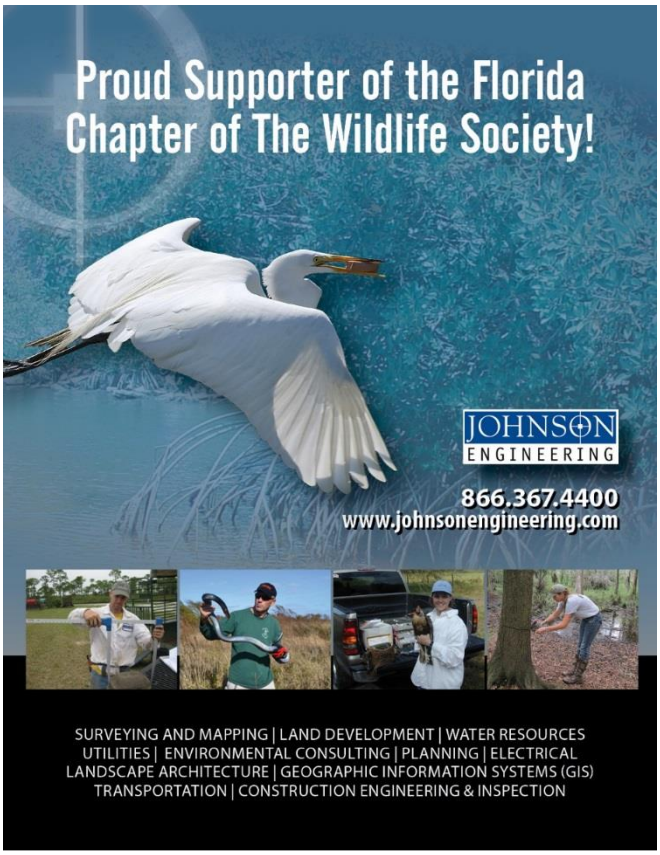

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