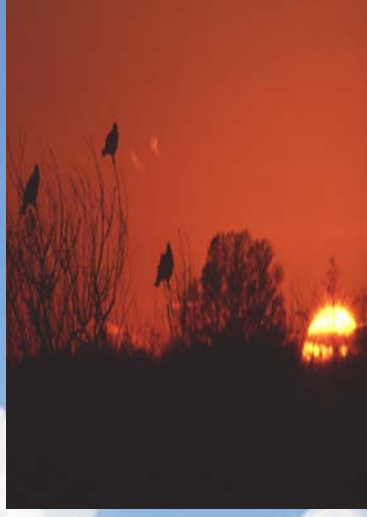
Florida Cooperative Fish and Wildlife Research Unit Annual Report January – December 2008



We dedicate this Annual Report to Dr. Wiley M. Kitchens

United States Department of the Interior
OFFICE OF THE SECRETARY
Washington, DC 20240

TAKE PRIDE IN AMERICA

CITATION

FOR MERITORIOUS SERVICE

WILEY M. KITCHENS

In recognition of his outstanding scientific and technical contributions to the U.S. Geological Survey (USGS) in wetlands ecosystem ecology and management.

Dr. Kitchens' ecology research has improved our understanding and management of significant elements of the Nation's wetland resources. His research career has been focused on resolving complex issues involving the impact of water management on fish and wildlife resources in large, generally degraded wetland landscapes. His works are models of multidisciplinary approaches to wetland system management, examining the complex interactions of biological species, habitats, hydrology and geomorphology. Because of Dr Kitchens' efforts to elucidate the ecological structure and function of tidal wetlands of the Savannah National Wildlife Refuge, the salinity regime of the estuary was restored for the largest remaining track of tidal fresh marsh along the East Coast. Because of his multidisciplinary background and wetland expertise, Dr. Kitchens was detailed to the Federal Taskforce planning the Restoration of the South Florida Ecosystem Initiative. In this role, he provided critical scientific leadership and authored key documents that were incorporated into the framework for the Everglades Restoration. More recently, he has conducted seminal research on the endangered Snail Kite, focusing on the consequences of hydrologic regimes and wetland habitat fragmentation to the Snail Kite. His investigations have helped to frame the issues and options for sustaining viable populations of Snail Kites in Florida, providing critical information to the U.S. Fish and Wildlife Service (USFWS) Multispecies Recovery Plan and elevating the Kite to the status of a system-wide performance measure of the success of the Everglades Restorations. Dr. Kitchens' work on Everglades and other wetland systems in Florida contributed importantly to the foundation for the multi-agency Greater Everglades Ecological Restoration Project and the USFWS Multispecies Recovery Plan for the South Florida Ecosystem. As an authority on wetland systems he has also provided briefings to the National Academy of Science to assist with their assessment of the efficacy of the Everglades' Restoration Plan and progress. For his outstanding contributions to the USGS, Dr. Wiley M. Kitchens, is granted the Meritorious Service Award of the Department of the Interior.

Timothy R. Petty
Acting Assistant Secretary for
Water and Science

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

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FLORIDA COOPERATIVE FISH AND WILDLIFE RESEARCH UNIT INTRODUCTION

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

Between 1979 and 2008, over 297 projects totaling more than $42.8 million were funded through the Unit. These projects covered a wide variety of fish, wildlife, and ecosystem subjects and have involved 49 line, affiliate, and adjunct faculty members as principal and co-principal investigators. Unit staff have their own research projects which accounted for about 1/3 of the total effort. Projects associated with the Unit have resulted in 389 publications, 104 technical reports, 89 theses and dissertations, and 155 presentations. Cooperation has been the Florida Unit's strength. As a Cooperative Research Unit of the U.S. Geological Survey, serves as a bridge among the principal cooperators, such as the University of Florida, the Florida Fish and Wildlife Conservation Commission (FFWCC), the U.S. Geological Survey (USGS), the U.S. Fish and Wildlife Service (FWS) and the community of state and federal conservation agencies and non-governmental organizations. Evidence of this role is the Unit's funding which has included contributions from FFWCC, 12 BRD research labs and centers, 12 offices within the USFWS Southeast Region, the University of Florida, U.S. Army Corps of Engineers, U.S. Navy, U.S. Department of Agriculture, U.S. Air Force, U.S. National Park Service, Environmental Protection Agency, St. Johns River Water Management District, South Florida Water Management District, U.S. AID, World Wildlife Fund, The Nature Conservancy, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, BRD, Florida Wildlife Federation, National Audubon Society, Florida Alligator Farmers' Association, American Alligator Farmers' Association, Florida Fur Trappers' Association, and other private contributions. Many Unit projects involve multiple investigators from several agencies. This cooperative interaction stimulates continuing involvement of funding sources, provides for student contacts with potential employers and agency perspectives, and directs transfer and application of research results.

RESEARCH MISSION STATEMENT

2008 Photo By: Dr. Margaret Lamont, FL CRU - Cape San Blas experiences one of the greatest rates of natural erosion in Florida. Built in 1875, this lighthouse keeper's house on Cape San Blas is almost victim of this erosion following Hurricane Earl in 1998. Coastal wildlife using this habitat must also respond to the extreme dynamics of this barrier island system.

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

UNIT COORDINATING COMMITTEE

Larry R. Arrington - Interim Vice President for Agriculture and Natural Resources, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, Florida.

Ken D. Haddad – Executive Director, Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida.

James W. Fleming - Southern Supervisor, Cooperative Research Units, U.S. Geological Survey, Biological Resources Division, Atlanta, Georgia.

Sam D. Hamilton - Regional Director, U.S. Fish and Wildlife Service Southeast Region, Atlanta, Georgia.

Donald F. McKenzie – Field Representative, Wildlife Management Institute, Ward, Arkansas.

BIOGRAPHICAL PROFILES OF UNIT SCIENTIST

H. Franklin Percival – Unit Leader, Courtesy Associate Professor, Department of Wildlife Ecology and Conservation and College of Natural Resources and the Environment at the University of Florida. His research interests lie in wetland wildlife, and have conducted long term collaborative projects on various aspects of alligator and migratory bird biology. He has teamed with geomaticists and aeronautical engineers to develop an unmanned aserial vehicle for assessment of wildlife populations and habitats. He has a special interest in natural resources administration, especially multidisciplinary, collaborative, and interagency research programs.

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

Wiley M. Kitchens – Assistant Unit Leader, Ecologist, Courtesy Professor, Department of Wildlife Ecology and Conservation. Dr. Kitchens' expertise is wetlands ecology with an emphasis on conservation and restoration of wetlands ecosystems. Given the restoration focus of his research, most of his projects are long-term, multidisciplinary, and targeted to resolving vegetation succession and faunal responses to hydrologic perturbations, both natural and anthropogenic. The approach generally involves identifying quantifying the factors that operate at multiple spatial and temporal scales in regulating ecologic structure and function of wetland ecosystems. In recent years, his research has focused on the Endangered Snail Kite, a wetland dependent species endemic to the Everglades and lacustrine wetlands of Central and South Florida. Given its endangered status and the generally perturbed state of these wetlands the approach has been to document population trends, demography, and movement patterns of the kites in response to habitat structure and quality in these wetlands. The overall goal is provide restoration managers information pertinent to the restoration of these systems.

AGENCY PERSONNEL CO-LOCATED WITHIN FLORIDA UNIT

Robert M. Dorazio – Research Statistician, Florida Integrated Science Center, USGS and Courtesy Associate Professor, Department of Statistics, University of Florida. He conducts scholarly research in the general areas of quantitative population dynamics, community ecology, and conservation biology. He develops and applies novel sampling designs and novel statistical models in quantitative investigations of exploited or imperiled fauna. He is also responsible for developing both theory and practice of adaptive natural resource management.

Fred A. Johnson – Research Wildlife Biologist, Florida Integrated Science Center, U.S. Geological Survey. His research focuses on the development and application of ecological theory, statistical modeling and estimation, and decision analysis in wildlife population and habitat management. His key responsibilities currently includes improving the adaptive-management protocols used by the U.S. Fish and Wildlife Service to regulate the take of migratory birds, developing optimal strategies for managing habitat for Florida scrub-jays, and provide training in decision analysis and adaptive management to ecological scientists and managers.

Elizabeth Martin – NBII Bird Conservation Node Manager, National Biological Information Infrastructure (NBII), U.S. Geological Survey, and PhD student, Department of Wildlife Ecology and Conservation, University of Florida. Her principal responsibility with NBII is management of the NBII Bird Conservation Node and coordination with partners to support development of web-based information products useful in management and conservation of North American birds. Her interests include the application of information technologies to avian conservation, and research on tradeoffs in resource use by migratory shorebirds.

COOPERATIVE UNIT PERSONNEL

Joan B. Hill, BA – Administrative Assistant, Florida Cooperative Fish and Wildlife Research Unit, Department of Wildlife Ecology and Conservation, University of Florida. Responsible for administrative details of $3.75M annual research program as well as supervision of staff; student activities, personnel, budgets, research work orders, contracts and grants within University, fiscal reports, travel, purchasing, payables, vehicles (State/Federal), website, and other related functions.

Amanda Burnett – Student Assistant, Florida Cooperative Fish and Wildlife Research Unit. Primarily responsible for visa card processes within the University financial system, The tracking and recording of spent funds on all grants and state funds. Maintains federal and state vehicle logs while maintaining DOI "Vroom" database for Florida Coop-Unit.

Jessica Gentry – Student Assistant, Florida Cooperative Fish and Wildlife Research Unit. Primarily responsible for greeting people coming into the CRU, manuscript processing, copying, filing, organizing of publications and data entry. Maintains database, and general office procedures.

COOPERATORS

University of Florida:

Michael S. Allen	Karen A. Bjorndal	Alan B. Bolten
Meghan Brennan	Mary Christman	Robert M. Cubert
Bon A. Dewitt	Peter C. Frederick	Bill Guiliano
Jeff Hostetler	Peter G. Ifju	Elliott R. Jacobson
Susan Jacobson	Steven Johnson	Linda Young
Michael Kane	Paul A. Klein	Ramon Littel
Frank Mazzotti	Martha C Monroe	Madan Oli
William (Bill) Pine	Brett Presnell	Carlos H. Romero
J. Perran Ross	Scot E. Smith	Marilyn G. Spalding
A. Abd-Elraham	Aaron Higer	Mark Hostetler
Nancy Denslow	Nancy Szabo	Robert Fletcher
Mark Clark	Todd Osborne	Scott Smith
Peter Ifju	Matthew J. Cohen	Ahmed Mohamed
Leda Kobziar	Carrie Reinhart-Adams	

St. Johns Water Management District:

Roxanne Conrow	James Peterson	Mike Coveney
Steven Miller		

Florida Fish and Wildlife Conservation Commission:

Joe Benedict	Joan Berish	Tim Breault
Larry Campbell	Dwayne A. Carbonneau	Harry J. Dutton
Cameron Carter	Patrick Delay	Rio Throm
Jim Estes	Chris Fonnesbeck	Tommy C. Hines
Richard Kiltie	Paul Kubilis	Henry Norris
Tim O'Meara	Stephen W. Rockwood	Scott Sanders
Lawson Snyder	Nick Wiley	Blair Witherington
Arnold Brunell	Janell Brush	Allan R. Woodward
Ron Hight	Rebeca Hayman	

U.S. Geological Survey:

Beverly Arnold	G. Ronnie Best	Jaime A. Collazo
Paul Conrads	Fred Johnson	Donald L. DeAngelis
Robert M. Dorazio	Michael Conroy	Tara Y. Henrichon
James Hines	Jeff Keay	William Kendall
Suzette Kimball	Lynn W. Lefebvre	Cynthia S. Loftin
Elizabeth Martin	Kelly McDonald	Clinton Moore
James D. Nichols	Kenneth G. Rice	Michael Runge
John Sauer	Daniel Slone	James Williams
Pamela Telis	Kenneth Williams	William L. Kendell
Amy Teague	Catherine Langtimm	

U.S. Fish and Wildlife Service:

Jon Andrew	Robert Blohm	Laura Brandt
Ed Eudaly	Chuck Hunter	Heather Tipton
Mark D. Koneff	Mike Legare	Fred Martin
Mark Musaus	Lorna Patrick	John Robinette
Russell Webb	Kathy Whaley	Paul Tritaik
Sandra Sneckenberger	Michael Jennings	Heath Rauschenberger
John Kasbohm	Shannon Ludwig	Paul Souza

Wofford College:	U.S. Air Force	U.S. Parks Service
Clarence L. Abercrombie	Bruce Hagedorn	Leonard Pearlstine
	Bob Miller	

University of Central Florida	University of West Florida	University of New Orleans
Llewellyn M. Ehrhart	Phillip C. Darby	Julie Whitbeck
Dean Bagley		

Dynamac Corporation	U.S. Army Corps of Engineers	William Zattau
Eric D. Stolen	William D. Meyer	Larry Taylor
David Breininger	Jon Lane	Paul Stodola

Environmental Project:	Others:	
Ritchie H. Moretti	Howard K. Suzuki	John Wooding
Sue A. Schaf	Lovett E. Williams	Ralph Dimmick

RESEARCH PERSONNEL

Post-Doctoral Associates

Margaret Lamont	Mark Miller	Paul Wetzel
Julien Martin	Christa Zweig	

Biologist

Matthew Burgess	Mike Cherkiss	Jemeema Carrigan
Adam Watts		

Ph.D Students

Sadie S. Coberley	Kathryn A. Garland	Fred Johnson
Christopher Cattau	Julie A. Heath	Holly J. Johnson
Taewoo Kim	Joyce L. Merritt	Adam Watts
Kristen Candelora	Mario Mota	Christa Zweig
Sara R. Gonzalez	Elizabeth Martin	Zachariah C. Welch
Ikuko Fujisaki	Mark Miller	

M.S. Students

Melanie A. Craig	Michelle Casler	Jenny Ketterlin
Melissa DeSa	Martha L. Maglothin	Kristianna Lindgren
James J. Berg	Andrea Bowling	Aletris Neils
Kyle Pias	Linda K. Dance	Jesse Senko
Christopher Bugbee	Lara Drizd	Brad Shoger
Kristen Candelora	Althea Hotaling	Brian Reichert
Cameron Carter	Brian M. Jeffery	Michelle Casler

Students and Personnel

Full Name: Adam Betuel (Field Tech)
Degree sought:
Graduation Date:
Research: Data collection on Wildlife Usage and Habitat Development on Spoil Islands in Lake Tohopekaliqa, Florida.

Full Name: Chad Anderson (Field Tech)
Degree sought:
Graduation Date:
Research: Snail Kite Survey and Monitoring.

Full Name: Andrea Bowling
Degree sought: M.S. Wildlife, Ecology, and Conservation
Graduation Date: December 2008
Research: Dispersal of juvenile snail kites across an increasingly degraded landscape.

Full Name: Suzanne Boxman (Field Tech)
Degree sought:
Graduation Date:
Research: Unmanned Aerial Vehicle (UAV) project.

Full Name: Matthew Burgess (Wildlife Ecologist)
Degree sought:
Graduate Date:
Research: Unmanned Aircraft Systems research project.

Full Name: Amanda S. Burnett
Degree sought: B.A. Wildlife Ecology and Conservation
Graduate Date: May 2012
Research: Currently assists in FL Cooperative Unit Office of Administration

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Full Name: Emily Butler (Field Tech)
Degree sought:
Graduate Date:
Research: Snail kite surveying and banding.

Full Name: Jemeema Carrigan
Degree sought: Wildlife Biologist (work title)
Graduation Date:
Research: Collects morphometric data on the American Crocodile, conducts nesting surveys, and collects data on juvenile growth and survival for the American Crocodile monitoring and assessment program (MAP)

Full Name: Michelle Casler
Degree sought: M.S.
Graduation Date: May 2008
Research: Looking at how hydroperiod and landscape characteristics affect anuran species richness in Big Cypress National Preserve and Everglades National Park.

Full Name: Chris Cattau
Degree sought: PhD Wetland Ecology
Graduation Date: December 2012
Research: Demography and Movement of the Snail Kite

Full Name: Mike Cherkiss
Degree sought: Work Title –Wildlife Biologist
Graduation Date:
Research: Project manager for the American crocodile monitoring and assessment program, collects morphometric data on the American Crocodile, conducts nesting surveys, and collects data on juvenile growth and survival (MAP).

Full Name: Melissa Ann DeSa
Degree sought: M.S. Interdisciplinary Exology
Graduation Date: December 2008
Research: Herpetofaunal and Fish Response to Lake Management on Lake Tohopekaliga, FL

Full Name: Lori Drizd
Degree sought: M.S. Wildlife Ecology and Conservation
Graduation Date: May 2010
Research: S. Florida vegetation (hydrilla) by apple snails in Lake Toho.

Full Name: Carolyn M. Enloe (Field Tech)
Degree sought:
Research: Project Leader Spoil Island project. Conducts herptofaunal, vegetation and avian community monitoring projects on large and small lakes throughout Florida.

Full Name: Ikuko Fujisaki
Degree sought: Statistician (work title)
Graduation Date:
Research: Analyzes American Alligator body condition for the American Alligator monitoring and assessment program (MAP).

Full Name: Kathryn Garland
Degree sought: PhD Wildlife Ecology and Conservation- Human Dimensions focus
Graduation Date: May 2010
Research: Title of Dissertation Research-
A Taste for Turtles: Green Turtle (Chelonia mydas) Consumption in Caribbean Nicaragua. This study involves social research looking at the conditions behind sea turtle consumptive use in Latin America.

Full Name: Wellington Guzman
Degree sought: Wildlife Biologist (work title)
Graduation Date:
Research: Collects morphometric data on the American Alligator for the American Alligator monitoring and assessment program (MAP)

Full Name: Rebecca Blair Hayman
Degree sought: M.S. Wildlife Ecology and Conservation
Graduation Date: December 2009
Research Blurb: To gauge current opinions, knowledge, and risk perceptions of American alligators. Compare changes in knowledge, attitudes, and variations relative to an earlier survey conducted in 1996. This work is in cooperation with FL FWCC and information gained will shape state management decision regarding alligators.

Full Name: Althea Hotaling
Degree sought: M.S.
Graduation Date: December 2008
Research: Project Leader of the Endangered and Illusive Vole Locating & Habitat Monitoring at Lower Suwannee National Wildlife Refuge.

Full Name: Spencer Ingley (Field Tech)
Degree sought: Undergraduate Wildlife Ecology and Conservation
Graduation Date: May 2010
Research: Unmanned Aerial Vehicle

Full Name: Brian Jeffrey
Degree sought: MS in Interdisciplinary Ecology
Graduation Date: May 2009
Research: Looking at the impact of off-road vehicles on the small mammal populations in Big Cypress National Preserve

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Full Name: Margaret Lamont, PhD
Degree sought:
Graduation Date: Post-Doctoral Associate with Dr. Carthy Research: My research involves examining how coastal species, such as sea turtles and shorebirds, are affected by natural and anthropogenic dynamics of barrier island systems.

Full Name: Elizabeth Martin
Degree sought: PhD Wildlife Ecology and Conservation
Graduation Date: December 2008
Research: Predation risk from diurnal raptors and effects on habitat use and foraging behavior of wintering Dunlin (Calidris alpine) at Merritt Island National Wildlife Refuge in Florida.

Full Name: Mark Miller
Degree sought: PhD
Graduation Date:
Research: Analyzes juvenile American Crocodile growth and survival data for the American crocodile monitoring and assessment program (MAP)

Full Name: Mario J. Mota
Degree sought: PhD
Graduation Date: May 2009
Research: Sea Turtle Nesting

Name: Jean Olbert (Field Tech)
Degree sought:
Graduation Date:
Research: Snail kite crew leader. Responsible for supervision, planning, surveying, banding, trapping birds as well as data entry, operating and maintaining airboats.

Full Name: Danielle Ogurcak
Degree sought: Wildlife Biologist (work title)
Graduation Date:
Research: Collects vegetative data for the American Alligator hole, distribution, and occupancy project.

Full Name: Mark Parry
Degree sought: Wildlife Biologist (work title)
Graduation Date:
Research: Collects morphometric data on the American Crocodile, conducts nesting surveys, and collects data on juvenile growth and survival for the American Crocodile monitoring and assessment program (MAP)

Full Name: Kyle E. Pias
Degree sought: M.S. Wildlife Ecology and Conservation
Graduation Date: December 2011
Research: Snail kite monitoring, habitat use of breeding snail kites.

Full Name: Brian E. Reichert
Degree sought: M.S.
Graduation Date: December 2009
Research: Snail kit monitoring of population demographics; exploring senescence and other aspects of survival.

Full Name: Mike Rochford
Degree sought: Wildlife Biologist (work title)
Research: Collects morphometric data on the American Alligator for the American Alligator monitoring and assessment program (MAP).

Full Name: Kimberly E. Schmidt (Field Tech)
Degree sought:
Graduation Date:
Research: Snail kite and apple snail monitoring.

Full Name: Amy Schwarzer
Degree sought: M.S.
Graduation Date: December 2010
Research: Body condition and pray selection of wintering and migratory Red Knots in Florida.

Full Name: Jesse Senko
Degree sought: M.S.
Graduation Date: December 2010
Research: Fin-scale movements and activity patterns of black turtles at a coastal foraging ground in Baja, California, Sur Mexico.

Full Name: Bradley Noal Shoger
Degree sought: M.S. Wildlife Ecology and Conservation
Graduation Date: December 2009
Research: Project lead in wildlife use of created Spoil Islands in Lake Tohopekaliga, FL.

Full Name: Jennifer Solis (Field Tech)
Degree sought:
Graduation Date:
Research: Conducts surveys for sea turtle nests along 8-km stretch of Archie Carr Nat'l Wildlife Refuge. Identifies nest to species and collects data and hatching success.

Full Name: Frank Solis (Field Tech)
Degree sought:
Graduation Date:
Research: Conducts surveys for assessment of coastal habitats and species impacted by hurricanes.

Full Name: Rio Throm (Field Tech)
Degree sought:
Graduation Date:
Research: Surveys in amphibian visual encounter and vocalization at Lake Apopka, FL

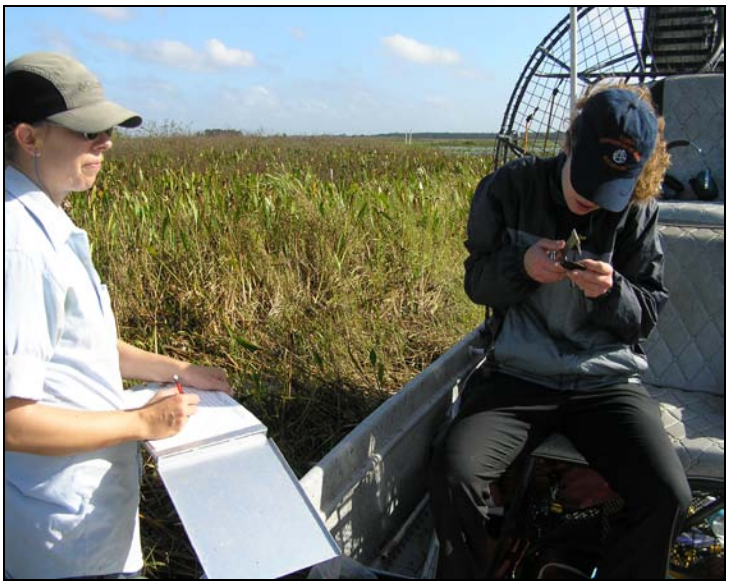
Full Name: Adam Watts
Degree sought: PhD
Graduation Date: December 2012
Research: Climate change and fire ecology

Full Name: Michelle Wcisle (Field Tech)
Degree sought:
Graduation Date:
Research: Turtle Nesting & Monitoring

Full Name: Zachariah C. Welch
Degree sought: PhD
Graduation Date: December 2009
Research: Restoring pattern without process: Lake restoration in an urban environment.

Full Name: Christa Zweig
Degree sought: PhD Wildlife Ecology and Conservation
Graduation Date: December 2008
Research: I am tracking changes in vegetation communities in WCA 3A and creating a model to predict community change under different hydrologic regimes.

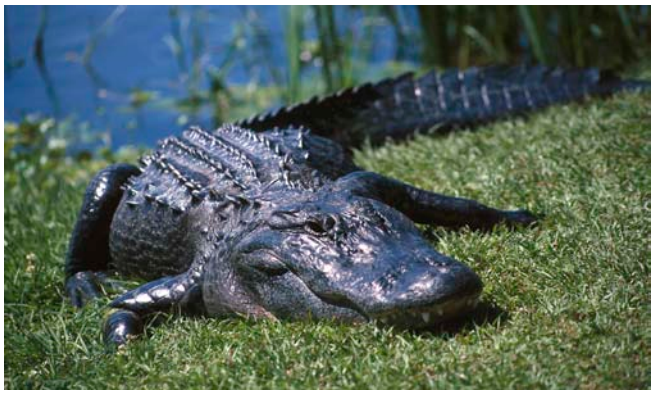
CURRENT PROJECTS
CO-OP UNIT AND BEYOND…



Sea Oats

COOPERATIVE RESEARCH

Unmanned Aerial Vehicle



American Alligator

Taking data……

Snail Kite Population Studies: Demography, Population Trends, and Dispersal Relative to Environmental Correlates, and Habitat Studies

Principal Investigator: **Wiley M Kitchens**
Funding Agency: USACE / U.S. Geological Survey
Expected Completion: 2/28/2008

The snail kite (*Rostrhamus sociabilis*) is an endangered raptor se distribution in the United States stricted to the South Florida Eco- System including watersheds of the Everglades, Lake Okeechobee, Kissimmee River, and Upper St. Johns River. Because snail kites feed almost excllusively on one species of aquatic snail, their survival depends directly on the hydrologic functioning of the wetlands associated with these watersheds. Although other endangered species Occur within this ecosystem, snail kites probably are the only species whose range both encompasses and is exclusively restricted to this ecosystem. Its population viability is therefore directly dependant on the hydrological/ecological condition and functioning of the entire network of wetlands with this ecosystem. Current data indicate the population is again in a steep decline. Estimates indicate the population has decreased by one-half (3400 to 1700 birds) in the past 4 years (since 1999). Aside from the studies that follow, there are currently no other systematic monitoring of snail kites in Florida.

Most researchers suggest declines in kite populations in the past several decades are correlated with changes in hydrology directly or indirectly. These include loss of habitat, both in terms of quality and spatial extent. These include changes in foraging and nesting habitat; effects on reproduction parameters; and adult and juvenile survival of snail kites. Population and survival responses to restoration activities will reflect the success of recovering the quality and spatial extent of the wetland ecosystem to the conditions required to support a viable nail kite population.

The current and future efforts will remain based on mark-re-sighting techniques. In contrast to the annual survey previously used, this technique has a long and solid statistical foundation for estimating survival and population size. However, given the declining numbers of birds banded, it has become critical to augment the mark-resight with radio-telemetry approaches to maintain integrity and robustness of statistical analyses. Given the very low reproductive rate observed in the recent years, the sample size of young birds marked is largely decreasing which is weakening our capacity to provide precise survival estimates. It is consequently essential to increase the probability of detection (by using radio telemetry), in order to compensate for this loss in precision. The following projects involve snail kite research but, funded differently:

Surveys of Snail Kite Breeding and Habitat Use in the Upper St. Johns River Basin

Principal Investigator: **Wiley M Kitchens**
Funding Agency: St. Johns River Water Management District
Expected Completion: 2/28/2008 (PJ#71241)
Graduate Students: Andrea Bowling
Field Technicians: Brian Reichert, Kyle Pias

Continued Snail Kite Monitoring Studies: Demographic, Population Growth, Extinction and Movement Parameters

Principal Investigator: **Wiley M Kitchens**
Funding Agency: U.S. Fish and Wildlife Service
Expected Completion: 3/30/2008 (PJ #66733)
Graduate Students: Brian Reichert, Chris Cattau, Andrea Bowling
Field Technicians: Brian Reichert

Radio Telemetry and Mark-Recapture Studies of Demographic, Movement and Population Dynamics of the Endangered Snail Kite

Principal Investigator: **Wiley M Kitchens**
Funding Agency: U.S. Army Corps of Engineers / U.S. Geological Survey
Expected Completion: 6/30/2008 (PJ #71123)
Graduate Students: Chris Cattau, Andrea Bowling, Brian Reichert
Field Technicians:

The snail kite (*Rostrhamus sociabilis*) is an endangered raptor whose distribution in the United States is restricted to the South Florida Ecosystem including watersheds of the Everglades, Lake Okeechobee, Kissimmee River, and Upper St. Johns River. In addition to being endangered, it is an obligate wetland-dependent species feeding almost exclusively on one species of aquatic snail, the apple snail (*Pomacea paludosa*). The viability of the kite in the United States is therefore dependent on the hydrologic conditions (both long and short-term) appropriate for maintaining snails in sufficient quantities and densities in the vegetation communities that provide foraging and nesting habitats across the region. Over half of the wetlands within central and southern Florida have been lost during the past century, and those that remain have been highly fragmented and severely degraded (Weaver et al. 1994). The impacts to kites constitute a major concern to restoration efforts now underway for the South Florida Ecosystem.

The objective of this continuing research is to monitor the birds' response to environmental changes (anthropogenic and natural). This research essentially focuses on the most critical demographic parameters: survival, reproduction, recruitment, and population growth rate (Bennetts et al. 1999, Bennetts and Kitchens 1999, Dreitz et al. 2001, Bennetts et al. 2002, Dreitz et al. 2002). Because those demographic parameters are heavily influenced by the behavior of the birds (i.e. their ability to move and select suitable habitats), movement studies constitute the other major aspect of the research. We have two over-arching objectives: 1) to evaluate the underlying mechanisms and processes driving the population dynamics of the kites; 2) to provide reliable estimates of demographic parameters and movement probabilities. The intent is to provide this information on demography, population status and movement strategies to responsible agencies for support in management decisions, in particular regarding water management.

This proposal is intended to contribute or augment the movement and demographic studies currently underway as well as focusing more specifically of the fate of juvenile kites originating from Lake Toho. The duration of the study suggested in this proposal is 3 years. The broader study begins November, 2007 and continues through November, 2010. For the telemetry studies (Lake Toho, principally), juvenile birds will be captured and equipped with radio transmitters. The aircraft surveys to locate radioed birds will commence in March 2008 and continue through April 2010 as a seasonal survey (~15 hrs/ season). The number of birds captured, locations, status and gender will be summarized in each of the 3 progress reports prepared annually (June 1, 2008, 2009, and 2010).

To Document Floral and Faunal Succession Following Alternative Habitat Restoration Techniques in a Large Central Florida LakeTohopekaliga

Principal Investigator: **Wiley M Kitchens**
Funding Agency: Florida Fish and Wildlife Conservation Commission
Expected Completion: 12/31/2008 (PJ#68576)
Graduate Students: Melissa DeSa, Zach Welch
Field Technicians: Carolyn Enloe, Brad Shoger, Amy Schwarzer

To enhance/restore fishery production in Florida lakes with documented declining fishery habitat, the Florida Fish and Wildlife Conservation Commission (FWC) recently embarked on an initiative to identify those resources which would best respond to restorative treatments. The goal of this effort is to recover the habitat quality and fishery production of the littoral reaches of approximately 30 lakes over the next 20 years. The resulting enhancement projects would typically include: extreme drawdowns, organic sediment removal, minimization of cattail and tussock habitats, creation of upland and in-lake spoil deposits, reestablishment of desirable native aquatic vegetation, and aggressive vegetation management.

While the benefits to Florida fishery resources associated with periodic extreme drawdowns have been documented for more than 30 years, it is known that accrued benefits are time-limited, generally less than 10 years. In an attempt to hasten habitat enhancement and extend the time periods between requisite drawdowns, the FWC initiated a program of mechanically removing tussocks and associated organics during planned drawdown periods as well as fortuitous unscheduled natural drawdowns. The apparent success of this combined drawdown and muck removal procedure for fishery habitat enhancement in demonstration projects has made this technique the preferred enhancement alternative. While these projects have unquestionably resulted in immediate and dramatic increases in short-term fish production, impacts on other resources are less well documented. Only cursory or speculative information is available regarding long-term effectiveness or overall impacts of current restoration techniques on wildlife resources. To date, there have been too few experimental trials to properly evaluate various vegetation responses to mechanical bottom scraping.

SUMMARY**:**
The effects of large-scale enhancement projects that include extreme drawdowns, organic sediment removal and aggressive herbicide application have not been well documented in terms of long-term habitat recovery or wildlife usage. This project provides detailed descriptions of pre-enhancement communities and documents their response up to four years post-treatment. Results can be found in the final report submitted to FFWCC in September, 2008.

Wildlife Usage and Habitat Development on Spoil Islands in Lake Tohopekaliga, Florida

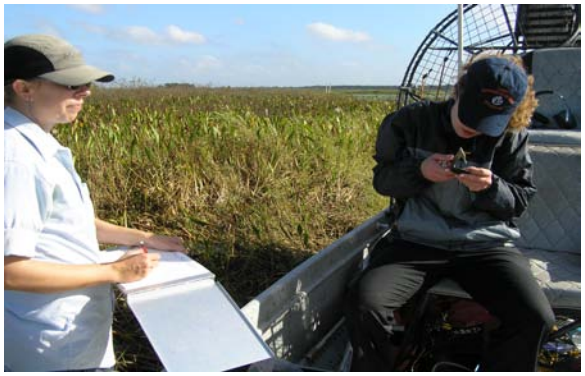


Photo: Amy Schwarzer and Carolyn Enloe, FL Coop-Unit Students measuring & recording.data.

Principal Investigator: Wiley M. Kitchens
Funding Agency: Florida Fish and Wildlife Conservation Commission
Expected completion: August 2009 (PJ #61029)
Field Technicians*:* Melissa DeSa, Carolyn Enloe, Brad Shoger, Amy Schwarzer, Jonathan Chandler,

Following the extreme draw-down and muck Removal project of 2004 conducted by the Florida Fish and Wildlife Conservation Commission (FWC) on Lake Tohopekaliga, several in-lake "wildlife islands" were created by stockpiling Scraped spoil materials. Although the preferred method of disposal includes moving severed materials outside the lake basin, limited availability of disposal in nearby upland settings and cost prohibitive expenses for trucking the materials long distances resulted in in-lake stockpiles of some materials. Artificially created islands such as these have been documented as having some benefits to wildlife (Chaney et al. 1978, Landin and Newling 1987, Yozzo et al. 2004, Hulon et al. 1998). Although much research has been done on coastal islands that offer sea bird refuge, very little is known about the habitat value and wildlife usage of freshwater lake islands such as these. By monitoring and documenting the dynamics of the floral and faunal communities present on these islands, we anticipate being able to relate island characteristics including shape, size, grazing, and proximity to shore with wildlife usage and habitat development through time. The intent is to make inferences on what particular island attributes are attractive to wildlife.

OBJECTIVES:
1) Document and describe wildlife occurrence and associated activities on select spoil islands in Lake Tohopekaliga.
2) Document and describe vegetation present on select islands and follow succession throughout the study period.
3) Relate wildlife occurrence to various island characteristics and attempt to elucidate associations. Avian, herpetofauanal, small mammal, and vegetation surveys will be conducted on all islands.

PROGRESS:
The pilot phase of the project came to an end over the summer 2007. Vegetation was surveyed at each island in July 2007 and avian, herpetofaunal, and small mammal surveying techniques were decided upon and initiated in September 2007. Two new field technicians were hired in August and September respectively. Data is currently being analyzed for the January report.

The protocol for vegetation surveys consists of two perpendicular belt transects bisecting each island. The transects face N-S and E-W respectively and cover the full topography of the island. Transects are marked with 2 inch PVC poles placed at 10m intervals. A 1 meter squared quadrat is used to identify species occurrence along the entire transect. At each 10m interval, a diagonal ½ inch PVC with markings every 5cm is laid across the quadrat to determine percent cover.

The herpetofaunal and small mammal sampling is conducted using a single drift fence array located on the lakeward portion of the island. The array is set up as a Y with two legs on the sloped and littoral portion of the island and one leg jutting into the upland. Each leg consists of 15m of industrial silt fencing and wooden stakes. 3 double-ended funnel traps, made with window screening, are placed along each side of each leg of the fence at 5m intervals thus giving 18 funnel traps per array. In addition, baited Sherman traps are placed on the upland leg in between the funnel traps and either side of the slope legs, above water line, giving 8 Sherman traps per array. The traps are run for 4 days per month and checked daily. All captures are identified to species, counted, and weighed before being released at the site of capture. Different arrangements of small mammal traps are being looked at to better sample the community.

Demographic, Movement, and Habitat of the Endangered Snail Kite in Response to Operational Plans in Water Conservation.

Principal Investigator: Wiley M. Kitchens
Funding Agency: USGS/Army Corps of Engineers
Expected Completion: 3/31/2010 (UFPJ#00073318)
Research Staff: B. Reichert, C. Cattau, K. Pias, E. Butler, J. Olbert, A. Bowling

Recent demographic analyses indicate alarming trends in the snail kite population in Florida. Kite abundance drastically and steadily declined between 1999 and 2003 and again between 2006 and 2008. The population size estimate for has approximately halved from 2006 to 2008 (1204 in 2006 to 685 in 2008). Our results suggest that the lack of recovery after 2002 is probably due to a reduction in recruitment, which has not shown any indication of changing. There were major droughts in the study area (Water Years 00/01 and 06/07) that negatively impacted both adult and juvenile survival. In addition, there are numerous hydrological management activities in the system that may well be affecting kite reproduction. Lake Okeechobee, one of the productive breeding sites of the system between 1985 and 1995, has undergone radical changes in its' hydrological schedule since 1996 and almost no fledging birds have been produced from this site since 1996. In addition, there have been major lake enhancements (draw downs) and extensive aquatic weed control activities in the Kissimmee Chain of Lakes and water level schedule changes in the in Water Conservation Area 3A (the prime reproductive unit for kites).

Excluding the drought impacted years, adult annual survival has been approximately 90% throughout the study period. This would tend to negate arguments of disease being a major causative factor for the declines. Given adult survival is relatively high and stable, reproduction and recruitment become particularly important to stemming the perceived declines. PVA models indicate that the lack of recruitment is critical both stemming of this decline and achieving a more sustainable population growth rate.

OBJECTIVES:
The snail kite (*Rostrhamus sociabilis*) is an endangered raptor whose distribution in the United States is restricted to the South Florida Ecosystem including watersheds of the Everglades, Lake Okeechobee, Kissimmee River, and Upper St. Johns River. Human-induced degradation of the hydrologic functioning of these watersheds has prompted large-scale restoration efforts (e.g. the Central and South Florida Project Restudy, Kissimmee River Restoration, and the South Florida Ecosystem Restoration Initiative).

During the first half of this century, snail kite populations declined dramatically. More recently, since the mid-1960's the population appeared to stabilize and perhaps even increase. However, our recent studies suggest the population is currently undergoing an alarming declining phase. The population size appears to have progressively and substantially decreased since 1999. The population in 2003 was estimated to be half its estimated size in 1999. The altered hydrology of wetlands representing its critical habitat is probably the primary environmental influence on the population. These include loss of habitat and changes in foraging and nesting habitat structure.

The objective of this research is to monitor the birds' response to environmental changes (anthropogenic and natural) focusing on the most critical demographic parameters: survival, reproduction, recruitment, and population growth rate. Because those demographic parameters are heavily influenced by the behavior of the birds (i.e. their ability to move and select suitable habitats), movement studies constitute the other major aspect of the research. There are 2 overarching objectives: 1) to evaluate the underlying mechanisms and processes driving the population dynamics of the kites; 2) to provide reliable estimates of demographic parameters and movement probabilities to upgrade management models to optimize management decisions.

PROGRESS:
This study is complementary to the demographic study entitled "Demographic, movement, and habitat studies of the endangered snail kite in response to hydrological changes". .

Our radio telemetry study conducted in 1992 to 1995 helped identify the critical kite habitat. However given the dynamics of those habitats (changes in hydrology, plant communities), it is reasonable to expect some spatial shifts in the use of those habitats after more than 8 years (for instance large number of kites used Lake Okeechobee

between 1992 and 1994, but stop using this area after 1995). Radio telemetry is the most efficient if not only way to track those changes.

Mark-recapture models provide a powerful framework for estimating critical demographic (survival, population growth rate) and movement parameters. The recent advances in modeling allow for the combination of mark recapture and radio telemetry information, providing better estimates of survival and movement rates, and increasing power of statistical inferences (Williams et al 2002, Nasution et al. 2001).

Senescence is defined as an increasing intrinsic rate of death, and is common among wild populations. By utilizing the long-term band-resight dataset, which began in 1976, we are able to identify senescence rates among the aging cohorts of the snail kite population. Understanding how severe environmental conditions (such as droughts) disproportionally impact the survival probabilities of older snail kites will help to refine vital rates that are critical to our monitoring efforts.

SUMMARY:
Very little is known about the extent of a numerical versus behavioral response of the snail kite to a disturbance event (such as a drought). Radio telemetry is the only way to assess the ability for the bird to resist a regional drying event. Further, it enables determination of the factors which are generating movement patterns such as patch size, distance between patches, and the carrying capacity of a specific wetland. This is particularly interesting when considering the effect of fragmentation on the dispersal abilities of the kites, as fragmentation typically reduce patch size and increases the linear distance between patches.

Assessing the Effects of Coastline Alteration on Sea Turtle Nesting and Faunal Assemblages at Cape San Blas, Florida

Principal Investigator: Raymond R. Carthy
Co-Principal Investigator: Margaret Lamont
Funding Agency: U.S. Department of Defense/Eglin Air Force Base
Expected Completion: 03/31/2009 (UF59990)
Graduate Students: Russell Scarpino
Field Technicians: Celeste Warner, Jennifer Solis, Frank Solis, Michelle Wcisel, Lori Brinn

Photo By: M. Lamont, PhD - ***Built in 1875, this lighthouse keeper's house on Cape San Blas is almost victim of this erosion following Hurricane Earl in 1998***

The Eglin Air Force Base (EAFB) property on Cape San Blas and St. Joseph Bay represent important nesting and developmental habitats for threatened and endangered marine turtles. Since 1998, the Florida Coop Unit has maintained a tagging and research program on the nesting turtle population on Cape San Blas, and in 2001 we began a study of the juvenile loggerhead, green and Kemp's ridley turtles that use St. Joseph Bay as a temporary nursery area. The highly dynamic coastline of Cape San Blas is receiving additional stress from Florida's rapid population growth: coastal residential and commercial development are encroaching on the beaches and increasing recreational

use of the area. The current work continues to build our long-term dataset through saturation tagging in an effort to examine effects of coastal erosion and accretion and elucidate habitat use by juvenile turtles.

OBJECTIVES:
The objectives of this project are to elucidate specific components of sea turtle ecology and interactions with humans:

1. Adult habitat use- study offshore movements in interesting habitat, effects of erosion debris fields.
2. Juvenile habitat use- population structure, residence time, over-wintering, fine scale movements.
3. Magnetic orientation- compass initiation and calibration in hatchlings.
4. Beach driving- evaluate temporal and mechanical strategies of rut removal to minimize effect on adults and hatchlings.

In 2008, approximately 3 miles of coastline along Cape San Blas, FL were surveyed on a nightly basis for nesting sea turtles from 1 May through 15 August. All nesting and non-nesting emergences (false crawls) were documented. Sixty-two false crawls were recorded and 48 nests were marked with wooden stakes, caution tape, and prohibitory signs. Nests were also covered with wire screen to prevent predation. Four of the 48 nests (8%) hatched. A mean of 83 eggs were laid per nest. Average hatching success of those nests that were not depredated or washed away was 28%, with 26.5% of hatchlings emerging from the nest. In the 2008 nesting season, a minimum of 214 loggerhead hatchlings were produced on Cape San Blas. Hatching success decreased sharply in 2008 as compared to 2007 (46%) and 2006 (77%). This was due primarily to the active tropical storm season in 2008. Three storms significantly impacted Cape San Blas in 2008: Tropical Storm Fay, Hurricane Gustav and Hurricane Ike. Forty-one of the 48 nests (85%) nests were severely impacted by storms this season (washed out to various degrees or suffered over-accretion): 34 of the 48 nests (71%) were completely washed away during the storms. The increase in tropical storm activity since 2006 and 2007 likely resulted in lower hatching success observed in 2008.

In addition to the nesting information gathered this season, we also tagged 25 nesting females this season. All tagged turtles received flipper tags in both front flippers as well as PIT tags. Of those 25 turtles, 3 had been tagged along Eglin Air Force Base property in previous years including 1 that was originally tagged nesting along EAFB property on Cape San Blas in 1998. Five turtles returned to nest again within the 2008 season. Our growing database on site fidelity will increase our ability to elucidate demographic factors for this nesting population.

SUMMARY:
With increased development pressures, and greater recreational and commercial use being made of the relatively pristine beach and aquatic habitat of the St. Joseph Peninsula in the Florida Panhandle, it is becoming increasingly important to delineate the habitat needs of the threatened and endangered species using the area, so that negative interactions can be minimized and sound management strategies put into place.

Assessment of Beach Compaction and Associated Effects on Loggerhead Sea Turtles (Caretta caretta) Nesting on Natural and Nourished Beaches in Northwest Florida

Principal Investigator: Raymond R. Carthy
Co-Principal Investigator: Lori A. Brinn
Funding Agency: U.S. Fish and Wildlife Services
Expected Completion: 9/30/2008 (UF#60640)
Graduate Student: Lori Brinn Field Technicians: Jennifer Solis

Beach nourishment is increasing in scope and execution as a response to coastal erosion in Florida. However, if sand used for nourishment has different properties than natural sand, then the beach ecosystem may be altered. Regulatory agencies maintain sand specifications for nourishment projects to monitor quality of fill materials. The reproductive effort of nesting sea turtles requires a suitable incubation environment: the effects of substandard fill material may be immediate (false crawl) or sub-lethal (poor incubation environment). Our objective was to

determine if the physical properties of sand on post-nourishment beaches differed from natural beach sand, and whether any differences observed appeared to affect nesting loggerhead (Caretta caretta) sea turtles. Compaction, bulk density, water content, color (chroma and value), and grain size distribution were analyzed on seven pairs of nourished beaches and natural beaches in northwest Florida in 2006. We hypothesized that any differences in these physical properties on nourished versus natural beaches could affect loggerhead sea turtle nesting success. While compaction measurements are often the primary method of evaluating beaches post-nourishment, measuring shear resistance may provide a more complete picture of a sea turtle's perception of the beach during nest chamber excavation. In summer 2007, shear resistance measurements were taken alongside compaction readings, using a device developed for this study. We saw a general trend of the physical properties of several recently nourished beaches returning over time to a state more similar to that of the native beach. The nesting density, hatching success, and emerging success of loggerhead sea turtles did not appear to be adversely affected by beach nourishment.

Because our findings suggest that sand compaction is not linearly correlated with shear resistance, we conclude that measuring shear resistance as a separate entity from beach compaction is critical. Measuring shear resistance provides additional information about the physical condition of sand placed on a beach during nourishment and may offer valuable insights from a sea turtle conservation management perspective. In order for the shear vane device to be implemented as a management tool following beach nourishment projects, further studies should be conducted. Studies should focus on higher density nesting beaches with a goal of obtaining a tolerable range of shear resistance levels for loggerhead sea turtles, both on the surface and at depth. If a tolerable range of shear resistance could be determined for nesting sea turtles on Florida beaches, guidelines could be established to promote a more suitable nesting habitat for sea turtles on nourished beaches. Our shear vane device was a more useful tool at depth than on surface sand, particularly on nourished beaches, where surface readings registered a zero value 93% of the time. These results may be improved by using a range of different shear vane sizes and perhaps pairing them with more or less sensitive torque wrenches, depending on the size of the shear vane used. Using different sized torque wrenches and shear vanes may combat the problem of the lower detectability limit observed for shear resistance measurements in this study.

Overall, beach nourishment practices in northwest Florida appear to be not incompatible with loggerhead sea turtle nesting; and implementing shear resistance measurements as an additional parameter to examine following a beach nourishment project would provide useful information to coastal managers. Other properties measured including compaction, bulk density, grain size distribution, water content, and soil color, also provide useful information and should be included in management protocols following a beach nourishment project. Hatching success and emerging success seem to be good indicators of the suitability of the incubation environment for loggerhead sea turtles, while nesting density appears to be a more useful indicator of nesting success on a particular beach than does the false crawl to nest ratio.

Adaptive Habitat Management for Florida Scrub-Jays at Merritt Island National Wildlife Refuge

Principal Investigator: H. Franklin Percival
Co-Principal Investigator: Fred Johnson
Funding Agancy: U.S. Geological Survey
Expected Completion: 12/31/08 (UF57425)

Problem Statement: Prescribed burning is the primary management tool for scrub-jays at MINWR and managers decide what frequency and density of fire in a collection of management units will best ensure the long-term persistence of the scrub-jay population. These decisions are difficult because of an incomplete understanding of fire dynamics, plant community secession, and the demographic responses of scrub-jays to various environmental drivers. We proposed to develop key components of a formal decision-making framework by accounting for uncertainty in scrub-jay and habitat dynamics, for uncontrolled environmental effects, for

imprecision in habitat and population monitoring programs, and for constraints on management actions. We also propose to develop methods that can reduce the uncertainty in predicting management outcomes, so that management performance can be improved over time.

Study Results and Conclusions

(1) Habitat Management - There are documented differences in the demographic success of scrub-jays among discrete classes of scrub height (<120 cm or "short," 120-170 cm or "optimal," >170 cm or "tall," and a combination of optimal and tall or "mixed"), and our objective was to calculate a state-dependent burning strategy that would maximize the population growth rate of jays. We used aerial imagery to estimate annual transition probabilities among the four scrub-height classes under three possible management actions: scrub restoration (mechanical cutting followed by burning), a prescribed burn, or no intervention. We first demonstrated how simulated annealing (SA) could be used to prescribe which management units should be treated each year in order to minimize the management costs while maximizing jay fitness. The advantage of using SA is that it can handle high-dimension problems, in this case involving the simultaneous consideration of 48 management units. A shortcoming of this approach, however, is that the annual sequence of decisions is optimal only if management actions are conducted as prescribed and habitat transitions occur as predicted. Therefore, we evaluated an alternative approach using stochastic dynamic programming (SDP), which has the advantage of providing an optimal management strategy based only on the current system state, and not on previous system states, transitions, or management actions. A key limitation of SDP, however, is that it is practical only for small-dimension problems. Therefore, in our case, we had to assume that management of any one unit could be considered independent of all others. Using this approach, we found that scrub restoration is optimal only in units dominated by mixed and tall scrub, and burning tends to be optimal for intermediate levels of short scrub. The optimal action is to do nothing when the amount of short scrub is >30%, because short scrub mostly transitions to optimal height scrub (i.e., that with the highest demographic success) in the absence of intervention. Based on published literature, we also examined an alternative model of scrub succession, which posits that restoration increases the growth rate of scrub and reduces the flammability of the landscape. Under this alternative, restoration is never an optimal management action and burning is prescribed even for sites with a relatively large amount of short scrub. We demonstrated how this model uncertainty can be recognized explicitly in the calculation of optimal management strategies by assigning weights that reflect the relative confidence in the alternative succession models. We also demonstrated how these weights can be updated over time using Baye's Rule and a comparison of predicted and observed vegetation changes.

(2) System Monitoring - If jay fitness is strongly and consistently correlated with scrub height, then it would be sufficient to monitor scrub height to make optimal and adaptive management decisions, as well as to predict jay population trends. But because other habitat attributes can affect jay population growth rates, we evaluated jay surveys as designed and conducted by the refuge during 1999-2006 to determine their usefulness for supporting management decisions. MINWR originally established approximately 300 sample points along logging roads, fire breaks, and trails specifically created for the survey (referred to as "transects") within areas having good-quality scrub-jay habitat. Sample points were placed at 150-meter intervals along transects, and ground-based observers tallied counts of jays at each point regardless of the distance at which birds were observed. In an attempt to increase the detection of jays, recordings of territorial calls were played at each sample point. Beginning in 2003, each site was re-sampled at least three times within a 1-week period, which provided a means to estimate the probability that observers missed jays that were actually present. Over all years, the mean probability of detecting a jay (given its presence) during a single site visit was only 0.22 (SE = 0.01), suggesting that single visits to a site would produce severely bias counts. Although this bias can be corrected using multiple site visits, the survey had several other shortcomings: (1) available sampling effort was insufficient to detect meaningful changes in jay abundance over time; (2) the effective sample area (i.e., that in which jays are available for detection) was unknown and likely varied among sites, thus compromising comparisons of jay abundance over space; (3) often, the same (marked) individuals were observed at multiple sites, thus violating the closure and independence assumptions necessary for unbiased estimates of detection probability and mean abundance; and (4) sample sites were not located randomly with respect to jay habitat, thus inference about refuge-wide jay abundance was not possible. In response to these

problems, MINWR abandoned the survey program in 2007 and decided to rely on capture-recapture methods to monitor jay abundance and vital rates.

The U.S. Geological Survey is continuing to work with MINWR to develop and implement an adaptive habitat management program for Florida scrub-jays. In response to the findings of this study, MINWR discontinued their survey program in 2007 and will rely on capture-recapture methods to monitor jay abundance and vital rates. Current developmental work is focused on considering additional habitat attributes that strongly affect jay fitness, and on novel management actions that might more rapidly and reliably return long-unburned scrub to optimal conditions.

Development of Unmanned Aerial Vehicles for Assessment of Wildlife Populations and Habitats: Phase 3

Principal: H. Franklin Percival
Co-Principal Investigator: Peter Ifju,
Funding Agency: U.S. Geological Survey
Expected Completion: 12/31/09 (UFID#75564)
Biological Scientist: Matthew Burgess

The purpose of this project is to pursue enhancements to an existing unmanned aerial vehicle (UAV) system to improve its present applicability and future potential for a variety of natural-resource uses. The research is interdisciplinary in nature and includes engineering, ecological, photogrammetric, and remote sensing elements and experts in those disciplines.

Photo by: Matthew Burgess, FL CRU *-Unmanned Aerial Vehicle*

OBJECTIVES: Research objectives and major tasks of this three-year project include, but are not limited to, the following:
1) Improvements in construction and electronics to enhance the reliability and ease of operation of the aircraft.
2) Progress in the development of geographical referencing capability for imagery collected from the aircraft.
3) Training of personnel for testing of a complete UAV system for research and management applications.
4) Development and testing of thermal infrared (TIR) sensor capability.
5) Evaluation of operating and maintaining a UAV system.
6) Exploration of future UAV system enhancements for remote-sensing applications.

2008 PROGRESS:

The Nova 1 Unmanned Aircraft System (UAS) was delivered to the Jacksonville District of US Army Corps of Engineers (USACE) early in 2008. Unfortunately, both the trainer and mission-capable UAS were severely damaged in crashes early in their operational uses. Negotiations on replacing those planes led to a plan to completely redesign the system based on lessons learned in usage and development of the Nova 1 platform. The Nova 2 is a much improved airframe in several ways. The pusher motor and its position on the aircraft allows for a much more efficient propulsion system contributing to longer duration flights (ca. 45 minutes) and additional power during takeoff. The addition of wing flaps enhances overall lift thus decreasing takeoff and landing speeds. The Nova 2 fuselage was specifically designed to be larger, tougher, and more

dependable for water- or skid-type landings. A robust tail boom adds buoyancy for water landings, as well as stability and strength to the airframe. The elevated tail assembly avoids submerging critical control surfaces and electronics during water landings. Addition of an onboard computer allows storage and rapid downloading of much more data than was possible on the Nova 1 platform. Point and shoot cameras have been replaced by Olympus E-420 single lens reflex digital cameras with 25 mm "pancake" lenses. Image resolutions of about 2 cm and image clarity have been dramatically improved with the change in imaging sensor. Potential use of two such cameras simultaneously leads to the additional advantage of capturing images separately in the red, blue, green, and near infrared spectra. An independent and much more precise Inertial Measurement Unit was mounted on the camera payload which generates georeferencing capabilities of ground-based targets to 5 m or less.

The first operational mission of the Nova 2 was flown over Indian Prairie Canal on the northwest shore of Lake Okeechobee. Ten separate flights totaling more than 5 hours of flight time recorded 6,860 images. The mission target was approximately 2,700 ha of water hyacinth and water lettuce which was to be, or had just been sprayed with herbicides by USACE contractors. The images collected were excellent and will be compared in subsequent missions to evaluate efficacy of the herbicidal applications. Because the images also captured assorted wading birds and basking alligators, a proof of concept and practice was achieved for future wildlife targets.

Additional USACE funding for Everglades Restoration was obtained by Dr. Peter Frederick (WEC) to build additional UAS platforms specifically for colonial nesting bird research. Frederick has been contracted to develop monitoring protocols for wading bird colonies. Preliminary flights in early 2008 with the Nova 1 under separate funding from the South Florida Water Management District proved quite successful. Images from the Nova 2 UAS will assist in assessing turnover rates in bird colonies over the duration of the nesting season, as well as provide data for other ecological assessments.

The concentration of time and effort on development of a new airframe, improved onboard data storage, new optical payloads, and improved georeferencing capabilities have supplanted anticipated progress on integrating multispectral and thermal infrared camera payloads into the Nova 2. Testing of multispectral and thermal infrared capabilities will occur in 2009, and are anticipated to be operational by 2010.

Southeastern Adaptive Management Group (SEAMG)

Principal Investigator: H. Franklin Percival
Co-Principal Investigators: Robert M. Dorazio, Fred A. Johnson
Funding Agencies: Florida Fish & Wildlife Conservation Commission / U.S. Geological Survey / U.S. Fish & Wildlife Service
Expected Completion: 12/31/2008 (UF62829 New UF75703)

The Southeastern Adaptive Management Group (SEAMG) was created in 2001 for the purpose of achieving a better science-based approach to wildlife conservation and management. The principal mission of the group is "To better integrate research and management for the purpose of improving how natural resource management decisions are made.? As part of this mission, the SEAMG is responsible for exploring and developing quantitative tools that improve and facilitate the integration of research and management. A distinguishing feature of the SEAMG is that it seeks ways to achieve a heightened level of integration between researchers and managers. At this level of integration, management actions themselves are viewed as opportunities for learning through experimentation, and the selection of management actions generally includes compromises between the (possibly) long-term value of learning and the short-term value of achieving more immediate management objectives. However, practical considerations also are expected to constrain the selection of management actions in most, if not all, resource management problems. A truly integrated program of research and management potentially offers great rewards; however, it is far more difficult and more costly to achieve than the more common situation where research is conducted in support of management without any direct involvement in the selection of alternative management actions. The SEAMG is interested in finding ways to achieve higher levels of integration in the activities researchers and managers to improve the decisions in problems of natural resource management and conservation. Institutional arrangements for establishment and operation of the SEAMG are described in a formal Cooperative Agreement among signatories of the U.S. Geological Survey (USGS), the U.S. Fish and Wildlife Service (USFWS), and the Florida Fish and Wildlife Conservation Commission (FFWCC). It is guided by a Steering Committee Statistics and the Program for Environmental Statistics at the University of Florida. SEAMG scientists interact closely with scientists and managers of cooperating organizations to solve problems of natural resource management.

American Alligator Distribution, Size, and Hole Occupancy and Crocodile Juvenile Growth and Survival

Principal Investigator: H. Franklin Percival
Co-Principal Investigators: Frank J. Mazzotti
Funding Agencies: U.S. Army Corps of Engineers
Expected Completion: 04/01/2010 (UF569014, #69015, #69016)

Responses of crocodilians are directly related to suitability of environmental conditions including hydropattern. Correlations between biological responses and environmental conditions contribute to understanding of species' status and trends over time. Positive or negative trends of this indicator relative to hydrologic changes permit assessment of positive or negative trends in restoration impacts. Restoration success or failure would be evaluated by comparing recent and future trends and status of crocodilian populations with historical population data and model

predictions; as stated in the CERP hypotheses related to alligators and crocodiles (CERP MAP section 3.1.2.5 and 3.1.2.6, 2004). Importantly, these data can be used in an analysis designed to distinguish between effects of CERP and non-CERP events such as hurricanes or droughts.

Progress in 2008
Task 1-Alligator Distribution and Condition: Second round of surveys completed. Captures of alligators were conducted in twelve (12) study areas.
Task 2- Alligator Nesting Ecology: No alligator nesting ecology work was conducted this quarter.
Task 3- Alligator Hole Mapping and Occupancy.
Task 4- Estimate juvenile growth and survival rates of crocodiles in areas affect by CERP projects: Spotlight surveys were performed of accessible coastal and estuarine shore line from western Everglades Nat'l Park around the coast to the mouth of the Miami river, including Key Largo, Barnes and Card Sounds, and Biscayne Bay.

Worked Planned For 2009
Task 1-Alligator Distribution and Condition: Evaluate hydrologic conditions to determine the start of night light surveys.
Task 2-Alligator Nesting Ecology: None scheduled
Task 3-Alligator Hole Mapping and Occupancy: None scheduled.
Task 4-Estimate juvenile growth and survival rates of crocodiles in areas affect by CERP projects.

Spotlight surveys will be performed of accessible coastal and estuarine shoreline from Everglades City around the coast to the mouth of the Miami River, including Everglades National Park, Key Largo and Biscayne Bay.

Crocodiles
1. Finish developing and testing a monitoring program for nesting, condition, growth and survival of crocodiles in areas that will be affected by CERP projects.
2. Monitor changes in nesting, condition, growth, and survival of crocodiles in response to CERP projects.

Experimental Evaluation of a Habitat Enhancement Project for Fish and Wildlife at Gant Lake, Florida

Principal Investigator: Mike S. Allen, Wiley M. Kitchens, H. Franklin Percival
Funding Agencies: Florida Fish and Wildlife Conservation Commission
Expected Completion: 12/20/2009 (UF65181)

Many Florida lakes have experienced altered hydrologic regimes due to channelization and water control structures for flood control, agriculture, and water supply activities. Altered hydrology has resulted in stabilized water levels compared to historical regimes and modified temporal (i.e., within and among year) patterns in water levels. Stabilized water levels allow dense emergent plants to flourish in the narrow zone of lake fluctuation, which leads to excessive deposition of organic matter and eventual loss of littoral habitat for fish, including recreationally important sport fish (Moyer et al. 1995; Allen and Tugend 2002). These degraded vegetation communities have been characterized as dense (percent-area coverages of 90-100%), with extremely high plant biomass (> 50 kg/m2) and poor habitat for fish (e.g., low dissolved oxygen) (Moyer et al. 1995; Allen and Tugend 2002).

To mitigate the influence of altered hydrology on fish habitat, The Florida Fish and Wildlife Conservation Commission (FWC) has conducted some of the world's largest lake habitat enhancement projects. Enhancement efforts have focused on lake drawdowns and muck (i.e., organic plant material and sediment) removals, with the goal of improving sport fish populations, angler access, and fishing quality. Although habitat enhancements improve fish habitat in the treated areas (Allen and Tugend 2002), these efforts do not always cause significant lake-wide increases in the population abundance and angler catch rates of sport fish such as largemouth bass Micropterus salmoides (Allen et al. 2003).

Minns et al. (1996) argued that freshwater habitat enhancement efforts should focus on ecosystem and multi-species benefits rather than benefits to a single species or group. Lake habitat enhancement projects have the potential to benefit all components of lake ecosystems including wildlife (e.g., amphibians, reptiles, birds) and fisheries resources. However, work is needed to understand the collective wildlife and fish community responses and processes, which can then be used to maximize the benefits of habitat enhancement efforts on lake ecosystems. Our proposal to evaluate the wildlife and fish community responses to a habitat enhancement project at Gant Lake, Florida has begun and is finishing the first year of field research. Our research approach will measure habitat characteristics and fish and wildlife community composition and abundance at Gant Lake and two control lakes before and after the habitat enhancement effort.

OBJECTIVES

This project is evaluating the wildlife and fish community responses to a habitat enhancement project at Gant Lake, Florida. The objectives of this study are to:

1) characterize aquatic vegetation communities including defining the environmental variables structuring these communities temporally and spatially within the littoral reaches of the lake.
2) quantify habitat composition including substrate type, water depth, and aquatic plant abundance and community composition before and after the habitat enhancement at Gant Lake with comparison to two referenece systems, and
3) quantify fish and wildlife community composition and abundance before and after the habitat enhancement with comparison to two reference systems.

PROGRESS:

The protocol for characterizing the aquatic vegetation communities in the littoral reaches of the lake were taken from previous research done on Lake Tohopekaliga in central Florida. Thus far, habitat sampling occurred at Gant Lake, Johnson Lake and Lake Lindsey in June 2008 and Decemeber 2008, at the peak and end of the growing seasons.

Vegetation sampling involves cutting the stems of all plants within a $0.25m^2$ area plot at the sediment surface at 24 randomly-selected locations on each lake during each sampling period. Plants are separated by species and the number of stems are counted and weighed in the field. There are eight vegetation sample locations in each of the three vegetation strata at Gant Lake, and 12 vegetation sample locations in each of the two strata at Johnson Lake and Lake Lindsey.

The vegetation data collected thus far in the first sample of the peak and the end of the growing season will be coupled with the vegetation sampling of the coming project year to gain insight into the habitat communities of Gant Lake. The data will be used to develop a multivariate statistically based regression tree modeling capability, CART and/or MRT. This modeling will provide managers both a descriptive and predictive capability defining plant community structure and responses to the habitat manipulation. Thus far no analysis has taken place but will for the June 2008 annual report to FWC.

The herpetofaunal community of Gant Lake has been sampled by littoral vegetation strata three times this year in April and October 2007 and January 2008. Because of the extended drought during the summer we were not able to sample during July 2007. However, in following years the lake will be sample four times a year. The two reference lakes were each sampled four times because of sufficient water levels.

Each sample occasion consisted of six consecutive trapping days per lake. Fifteen permanent trapping transects were randomly placed at each lake. Each transect of Gant Lake has three individual trap locations, one in each of the three vegetation stratum at the approximate midpoint of each stratum. One crayfish trap and one minnow trap, each constructed of ½-inch vinyl coated hardware cloth, are used at each trap location. During the sampling period, each trap is checked every 24 hours and its contents are identified, counted, weighed, and measured depending on the species captured. The animals are then released at the trap site. After the initial 48-hour sampling period, the traps are moved 10 meters to the left or right for 48 hours, then in the other direction for another 48 hours. This sampling design results in a total of 45 trap locations per stratum per sample period.

Effects of Environmental Mercury Exposure on Development and Reproduction in White Ibises

Principal Investigator: Peter Frederick
Funding Agency: U.S. Army Corps of Engineers
Expected Completion: 9/30/2008 (RWO 234 UF58961)
Graduate Students: Nilmini Jayasena, Evan Adams
Bird Keepers: Leslie Straub, Bobbie Jo Sampson

The South Florida environment has been highly contaminated with methylated mercury, but the effects on this contamination on animals at top trophic levels is impossible to project from existing information. The role of mercury in determining reproduction and survival of fish eating birds is of particular importance, since these parameters are also considered to be key to achieving a restored Everglades. This project is designed to understand the potential effects of environmentally relevant methylmercury exposure on the development, behavior, reproduction, health and endocrine function of a representative long-legged wadding bird, the White Ibis. Birds will be raised from a young age in a large free-flight aviary, and maintained on diets with 0, 0.05, 0.1 and 0.3 mg methylmercury/kg food. Effects will be examined by measuring growth parameters, health parameters, behavior, fecal hormone levels, and reproduction.

OBJECTIVES:

- Establish a captive population of ibises and develop methods to maintain them on predetermined levels of dietary mercury.
- Examine the effect of methylmercury in a controlled environment on behavior, endocrine function, health, growth and reproduction.
- Relate any effects to the wild state by modeling effects at the population level.

PROGRESS STATEMENT:

Since July 1, we have maintained the aviary and continued to monitor nesting. While nesting tailed off during July, there were over 30 nesting attempts, and the last few nests have continued into August. The pattern for the third year of nesting was similar to the previous two years – homosexual nesting continued to be highest in the dosed cages and nonexistent in the control cage. However, the levels of homosexual behavior have also shown a decrease over time, with the lowest levels in 2008 in all cages. This suggests either that homosexual tendencies are becoming suppressed as the adults mature, or that birds are simply choosing different partners based on past nesting success.

WORK PLANNED FOR NEXT 30-60 DAYS

1. Begin analysis of testosterone and corticosterone from 2008 fecal samples.
2. Find homes for the flock in zoos.
3. For animals that cannot be placed in zoos, begin releasing birds into appropriate habitat in November.
4. Perform an experiment investigating the effect of mercury on immune function.
5. Perform an experiment examining the degree of brain lateralization using behavioral techniques.

Monitoring of Wading Bird Reproduction in WCAS 1, 2, and 3 of the Everglades

Principal Investigator: Peter Frederick
Funding Agency: U.S. Army Corps of Engineers
Expected Completion: 3/30/2009 (RWO 230 - UF54346)
Graduate Students: Rena Borkhataria, Kate Williams
Research Coordinator: John Simon
Field Technicians: Sam Edmonds, Andrew Spees, Becky Smith, Elizabeth Kreakie

The proposed work is to continue a long-term monitoring project that annually measures responses of breeding wading birds to hydrological conditions in the water conservation areas of the Everglades. This project is compatible and integrated with a larger effort designed to monitor reproductive responses of wading birds to Everglades water management and restoration activities, from Lake Okeechobee to Florida Bay. Responses monitored will be numbers of nesting pairs of 8 species (nesting effort) and reproductive success and productivity of selected species (White Ibises, Wood Storks, Great Egrets, Snowy Egrets) in large and regionally significant colonies.

OBJECTIVES:

- Annually document numbers of nesting pairs in WCAs 1, 2, and 3 of the Everglades through the use of aerial and ground survey techniques.
- Develop new methods for estimating numbers of nests, particularly in large colonies.

Wading bird nesting responses (timing, location, numbers of nests) are an important variable in evaluating the success of the Comprehensive Everglades Restoration Plan (CERP). Although records of nesting wading birds go back to the late 1800's and the coverage has been thorough in some parts of the Everglades for a decade, there are several parts of the south Florida ecosystem that have not been surveyed at all, or have not been surveyed regularly or systematically. The purpose of this CERP-funded MAP project is to expand coverage of the surveys to give a comprehensive picture of nesting in the south Florida ecosystem, including Lake Okeechobee, the Water Conservation Areas, Big Cypress National Preserve, Holey Land and Rotenberger, Everglades National Park and Florida Bay. Not all species of wading birds are considered of equal importance in monitoring the success of CERP, and the focus is now on large white species, especially Wood Storks, White Ibises, Snowy Egrets, and Roseate Spoonbills. Four entities were involved in the systematic surveys – University of Florida (BICY and WCAs), Florida International University (Lake Okeechobee), National Audubon Society (Florida Bay) and Everglades National Park (ENP).

During this reporting period we have concentrated largely on reporting issues (below), getting prepared for the next field season, and progressing on the development of unmanned aerial devices (UAS or Unmanned Aerial Systems) for use in the 2009 field season.

Reporting issues – We've concluded an agreement with USGS, USCOE and MAP personnel that will in effect substitute the System Status Report due in March 2009 for the 2008 final report on this project.

Preparation for next field season – We have to date hired all of the technicians necessary to pursue this work in spring 2009. We also have renovated and prepared field equipment for same. We have also rented a house in south Dade county for the 2009 spring and early summer.

Development of UAS for use in 2009. This work is progressing reasonably smoothly. The UAS airframe developed for us by Mechanical and Aerospace Engineering at UF (MAE) has now been flown six times and has performed admirably on all of those flight dates. The airframe seems robust to its design carrying capacity, seems to respond well to gusty winds, seems to take off and land well, and is forgiving enough for student pilots to fly. Resolution of pictures has been a difficult hurdle, and until late October we were still getting only rough resolution of flamingo decoys from 200ft. altitude. However the introduction of an SLR camera in combination with a pancake lense, and the use of high speed aperture settings has overcome this. We are now able to count golf balls easily that are laid out as though in a nest, from 400 ft altitude. This is a major hurdle that now opens the way for many different applications of this device. We have also made tremendous progress on integration of systems on the airframe, including communications, storage and sensors on the aircraft, which have all now been bundled onto a single custom designed computer board. There is

reasonable hope that the pictures will be GPS stamped, and that the GPS stamps will be accurate to a minimum of 40 meters. Given the other landmarks that are probably available in most pictures of colonies, this seems reasonable criteria for the use of this UAS in wading bird colonies. Finally, John Simon is our staff member who has been trained to fly the UAS, and all reports indicate that he has progressed well and will be able to fly the aircraft in spring 2009.

WORK PLANNED FOR NEXT 30-60 DAYS we plan to:
1) Move equipment and machinery to south Florida 2) Train field technicians for field operations
3) Develop contract for aerial surveys 4) Design and test an airboat mounted launch system for the UAS
5) Field test the UAS in January over existing targets and wading bird colonies.

Wading Bird Colony Location, Size, Timing and Wood Stork Nesting Success

Principal Investigator: Peter Frederick
Funding Agency: U.S. Army Corps of Engineers
Expected Completion: 10/30/2009 (RWO 236 - UF68415)
Research Staff: John Simon, Kate Williams

The proposed work is to continue a long-term monitoring project that annually monitors responses of breeding wading birds to hydrological conditions in the water conservation areas of the Everglades, and to monitor reactions of Wood Storks (*Mycteria americana*) to hydrological change. While this work continues the work carried out over the past decade, this project expands the area covered to include nesting in Big Cypress National Preserve and Everglades National Park, and to facilitate and standardize surveys occurring in Florida Bay and Lake Okeechobee.

This work is to continue a long-term monitoring project that annually documents responses of breeding wading birds to hydrological conditions and restoration efforts, and to expand the coverage of these surveys to include Everglades National Park and Big Cypress National Preserve. In addition, we hope to document specific responses of Wood Storks to restoration activities. A final goal is to ensure coordination and standardization of breeding wading bird surveys in the entire watershed, from Lake Okeechobee to Florida Bay. This will greatly enhance our ability to detect both system-wide responses, and to compare responses in different parts of the ecosystem.

PROGRESS ACCOMPLISHED THIS PERIOD
During this reporting period we have concentrated largely on reporting issues (below), getting prepared for the next field season, and progressing on the development of unmanned aerial devices (UAS or Unmanned Aerial Systems) for use in the 2009 field season.

Reporting issues – We've concluded an agreement with USGS, USCOE and MAP personnel that will in effect substitute the System Status Report due in March 2009 for the 2008 final report on this project.

Preparation for next field season – We have to date hired all of the technicians necessary to pursue this work in spring 2009. We also have renovated and prepared field equipment for same. We have also rented a house in south Dade county for the 2009 spring and early summer.

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reasonable hope that the pictures will be GPS stamped, and that the GPS stamps will be accurate to a minimum of 40 meters. Given the other landmarks that are probably available in most pictures of colonies, this seems reasonable criteria for the use of this UAS in wading bird colonies. Finally, John Simon is our staff member who has been trained to fly the UAS, and all reports indicate that he has progressed well and will be able to fly the aircraft in spring 2009.

WORK PLANNED FOR NEXT 30-60 DAYS

During the next 30 – 60 days, we plan to:
1. Move equipment and machinery to south Florida.
2. Train field technicians for field operations
3. Develop contract for aerial surveys
4. Design and test an airboat mounted launch system for the UAS
5. Field test the UAS in January over existing targets and wading bird colonies.

Historic Pond Restoration in the Florida Panther National Wildlife Refuge

Principal Investigator: Carrie Reinhardt-Adams
Co-Principal Investigator: Michael Kane
Funding Agency: U.S. Fish and Wildlife Service
Expected Completion: 5/1/2008 (UF63308)
Graduate Students: Scott Stewart, Danielle Watts
Research Staff: Nancy Steigerwalt, Christine Wiese, Stacy McCauley

In the Comprehensive Conservation Plan for Florida Panther National Wildlife Refuge, the U.S. Fish and Wildlife Service (USFWS) identifies the restoration of the historical ponds and wetlands on the refuge as critical for development of wading bird and epiphytic orchid habitats, and ensuring ecological diversity. As a consequence of both natural and man-made impacts on hydrological regimes, many ponds and wetlands found in the Refuge have experienced deterioration in both their function and biodiversity. This is especially important since 26% of the plants and 45% of the animals listed as threatened or endangered are directly or indirectly dependant on these habitat types for survival. To mitigate further degredation, the USFWS have developed the following priorities:

- Protect, restore and manage candidate, threatened and endangered species and their habitats.
- Protect, restore and manage migratory birds and protect, restore and manage their habitats.
- Protect, restore and manage wetlands and other freshwater habitats.
- Protect, restore and manage for biodiversity.

OBJECTIVES:
The overall goal of the proposed research is to develop best management practices for efficient and ecologically-sound pond restoration procedures which will ensure re-establishment of habitats critical to threatened and endangered flora and fauna. The specific objectives of the project are to:

- Excavate a minimum of three historic ponds on the Refuge;
- Develop a floristic list of the aquatic/wetland species associated with the historic ponds on the Refuge
- Collect aquatic and wetland plant propagules (seed, stem and rhizome cuttings) from numerous on-site genotypes for propagation by greenhouse seed/cutting propagation and micropropagation;
- Provide ecologically focused input into the elevation and contour design and resultant hydrologic regime of the excavated ponds which will ensure long-term sustainability and decreased post-planting maintenance;
- Evaluate effects of genotype, planting density and elevation on establishment of propagated aquatic and wetland species over numerous growing seasons;
- Evaluate post-planning maintenance practices which promote long-term sustainability of the plant community in the restored ponds.

Qualitative and quantitative data were collected February 2008. Quantitative data collection consisted of measuring plant volume and recording plant survivorship. Qualitative data collection consisted of visually assessing percent cover per plot and whether seed production was present or not. Wells were constructed and

installed to monitor water levels. Preliminary results show that plant growth and establishment is highly dependent on species and location (pond 1 or pond 2), but not elevation (Figures 2a & b). Growth and establishment data was also analyzed for plugs and 5" container plants. Initially, results dictate that survivorship is highly dependent on species, but not elevation or location (Figures 3a & b). Statistical significance of these differences is currently being analyzed. Further monitoring will continue every 3 months.

Quantitative data was collected again June 2008. ANOVA (α=0.05) was used to compare significant differences for both experiments (Tables 6a & b). Percent survival (Fig. 4, 5) was determined to be species-dependent for both experiments, however, the trend in percent survival increased as time increased. This increase in survival is likely associated with the seasonal fluctuation in hydrology of this ecosystem; dry conditions supported fewer plants, and wetter conditions supported more plants Plant volume significantly differed with species for both experiments, but also interestingly, plant volume differed per pond (Fig. 6). Dense and rapid *Bacopa caroliniana* recolonization in pond 1 may have suppressed plant establishment which causes overall plant volume to be lesser in pond 1 compared with pond 2 for experiment 1. In contrast, limited recolonization of *Bacopa caroliniana* in pond 2 allowed plants to establish more quickly and increased plant volume for experiment 1. Because both 6- and 12-months after planting 5-inch potted plant survival was greater in all species (except *Bacopa caroliniana* at 6 months after planting, Fig. 7), it is recommended to revegetate with larger propagules (5 inch potted plants) if the desired results are quick establishment and greater surface area of vegetation. However, if project objectives include reduced initial costs, then smaller propagules (plugs) may suffice for some species; species-level information for this recommendation will be available after more observation and data collection.

Qualitative data were collected October 2008. Since ponds were inundated, very little data were collected. Because of the extensive precipitation, very few species were in flower in either pond (Tables 7a & b). Interestingly, *Najas wrightiana*, a plant native to the Big Cypress Basin, was discovered in the bottom of pond 2. Since a majority (~75%) of pond 1 is being infested with *Typha latifolia*, a chemical treatment (maximum rate of Rodeo (glyphosate) in concert with 24 ounces of Habitat (imazapyr) per acre) will be applied in late winter since this is the best application time as translocation is maximal in the downward direction. The main objective in chemically treating these species is to maintain an open-water marl prairie pond.

PROJECT SUMMARY STATEMENT

The overall goal of the research is to develop best management practices for efficient and ecologically-sound pond restoration procedures for habitat critical to threatened and endangered flora and fauna. In addition, we hope to contribute to general planting practices for aquatic ecosystems which most efficiently return native plant communities to recently restored sites.

Directing Succession Through Adaptive Management in National Wildlife Refuges: Reed Canary Grass Control & Transition to Wetland Forests & Meadows

Principal Investigator: Carrie Reinhardt-Adams
Funding Agency: Department of Interior / U.S. Geological Survey
Expected Completion: 10/31/2010 (RWO 237, PJ#66026)
Graduate Students: Julie Sorenson
Research Staff: Nancy Steigerwalt, Leah Cobb, Ryan Graunke

Invasive species present a challenge to the efforts of National Wildlife Refuges (NWRs) to preserve appropriate plant community habitat. Reed canary grass (*Phalaris arundinacea*, RCG) is an invasive plant species that presents such a challenge. This species has partially or heavily infested approximately 37,400 acres of NWRs located in U.S. Fish and Wildlife Service Region 3 (Midwest Region) and Region 6 (Mountain-Prairie Region). To improve management of RCG and assist in the recovery of degraded wet meadow and floodplain forest ecosystems within these NWRs, an adaptive management (AM) framework will be utilized. Through AM, the goal of this project is to generate the information needed for refuge managers to *make good and defensible decisions about when, where, and*

how to treat RCG for purposes of maintaining or restoring target communities and the wildlife they support (from RCG Workshop Problem Statement, July 2006, Williams et al. 2007).

OBJECTIVES:

- Conduct initial coordination meeting and annual coordination meeting
- Conduct visits by the science team to the participating refuges to facilitate the selection of experiment sites
- Launch project website
- Design experiments and select sites
- Create a study plan and field protocols
- Train participants and collect initial vegetation monitoring data, seed bank samples and soil samples
  YEAR 2: Implement experiments and collect pre-treatment and response data
- Collect pre-treatment vegetation data
- Implement herbicide treatments at selected sites
- Conduct visits by the science team to participating refuges
- Collect response data
- Conduct annual coordination meeting
- Implement re-vegetation treatments
  YEAR 3: Continue treatments and data collection
- Implement follow-up herbicide treatments
- Collect response data
- Conduct visits by the science team to participating refuges
- Conduct annual coordination meeting
  YEAR 4: Finish data collection and create final report
- Collect response data and write final report

PROGRESS 2008:

Seed bank densities were determined for several meadow management units. These results indicate that some management units have significantly dense RCG seed bank densities. In Fall 2008, samples were processed for the remaining meadow and forest management units at University of Florida facilities. Meadow seed bank samples were placed in the greenhouse in November 2008, and the forest seed bank experiment was set up in December 2008. Initial germination of reed canary grass occurred in each experiment after one week. Additional results will be forthcoming.

Pre- and post- treatment vegetation cover data were collected from all refuges during the 2008 field season. Other data collected at each management unit this field season are monthly and event well and staff gauge data and flooding information (see Project Fiscal and Administrative Issues for effects of flooding on data collection). Fusilade and glyphosate treatments occurred this season in most management units (except those affected by severe flooding).

Much of the September-December 2008 reporting period was spent gathering and formatting GIS-based soil and spatial information to develop a spatially-explicit decision support tool for refuges. Tim Fox, of the USGS-Upper Midwest Environmental Sciences office in La Crosse, WI, provided support. We refined the spatially explicit wet meadow model and have incorporated state-dependent management actions indicated by a non-spatial stochastic dynamic program. We developed a non-spatial forest model, which will be reviewed by the science team and then developed into a spatially-explicit version.

Rapid Delineation of Provenance for Florida Sea Oats Used for Beach and Dune Stabilization

Principal Investigator: Michael Kane
Funding Agencies: U.S. Department of the Interior
Expected Completion: 6/30/2009 (UF#58323)
Research Staff: Nancy Philman, Pete Sleszynski, Scott Stewart, Daniela Dutra

Florida's coastal dune system not only provides unique wildlife habitats, it also serves as a natural defense system against erosion resulting from hurricanes and human activity. The extremely active 2004 and 2005 hurricane seasons has resulted in 365 of the 825 miles of Florida's sandy beach shoreline e now been assessed as critically eroded. Beach and dune restoration typically involves beach renourishment followed by planting of native species for stabilization. The most effective species planted for dune stabilization and building are perennial grasses including Sea oats (*Uniola paniculata*). Nursery-grown sea oats propagated from seed as liners or containerized plants have planting sites. One major ecological concern is the planting of non-adapted sea oats genotypes geographic source of sea oats plants. The overall goal of the project is to develop a reliable genetic database used to delineate and determine the source of sea oats to ensure ecologically sound beach and dune restoration. Ultimately, plant micropropagation technology and cryopreservation will be used to create a germplasm library of multiple genotypes from each major sea oats population. This both ensures a long-term reserve of population specific genotypes for beach and dune restoration.

OBJECTIVES:

- To establish a germplasm library of sea oats genotypes from all major populations along Florida's Atlantic and Gulf coasts.
- To determine the genetic diversity and distance of seedlings collected from the major sea oats populations along the Florida Gulf and Atlantic coasts using AFLP fingerprinting procedures.
- To evaluate use of the sea oats diversity genetic database as a tool to delineate sea oats provenance distance along Florida's Atlantic and Gulf coasts.

PROGRESS:

All immediate objectives have been accomplished. Sea oats seed was harvested from sixteen Florida State Parks or Recreation Areas: Perido Key, Navarre Beach, Henderson Beach, St. Andrews, St. George, Little Talbot Island, Anastasia, Gamble Rogers, Honeymoon Island, Sebastian Inlet, John D. MacArthur, Don Pedro Island, Delnor-Wiggins Pass, John U. Lloyd, and Bill Braggs Cape Florida. Park managers and biologists were consulted to assure that seed was only harvested from areas that had not been replanted. Seed production varied significantly between populations. Seed was surfaced sterilized in a three-step process and germinated *in vitro* on Murashige & Skoog Medium in 150 X 25 mm glass culture tubes. We found that germination could be significantly enhanced by maintaining the culture tubes on a heating mat at about 37 C (Figure 1a). In vitro germination rates and seedling growth varied considerable between the sea oats populations and genotypes (Figure 1b). We have now completed establishment of seed cultures from all sea oats the populations sampled. These data are being analyzed to determine if there are any population specific differences in germination and initial seedling growth. To establish clonal lines, unbranched 7-week old seedlings were transferred to sea oats shoot multiplication medium.

Status, Ecology, and Conservation of Rare and Endangered Florida Orchidaceae-Bletia purpurea

Principal Investigator: Michael Kane
Funding Agencies*:* U.S. Fish and Wildlife Service
Expected Completion: 6/30/2008 (UF#00064295)
Research Staff*:* Scott Stewart, Tim Johnson, Daniela Dutra, Philip Kauth

The continuing loss of native orchid habitat throughout the world has lead to an increased emphasis on species-level orchid conservation through comprehensive methods. Orchids cannot be considered independent organisms within their habitats- they are integrally connected to their habitats through mycorrhizae, pollination specialization, and a host of other biotic factors. An integrated view of conservation is critical if orchid species are to be conserved within their natural habitats. The current project will demonstrate the effectiveness of an integrated conservation approach to species-level conservation of the Florida terrestrial orchid *Bletia purpurea*. In its first phase, this study will examine aspects of both the asymbiotic and symbiotic seed germination of *B. purpurea.* A preliminary asymbiotic seed germination protocol has been determined and will be used to further examine biotic and abiotic factors effecting the growth and development of this native orchid species. The determination of a symbiotic seed germination protocol for *B. purpurea* is currently being planned and will examine not only the physiological role of a mycobiont during germination, but will also explore the role of photoperiod during symbiotic germination. All propagation studies will lead to the greenhouse establishment of plants of *B. purpurea.* These greenhouse plants will eventually be used in translocation and reintroduction studies at the Florida Panther National Wildlife Refuge.

OBJECTIVES:

- Collect and store naturally-pollinated mature seeds of *B. purpurea* for use in later seed germination experiments
- Isolate and identify mycobionts of *B. purpurea* from southwest Florida, and store these mycobionts for use in later experiments
- Determine the asymbiotic and symbiotic seed germination requirements for *B. purpurea*, examining seed germination rates and *in vitro* development
- Develop greenhouse acclimatization procedures for both asymbiotic and symbiotic seedlings of *B. purpurea*
- Suggest an integrated conservation and recovery plan for *B. purpurea* based on the results of the aforementioned studies

PROGRESS STATEMENT:

Mature seed (flowering year 2006) of *B. purpurea* had been collected from sites within the Florida Panther National Wildlife Refuge (FPNWR; Collier Co.) in southwest Florida. All seed was stored according to standard practices in the cold-storage collection housed at the Kane lab (University of Florida-Gainesville).

During this period, procedures for optimum asymbiotic seed germination and seedling acclimatization were developed for *Bletia purpurea*. Six asymbiotic orchid seed germination media Knudson C, *Phyto*Technology Orchid Seed Sowing Medium, Malmgren Modified Terrestrial Orchid Medium, Vacin & Went Modified Orchid Medium, ½-strengh Murashige & Skoog, and BM-1 Terrestrial Orchid Medium were examined for their effectiveness in promoting seed germination and protocorm development of *B. purpurea* in either complete darkness or 16/8 h L/D photoperiod. Germination occurred regardless of photoperiod or germination medium. However, advanced seedling development (Stage 6) only occurred on Vacin and Went under the 16/8 h L/D photoperiod. Further effects of photoperiod on *in vitro* seedling development from seed germinated on Vacin & Went medium were also examined. Shoot length, leaf width, root number, root length, fresh weight and dry weight measurements were all significantly different for 16/8 h L/D photoperiod when compared to 8/16 h and 12/12 L/D photoperiods. *In vitro* seedlings readily acclimatized to greenhouse conditions. Seedlings acclimatized on Fafard 2 developed more roots and a greater average fresh weight. However, seedlings grown in Fafard 4 potting mix displayed a significantly greater leaf production, longer shoots and roots. Corm formation occurred regardless of the potting media. A referred paper describing these results has been submitted for publication (see below).

Determination of Population Diversity in the Florida Endangered Orchid Cytopodium punctatum

Principal Investigator: Michael E. Kane
Funding Agencies: U.S. Department of Interior, USGS
Expected Completion: 9/30/2010 (RWO 251, UF#77491)

ABSTRACT OF PR OJECT**:**
Cytopodium punctatum, the cigar orchid, is an endangered plant in the state of Florida. The species distribution ranges from Florida and the West Indies. The genus *Cyrtopodium* comprises about 35 species, with *C. punctatum* being the only epiphytic member and northernmost ranging species. *Cyrtopodium punctatum* is a very large showy orchid that bears showy flowers. Due to its appeal, the species was over collected during the past century and today only a few plants still exist in inaccessible and protected areas. Three distinct populations are located in Unit 51 (ca. 7 plants), 54 ca. 14 plants) and an 3 plants in Unit 38 at the Florida Panther National Wildlife Refuge (FPNWR; Collier Co., FL). With previous funding from the FPNWR, a seed propagation protocol has been developed for the future reintroduction of *C. punctatum*. Breeding system type is one of the most important determinants of the genetic composition of plant populations. Consequently, pollination biology and breeding system studies are being completed in two FPNWR *C. punctatum* populations to understand the ecology and population genetics of this species *in situ*. However, the current genetic diversity and structure in the FPNWR *C. punctatum* populations is not known. This information is critical for development of ecologically sound integrated conservation plans.

OBJECTIVES OF PROJECT:

- Determine genetic diversity of *C. punctatum* populations in the FPNWR.
- Compare genetic diversity between and within *C. punctatum* populations
- Interpret results in light of ongoing reintroduction efforts with this species.

OBJECTIVES YR 1: Determine genetic diversity of *C. punctatum* populations in the FPNWR.
TASKS: Leaf samples from newly developed leaves will be collected from all known plants throughout the FPNWF (totaling about 20 plants). DNA will be extracted using DNeasy Plant Mini Kits. Purified DNA will be subjected to Amplified Fragment Polymorphism (AFLP) analysis.

OBJECTIVES YR 2: Compare genetic analysis between and within *C. punctatum* populations.
TASKS: Analyze AFLP data using GeneMarker software, Use POPGENE software to estimate fixation indexes (F_{IS}, F_{IT}, and F_{ST}), effective population size (N_m), H_O, and expected Nei's and Shannon's heterozygosity estimates (H_E). Use the program STRUCTURE v 2.2 for population assignment and principle coordinate analysis of data. Intepret results with respect to development of a ecologically-sound re-introduction program.

PROGRESS 2008:

A site visit was made to the FPNWR on December 2, 2008 to discuss sampling procedures with Larry Richardson. Since newly developed leaves of *C. punctatum* are required for "clean" DNA extraction, sampling will not begin until late March 2009 when new leaves on the donor plants will available.

Techniques for Field Establishment and Reintroduction of Calopogon tuberosus Var. tuberosus

Principal Investigator: Michael E. Kane
Co-Principal Investigator: Philip J Kauth
Funding Agencies: U.S. Department of Interior, FWS
Expected Completion: 8/30/09 (UF#69941)

While much of the literature regarding orchids focuses on propagation techniques, little information exists on reintroduction, translocation, and field transplanting. Habitat destruction or degradation is responsible for loss of orchid habitat and orchid populations. Reintroduction of seedlings into natural habitats is becoming a popular technique for conservation, but field-establishment often fails Much of the information regarding re-establishment focuses on seedlings. A major obstacle to field establishment is initial survival. Only a few articles discuss techniques for increasing survival of orchid seedlings. One technique used to increase survival is planting dormant storage organs such as tubers or corms. Calopogon tuberosus var. tuberosus is a corm forming species found throughout eastern North America including southwest Florida. In south Florida, this species has up to ten magenta flowers that open in succession. The flowering season begins in April and continues through the end of May in south Florida. Seed capsules are fully ripe approximately 6-8 weeks after pollination. Reintroduction of *Calopogon tuberosus* to suitable habitats is the next logical step in a propagation experiment. We have successfully germinated seeds of *C. tuberosus* to the seedling stage, and have successfully grown seedlings from other populations under greenhouse conditions.

OBJECTIVES:

- Reintroduce *Calopogon tuberosus* seedlings and corms to the Florida Panther National Wildlife Refuge (FPNWR).
- Compare survival of seedlings and corms of *C. tuberosus* following field reintroduction.
- Determine the time of year that ensures the highest survival of *C. tuberosus* propagules.
- Establish permanent field transplant plots.
- Determine if mycorrhizal fungi colonize roots of reintroduced propagules.

PROGRESS:

In April 2008, 192 *C. tuberosus* propagules were planted at the Florida Panther National Wildlife Refuge. Three 10 m transects were randomly selected in unit 23 of the FPNWR in an area where C. tuberosus currently grows. Within each transect four quadrats (30 cm x 30 cm) were placed every 2.5 m. Each quadrat was divided into 16 subplots. Of the 16 subplots, eight were randomly assigned for seedlings and eight were assigned for corms. In July 2008, data was taken on survival. Currently, approximately 200 additional seedlings are under greenhouse conditions. In February 2009, these seedlings will be transferred to soil at the FPNWR. Data will be taken on the propagules in unit 23 at this time as well.

Conservation of South Florida's Orchids—Developing Reintroduction Methods for Eight Native Species Including the State Endangered Ghost Orchid (Dendrophylax lindenii)

Principal Investigator: Michael Kane
Funding Agencies: U.S. Department of the Interior
Expected Completion: 8/30/2009 (UF69944)
Research Staff:: Tim Johnson, Daniela Dutra, Philip Kauth, Nancy Philman

North America possesses approximately 250 unique species of both epiphytic and terrestrial orchids, with Florida having 118 of those species (56 state endangered, 17 state threatened; Coile and Garland, 2003). Florida native orchids are faced with continual habit loss due to land conversion to agricultural uses, habitat urbanization, exotic plant invasion, poaching, and habitat mismanagement. While no Florida native orchid is federally-listed as endangered or threatened, many of the state's orchid species face the immediate possibility of extinction if face the immediate possibility of extinction if conservation and recovery plans are not developed and implemented.

Daniela Dutra & Tim Johnson conducting native orchid field research/FL Panther Nat'l Wildlife Refuge, Naples FL

Given the current rate of ecosystem degradation, fragmentation, and destruction of Florida ecosystems, the stability of Florida's native orchid populations seems uncertain at best. Because of these threats, *in situ* habitat protection may not be enough to protect Florida's native orchids from extinction. Therefore *ex situ* germplasm conservation combined with scientifically sound reintroduction methods should be used to help insure the continued existence of orchids in Florida. This project addresses the current need to develop reintroduction methods for subtropical epiphytic and terrestrial orchids in Florida. In addition, the information gained by using a number of orchid species to test hypotheses about the reintroduction of orchid plants may prove useful in developing effective management and reintroduction plans for orchid taxa throughout North America.

OBJECTIVES:

- Assess the use of various *in situ* reintroduction methods and the effect of substrate on the survival and growth of epiphytic orchids native to south Florida in intact and hydrologically altered habitats.
- Assess the impact of various reintroduction methods on the survival, growth, and recruitment of terrestrial orchids native to south Florida.
- Determine whether home-site advantage improves reintroduction success of *Bletia purpurea* seedlings at various sites within the Florida Panther National Wildlife Refuge.
- Incorporate findings into existing management plans for the study species.

PROGRESS:

Reintroduction methods for epiphytic Florida orchids -
Five epiphytic orchid species (*C. punctatum*, *D. lindenii*, *E. tampensis*, *E. nocturnum*, and *P. cochleata* var. *triandra*) will be used to examine how reintroduction method, substrate, aspect, hydrology, and elevation affect plant survival and growth within the confines of the FPNWR. Seedlings generated using asymbiotic orchid procedures, will be secured to various tree substrates (i.e. *Annona glabra*, *Fraxinis caroliniana*) at various heights with one of three methods: adhesive, monofilament line, or plastic gutter mesh. Preliminary studies have indicated the usefulness of using plastic gutter mesh in the reintroduction of *P. cochleata* var. *triandra* (S. Stewart and L. Richardson, pers. com.) and *E. nocturnum*. In December 2007, a visit was made to the Florida Panther National Refuge to begin surveying potential sites. The exact number of replications/sites will be determined after a more thorough field site assessment. No fewer than five replicates, each consisting of 10 seedlings, will be performed at as many as five reintroduction sites at the FPNWR. Plants will be introduced both at sites where orchids are currently found, as well as sites where orchids are not found. In this way, seedlings will be used as bioassays for suitable habitat. This may be helpful in identifying key factors that limit the establishment of orchid populations in south Florida. *Reintroduction methods for terrestrial Florida orchids* Two terrestrial orchid species (*E. alta* and

H. odontopetala) will be used to examine the effect of reintroduction method on survival, growth, and recruitment. Seedlings will be introduced into plots that have been cleared of vegetation mechanically, mowed, burned, or tilled. Unaltered plots will be used as control treatment.

Data collection and analysis:
For each species of study data will be collected every two months for 12 months. Experimental treatments will be compared to each other and to control treatments by collecting data on seedling survivorship, root growth (number and length), and plant size (height, width, number of shoots, flowering/nonflowering) over the course of the study.

Seed Ecology, Habitat Characterization, and Reintroduction Methods of Rare and Endangered Florida Orchidaceae—Bletia purpurea and Eulophia alta

Principal Investigator: Michael Kane
Funding Agencies: U.S. Department of the Interior
Expected Completion: 8/30/2008 (UF69301)
Biological Scientist: Nancy Philman
Research Staff: Tim Johnson, Daniel Dutra, Philip Kauth,

The ecology & reproductive biology of the native FL orchid species, Eulophia alta.

North America possesses approximately 250 unique species of both epiphytic and terrestrial orchids with Florida having 118 of those species. Florida native orchids are faced with a constant on-slaught of habitat loss due to land conversion to agricultural uses or home site construction, exotic plant invasion, poaching, and habitat mismanagement. While no Florida native orchid is federally-listed as endangered or threatened, many of the state's orchid species face the immediate possibility of extinction if conservation and recovery plans are not investigated and instituted. This research is designed to study the seed ecology, habitat preferences and reintroduction methods of the native Florida terrestrial orchids *Bletia purpurea* (Lamark) de Candolle and *Eulophia alta* (Linnaeus) Fawcett & Rendle. At the current time, these species have no formal conservation plan. A study of the biotic and abiotic factors that influence seedling recruitment in order to develop reintroduction protocols and implement best management practices for *B. purpurea* and *E. alta* is proposed.

OBJECTIVES:

1) Identify the critical biotic and abiotic features of sites containing *B. purpurea* and *E. alta* populations, and use the data to predict suitable sites for reintroductions.
2) Conduct symbiotic germination experiments on *B. purpurea* and *E. alta* under greenhouse and semi-natural conditions to determine the timing of germination, germination percentage *in situ*, and rates of seedling growth *in situ*.
3) Confirm the identity of germination-promoting mycobionts of *B. purpurea* and *E. alta* from field grown seedlings and use these data to validate conclusions about *in vitro* fungal specificity.
4) Assess the intra- and inter-population genetic diversity of *B. purpurea* on the FPNWR and interpret these results in the context of pending reintroduction efforts.
5) Develop integrated management practices that protect existing populations and promote the recruitment of seedlings in existing and new populations.

Objective 1: Soil analysis and accompanying species data has been completed for *Eulophia alta* at two sites: Public Trail (PT) and Western Refuge (WR). Key results of this study include that soils and accompanying species at these two sites are distinct. PT soils were found to have a higher pH, detectable soil phosphorus, total Kjeldahl nitrogen, organic matter, and moisture content with lower bulk density than WR soils. Principal coordinate

analysis of species presence/absence data reveals some overlap in species compositions at the two sites, but indicates that the two sites have detectably distinct plant communities.

Habitat characterization of *Bletia purpurea* sites is scheduled to begin in May 2009. Populations to be sampled include those at the Western Helipad, Pistol Pond, and McBride's Pond sites.

Objective 2: Two attempts were made to examine the effect of burial on symbiotic seed germination of *E. alta* under greenhouse conditions. Results of the second run of this experiment revealed that seeds had lost their viability during cold storage. A new set of experiments will be conducted to examine how storage affects viability, germinability, and symbiotic germination of *E. alta* seeds since seed storage appears to be a major obstacle to experimentation.

Two attempts were made to isolate germination promoting fungi from *B. purpurea* roots for symbiotic seed germination in July 2002 and again in December 2007. None of the isolates tested supported symbiotic seed germination. Attention has thus been turned to optimizing asymbiotic seed germination procedures.

Objective 3: Objective 3 could not be met during this period due to limitations in seed viability of *E. alta* seeds and lack of symbiotic fungi for *B. purpurea*.

Objective 4: In 2007, leaf tissue was collected from three populations of *B. purpurea* on the FPNWR and stored over silica gel desiccant. DNA extracted from these samples was degraded, likely due to slow drying of the fibrous leaves of *B. purpurea*. Fortunately DNA extracted from fresh material was high quality. Because fresh material appears to work better for DNA extraction, a library of living material is currently being compiled by collecting *B. purpurea* corms in the field and growing plants under greenhouse conditions in Gainesville, FL. This living library will be used for future studies on morphological differences among *B. purpurea* populations within the FPNWR.

As an accompaniment to this study, an investigation of cleistogamy rates of B. purpurea on the FPNWR has also been initiated. Year one results are that exclusion of pollinators did not limit capsule set, indicating that cleistogamy may be the dominant mode of reproduction.

Objective 5: At the completion of this project, management plans and suggestions for additional study will be developed for *E. alta* and *B. purpurea*. It appears that *E. alta* populations on the west side of the FPNWR and those found near the public access site occupy very different habitats, though it is not clear if they require different management strategies. Observations of these two populations over two years indicates that both populations are healthy, flowering copiously, and producing numerous capsules per inflorescence.

Suggestions for the management of *B. purpurea* would be premature at this time. It is disconcerting that germination promoting fungi have not yet been successfully isolated since symbiotic seed germination would be the preferred method of propagation for reintroductions. However, asymbiotic seed germination methods have worked will with this species in the past and may be the most reliable method of propagation for reintroductions.

This project is a continuation of efforts to insure that native Florida orchids will continue to thrive in their natural habitats as independent organisms. The development of successful procedures for the conservation of these native orchid species will allow others to apply these same procedures to other orchid species throughout Florida.

Factors Affecting Population Density and Harvest of Northern Bobwhite (Colinus virginianus) on Babcock/Webb Wildlife Management Area, Charlotte County, Florida

Principal Investigator: **H.F. Percival, Ralph W. Dimmick**
Co-Principal Investigator: Madan Oli
Funding Agency: Florida FWCC
Expected Completion: 6/30/2009 (PJ#62565)
Research Staff: Susan Dimmick, Steven Brinkley, Jeff Hostetler
Field Technicians: Gerald Coker, Amy Brinkley, Chris Jones

Babcock/Webb WMA has been an important recreational resource in south Florida since at least the early 1940's, with quail hunting being a particularly significant activity on the area for more than a half-century. Bobwhite populations have varied widely over time, as have the annual harvest and hunting pressure. Since 1981, the annual harvest has declined to a persistently low level, and the population has not produced summer gains comparable to those experienced prior to 1981. Hunting effort remained relatively constant at less than 2000 hunter-days until 1988. Following that season, hunting pressure increased markedly, peaking at 4000 hunter-days in 1992. A decline in harvest and productivity preceded the increase in hunting pressure by 7 or 8 years. Available data suggest that neither harvest nor hunting pressure may be the dominant factor suppressing population recovery, but neither do the data imply that hunting pressure and/or harvest may not be contributing factors.

Other environmental and demographic factors may be interacting to influence population behavior. Such factors may include non-hunting mortality of adults and chicks, nesting effort and success rates, habitat quality and availability, and catastrophic events such as hurricanes or extended drought.

The basic hypotheses to be tested are that neither harvest nor hunting pressure influences bobwhite population demographics significantly on Babcock/Webb WMA. Three levels of hunting pressure and harvest have been established by regulation on the WMA. Zones A-D permit hunting 4 days per week for 6 consecutive weeks beginning in November. Zones A and B each admit 10 hunters per day, providing a hunting opportunity for 240 hunter-days and a potential seasonal harvest of 1440 birds in each zone. Zones C and D allow unlimited hunter access with equivalent daily bag limits, but a potential harvest limited only by the total number of hunters who choose to hunt there. The Field Trial Course permits 2 days hunting for 25 hunters in January with a potential harvest of 600 bobwhites.

Other data to be obtained and evaluated will include spring call counts of territorial males, fall covey counts, and survival rates, nest success rates, home range size, and habitat use as determined by radio-telemetry techniques. Weather information from regional weather stations will be evaluated to detect patterns or unusual events that may impact elements of bobwhite survival or ecology on the WMA.

OBJECTIVES:

- To determine if annual survival rates of bobwhites on the three experimental hunt units are related to hunting pressure.
- To determine if survival rates are related to annual harvest.
- To determine if productivity is influenced by harvest and /or hunting pressure.
- To delineate nest success rates and factors influencing nest success including predation and weather.
- To identify and quantify non-hunting mortality factors affecting bobwhite survival.
- To identify habitats utilized and preferred by bobwhites seasonally.
- To delineate home range size and movement patterns related to habitat, disturbance, and weather events.
- To chronicle hunter perceptions and behavior related to hunter access and harvest regulations.

PROGRESS:

- For the period 10 Oct 2002 to 23 Dec 2008, 2135 bobwhites were captured and 2015 were radio-tagged.
- Currently, 84 quail are being radio-tracked.
- During 2008, from April 1 to October 1, 77 bobwhite nests were located. Of these nests, 44 hatched (57.1%), 28 were destroyed, and 5 were abandoned.
- 25 of 56 females that were alive on 4/01/200 were known to incubate a nest. These females incubated a total of 30 nests, an average of 1.2 nests per nesting female.

- The cohort of 56 females alive on 4/01 produced 20 successful nests (1 successful nest per 2.8 hens).
- 10 of the 56 females (17.9%) survived until the end of the nesting season (October 1).
- 10 of 79 males alive on 4/01/2008 incubated 10 nests. Five hatched and 5 were destroyed.
- 27 of the 79 males (34.2%) survived until the end of nesting season (October 1).
- Quail hunters logged 849 hunter-days during the 2008 quail hunting season, harvesting 754 bobwhites (0.9 birds/hunter-day). The mortality rate due to hunting (retrieved birds and non-retrieved cripples) was estimated to be 28.2%.
- The number of hunter-days was slightly higher than the targeted number (832). Including an estimated crippling loss of 13.8%, the total harvest was 874 quail (1.0 birds/hunter-day)

PROJECT SUMMARY; 2015 bobwhites have been radio-tagged during this study. 84 are currently being radio-monitored. During the 2008 nesting season, 77 bobwhite nests were located; 44 (57%) were successful. 849 hunter-days resulted in a recovered harvest of 754 quail (0.9 birds/h-d). Hunting mortality including cripples not retrieved was 28.2%.

Evaluating Decomposition Dynamics, Community Composition, and Ridge-Top Senescence in the Ridge-Slough Mosaic in Response to Climate Change and Water Management.

Principal Investigator: **Mark W. Clark**
Co-Principal Investigator: Todd Osborne
Funding Agency: Department of Interior / U.S. Geological Survey
Expected Completion: 03/31/2010 (PJ#65362)
Graduate Student: Danielle Watts
Research Staff: Tae-Goo Oh, Justine Vogel

The proposed work will build on the findings of Clark et all. (2003, 2004), Lewis (2005 and Jorczak (2006). Previous research was conducted under a CESI funded project titled: *Spatial Variability and Modeling of Soil Accretion in Shark River Slough.* That study evaluated ridge and slough vegetative characteristics, accretion rates and mechanisms of formation. Findings from that study indicate that study indicate that although soil surface elevation varied between ridge and slough communities, underlying bedrock surface elevation did not significantly vary and did not vary in any pattern similar to surface soil characteristics. This suggests that mechanisms regulating differences in surface soil topography are mostly independent of bedrock geomorphologic factors and instead driven by the interaction of biologically mediated organic and inorganic matter deposition with environmental forcing functions such as fire, hydrology and nutrient regime. Differences in standing biomass production within ridge and slough communities indicate a large difference in potential organic matter input to these systems. Investigation of the quality (nutrient content and tissue fiber recalcitrants) indicated that species most commonly found in ridges (*C. jamaicense*) have three times greater amounts of residual fiber (lignin) than species found in wet prairie or slough communities. In addition, C:N ratios indicate that ridge biomass has a greater limitation for nitrogen than that of slough biomass suggesting a reduced decomposition rate. Therefore, based on tissue recalcitrants and C:N ratio, tissue being produced in ridges indicates a slower decomposition rate potential than that of sloughs. This combined with increased biomass production rates in ridges suggest that Ridges have a greater soil accretion rate potential than slough habitat. To corroborate these findings a decomposition study was preformed using litter bags. *C. jamaicense* tissue (representing ridge biomass) and Eleocharis spp. (representing slough biomass) were deployed in ridge and slough environments. Findings suggest that tissue characteristic is the primary regulator of litter decomposition (*Eleocharis spp.* decomposed faster than *C. jamaicense*) followed by environmental conditions (ridge decomposition faster than slough decomposition rate) although both factors had significant effects

OBJECTIVES:
YEAR 1: Meetings for finalizing workplan, locate field sites,initiate mesocsom experiments, intitate ramet transplant study
YEAR 2: Continue field research on mesocosm and ramet transplant
YEAR 3: Conclude filed rasearch and data analysis, prepare final reports, and participate in AT Committee final report process.

PROGRESS 2008:
Current research effort aims to clarify the relationships between hydrology (hydroperiod, inundation depth)and evolution of dominant plant communities that make up the unique mosaic of ridge and slough systems in the Everglades. Recently, the ridge/slough mosaic has begun to fragment and decompose (spatial patterns) presumably due to alteration of natural hydrology. It is the purpose of this research program to determine the appropriate hydrology for the maintenance and successful restoration of the unique ridge and slough ecosystem of the Everglades. Recon flights for Sawgrass senescene conducted in March 2008. Video and pictures of 12 PSU sites were taken.

Regional Distribution of Soil Nutrients - Hierarchical Soil Nutrient Mapping for Improved Ecosystem Change Detection

Principal Investigator: **Todd Z. Osborne**
Co-Principal Investigator: Matthew J. Cohen
Funding Agency: Department of Interior / U.S. Geological Survey
Expected Completion: 03/31/2009 (RWO 242, PJ#65365)
Personnel: S. Lamsal, B. White

The proposed research enhances and builds-upon previous work funded by the South Florida Water Management District (SFWMD) for mapping soil nutrients throughout the Greater Everglades. The Everglades Soil Mapping (ESM: K.R. Reddy - Principle Investigator [PI], S. Newman – Co-PI) was intended to provide a regional benchmark for restoration assessment (Bruland et al. 2006, Corstanje et al. 2006). Soil nutrients and other chemical and physical attributes integrate environmental condition; monitoring soils as performance measures of ecological restoration progress requires a regional benchmark. The scope of ESM was comprehensive: samples were obtained via helicopter from over 1300 locations throughout Everglades National Park (ENP), Big Cypress National Preserve (BCNP), the Water Conservation Areas (WCAs) and various other parcels comprising the Greater Everglades. Samples, collected during 2003-2004, were analyzed for a suite of key biogeochemical indicators that have been used to both improve understanding of regional ecological dynamics and also to specify a comprehensive benchmark for future studies. Our proposed MAP activities interface directly with the ESM project and will be implemented by the personnel responsible for much of the ESM work. In particular, this project focuses on change detection. Future iterations of the comprehensive sampling protocol developed in the ESM project will provide maps of key variables that can be compared with 2004 conditions. The key problem will be determining whether observed differences arise from natural variability, which is known to be substantial even over short distances in the Everglades, or from regional ecosystem responses to restoration efforts. In order to effectively evaluate change, additional data are required on small-scale variability, spatial patterns of local ecosystem-driven variability and signal detection; the MAP activities that we propose will assist in this regard, greatly enhancing the interpretive value of additional soil monitoring efforts, which have a high probability of being implemented as soon as 2008.

OBJECTIVES:

Mapping soil quality (nutrients, carbon quality, process dynamics) has recently been undertaken as part of an effort to characterize baseline conditions for performance assessment of Everglades recovery activities. While large scale maps are useful for characterization of spatial pattern, several layers of uncertainty limit use as measures of performance and restoration progress. In particular, large scale maps (Greater Everglades) make specific assumptions about short range variability that are not well quantified. Nugget variance (variability in space over short separation distances) directly confounds use of baseline map products because future spatial sampling will not, in practicality, be at identical locations. If nugget variability is high, then significant uncertainty about ecosystem

change arises from not knowing if observed differences arise from intrinsic ecosystem processes or from responses to human management. *Our primary objective is to determine the extent to which spatial variability and sampling uncertainty confound ecological change detection.* We will use hierarchically nested sampling of soils to establish nugget variability so that change through time can be assigned as observational uncertainty or management response.

YEAR 1: Meetings for work plan and finilazation of work plan, literature review,determine field sites, field sampling, initiate laboratory anlaysis, reporting.
YEAR 2: Conclude laboratory anlaysis, semi-variogram development, metrics of change analysis, variance partitioning, reporting.

PROGRESS 2008:
To determine if CERP restoration targets are being met and whether or not efforts at restoration of the Everglades are making headway, we must be able to measure change effectively at the landscape scale. This works is designed to measure landscape properties, specifically soil nutrients (a designated CERP performance measure), and determine the amount of relative variability involved with the scale and number of observations used to measure ecosystem changes in the Everglades. Without a measure of variability, it is unclear how much change is actually being detected over long term monitoring programs and how much of the variability is attributable to natural variation at the landscape scale. This work will both quantify and project that variability in measuring soil nutrients so that future monitoring efforts can be effectively designed and instigated, and the data more clearly interpreted with respect to change in landscape scale measurements.

Lake Apopka North Shore Restoration Area Alligator Monitoring Study

Principal Investigator: **H. Franklin Percival**
Co-Principal Investigator: Raymond R. Carthy
Funding Agency: Fish and Wildlife Service
Expected Completion: 02/01/08 (PJ#70779)
Research Staff: Rio Throm, Edward Larrivee

The restoration of Lake Apopka greatly depends on the ability to restore the structure and function of approximately 20,000 acres (8,100 ha) of wetlands along its north shore, the North Shore Restoration Area (NSRA). The north shore marsh was drained and farmed for several decades. The impoundment and succeeding non-point pollution caused eutrophication and contributed to the impairment of Lake Apopka. In the late 1990s, the St. Johns River Water Management District (SJRWMD) and Natural Resources Conservation Service (NRCS) began efforts to restore the north shore marsh for the restoration of Lake Apopka. Restoration of the north shore has been hindered because levels of residual organochlorine pesticides (OCPs) in soils from historic agricultural applications in certain flooding blocks may pose a threat to wildlife, including migratory birds and threatened and endangered species.

American alligators (*Alligator mississippiensis*), top order predators, have been shown to accumulate OCPs, and considerable data exist for the species on Lake Apopka (Campbell 2003). Because adult females have a limited home range, consume a variety of prey items, and have easily identifiable nests; monitoring their level of exposure, hatching success and habitat use can provide some measure of ecosystem health and trends in specific areas of the NSRA ecosystem. Monitoring OCP levels and hatch rates in alligators may aid in evaluating remediation efforts and trends in OCP accumulation in a top level, oviparous predator.

OBJECTIVES:
Task 1: Determine alligator nesting distribution and density
Aerial surveys will be conducted to determine alligator nesting distribution and density on Lake Apopka proper and on the NSRA. These aerial surveys will also aid in the location of alligator nests and the collection of the alligator eggs.

Task 2: Collect and incubate alligator egg clutches. We will collect 30 alligator egg clutches from Lake Apopka and 30 alligator egg clutches from the NSRA. These clutches of eggs will be transported to the Florida Fish and Wildlife Conservation Commission's Research Lab, 4005 South Main Street, Gainesville, Fl. 32611. The clutches will be artificially incubated in a specially designed incubator that will be kept at a constant temperature and humidity level appropriate for egg incubation and development.

Task 3: Collect yolk samples for contaminant analyses
We will collect yolk from 2 eggs per clutch, one from a viable and one from an unviable egg. These samples will be placed in a small labeled container and placed in an ultra cold freezer. Once all samples are collected they will be sent to Pace Lab for analyses.

Task 4: Viability analyses on alligator clutches
Number of alligators successfully hatching and living≥ 1 day will be recorded and used to analyze and compare clutch viability among study sites. This will give us an idea if contaminant levels affect alligator clutch viability.
Task 5: Release hatchling alligators
All hatchling alligators will be weighed, measured, and tagged. These alligators will then be released at nest site.

Lake Apopka North Shore Restoration Area Amphibian Monitoring Study

P*rincipal Investigator: Raymond R. Carthy*
Co-Principal Investigator: H. Franklin Percival
Funding Agency: Fish and Wildlife Service
Expected Completion: 02/01/08 (PJ#68282)
Research Staff: Rio Throm, E. Larrivee
Field Technicians

The restoration of Lake Apopka greatly depends on the ability to restore the structure and function of approximately 20,000 acres (8,100 ha) of wetlands along its north shore, the North Shore Restoration Area (NSRA). The north shore marsh was drained and farmed for several decades. The impoundment and succeeding non-point pollution caused eutrophication and contributed to the impairment of Lake Apopka. In the late 1990s, the St. Johns River Water Management District (SJRWMD) and Natural Resources Conservation Service (NRCS) began efforts to restore the north shore marsh for the restoration of Lake Apopka. Restoration of the north shore has been hindered because levels of residual organochlorine pesticides (OCPs) in soils from historic agricultural applications in certain flooding blocks may pose a threat to wildlife, including migratory birds and threatened and endangered species.

Amphibian populations, especially anurans (frogs and toads), may serve as a great indicator of overall ecosystem health (Dale and Beyeler 2001) in the Lake Apopka marsh. Amphibians can readily absorb environmental contaminants through their integument, as well as through their gastrointestinal tract, with contaminants being one of many hypothesized causes for global amphibian declines (Collins and Storfer 2003). Recent research has demonstrated that amphibians can transmit contaminants to their offspring through eggs (Hopkins et al. 2006) and that endocrine disruption and other sub-lethal effects of pesticides have the potential to reduce survival and reproduction of amphibian populations (Hayes et al. 2006).

In this study, we plan to combine population level data with existing data on the spacial distribution of OCP contaminants and this will allow for an examination of the relationships between OCPs and the distribution of anuran species. This would allow testing of the hypothesis that higher levels of contaminants result in lower occupancy (or probability of occurrence) of anurans on a species-by-species basis. This type of sampling and analysis would address an important ecological question, and provide the framework for a monitoring program that would be well suited to an adaptive management program for the restoration and management of the north shore marsh.

OBJECTIVES:
Task 1: Anuran site-occupancy estimations
Anuran population sampling will be conducted using a standardized visual encounter survey approach (Crump and Scott 1994). During these surveys anurans observed will be captured, identified to species, and measured snout-to-urostyle length (SUL). In addition, all species of anurans heard vocalizing will be noted. Environmental data will also be collected. Anuran data will be analyzed in the site occupancy framework described in Mackenzie et al. (2006).

Task 2: Pig Frog captures for contaminant analysis
Pig frogs will be captured at night and euthanized by rubbing Benzocaine in the form of Orajel brand dental analgesic on the ventral surface. These frogs will be wrapped in tin foil and placed in a zip lock bag on ice until they are taken to a freezer. Pig frogs will be captured from 4 areas for a comparison of pesticide levels. Once all samples are collected they will be sent to Pace Lab for analysis.

Science Fellowship for Assessment of Coastal Habitats and Listed Species

Principal Investigator: **Raymond R. Carthy, PhD.**
Co-Principal Investigator: Margaret Lamont, PhD.
Funding Agency: Fish and Wildlife Service
Expected Completion: 04/30/09 (RWO 240, PJ#61306)
Research Staff:

One of the world's prime areas for coastal species is found along 20 miles of Florida's eastern coast. Designated in 1991 as the Archie Carr National Wildlife Refuge (ACNWR), this area represents the most important nesting site for loggerhead turtles (*Caretta caretta*) in the Western Hemisphere. Nearly 25% of all loggerhead nests laid in Florida are laid along ACNWR beaches. In addition, nearly 35% of all nests deposited by the endangered green turtle (*Chelonia mydas*) in Florida, and an increasing number of critically endangered leatherback turtle (*Dermochelys coriacea*) nests, are found within the Refuge. The Refuge also supports a large number of other species that rely on this protected stretch of beach for foraging and nesting, such as the endangered Piping Plover (*Charadrius melodus*), American Oystercatcher (*Haematopus palliatus*), and Brown Pelican (*Pelicanus occidentalis*). Although critically important to many coastal species, this area is also affected by a large number of tropical storms that create extensive instability along the coast. In 2004 and 2005, five storms affected this area, causing significant damage to homes and businesses and greatly affecting the natural habitat. How these storms influenced abundance and distribution of coastal species relying on ACNWR for survival, including nesting of threatened and endangered sea turtles, is unknown.

When attempting to nest, sea turtles must first select a beach, then emerge from the water, and finally place a clutch within that beach. Beach characteristics such as temperature, salinity, slope, moisture, width, and sand type have been shown to influence nest placement within the beach (Johannes and Rimmer 1984, Garmestani et al. 2000, Wood and Bjorndal 2000). When optimal, these factors may allow turtles to expend less energy locating nesting sites that will provide the greatest reproductive success. Along dynamic beaches, these factors are constantly changing; this may reduce a turtle's ability to identify high quality nesting sites.

PROJECT SUMMARY:
In 2008, 1,402 sea turtle nests were marked for this project within the 8-km sampling area in ACNWR. Locations of all nests within the 8-km sample site for this project were recorded using GPS and hatching success was determined. In addition, shorebirds were counted and identified to species every morning along the entire 8-km stretch of coastline.
These numbers represent the 4th, 5th, and 6th lowest numbers of sea turtle nests deposited along this 8-km stretch of beach since 1989. Mean number of nests for 2006-2008 was lower than mean number of nests for 1989-2005 (t-test; $p<0.05$). For 2006-2008 there was a mean of 1,211 false crawls, and for 1989-2005 there was a mean of 1,605 false crawls. The ratio of false crawls to nests was similar in 2006 (50%), 2007 (48%) and 2008 (45%) to ratios from 1989 to 2005 (mean 48%; range 40% to 57%). We are currently analyzing hatching success to compare success

from 2006-2008 to historical success numbers. In addition, we will enter all nest locations from 1989 through 2008 into the GIS to spatially analyze nesting and hatching data and determine effects of human alterations on nesting and hatching success. Nesting distributions will be compared to changes in oceanographic features as determined by LEO data.

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Ecology and Conservation of Snowy Plovers In The Florida Panhandle

Principal Investigator: **Steven Johnson**
Co-Principal Investigator: N/A
Funding Agency: U.S. Geological Survey
Expected Completion: 06/30/09 (PJ#65109)

In Florida, recent statewide surveys have shown that Snowy Plovers nest along sandy Gulf beaches in two main regions: the Panhandle from Escambia County east to Franklin Co. and Southwestern Florida from Pasco Co. south to Collier Co. The panhandle region supports the majority of breeding pairs in Florida. Threats to Snowy Plovers include development of beachfront property, disturbance by people and pets, predation, and potential habitat loss or degradation due to coastal engineering activities for shoreline protection such as beach nourishment, armoring, and/or inlet management. Florida's panhandle has been severely impacted by hurricanes over the past few years. The resulting engineering response with a large number of projects designed to re-nourish beaches, armor shorelines, and reestablish dunes have the potential to cause major impacts to Snowy Plovers, though little is known about how such projects will specifically affect Snowy Plover nesting, foraging, roosting, and brood rearing ecology. In order to minimize impacts from state or federally sponsored and permitted projects on Snowy Plovers and their habitat (e.g., projects conducted by the Florida Department of Transportation, the Florida Department of Environmental Protection, or the US Army Corps of Engineers), basic ecological research is needed. Such research will form the basis for sound management actions targeted at preventing the species from being federally listed.

The ultimate goal of this proposed project is to collect such data and make management recommendations for Snowy Plovers in Florida. The proposed project will occur over the course of two breeding seasons—Feb.-Aug. 2007 and 2008. It will occur in an area of some of the most densely-nested barrier islands in the panhandle, namely Crooked Island and St. Joseph Peninsula in Bay and Gulf Counties. This is collaborative project among the USFWS, FWC, American Bird Conservancy, and the University of Florida.

OBJECTIVES:
The specific objectives of this project will be developed over the next several months (see project schedule) through a collaborative effort of the project partners and a Snowy Plover Working group. Likely objectives include, but are not limited to the following:

1) Determine nest and brood success for two breeding seasons
2) Identify sources of nest and brood failure (e.g. predators, disturbance)
3) Identify important habitat features of nest sites
4) Identify and quantify important brood foraging habitats
5) Test the hypothesis that brood success is tied to habitat quality
6) Develop protocols to compare site quality among locations that could be used to evaluate the effects of engineering projects on foraging and/or brood rearing habitat.

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Structured Decision Making, Ecological Thresholds and The Establishment of Management Trigger Points

Principal Investigator: **Wiley M. Kitchens**
Funding Agency: U.S. Department of Interior / U.S. Geological Survey
Expected Completion: 12/31/2009 (PJ#68409)
Research Staff: Julien Martin

Discussions of "ecological thresholds", "acceptable variation" and "management trigger points" occur frequently in discussions of ecological monitoring programs (e.g., Noon 2003). However, these discussions tend to be vague and rambling, with some agreement on the general need for thinking about such issues, but little detail about how to proceed to actually define these concepts either generally or for specific problems (e.g., specific monitored systems). This recognition appears to have motivated the Request for Proposals on this topic as part of the USGS National Park Monitoring Program.

The concepts of "ecological thresholds", "acceptable variation" and "management trigger points" all refer (explicitly or implicitly) to values of system state variables that should prompt specific management actions. In the simple case where a management decision is to perform a single management action or not, the threshold or trigger point simply divides the state space into two regions where management is or is not recommended. For example, if the state variable was population size of an indicator species or species of special interest, then we might seek a population size such that management was recommended if population size declined below this value, but not if population size exceeded the value.

Some discussions about defining such thresholds or trigger points have viewed the problem as one of statistical hypothesis testing (e.g., Skalski 1995, Noon 2003). This framework invites discussion about type I and II error rates and the relative risks associated with these different kinds of errors (e.g., Schrader-Frechette and McCoy 1993). Decisions are then made about what error rates are most likely to yield good decisions with respect to the true objectives of management.

We prefer an approach to decision making that focuses directly on the objectives of management, with an aim to provide decisions that are optimal with respect to those objectives, given existing knowledge (and lack of knowledge) about system behavior. Such an approach clearly distinguishes the components of the decision process that are inherently subjective (objectives, available management actions) from those that are more objective (models of system behavior, estimates of system state). We believe that issues about ecological thresholds, acceptable variation and management trigger points are most usefully considered to be problems in structured decision making rather than as problems in statistical hypothesis testing (Yoccoz et al. 2001, Williams et al. 2002, Nichols and Williams 2006).

Structured decision making is an approach to conservation and management that has been specifically identified by the U.S. Geological Survey and the U.S. Fish and Wildlife Service as an approach meriting increased collaboration between scientists and managers of the two agencies. The U.S. Department of Interior guidance on adaptive management similarly recognizes this specific approach to structured decision making as an approach to be emphasized. In addition to this institutional support, structured decision making, both in general and specifically as a means of integrating monitoring and conservation, has strong scientific support (Walters 1986, Kendall 2001, Yoccoz et al. 2001, Williams et al. 2002, Burgman 2005, Nichols and Williams 2006).

OBJECTIVES:

- To provide a conceptual framework for thinking about the concepts of thresholds, acceptable variation and trigger points in terms of a structured decision process. In particular, we will demonstrate that structured decision making provides a natural framework for such concepts and leads to clear thinking about the nature of such concepts and means of defining them.

- To provide a step by step procedure that leads to a decision matrix for optimal decisions. Decision matrices specify what management action to take for each possible set of values of the state variable(s) of interest and thus explicitly provide thresholds and trigger points that are optimal with respect to objectives.
- To work with National Park personnel from one or more parks to implement the approach with one or more example issues. Specifically, we will begin with the development of objectives and available management actions, move to model(s) development, consider the kind of monitoring program(s) available to estimate system state and then develop decision matrices that are optimal with respect to the objectives.

PROGRESS:
Thresholds and their relevance to conservation have become a major topic of discussion in the ecological literature. Unfortunately, in many cases the lack of a clear conceptual framework for thinking about thresholds may have led to confusion in attempts to apply the concept of thresholds to conservation decisions. We have published a peer reviewed publication that advocate a framework for thinking about thresholds in terms of a structured decision making process. The purpose of this framework is to promote a logical and transparent process for making informed decisions for conservation. Specification of such a framework leads naturally to consideration of definitions and roles of different kinds of thresholds in the process. We distinguish among three categories of thresholds. *Ecological thresholds* are values of system state variables at which small changes bring about substantial changes in system dynamics. *Utility thresholds* are components of management objectives (determined by human values) and are values of state or performance variables at which small changes yield substantial changes in the value of the management outcome. *Decision thresholds* are values of system state variables at which small changes prompt changes in management actions in order to reach specified management objectives. The approach that we present focuses directly on the objectives of management, with an aim to providing decisions that are optimal with respect to those objectives. This approach clearly distinguishes the components of the decision process that are inherently subjective (management objectives, management actions) from those that are more objective (system models, estimates of system state). Optimization based on these components then leads to decision matrices specifying optimal actions to be taken at various values of system state variables. Values of state variables separating different actions in such matrices are viewed as decision thresholds. Utility thresholds are included in the objectives component, and ecological thresholds may be embedded in models projecting consequences of management actions. Decision thresholds are determined by the above-listed components of a structured decision process. These components may themselves vary over time, inducing variation in the decision thresholds inherited from them. These dynamic decision thresholds can then be determined using adaptive management. In our first publication we provided numerical examples (that are based on patch occupancy models) of structured decision processes that include all three kinds of thresholds. We have also developed models for the Golden Eagle case study in Denali National Park, Alaska.

An Assessment of Gulf Sturgeon Population Status in the Gulf of Mexico

Principal Investigator: **William Pine**
Funding Agency: Fish and Wildlife Service
Expected Completion: 12/31/09 (PJ#69001)
Research Staff: H. Jared Flowers

A juvenile *Acipenser oxyrinchus desotoi* (Gulf Sturgeon) was collected from the Santa Fe River, a major tributary of the Suwannee River, FL, on 6 December 2006. The Suwannee River is believed to contain the largest existing population of Gulf Sturgeon; however, our specimen is only the third Gulf Sturgeon collected from the Santa Fe River. Based on these observations, we believe that the Santa Fe River should be studied further to determine its importance as Gulf Sturgeon habitat, especially in the face of future management plans that may alter the hydrology of the system.

Acipenser oxyrinchus desotoi Vladykov (Gulf Sturgeon) is listed as Federally Threatened and as a Species of Special Concern by the State of Florida (USFWS 1995). Gulf Sturgeon can reach sizes of over 90 kg and 2.4 m total length, live over 25 years, and are thought to reach sexual maturity between

ages 7–12 years (Huff 1975). Gulf Sturgeon range throughout the northern Gulf of Mexico from Tampa Bay, FL to the Mississippi River drainage (Wooley and Crateau 1985). They are anadromous, spending over half the year in freshwater rivers, where they generally spawn on shoals with a hard, rocky bottom (Huff 1975). The mainstem Suwannee River of northwest Florida is believed to support the largest remaining population of Gulf Sturgeon and has been frequently studied (i.e., Carr et al. 1996, Pine et al. 2001, Sulak and Clugston 1998). Its tributaries, however, have received much less attention in regard to Gulf Sturgeon research. Observations discussed in this paper suggest the tributary Santa Fe River also may provide important Gulf Sturgeon habitat
OBJECTIVES: This project will conduct a series of workshops to compile historical data and conduct a stock assessment to assess the current status of Gulf sturgeon and identify areas for future research to fill knowledge gaps identified by the stock assessment.

Population models are a valuable tool in natural resource conservation. Because of this, they are often required by the recovery plans of species of concern. In this study, a population model was used to evaluate several management scenarios for a threatened Gulf sturgeon population in the Apalachicola River. This was accomplished using existing data and more importantly, for any species of concern, without affecting or harming actual populations. The model in this study produced demonstrations of what may actually be occurring in wild Gulf sturgeon populations so that resource managers will not be forced to make assumptions about the behavior of these populations. This model has also identified existing problems with current recovery policy, such as vague recovery criteria and weak monitoring program. Specifically, the model has provided insight into the possible levels of change that may occur, which monitor programs must be designed to detect.

Effective management programs are those that successfully integrate modeling approaches with field research. Models can never be “right” and are not replacements for well planned field experiments. If management actions are taken with the intent to improve Gulf sturgeon populations, then this model could be used to make predictions of population response, and then these predictions compared to data collected following the management action to assess model performance. This iterative process, termed “adaptive management”, of identifying management objectives, identifying management actions, using models to predict population response to management actions, implementing the management action, and then testing the model with data from the management action, has been a successful approach in the past for maximizing learning and management effectiveness (Walters 1986). A true adaptive management framework, using models in conjunction with field studies to evaluate and inform management policies, may be the best and most powerful method available for managers to use in managing animal populations.

Technical Assistance For Continuing Development of Content For Focal Species Website and Bird Conservation Node Website

Principal Investigator: **H. Franklin Percival**
Funding Agency: U.S. Geological Survey
Expected Completion: 07/30/08 (PJ#69949)
Research Staff: Elizabeth Martin, Amy Schwarzer

The National Biological Information Infrastructure (NBII) is a broad, collaborative program managed by the U.S. Geological Survey (USGS) whose aim it to provide access to a vast array of biological and natural resources data and information products that support and enhance science-based decision-making. The Bird Conservation Node of the NBII maintains a series of websites and online tools that increase access to existing data and information used to support bird conservation in North America. One of those websites is the Focal Species website (http://focalbirds.nbii.gov), which was developed to support the Focal Species Strategy being implemented by the Migratory Bird Program of the U.S. Fish and Wildlife Service. One hundred and thirty-nine focal species were selected as candidate species for focused conservation action. Campaigns for development and implementation of species action plans for 11 of those species were initiated in 2005, and more will be undertaken in future years to

progressively address the rest of focal species. The focal species website maintained by NBII provides a common site to post species action plans as they become available, and in addition it provides general species information and links to existing web resources for those species. This project secures research services from the Florida Cooperative Fish & Wildlife Research Unit of the University of Florida for content development and identification of suitable online resources to populate new focal species pages to be developed by NBII in 2007 and 2008.

OBJECTIVES:
The purpose of this project is to secure technical assistance with content development for new focal species web pages. The following activities will be conducted on selected focal species:
(1) research and development of brief summaries of information on why selected focal species are species of concern,
(2) discovery and prioritization of relevant online information resources for focal species and Bird Conservation Node websites, and
(3) identification of species images for use in focal species website.
It is expected that content for 10-15 new focal species will be developed by this project.

PROGRESS:
In May 2008, the U.S. Fish and Wildlife Service identified 22 new focal bird species for which conservation plans will be developed in the upcoming years. NBII was required to develop web pages for 10 focal species by the end of September 2008. Since content for 5 additional species pages had already been provided by Amy Schwarzer during the fall of 2007, the FL Cooperative Fish & Wildlife Research Unit hired a technical assistant for a month and a half during the summer of 2008 to develop content for at least 5 more focal species pages. The assistant, Matthew Reetz, had just received a Ph.D. from the Wildlife Department at the University of Florida, and had ample expertise with avian research. During his tenure as an assistant for the focal species website project, Matthew performed exceptionally providing full content needed to develop web pages for 14 species of those identified by U.S. Fish and Wildlife Service (FWS) in May 2008. He researched and developed descriptive summary paragraphs on why the selected focal birds were considered species of conservation concern, researched and recommended online resources providing biological and/or conservation information on those species, and solicited electronic images for use in the website including securing permissions for their use. In addition, Matthew developed descriptive summary paragraphs for the remaining 7 species identified by FWS earlier this year. At the end of his tenure, Matthew provided to the NBII Bird Conservation Node Manager all files and materials collected and developed as part of his work on this project. The services provided by the FL Cooperative Fish and Wildlife Research Unit at the University of Florida to this focal species website project were completed by August 2008 and the content developed and provided by the project staff has been incorporated into web pages for the following 10 focal species that are now online: Black Oystercatcher, Tricolored Blackbird, Golden-winged Warbler, Henlow's Sparrow, Red Knot, Dusky Canada Goose, Gull-billed Tern, Reddish Egret, Rusty Blackbird, Trumpeter Swan. Content developed by project staff for the remaining 17 species will be incorporated into web pages to be developed in 2009.

Evaluating Endocrine Disruption in Fish Exposed to Waters at Turkey Creek

Principal Investigator: **Nancy Denslow**
Co-PI: Nancy Sazbo
Funding Agency: U.S. DOI / U.S. Geological Survey
Expected Completion: 07/30/08 (RWO 247 - PJ#72266)
Research Staff: Roxana Weil, Iris Knoebl

Okaloosa darter populations that live in streams subjected to municipal effluent sprayfields are depressed and reproduce with minimal success. This study is designed to support a holistic evaluation of the chemical stressors that are impeding the recovery of darter populations. Although the initial goal is identification, the eventual objective is reduction or elimination of the stressors. To model contaminant exposures experienced by the Okaloosa

darter, adult male fathead minnows (FHM) will be caged at three Turkey Creek sites and two reference sites for 48 hours. At the end of the exposure, the fish will be sacrificed and tissues will be collected for RNA expression using the FHM microarray (15,000 genes) and contaminant (Priority Pollutant Metals) assay. Semi-permeable membrane devices (SPMD) and POCIS (polar organic c*2008 Photo By: Dr. Margaret Lamont, FL CRU* chemical integrative samples) will be deployed for a minimum of one week in the waters at the three exposure sites and at one of the reference sites as a means of evaluating average contaminant levels (chlorinated hydrocarbons and estrogenic hormones).

OBJECTIVES:
1) Expose caged fathead minnows in 3 Turkey Creek and 2 reference sites for 48 hr to model contaminant exposure experienced by the Okaloosa darter.
2) Measure changes in gene expression in the liver and the gonad of FHM from all sites to determine pathways that are affected by the exposures.
3) Validate the changes by real time RT-PCR for 6 genes of interest
4) Characterize contaminants present at the Turkey Creek site by measuring levels of priority pollutant metals in the carcasses of caged fathead minnows and levels of organochlorine pesticides (OCP), total polyaromatic hydrocarbons (TPAH), total polychlorinated biphenyls (TPCB), and estrogenic hormones in water extracts from the Turkey Creek sites and from one reference site. This project provides a holistic evaluation of chemical stressors in Okaloosa darter streams subjected to municipal effluent sprayfields using the fathead minnow as a model. In addition to evaluating the minnows using microarray for comparison of gene activity among fish from the Turkey Creek and reference sites, we will also monitor priority pollutant metals, chlorinated hydrocarbons, and estrogenic compounds from impacted and reference sit.

PROGRESS:
Objective 1: Completed: The field portion of this study was conducted in spring 2008 through the efforts of Dr. Jon Hemming and the US FWS. There were problems with the 48 h exposure in the field since some of the sites varied considerably in temperature and at one of the control sites, all of the control fish died. We decided to bring water from each of the sites into the laboratory where we could perform the exposures and control the temperature. This was done and the exposures were carried out in the Aquatic Toxicology Laboratory at UF in July, 2009.
Objective 2: Microarrays have been performed for the liver tissues of the exposed animals and the analysis of the data is ongoing. Microarrays for the gonad tissues will be performed in the next period.
Objective 3: We have cloned gene fragments of interest for the 6 genes. Q-PCR experiments will be performed in the next period.
Objective 4: Completed. OCP, PAH, and TPCB from the site waters were analyzed from the membrane extracts of deployed SPMD devices via GC-MS. Estrogens from the site waters were analyzed from the membrane extracts of deployed POCIS devices via LC-MS/MS. Due to size of FHM and the short period of deployment, FHM were not utilized as an indicator of priority pollutant metals. Instead Notropis sp, a small fish of similar size, trophic level and habit to the darter were captured from each site and analyzed for the selected suite of metals using US EPA protocols.

Spectral and Response Assessment of Turtle-Friendly Lighting Study

Principal Investigator: **Raymond R. Carthy**
Co-PI: Margaret Lamont
Funding Agency: Progress Energy of Florida
Expected Completion: 04/30/2010 (UFPJ#00074216)
Research Staff: Frank Solis, Jennifer Solis

Artificial lighting disrupts the orientation ability of hatchling sea turtles as they crawl from their nest to the sea. Both intensity and wavelength of the light contribute to this disruptive effect. Studies have indicated that loggerhead and green hatchlings will orient towards shorter wavelength light and will have minimal response to longer wavelength light (Witherington 1991; Levenson et al. 2004). Therefore, managers attempting to reduce hatchling disorientation due to artificial lighting have promoted lights with shorter wavelengths such as low-pressure sodium lamps. Currently, low-pressure sodium lamps are the only lamps to be labeled “turtle friendly” by the Florida Fish and Wildlife Conservation Commission. Development of an alternative to the low-pressure sodium

lamp that has minimal to no effect on orientation of hatchling turtles would provide options for residents, business owners and energy companies.

Experimental arena trials will be conducted at one site along Eglin Air Force Base property on Cape San Blas, Florida. Hatchlings that emerge naturally from a nest will be placed in the center of the arena and then remotely released. Their movements will be recorded to determine orientation. Orientation data will be analyzed to determine if groups of turtles were significantly oriented, to assess whether groups of turtles were significantly oriented toward the most direct route to the sea (0°), and to determine if orientation significantly differed between control and experimental treatment groups.

OBJECTIVES:
The primary objective of this project is to determine the effect of the newly designed turtle-friendly lamp on sea turtle hatchling orientation. We will also gather spectral information and hatchling orientation data on the most popular lamps, including low pressure sodium and high pressure sodium lamps.

PROGRESS:
On July 30 and July 31, light intensities were measured for 6 lamps: 100 and 150 watt High Pressure Sodium; 100 and 150 watt High Pressure Sodium with an Amber Lens; and 100 and 150 watt Coated Test Lamps. We gathered lighting data at three distances from our test arena: 15 meters, 30 meters and 50 meters; and all light readings were taken within "turtle friendly" wavelengths (545-700 nm) and "non-turtle friendly" wavelengths (300-500 nm).

Following completion of these readings, reviews of the project protocol were received from the Florida Fish and Wildlife Conservation Commission (FWC). At their suggestion, 1 of the distances was eliminated to increase sample size. The protocol was changed to test light intensities and hatchling reactions at 15m and 50m.

On August 26, light intensities were gathered for two additional lamps (55 watt Low Pressure Sodium and 90 watt Low Pressure Sodium) and again for the Coated Test Lamp to compare readings taken in August with those taken in July. These tests allowed for completion of light intensity readings for all lamps included in the trials. On August 22, Tropical Storm Fay impacted the research site. Nearly all nests deposited along the research site were either washed away or inundated by this storm. No hatchlings emerged from these nests and no arena trials were completed. On October 21, a complete lighting assessment was made including: 55W LPS, 100W test, 100W amber lens, and 100W HPS; and 90W LPS, 150W test, 150W amber lens, and 150W HPS. During this complete set of readings, the radiometer was placed in a mounting system that maintained directionality of the lens throughout the readings, thereby reducing variability due to lens movement.

PROJECT SUMMARY STATEMENT:
Artificial lighting disrupts the orientation ability of hatchling sea turtles as they crawl from their nest to the sea and currently there are few options for turtle-friendly lighting. Development of an alternative to the low-pressure sodium lamp that has minimal to no effect on orientation of hatchling turtles would provide options for residents, business owners and energy companies.

Monitoring for St. Joseph Peninsula Beach Restoration Project

Principal Investigator: **Raymond R. Carthy**
Co-PI: **Margaret Lamont**
Funding Agency: MRD Associates
Expected Completion: 10/31/2008 (UFPJ#00075116)
Research Staff: F. Solis, J. Soli, M. Wcisel, C. Warner

The Florida Cooperative Fish and Wildlife Research Unit (Coop Unit) at the University of Florida has been conducting sea turtle surveys along Cape San Blas at the southern tip of the St. Joseph Peninsula since 1994. Prior to these surveys, little was known about species, nesting densities, site fidelity and distribution of nesting in this region. Since we initiated our surveys, our data has helped determined that the group of loggerhead turtles nesting

in Northwest Florida is genetically distinct from loggerheads nesting throughout the southeast and that the St. Joseph Peninsula supports the greatest nesting density of these unique turtles. Our surveys involve nest marking, data collection, nest relocation, screening for predators when necessary, and hatching inventories. In 1998, the Coop Unit initiated a saturation tagging program that involves nightly surveys for nesting turtles. When a nesting female is encountered, she is tagged and morphometric data are collected. Tagging the turtle enables us to individually identify nesting females which helps estimate population size, site fidelity, and movement patterns. Since 1998, more than 300 turtles have been tagged. The Coop Unit will use the knowledge and many of the methods gained from conducting surveys for 14 seasons along Cape San Blas to survey nesting turtles on the adjacent 7.5 km along the St. Joseph Peninsula.

The Coop Unit will begin sea turtle surveys along St. Joseph Peninsula on May 1, 2008. Surveys will begin just prior to sunrise and will be conducted via ATV. Data collected during surveys will include number and type of false crawls, number of nests, and location of nests. Crawl and nest locations will be marked with a hand-held GPS and will be recorded in latitude and longitude. Any abnormalities in crawls or nests will be documented, and any signs of disorientation in the nesting female will be recorded. The following measurements will be gathered: crawl width, crawl length, height of crawl (and/or nest) above the mean high water mark, distance from nest to nearby structures (natural or man-made), number of eggs, and depth to top of clutch. The nest will be marked with four stakes, flagging tape, and an FWC turtle sign. Additional stakes will be placed in the dune in case the nesting stakes are washed away.
All nests laid in the yet-to-be-nourished portion of the beach will be relocated before 9:00am. Nests laid in areas already nourished will be left in situ. Nests laid on the northern half of the survey area will be relocated to within St. Joseph State Park or to Eglin Air Force Base property on Cape San Blas.

All nests will be checked daily for signs of disturbance, depredation or erosion. The number of nests inundated, lost to erosion, disturbed or depredated will be recorded. Beginning at 45 days incubation, nests will be observed for signs of hatching. Hatching inventories will be conducted following all standard FWC protocols. Hatchling emergences will be observed for signs of disorientation. Data collected will include the number of: unhatched eggs, depredated eggs, live pipped eggs, dead pipped eggs, live hatchlings in the nest, dead hatchlings in the nest, hatchlings emerged, hatchlings disoriented and hatchlings depredated.

As sea levels rise, coastal habitat erodes and humans utilize various techniques to reduce erosion from damaging or destroying their homes and investments. Beach nourishment is rapidly becoming the primary method used to restore highly eroded beaches. However, affects of an ongoing nourishment project on nesting sea turtles is largely unknown. Data collected during this project will provide valuable information regarding effects of beach nourishment on abundance and distribution of sea turtle nests, nesting success, and hatching success. It will also expand our long-term dataset and analysis of site fixity.

OBJECTIVES OF PROJECT:
Determine the effects of an active beach nourishment project on:

1. nesting distribution
2. nesting abundance
3. nesting success, and
4 hatching success of sea turtles nesting along the St. Joseph Peninsula

PROGRESS:
The first sea turtle crawl observed along the St. Joseph Peninsula (SJP) in 2008 occurred on May 25 and was a false crawl. The first nest was deposited on May 28. During the 2008 nesting season, 102 nests were deposited along SJP; 93 were deposited by loggerhead turtles and 9 were deposited by green turtles. The last nest of the season was observed on August 25.

Of the 102 nests, 28 (27.5%) were deposited in nourished sand and 71 (72.5%) were deposited in natural sand. Of the loggerhead nests, 23.7% were deposited in nourished sand whereas 66.7% of green turtle nests were laid in nourished sand. All nests laid in natural sand, except two, were relocated and all nests deposited in nourished sand were left *in situ*.

Three tropical systems affected SJP nesting this season (TS Fay, H. Gustav, and H. Ike) resulting in the loss of 34.3% of the nests and inundating many nests. Success of all nests remaining after the storms was 51.2%. Success

of all nests laid in the nourished sand was 75.4% and of all nests laid in non-nourished sand was 48.2%. Success of loggerhead nests laid in nourished sand was 69.5% versus 49.4% of nests laid in non-nourished sand. Success of green turtle nests was 79.4% in nourished sand versus 27.9% in non-nourished sand. The mean incubation rate of all nests laid in nourished sand was 62 days whereas mean incubation rate of all nests laid in non-nourished sand was 60 days.

ERDC Participation in 2008 USACE UAS Program

Principal Investigator: H.F. Percival
Co PI: P. Ifju, B. Dewitt, S. Smith
Funding Agency: USGS/Army Corps of Engineers
Expected Completion: 09/30/2008 (PJ# 73233)
Research Staff: A. Watts, J. Perry, W. Bowman, M. Morton

Support from Engineer Research and Development Center will allow the University's UAS program to make further progress in three focus areas: further development of Unmanned Aerial Systems platform and sensors; geo-referencing technique development; and application research.

We will continue ongoing reliability testing and guidance system calibration against a high-accuracy inertial measurement unit (IMU). Also, development and integration of a medium-grade guidance system based on tactical-grade MEMS-based IMU/GPS integrated system will be explored. This work already has enabled us to measure the error with which the autopilot's IMU is able to measure the position of the aircraft and, thus, the potential accuracy with which we can use it to georeference imagery we gather with the aircraft. (This step is critical to the use of aerial imagery to measure change in position or extent of wildlife, vegetation, or other environmental phenomena.) During the project period, we will further refine our error estimates. We also will begin the first stages of work on a sensor payload that includes its own IMU, which would dramatically increase the accuracy of position estimates linked to imagery.

Geo-referencing technique will involve ground-truthing software and techniques previously developed for linking positional telemetry with image data in order to provide position estimates of objects in imagery we gather. Although preliminary test flights have been conducted to test these techniques, these attempts have been secondary to other objectives and have involved only short series of images. We plan to conduct this work during missions also designed to answer additional research questions, described below.

Two research missions were planned during the project period that was supported by a number of sources, including ERDC. The first mission consisted of a series of flights over Water Conservation 3A (or nearby area with similar habitat) in the Florida Everglades with the following objectives: 1) study the effects (if any) of low-altitude UAV flights on bird behavior; 2) measure the detection probability of individual wading-bird colonies using low-altitude aerial images of tree islands containing known (via intense ground-based surveys) numbers of bird colonies; and 3) use repeated low-altitude UAV surveys to estimate nest turnover rates. The third objective was dependent on the UAV's ability to follow a pre-programmed path with high repeatability and accuracy, and on our ability to assemble images into time-series photomosaics which can be analyzed for changes in numbers of nests in known areas.

The second mission a series of flights over Seahorse Key, the home of University of Florida's Marine research Laboratory. This series of flights will support 1) a current pilot project with the Florida Fish and Wildlife Conservation Commission (FWC) to determine the feasibility of using UAS to conduct shorebird surveys; and 2) an ongoing study by UF faculty to characterize habitat and coastal vegetation on the entire island. One objective of this study is to provide baseline data on vegetation and beach condition that may be useful for future studies of sea-level rise, which would use the UAV as well as other methods.

Supplement to 'Directing Succession Through Adaptive Management in National Wildlife Refuges: Reed Canary Grass Control and Transition to Wetland Forests and Meadows

Principal Investigator: Carrie Reinhart-Adams
Funding Agency: USGS/Fish and Wildlife Service
Expected Completion: 02/28/2009
Research Staff:

Soil Texture and Nutrient Analysis:
By characterizing the soil at experimental sites, we will be able to explain how treatment differences are related to these abiotic conditions, thereby yielding more predictive power to our recommendations for further treatment. We have an agreement with the UF soils judging team to test the samples and provide a texture characterization for each sample. Their coordinator, James Bonczek, has offered to do regular quality control testing to ensure data reliability. We also have an agreement with the Environmental Horticulture program who will conduct a suite of nutrient analyses (TKN, Nitrite/Nitrate, Organic Matter, and pH) for each sample under the coordination of Nancy Steigerwalt. Soil storage will be provided by University of Florida.

Timeline and cost:
Soil texture characterizations will begin Fall 2008 and will be complete in 2009.
Soil nutrient analyses will begin Fall 2008 and will be complete in 2009.

Seed Bank Assay:
Characterizing the seed bank at experimental sites will allow us to explore the relationship between potential vegetation at the site and community composition resulting from treatments. Seed bank samples have been collected from Upper Mississippi Refuge meadow sites and from Region 6 meadow sites from refuges where flooding prevented earlier collection. Forest site seed bank samples will be collected in October 2008. Approximately 305 samples will be assayed for species composition for this second seed bank assay of the project. Equipment and supplies (pond liner, trays, potting medium) will be provided by the University of Florida. The assay which will begin November 2008 and will be complete by August 2009.

An Assessment Of The Use of Unmanned Aerial Systems For Surveys of Wading Birds in The Everglades

Principal Investigator: Peter Frederick
Funding Agency: USGS/Army Corps of Engineers
Expected Completion: 09/30/2008 (PJ# 74325)
Research Staff: A. Watts, A. Abd-Elrahman, A. Mohamed, B. Wilkinson, J. Perry, K. Lee, Y. Kaddoura

Monitoring of wading bird populations in the Everglades is considered essential to the evaluation of the Comprehensive Everglades Restoration Plan (http://www.evergladesplan.org/pm/recover/recover_map_part2.aspx). Systematic monitoring to locate nesting colonies and estimate nests over this very large area (1300 square miles convert) has been accomplished traditionally using systematic aerial surveys of various kinds using fixed-wing and helicopters (Frederick et al. 1996, Bancroft et al. 2002). While these survey methods are effective, they are also expensive, involving large expenditures, and exposing biologists and pilots to risks associated with manned air missions.

Unmanned Aircraft Systems (UAS's) offer the potential to reduce the risks and costs associated with monitoring natural resources from the air. UAS's typically include a small (5 – 50 lb convert) aircraft piloted by a computer autopilot and guided by GPS along a pre-programmed path. The can collect imagery or other sensor based data along flight paths with high repeatability and reliability. The range of these aircraft can be comparable to small

manned aircraft (eg, transatlantic crossings have been documented). The advantages of UAS's include logistical flexibility, no risk to humans, transportability, the ability to operate far from airports, and the potential for reduced operating costs compared to manned aircraft. These systems have been used for many years in the military theater with considerable success, and civilian applications are growing rapidly as technology of imagery and electronics have become more sophisticated, miniaturized and affordable.

The University of Florida and the Florida Cooperative Research Unit have been innovators in the UAS field for 10 years, and have developed an aerial platform optimized for natural resource monitoring questions (Watts et al. 2008). The University of Florida has also carried out ground and aerial surveys of wading birds in the Everglades for over 20 years (Frederick and Ogden 2003) and has a field crew based annually in south Florida. Thus the tools for carrying out a field study are available.

Objectives:

1. Carry out a field based feasibility study of the use of UAS technology for detecting and monitoring populations of breeding wading birds in the Everglades.

2. Determine optimal altitude for detection of wading bird colonies.

The objective here is to be able to independently recognize colonies of wading birds from aerial photos collected by the UAS. In order to measure detectability, we will fly the UAS in a grid like pattern over areas known (through existing manned surveys in the same month) to contain at least one colony (but many tree islands without colonies). We plan to repeat this survey in at least three areas over the course of several days. Detectability will be expressed simply as colonies found/colonies present.

Monitoring of Wading Bird Reproduction in WCAS 1,2, and 3 of the Everglades - UAV

Principal Investigator: H. Franklin Percival
Funding Agency: USGS
Expected Completion: 03/30/2009 (PJ# 75986)
Research Staff: A. Watts, J. Perry, M. Burgess, S. Ingley

This original work of this project is modified to add continued UAV research for FY08 at no additional cost to the project. The SOW includes monitoring of wading bird colonies by coordinated systematic aerial (via manned aircraft) and ground surveys during the breeding season. The University of Florida, in collaboration with USGS and US Army Corps of Engineers, has been developing unmanned aerial vehicles (UAV) specifically for use in natural resources applications. These small aircraft have the ability to follow flight paths very closely, resulting in remarkable repeatability of survey paths that can be georeferenced. The UAVs also have the distinct advantage of being unmanned, alleviating the risk of accident involving humans, over that of manned flights.

One promising application of UAVs is their use with the discovery and monitoring of wading bird colonies. A pilot study in early May 2008 suggests that pictures taken from UAVs can be used to identify and count colonies accurately. Early estimates suggest that use of the UAV may keep human observers out of the air for an estimated 125 hours per field season, thus reducing fuel costs, labor coasts, and safety risks.

Work to be performed during Summer 2008 is to have three fully functional aircraft and one training aircraft with capabilities and spare parts ready for the 2009 field season. A working prototype of the aircraft exists and is to be used to guide this task. The work to be performed includes the following:
1) Building four aircraft from the fully functional existing prototype (three fully functional units, one trainer), with associated travel cases.
2) Development of an airboat-based launch system.
4) Testing and fitting a better quality SLR digital camera into the body.

5) Development of software capabilities to allow accurate georeferencing and overlays.
6) Radio control pilot training of one member of the wading bird team, and training in all aspects of post-processing.
6) Field testing of prototypes and refinement of launch, retrieval, post-processing, and maintenance procedures.

Effects of Climate Change on Barrier Island Habitat and Nesting Sea Turtles

Principal Investigator: R.R. Carthy
Co-PI: M. Lamont
Funding Agency: USGS/Eglin Air Force Base
Expected Completion: 05/31/2012 (PJ# 00078317)
Research Staff:

As the global climate changes it is likely to have significant effects on coastal habitats and the species that rely on this habitat for survival. Warmer temperatures and rising seas can increase beach erosion, altering oceanographic patterns and influencing sand temperatures. These changes to the coastal environment may greatly affect species such as sea turtles. Sea turtles spend most of their life at sea but rely on the shoreline for one critical life-history phase: nesting. Changes to beach topography, sand temperatures and oceanographic patterns may impact nesting success, change incubation rates and influence nesting site fidelity. Determining the effects of climate change on nesting sea turtles will help provide better management information for this threatened species.

Eglin Air Force Base (EAFB) owns approximately 250 hectares along Cape San Blas, Florida. Research conducted by the Florida Cooperative Fish and Wildlife Research Unit from 1994 to 1997 indicated that this property supports the greatest density of loggerhead turtle nesting in the Florida panhandle. In 1998 it was determined that turtles nesting in Northwest Florida are genetically distinct therefore EAFB property on Cape San Blas is critical for the success of this nesting group. Although this region supports a significant group of nesting sea turtles, it has also been determined that Cape San Blas experiences one of the greatest rates of erosion in Florida. Portions of the west beach of Cape San Blas lose approximately 10 meters of sand per year, while sections of the east beach gain about 4 meters per year. These fluxes may increase substantially when influenced by tropical storms.

This project aims to further elucidate specific components of sea turtle ecology and climate change by:

a. continuation of a long-term tagging study and nest monitoring
b. investigating effects of changes in beach morphology on sea turtle movements during the internesting period
c. examining effects of erosion debris fields on nesting success 1) identification and GIS mapping of Coast Guard Station debris onshore and off-shore 3) statistical comparison of mean number of false crawls in debris areas versus non-debris areas
d. researching effects of climate change on incubation length

These activities will be conducted annually for 3 nesting seasons (2009, 2010 and 2011), and will augment our research in support of management as well as strengthen the context of our conceptual framework for effects of climate change in this dynamic coastal region.

COMPLETED PROJECTS of Florida Unit….

1. Winter Feeding Ecology of Black Skimmers on the Florida Gulf Coast,
   PI: L.D. Harris; Personnel: B. Black; Completion Date: 1981

2. Sinter Food Habits and Factors Influencing the Winter Diet of River Otter in North Florida.
   PI: L. Cooley; Completion Date: December 1983

3. Feeding Ecology of the Common Moorhen (*Gallinula Chloropus*) and Purple Gallinule *Porphyrula Martinica*) on Orange Lake, Florida. PI: R. Mulholland; Completion Date: December 1983

4. Monitoring River Otter Population: Scent Stations vs Sign Indices. PI: M. Robson;
   Completion Date: December 1983

5. Aspects of the Thermal Biology and Ecological Considerations of the Blue Tilapia.
   PI: J.A. McCann; Personnel: A.V. Zale; Completion Date: December 1984

6. Winter Food Habits & Factors Management Influencing the Winter Diet of River Otter in North Florida.
   PI: H.F. Percival; Personnel: L.S. Cooley

7. Habitat Preference of Early Life Stages of Fishes in Orange Lake, Florida With an Evaluation of Alligator Sampling Methods –Winter Ecology of Ring-Necked Ducks in North-Central FL.
   PI: H.F. Percival, J. Thul; Personnel: C.W. Jeske; Completion Date: August 1985

8. Reproductive Behavior & Florida Wild Turkey (Meleagris Gallopavo Osceola) Nesting.
   PI: L. Williams; Completion Date: December 1985

9. Evaluation of Alligator Hatchlings Removal From Wild Populations in Florida.
   PI: H.F. Percival; Personnel: M.L. Jennings, Completion Date: March 1986

10. Nest Site Selection and Habitat Use by Largemouth Bass. PI: R.W. Gregory; Personnel:
    N.A. Bruno; Completion Date: December 1984

11. Research/ Management Plan For The Crystal River West Indian Manatee Population Levy &
    Citrus Counties, FL. PI: R.W. Gregory, H.F. Percival; Completion Date: December 1983

12. Site-Specific Reduction of Manatee Boat/Barge Mortalities in Florida. PI: H.F. Percival,
    R.W. Gregory; Personnel: M.F. Kinnaird; Completion Date: May 1984

13. Mitigation of Fish & Wildlife Values in Rock-mined Areas of S. Florida. PI: R.W. Gregory,
    H.F. Percival; Personnel: R.W. Repenning; Completion Date: August 1984

14. Wildlife Values of Southeastern Bottomland Forests. PI: L.D. Harris; Completion Date: September 1984

15. The State of Knowledge of Gray Fox Harvest. PI: R.F. Labisky, S.R. Humphrey, H.F.Percival;
    Personnel: J.A. Hovis; Completion Date: January 1984

16. Foraging Habitat Requirements of The Red=Cockaded Woodpecker in Pine Habitats of North Florida.
    PI: R.F. Labisky; Personnel: M.L. Porter; Completion Date: September 1984

17. Habitat Suitability Index Models for Gulf of Mexico Coastal. PI: R.W. Gregory, H.F. Percival;
    Personnel: R. Mulholland; Completion Date: November 1984

18. Effect of Nutrient Leaching on Fish Spawning & Nursery Habitat in Great Lakes Nearshore Water.
    PI: R.W. Gregory, H.F. Percival; Personnel: L.C. Brasel; Completion Date: November 1984

19. Development of Hybrid Grass Carp Production Techniques. PI: J.V. Shireman; Completion Date: September 1984

20. Conceptual Model of Salt Marsh Management on Merritt Island, Florida. PI: C.L. Montague, H.F. Percival; Personnel: A.V. Zale; Completion: December 1984

21. Studies of Grass Carp in Aquatic Weed Control. PI: J.V. Shireman; Completion Date: October 1984

22. Factors Affecting Reproductive Success of Sea Turtles on Cape Canaveral Air Force Base. PI: R.F. Labisky; Completion Date: September 1984

23. Ecology & Management of Impounded Coastal Wetlands of The Georgia Bight. PI: C.L. Montague, H.F. Percival; Personnel: A.V. Zale; Completion: June 1985

24. Status Survey of the Rosemary Wolf Spider in Florida. PI: J. Reiskind; Completion Date: April 1985

25. Determination of the Food Habits of Manatees. PI: G.B. Rathbun, H.F. Percival; Personnel: L.A. Hurst, Completion Date: August 1985

26 Evaluation of Captive Breeding & Reintroduction of the Flroida Panther. PI: J.F. Eisenbert; Completion Date: June 1985

27. Biometrical support For GFC's Gainesville Research Laboratory. PI: H.F. Percival: Personnel: C.L. Abercrombie, T.O'Brien; Completion Date: June 1985

28. Black Bear Habitat Variables. PI: L.H. Harris, D. Maehr; Personnel: C.W. Jeske; Completion Date: July 1985

29. Status Survey of the Florida Grasshopper Sparrow. PI: M.L. Delany, H.F. Percival; Personnel: J. Cox; Completion Date: March 1985

30. Status Survey of the Schaus' Swallowtail in Florida. PI: T.C. Emmel; Completion Date: March 1985

31. Population Index & Mark/Recapture Methodology For the West Indian Manatee In Florida. PI: H.F. Percival, Completion Date: August 1985

32. Effects of Low Altitude Training Flights on Florida's Brown Pelican & Wading Bird Colonies. PI: M.W. Collopy, B.B. Black, P.G. Bohall; Completion Date: January 1985

33. Habitat Use & Management of Sherman's Fox Squirrel. PI: S.R. Humphrey; Personnel: A.T. Kantola; Completion Date: June 1986

34. Evaluation of Electro-fishing Systems for Quantitative Sampling of Blue Tilapia. PI: H. Schramm; Completion Date: May 1986

34. Pancreatic Necrosis Virus as a Pathogen of Striped Bass. PI: R.W. Gregory, W.M. Kitchens, J.V. Shireman; Personnel: S. Wechsler; Completion Date: May 1987

35. Production, Sterility, & Food Habits of Bighead Carp. PI: J.V. Shireman; Completion Date: July 1987

36. Evaluation of Population Parameters of Black Duck. (RWO27) PI: H.f. Percival, M.J. Conroy, M. Haramis; Personnel: D.G. Krementz, B.R. Charest; Completion Date: July 1987

37. Status of the Cape Sable Seaside Sparrow in East Everglades. PI: W.R. Marion; Personnel: T.O'Meara; Completion Date: September 1987

38. Evaluation & Control of Bird Damage to Rice. PI: M. Avery, H.F. Percival, P. Lefebvre; Personnel: D. Daneke; Completion Date: December 1987

39. The Ecology & Management of Impounded Coastal Wetlands of the Georgia Bight: Workshop (RWO33) PI: C.L. Montague, H.F. Percival; Personnel: A.V. Zale; Completion Date: September 1987

40. Movement & Survival of Captive-Reared Gharials in the Narayani River, Nepal. PI: H.F. Percival; Personnel: T.M. Maskey; Completion Date: December 1988

41. Egg Viability From Four Wetlands in Florida. PI: H.F. Percival, A.R. Woodward: Personnel: M.L. Jennings; Completion Date: April 1988

42. The Ecology & Management of Hydric Hammocks (RWO24). PI: S.R. Humphrey; Personnel: S. Vince; Completion Date: July 1988

43. A Comparison of Passerine Feeding Habits in Two Tidal marsh Communities (RWO30). PI: G.W. Tanner, W.M. Kitchens; Personnel: L. Peterson; Completed: January 1989

44. Population Analysis & Roosting & Feeding Flock Behavior of Blackbirds Damaging Sprouting Rice in SW Louisiana. PI: R.R. Labisky, N.R. Holler; Completion: September 1989

45. Performance of the Female Habitat Use, Movements, Migration Patterns, & Survival Rates of Sub- Adult Bald Egles in Florida. PI: M.W. Collopy; Personnel: P.B. Wood; Completion Date: December 1991

46. Effectiveness of Wildlife Crossing Structures on Alligator Alley (I-75) For Reducing Animal/Auto Collisions. PI: S.R. Humphrey; Personnel: M.L. Foster; Completion Date:December 1991

47. Impact Assessment of Grass Delivery Program on Wading Carp (RWO34). PI: J.V. Shireman, W.M. Kitchens; Completion Date: September 1989

48. Status Survey of Three Florida Lizards (RWO35). PI: P. Moler, H.F. Percival, R.F. Labisky; Personnel: K. Enge; Completion Date: October 1986

49. Vegetation Management for Key Deer (RWO36) PI: S.R. Humphrey G.W. Tanner: Personnel: J. Wood, P. Carlson; Completion Date: December 1989

50. Status Survey of Seven Florida Mammals: Micro Cottontail Rabbit, Micro Cotton Rat, SE Beach Mouse, Goff's Pocket Gopher, Anastasia Island Cotton Mouse and Beach Mouse (RWO37). PI: S.R. Humphrey, M. Bentzien; Completion Date: July 1987

51. Relative Abundance, Size Class, Composition, & Growth Patterns of Wild Green Turtles at the Culebra Archipelago, Puerto Rico (RWO38) PI: J.A. Collazo, H.F. Percival; Personnel: T. Tallevast; Completion Date: December 1989

52. Effects of Modified Water Bird Nesting Success & Foraging Dispersion in Water Conservation. PI: M.W. Collopy; Personnel: P.D. Frederick, Completion Date: April 1988

53. Effects of the Modified Water Delivery Program on Nest Site Selection & Nesting Success of Snail Kites in Water Conservation Area 3A (RWO40). PI: M.w. Collopy, s. Beissinger; Personnel: R. bennetts; Completion Date: February 1988

54. Comparative Graminoid Community Compositon & Structure Within the Northern Portion of Everglades Nat'l Park, NE Shark River Slough, Water Conservation Area 3A & 3B (RWO41)
PI: G.W. Tanner; Personnel: J.M. Wood; Completion Date: November 1986

55. Human/Wildlife Interaction J.N. "DING" Darling Nat'l Wildlife Refuge (RWO42).
PI: S.R. Humphrey, H.F. Percival; Personnel: M.V. Klein; Completion Date: June 1989

56. Status Survey of Two Florida Seaside Sparrows (RWO43). PI: K. McNab, V. MacDonald; Completion Date: October 1988

57. Soil/Plant Correlation Studies in Florida (RWO46). PI: G.R. Best, W.M. Kitchens; Completion Date: March 1987

58. Reproductive cycles in Striped Bass Maintained in Recirculation Silos: Histological Analysis.
PI: L.J. guillette, Jr.; Personnel: C.A. Goudie; Completion Date: October 1986

59. Aquatic Plant Management Technology Improvement (RWO47). PI: J.C. Joyce, W.T. Haller; Personnel: V. Ramey, T. Willard; Completion Date: April 1988

60. Effects of Ground Water Levels Upon Reproduction success of American Crocodiles In Everglades Nati'l Park (RWO50). PI: F.J. Mazzotti; Completion Date: April 1989

61. Factors Affecting Productivity & Habitat Use of Florida SandHill Cranes: An Evaluation of Three Areas in Central Florida as Potential Reintroduction Sites for a Mommigratory Population of Whooping Cranes. PI: M.W. Collopy; Personnel: M. Bishop; Completion: October 1988

62. Manatee Protection Project: Survey of Boat Usage Patterns. PI: J.W. Hutchinson, J.W. Alba; Completion Date: September 1988

63. An Evaluation of Manatee Distribution Patterns in Response to Public Use Activities, Crystal River,) Florida. (RWO52) PI: W.M. Kitchens; Completion Date: December 1989

64. An Evaluation of Cumulative Impacts to the Habitat of The West Indian Manatee, Crystal River Nat'l Wildlife Refuge (RWO53) PI: W.M. Kitchens; Personnel: L.G. Pearlstine, C.Buckingham; Completion Date: December 1989

65. Status Survey of The Florida Saltmarsh Vole (RWO54) PI: C.A. Woods; Personnel: L. Hay-Smith; Completion Date: September 1988

66. Impact of Mosquito Control Pesticides on the Endangered Schaus Swallowtail & Related Insects in The Florida Keys (RWO56) PI: T.C. Emmel; Personnel: P. Eliazar; Completion Date: Jan 1989

67. Effects of Mosquito Control Pesticides on Non-Target Organisms in the Florida Keys (RWO57)
PI: D.H. Habeck; Personnel: M. Hennessey; Completion Date: October 1989

68. Development of Guidance Manual For Monitoring Water Quality & Vegetative Changes on Nat'l Wildlife Refuges (RWO58) PI: W.M. Kitchens; Completion Date: December 1988

69. Applicability & Comparison of Satellite Image Data to Delineation of Cover type in The Lower Suwannee River Region (RWO60) PI: W.M. Kitchens; Completion Date: December 1988

70. Distribution & Population Structure of Sea Turtles Inhabiting The Cape Canaveral Entrance Channel (RWO62) PI: A.B. Bolten, K.A. Bjorndal; Completion Date: December 1991

71. Determination of the Causes of Low Response with the Water Fowl Hunter Questionnaire & Estimation of the Resultant Biases (RWO76) PI: H.F. Percival; Personnel: R.J. Barker, P.H. Geissler: Completion Date: September 1990

72. The Ecology of Manatees in Georgia with Emphasis on Cumberland Sound (RWO65)
PI: H.F. Percival, B.J. Zoodsma; Completion Date: December 1990

73. Scientific Review of Alligator Export Proposals to USFWS (RWO69)
PI: H.F Percival; Personnel: P.N. Gray, F. Nunez-Garcia; Completed: July 1990

74. Fish Community Structure in Naturally Acid Florida Lakes (RWO73)
PI: W.M. Kitchens; Personnel: C.A. Jennings, D.E. Canfield, Jr.; Completed: July 1990

75. Development & Application of A Habitat Succession Model For the Wetland Complex of the Savannah river Nat'l Wildlife Refuge (RWO30) PI: W.M. Kitchens; Personnel: L.G. Pearlstine, P. Latham, L. Peterson, G. Tanner; Completion Date: December 1990

76. Plant species Association Changes & Interactions Across a Gradient of Fresh, Oligohaline & Mesohaline Tidal Marsh of the Lower Savannah River (RWO30)
PI: W.M. Kitchens; Personnel: P.J. Latham; Completion Date: December 1990

77. Biology of Florida's Mottled Duck. PI: H.F. Percival; Personnel: P.N. Gray; Completed: May 1992

78. Modeling Waterfowl Harvest & The Effects of Questionnaire Non-response on Harvest Estimate.
PI: H.F. Percival; Personnel: R.J. Barker, J.D. Nichols; Completion Date: May 1992

79. Environmental Influences on Reproductive Potential & Clutch Viability of the American Alligator From Seven Study Sites in Florida. PI: H.F. Percival; Personnel: G.R. Masson;
Completion Date: July 1992

80. Nesting Biology of the American Alligator in Florida. PI: H.F. Percival; Personnel: K.G. Rice;
Completion Date: September 1992

81. Alligator Egg Viability & Population Trends on Lake Apopka, Florida. PI: H.F. Percival,
L.J. Guillette, Jr.; Personnel: G.R. Masson, K.G. Rice, Completed: June 1993

82. Alligator Nest Production Estimation in Florida. PI: H.F. Percival; Personnel: K.G. Rice, A.R. Woodward; Completion Date: August 1992

83. Habitat Use By Migratory Shorebirds at the Cabo Rojo Salt Flats, Puerto Rico (RWO78)
PI: J.A. Collazo, H.F. Percival; Personnel: J.S. Grear; Completion Date: August 1992

84. Wading Bird Use of Wastewater Treatment Wetlands in Central Florida (RWO83)
PI: P.C. Frederick; Completion Date: December 1992

85. Evaluating The Regional Effects of Citrus Development on The Ecological Integrity of South-West Florida. PI: F.J. Mazzotti, W.M. Kitchens; Personnel: L.A. Brandt, L.G. Pearlstine;
Completion Date: May 1992

86. Workshop in Florida Manatee (*Trichechus Mantus*) Population Biology (RWO88)
PI: T.J. O'Shea, H.F. Percival; Personnel: B.B. Ackerman; Completed: October 1993

87. Issues & Options Related to Management of Silver Springs Rhesus Macaques.
PI: C.L. Montague, H.F. Percival; Personnel: J.F. Gottgens; Completed: December 1993

88. Sea Turtles Inhabiting The Kings Bay, St. Mary's Entrance Channel: Distribution & Population Structure (RWO72) PI: K.A. Bjorndal, A.B. Bolten; Completed: September 1983

89. Wading Bird Nesting Success Studies in The Everglades (RWO110) PI: P.C. Frederick,
Completed: December 1993

90. Captive Propagation & Restoration Ecology of The Endangered Stock Island Tree Snail (RWO94) PI: T.C. Emmel; Completion Date: October 1993

91. Status Monitoring & Experimental Reintroduction of The Endangered Schaus Swallowtail (RWO84) PI: T.C. Emmel, P.J. Eliazar, M.C. Minno; Completed: September 1993

92. Conservation Status of The Freshwater Mussels of The Apalachicola River Basin (RWO86) PI: J.D. Williams; Personnel: J.C. Brim-Box; Completion Date: October 1993

93. Statistical Aspects of Line Transect Sampling (RWO68) PI: K.M. Portier, Completed: 1993

94. A Geographic Information System Model of Fire Damage & Vegetation Recovery in The Loxahatchee Nat'l Wildlife Refuge. PI: W.M. Kitchens; Personnel: J.E. Silveira, J.R. Richardson; Completion Date: December 1993

95. Mercury Concentrations in Blood & Feathers of Nestling Bald Eagles (RWO108) PI: P.B. Wood; Personnel: J.H. White, A. Steffer, H.F. Percival; Completed: December 1994

96. Effects of Artificial Lighting on Nesting Adult & Hatchling Sea Turtles (RWO75) PI: K.A. Bjorndal, A.B. Bolton; Personnel: B.E. Witherington; Completed: September 1994

97. Summary Report of Air Quality Studies Done at Chassahowitzka Nat'l Wildlife Refuge (RWO102) PI: E.R. Allen; Completion Date: June 1994

98. Evaluations of The Efficacy of Exotics as Aquaculture & Management Species in Florida (RWO109) PI: J.V. Shireman; Personnel: J.E. Weaver, K. Opusbynski; Completed Date: February 1994

99. Assessing The Impact of Vehicular Traffic on Beach Habitat & Wildlife, Cape San Blas, FL PI: H.F. Percival; Personnel: J.H. Cox, Jr., S.V. Colwell; Completion Date: June 1994

100. Early Life History & Relative Abundance of Sturgeon In The Suwannee River (RWO61) PI: J.V. Shireman, J.P. Clugston, A.M. Foster; Completion Date: October 1994

101. Distribution, Population Structure & Exploitation of Sea Turtles in The Bahamas (RWO67) PI: K.A. Bjordnal, A.B. Bolton; Completion Date: September 1994

102. Sea Turtle Populations in The Eastern Gulf of Mexico: Biology, Distribution & Population Structure (RWO77) PI: K.A. Bjordnal, A.B. Bolten; Personnel: J.R. Schmid; Completion Date: September 1994

103. Distribution & Status of The Red-Cockaded Woodpecker on The Eglin Air Force Base, Florida. PI: H.F. Percival, R.J. Smith; Completion Date: March 1994

104. Factors Affecting Abundance of Spotted Seatrout & Year-Class Strength (RWO81) PI: H.F. Percival, N.A. Funicelli, J.V. Shireman; Completion Date: June 1994

105. Re-establishment of the Anastasia Island Beach Mouse (*Peromyscus Polionotus Phasma*) PI: S. Humphrey; Personnel: P.A. Frank; Completion Date: January 1994

106. Captive Propagation and Habitat Reintroduction for the Schaus Swallowtail Following Hurricane Andrew. PI: T.C. Emmel; Personnel: J.C. Daniels A. Sourakov, P.J. Eliazar; Completion Date: September 1994

107. Development Abnormalities of the Reproductive System of Alligators From Contaminated & Control Lakes in Florida. PI: H.F. Percival; Completion Date: May 1994

108. Land Management Practices in the Mountain Region of Puerto Rico: Monitoring Bird Reproductively in Carite State Forest PI: H.F. Percival; J.A. Collazo; Personnel: F. Nunez-Garcia; Completion Date: December 1995

109. Methods For Determining change in Wetland Habitats in Florida (RWO95) PI: W.M. Kitchens; Personnel: J. Silviera, W. Bryant; Competed: September 1995

110. Population Ecology of Bartram's Ixia (RWO101) PI: G.W. Tanner; Personnel: A. Miller; Completed: October 1995

111. Maintenance, Propagation, and Restoration of the Endangered Stock Island Tree Snail Following Hurricane Andrew (RWO106). PI: T.C. Emmel; Personnel: K.A. Schwarz, R.A. Worth, N.D. Eliazar; Completion Date:: October 1995

112. Changes in Salinity & Vegetation Following Re-establishment of Natural Hydrology on the Lower Savannah River (RWO117). PI: W.M. Kitchens; Personnel: P.J. Latham, L.P. Peterson; Completion Date: March 1995

113. Follow-Up of a 14 Year Old Crested Wetland/Upland Landscape on Phosphate-Mined Land in Central Florida (RWO120) PI: G.R. Best, W.M. Kitchens; Completed: March 1995

114. Trends, Status & Aspects of Demography of The Red-Cockaded Woodpecker in The Sandhills of Florida's Panhandle (RWO124). PI: H.F. Percival; Personnel: J.L. Hardesty, R.J. Smith; Completion Date: March 1995

115. Status & Distribution of The Florida Scrub Jay on Cape Canaveral, Flordia (RWO127) PI: H.F. Percival; Personnel: J.L. Hardesty, D.B. McDonald; Completion Date: May 1995

116. Mercury Contamination in Great Egrets in Southern Florida (RWO132). PI: P.G. Frederick; Personnel: M.G. Spaulding, M.S. Sepulveda: Completed: September 1995

117. The Acute Toxicity of Malathon to Glochidia & Freshwater Mussels (RWO133) PI: E.J. Philips; Personnel: A.E. Keller; Completion Date: March 1995

118. The Role of Environmental Contaminants in The Prevalence of Fish Infected With A Wading Bird Parasite (RWO134). PI: D.J. Forrester; M.G. Spaulding; Personnel: D. Morrison; Completion Date: September 1995

119. Development of an Ecologically Stable Cost Efficient Biological Water Treatment system & Technology Tranfer System (RWO135) PI: J.V. Shireman; Personnel: N.A. Furnicelli; Completion Date: September 1995

120. Status & Distribution of the Florida Scrub Jay on Cape Canaveral, FL (RWO136) PI: H.F. Percival; Personnel: D.B. McDonald, J.L. Hardesty; Completed: October 1995

121. Disruption of Endocrine Function & Reproductive Potential By Environmental Contaminants on Lake Apopka's Alligators & Other Taxa (RWO137) PI: H.F. Percival; Personnel: L.J. Guillette, T.S. Gross, K.G. Rice; Completed: October 1995

122. The Epidemiology of Upper Respiratory Tract Disease in Desert Tortoises at Three Sites in The California Deserts (RWO138) PI: M. Brown; Personnel: I.M. Schumacher, P.A. Klein; Completion Date: April 1995

123. The Relationships Between Host Plant & Habitat For The Distribution of Three Potentially Endangered S. Florida Butterfly Species (RWO145) PI: T.C. Emmel; Personnel: R.A. Worth; Completion Date: September 1995

124. Snail Kite Census PI: W.M. Kitchens; Completion Date: December 1995

125. Refinement of Population Estimation Techniques For Wild Turkeys YR 3.
PI: G.W. Tanner; Completion Date: June 1995

126. Egg Viability, Sexual Development, Hatchling Viability & Growth in Alligators From Lake Apopka & Lake Beauchair. PI: H.F. Percival; Personnel: C.L. Abercrombie, A.R. Woodword, K.G. Rice; Completion Date: July 1995

127. Mineral Interactions Between embryo, Eggshell & Subtrate in Developing Sea Turtles (RWO92)
PI: K.A. Bjorndal; Personnel: A.B. Bolten, R.R. Carthy; Completion Date: August 1996

128. Ecological Correlates of Red-cock Woodpecker Foraging Preference, Habitat Use, & Home Range Area on Eglin Air Force Base, Florida (RWO99) PI: H.F. Percival; Personnel: R.J. Smith, J.L. Hardesty; Completion Date: March 1996

129. Understory Response to Longleaf Pine-Sandhill Restoration Techniques (RWO111)
PI: G.W. Tanner; Personnel: J.L. Hardesty, Completion Date: March 1996

130. Habitat Associations, Reproduction, and Foraging Ecology of Audubon's Crested Caracara in South-Central Florida (RWO114). PI: S.R. Humphrey; Personnel: J.L. Morrison, S.M. McGehee; Completion Date: May 1996

131. Landscape Dynamics of Scrub Lizard on Avon Park Air Force Range (RWO122)
PI: L.C. Branch; Personnel: D.G. Hokit, B.M. Stith; Completion Date: September 1996

132. Post Hurricane Density & Recovery Status of the Key Largo Woodrat and Cotton Mouse (RWO123)
PI: H.F. Percival; Personnel: K. Miller, B.W. Keith; Completion Date: August 1996

133. Evaluation of Sampling and Analytical Protocols for Manatee Capture-Recapture and Telemetry Data (RWO125) PI: H.F. Percival; Personnel: L.W. Lefebvre: Completed: July 1996

134. Community Response to Restoration Techniques in Degraded Florida Sandhill Systems (RWO 128)
PI: G.W. Tanner; Personnel: D.R. Gordon, H.F. Percival; Completion Date: March 1996

135. Marine Turtle Nesting Biology & Assessment of Anthropogenic Disturbances to Hatchling Orientation at Eglin Air Force Base (RWO129) PI: H.F. Percival; Personnel L.G. Pearlstine, Completion Date: April 1996

135. Necropsies of Ill and Dying Desert Tortoises From California and Elsewhere in The Southwestern United States (RWO131) PI: B.L. Homer; Personnel: E.R. Jacobson, K.H. Berry; Completed:March 1996

137. Potential Effects of Endocrine Disrupting Contaminants (RWO140)
PI: T.S. Gross; Personnel: H.F. Percival, K.G. Rice, A.R. Woodward; Completed: June 1996

138. Interactions Among Cavity Dependent Species in Longleaf Pine Forests: The Roles of Snags and Red-Cockaded Woodpecker Cavities (RWO143) PI: J.D. Harris; Personnel: R. Costa, J.J. Kappes, Jr.; Completion Date: August 1996

139. Habitat Assessment in a Landscape Context: Analysis of The Factors Affecting The Distribution & Abundance of Florida Scrub Lizard (RWO156) PI: L.C. Branch; Personnel: D.G. Hokit, Completion Date: April 1996

140. Estimation & Environmental Correlates of Survival & Dispersal of Snail Kites in Florida.
PI: W.M. Kitchens; Personnel: P.C. Darby; Completion Date: February 1996

141. Egg Viability & Population Trends of Lake Apopka Alligators: Relation Ships Among Populations & Biographical Parameters. PI: H.F. Percival; Personnel: K.G. Rice; Completed: July 1996

142. Evaluation of S.R.46 Wildlife Crossing.
PI: H.F. Percival; Personnel: J.C. Roof, J.B. Wooding; Completion Date: May 1996

143. An Ecosystem Approach To Public Education & Information at Eglin Air Force Base (RWO107)
PI: S.K. Jacobson; Personnel: S.B. Marynowski; Completion Date: September 1997

144. Genetic Analysis of Sea Turtle Populations in The Western Atlantic Ocean With Emphasis on The Southeast United States (RWO115) PI: B.W. Bowen, A.B. Bolten; Completion Date: June 1997

145. Cape San Blas Ecological Study (RWO126)
PI: W.M. Kitchens, H.F. Percival, R.R. Carthy; Completion Date: August 1997

146. Enhancement & Evaluation of a Designated Watchable Wildlife Site (RWO130)
PI: J.M. Schaefer, S.K. Jacobson; Completion Date: January 1997

147. Research Objectives to Support The S. Florida Ecosystem Initiative-Water Conservation Areas, Lake Okeechobee & The East-West Waterways (RWO139) PI: W.M. Kitchens;
Completed: September 1997

148. Trends, Status and Aspects of Demography of The Red=Cockaded Woodpecker in the Sandhills of Florida's Panhandle, PartII (RWO146) PI: H.F. Percival, J.L. Hardesty; Personnel: K.E. Gault, L.F. Phillips; Completion Date: March 1997

149. Use of Unionid Mussels as Bioindicators of Water Quality in Escambia Conecuh River System (RWO149) PI: E.Philps; Personnel: A. Keller; Completion Date: June 1997

150. Captive Propagation & Experimental Reintroduction of Florid's Schaus Swallowtail (RWO151)
PI: T.C. Emmel; Personnel: J.P. Hall, K.M. Wilmott, J.C. Daniels; Completed: December 1997

151. Testing & Implementation of Selected Aquatic ecosystem Indicators in The Mississippi River System, 1995: Potential Effects of Endocrine Disrupting Contaminants (RWO153)
PI: T.S. Gross; Completion Date: September 1997

152. Wading Bird Population Monitoring, Environmental Correlates of Adult Foraging Success & Measurement of Nesting Energetic Needs in The Everglades: Part I (RWO158)
PI: P.C. Frederick; Personnel: J.Surkick, J.Salantas; Completion Date: April 1997

153. Marine Turtle Conservation on The Caribbean Coast of Nicaragua (RWO171)
PI: L.J. Guillette, Jr.; Personnel: C.L. Campbell; Completed: December 1997

154. Evaluating The Ecological Role of Alligator Holes In The Everglades Landscapes.
PI: E.J. Mazzotti, H.F. Percival; Personnel: L.A. Brandt; Completion Date: December 1997

155. Two GIS & Land Use Analysis of Freshwater Mussels in The Apalachicola River Drainage (RWO164) PI: J. Mossa; Personnel: J. Howard; Completion Date: July 1997

156. Egg Viability & Population Trends of Lake Apopka Alligators. PI: H.F. Percival; Personnel: K.G. Rice; Completion Date: July 1997

157. Effect of Marine Pollution on Juvenile Pelagic Sea Turtles (RWO66) and Biology of and the Effects of Marine Debris (RWO118) PI: K.A. Bjorndal; A.B. Bolten; Completed: June 1998

158. Enhancement of Natural Dune building & Re-vegetation Processes on Santa Rosa Island (RWO159) PI: D.L. Miller, Mack Thetford; Completion Date: August 1998

159. Pathogenic, Molecular, and Immunological Properties of Herpersvirus Associated with Green Turtle Fibropapillomatossis: Phase I Virus Isolation & Transmission (RWO161) PI: P.A. Klein; Completion Date: June 1998

160. Migrations & Habitat Use of Sea Turtles in The Bahamas (RWO166). PI: K.A. Bjornal, A.A. Bolten: Completion Date: September 1998

161. Population Genetic Structure of Marine Turtles In The Southeastern United States and Adjacent Caribbean Region (RWO167) PI: B.W. Bowen, A.L. Bass; Completed: June 1998

162. Distribution and Abundance of Sensitive Wildlife at Avon Park Air Force Base Range (RWO169) PI: R. Franz; Completed: December 1998

163. Red-Cockaded Woodpecker Cavities & Snags in Longleaf Pine Forest: Cavity Nester Use & Nesting Success (RWO170) PI: K.E. Sieving; Completion Date: September 1998

164. Plant & Invertebrate Community Responses to Restoration Techniques In Degraded Florida Sandhills: YR3 Post-Treatment (RWO174) PI: G.W. Tanner, D.R. Gordon; Completed: July 1998

165. Demographics, Genetic Relationships & Impacts From Rd Imported Fire Ants on The Florida Grasshopper Sparrow (RWO175A) PI: H.F. Percival; Completion Date: March 1998

166. Red Imported Fire Ants on The Endangered Florida Grasshopper Sparrow (RWO175B) PI: H.F. Percival, Completion Date: June 1998

167. Wading Bird Population Monitoring, Environmental, Correlates of Adult Foraging Success & Measurements of Nestling Energetic Needs in The Everglades Phase II (RWO176) PI: P.C. Frederick; Completion Date: April 1998

168. Population characterization of Kemp's Ridley Sea Turtles in The Big Bend Area, Gulf of Mexico, Florida Monitor, Assess, and Predict Status of Impacts to Protected Species & Their Ecosystems (RWO177) PI: R.R. Carthy; Completion Date: September 1998

169. Breeding & Reintroduction of The Endangered Schaus Swallowtail (RWO179) PI: T.C. Emmel; Completion Date: July 1998

170. Estimating Survival & Movements in Snail Kite Population (RWO183) PI: W.M. Kitchens, R.E. Bennetts; Completion Date: July 1998

171. Tree Island Biological Inventory: Landscape Level Assess and Determination of Island Aream Shape & Vegetation Zones (RWO184) PI: W.M. Kitchens, L.A. Brandt; Completion Date: September 1998

172. Biological Diversity in Florida: And Evaluation of Potential Species in Relation to Habitat and Existing Reserves (RWO 98) PI: W.M. Kitchens, L.G. Pearlstine, S.E. Smith, J.L. Hardy; Completion Date: September 1998

173. Improving Survey Methods and Assessing Impoundment Effects on Waterfowl Ecology at the Merritt Island National Wildlife Refuge (RWO 186) PI: R.R. Carthy; Completion Date: June 1999

174. Effects of Prescribed Fire on Soil Nutrients, Forage Quality and Plant Community Composition and on Breeding Bird Communities on the Florida Panther NWR (RWO 168) PI: M.B. Main; Completion Date: July 1999

175. Florida Gap Analysis (RWO 187) PI: L.G. Pearlstine, S.E. Smith; Completion Date: December 1999

176. Modeling and Simulation Support for ATLSS (RWO 154a) PI: P.A. Fishwick; Completion Date: December 1999

177. The Effect of Everglades Food Items (Prey) on Crocodilian Growth Development and Fertility (RWO 154b) PI: P.T. Cardielhac; Completion Date: December 1999

178. American Alligator Distribution, Thermoregulation and Biotic Potential Relative to Hydroperiod in the Everglades National Park (RWO 154c) PI: H.F. Percival, K.G. Rice; Completion Date: December 1999

179. Nesting, Growth and Survival of American Crocodiles in Northeastern Florida Bay, Everglades National Park- Phase I (RWO 178) PI: F.J. Mazzotti, L.A. Brandt; Completion Date: April 2000

180. Creation of Upland Cover Map of Florida PI: L.G. Pearlstine, W.M. Kitchens; Completion Date: August 1999

181. Orientation of Digital Aerial Images and Protocol Development PI: L.G. Pearlstine, S.E. Smith; Completion Date: April 1999

182. Produce a Manual of Sea Turtle Research and Conversation Techniques PI: K.A. Bjorndal, A.B. Bolten; Completion Date: July 1999

183. Wildlife Refuge Waterfowl Survey Database (RWO 202) PI: R.R. Carthy, E. McMichael, R. Subramaniya; Completion Date: December 2000

184. Movements, Spatial Use Patterns and Habitat Utilization of Radio-Tagged West Indian Manatees (*Trichechus Manatus*) Along the Atlantic Coast of Florida and Georgia (RWO 163) PI: H.F. Percival, B.J. Deutsch, L.W. Lefebvre; Completion Date: July 2000

185. Pathogenic, Molecular and Immunological Properties of a Virus Associated with Sea Turtle Fibropapillomatosis, Phase II: Viral Pathogenesis and Development of Diagnostic Assays (RWO 180) PI: P.A. Klein, E.R. Jacobson, D.R. Brown, S.S. Coberly, D. Bagley; Completion Date: June 2000

186. Dry Down Tolerance of Florida Apple Snail (*Pomacea Paludosa*): Effects of Age and Season (RWO 182) PI: H.F. Percival, P.C. Darby, Z.C. Welch; Completion Date: August 2000

187. Effects of Coastal Erosion on Nesting sea Turtles Along the Florida Panhandle (RWO 185) PI: R.R. Carthy, M.M. Lamont; Completion Date: May 2000

188. A Comparison Between the Population of the Potential Tumor-Promoting Dinoflagellate, Prorocentrum SPP and the Incidence of Fibropapillomatosis in Green Turtles (*Chelonia Mydas*) in Florida and Hawaii PI: R.R. Carthy, Y.C. Anderson; Completion Date: December 1999

189. Incubation Temperatures and Sex Ratios of Loggerhead Sea Turtles (*Caretta Caretta*) Hatched on Northwest Florida Beaches (RWO 197a) PI: R.R. Carthy, M.L. Maglothin; Completion Date: Aug. 2000

190. Biology of Nesting Sea Turtles Along the Florida Panhandle (RWO 197b) PI: R.R. Carthy, M.M. Lamont; Completion Date: August 2000

191. A Comparison Between Hawaii and Florida: The Potential Link Between the Tumor-Promoting Dinoflagellate, Prorocentrum SPP and the Prevalence of Fibropapillomatosis in Green Turtles (RWO 210) PI: R.R. Carthy, Y.C. Anderson; Completion Date: December 2000

192. Feeding Ecology and Habitat Affinities of Kemp's Ridley Sea Turtles in the Big Bend, Florida (RWO 189) PI: R.R. Carthy, J.S. Staiger; Completion Date: August 2001

193. Time Lapse Landscape Ecology: Merritt Island National Wildlife Refuge (MINWR) (RWO 189) PI: R.R. Carthy, J.B. Wooding, W.J. Barichivich; Completion Date: December 2001

194. Application of the Species at Risk Conservation for the Florida Army National Guard at Camp Blanding Training Site, Clay County, Florida (RWO 201) PI: R.R. Carthy, C.J. Gregory, A.J. Gruschke, L.G. Pearlstine; Completion Date: August 2001

195. Hydrological Characterization of the White River Basin (RWO 203) PI: W.M. Kitchens; Personnel: M.A. Craig, M.R. Wise; Completion Date: September 2000

196. A Multimodel Implementation Supporting ATLSS: Across Trophic Level System Simulation (RWO 204) PI: P.A. Fishwick; Personnel: R.M. Cubert, L.K. Dance; Completion Date: December 2001

197. Relations of Environmental Contaminants, Algal Toxins and Diet with the Reproductive Success of American Alligators on Florida Lakes (RWO 193) PI: H.F. Percival, T.S. Gross; Personnel: B. Bradford; Completion Date: August 2001

198. Further Strategies for Evaluating the Etiological Role of a Tumor-Associated Herpesvirus in Marine Turtle Fibropapillomatosis (RWO 194) PI: E.R. Jacobson, P.A. Klein; Personnel: D.A. Bagley, S.S. Coberly, R. Hirschman; Completion Date: September 2001

199. Evaluation of Desert Tortoises in and Around Fort Irwin for Exposure to a Tortoise Herpesvirus (RWO 196) PI: E.R. Jacobson, P.A. Klein; Personnel: F.C. Origgi, S. Tucker; Completion Date: April 2001

200. Response of Nesting Seat Turtles and Foraging Shorebirds to Barrier Island Dynamics (RWO 206) PI: P.C. Frederick; Personnel: J.D. Semones, R.A. Hylton, G.A. Babbitt, J.A. Heath; Completion Date: April 2002

201. Ecological Inventory of Moody Air Force Base and Surrounding Properties (Z 038) PI: W.M. Kitchens; Personnel: C.J. Gregory, M.M. Lamont; Completion Date: March 2003

202. Ecological Inventory of Moody Air Force Base and Surrounding Properties (Z 039) PI: R.R. Carthy; Personnel: C.J. Gregory; Completion Date: March 2003

203. Large Scale Habitat Monitoring for Migratory Birds: Digital Video Mosaics in Multi-Level Images (RWO 215) PI: B.D. Dewitt, L.G. Pearlstine; Personnel: G. Trull, S.R. Gonzales, G.P. Jones, IV; Completion Date: August 2003

204. Inventory and Monitoring of the Amphibians of Everglades National Park, Big Cypress National Preserve and Virgin Islands National Park (RWO 208) PI: H.F. Percival, K.G. Rice, R.R. Carthy, J.D. Nichols; Personnel: C.D. Bugbee, M.E. Crockett, A.D. Dove, B. Jeffrey, A.J. Maskell, J.H. Waddle; Completion Date: December 2003

205. American Alligator Distribution, Thermoregulation and Biotic Potential Relative to Hydroperiod in the Everglades (RWO 199) PI: H.F. Percival, K.G. Rice; Personnel: M.D. Chopp, A.G. Finger, P. George, B. Jeffrey, M.T. Tuten; Completion Date: December 2003

206. Sereopidemiological Studies of Herpesvirus-Associated Diseases of Marine Turtles: Fibropapillomatosis and Lung-Eye-Trachea Disease (RWO 213) PI: R.R. Carthy, P.A. Klein, E.R. Jacobson; Personnel: D.A. Bagley, S.S. Coberly (Curry), R. Hirschman; Completion Date: December 2003

207. An Estimate of Population Age Structure for Gulf of Mexico Sturgeon, Acipenser O. Desotoi, on the Yellow River (RWO 214) PI: M.S. Allen; Personnel: J. Berg; Completion Date: December 2003

208. Contaminant Screening to Investigate Wildlife Mortality on Lakes in Central Florida (RWO 196) PI: H.F. Percival, J.P. Ross; Personnel: Y. Temsiripong; Completion Date: April 2003

209. Hibernation vs Migration Overwintering Strategies of Juvenile Sea Turtles in the Florida Panhandle (UF Project #00037385) PI: R.R. Carthy, E. McMichael; Personnel: R. Scarpino; Completion Date: August 2004

210. Estimation of Critical Demographic Parameters of the Florida Snail Kite During and After Drought Conditions (RWO 216) PI: W.M. Kitchens; Personnel: J. Martin, C. Cattau, C. Rich, D. Piotrowicz; Completion Date: December 2004

211. Demographic Movement and Habitat Studies of the Endangered Snail Kite in Response to Hydrological Changes (RWO 207) PI: W.M Kitchens; Personnel: J. Martin, C. Cattau, A. Bowling, D. Huser, M. Conners; Completion Date: March 2005

212. Monitoring of Wading Birds Nesting Activity in WCAS I, II and II of the Everglades and Study of Wood Stork Survival and Movements (RWO 218) PI: P.C. Frederick; Personnel: R. Hylton, J.D. Sermones, M. Bokach, J. Heath, J. Simon, K. Williams; Completion Date: March 2005

213. Evaluation of Sea Turtle Hatchling Disorientation and Assessment of Techniques for Minimizing Lighting Impacts at Tyndall AFB, Bay County Florida (RWO 217) PI: R.R. Carthy; Personnel: R. Scarpino; Completion Date: March 2005

214. Partnership in Case Studies for Training and Outreach (UF Project #00050944) PI: H.F. Percival, M. Monroe; Personnel: K. Bender; Completion Date: August 2005

215. Continued Vegetation Monitoring of the Savannah River Tidally Influenced Marshes PI: W.M. Kitchens; Personnel: K. Lindgren, Z. Welch; Completion Date: December 2005

216. Geomorphic Assessment of Channel Changes along a Modified Floodplain Pascagoula Basin, Mississippi PI: J. Mossa; Personnel: D. Coley, J. Rasmussen, R. Godfrey, A. Villegas; Completion Date: December 2005

217. Geomorphic Assessment of Channel Changes along a Modified Floodplain Pascagoula Basin, Mississippi PI: J. Mossa; Personnel: J. Williams; Completion Date: June 2006

218. Factors Affecting Population Density and Harvest of Northern Bobwhite (*Colinus Virginianus*) in Babcock/ Webb Wildlife Management Area, Charlotte County, Florida PI: H.F. Percival, R. Dimmick, M. Oli; Personnel: S. Dimmick, S. Brinkley, J. Hostetler, G. Coker, A. Brinkley, C. Jones; Completion Date: June 2006

219. Cost and Accuracy of Analysis of Gopher Tortoise Population Estimation Techniques PI: R.R. Carthy, M. Oli; Personnel: E. Langan, J. Wooding, S. Nomani, E. Cantwell, K. Miller, M. Voight; Completion Date: July 2006

220. Surveys of Snail Kite Breeding and Habitat Use in the Upper St. John's River Basin PI: W.M. Kitchens; Personnel: J. Martin, C. Cattau, A. Bowling, S. Stocco, B. Reichert; Completion Date: February 2006

221. Qualitative Analysis Supporting Reptile and Amphibian Research in Florida's Everglades PI: H.F. Percival, F. Mazzotti; Personnel: M. Miller; Completion Date: August 2006

222. Sea Turtle Habitat Use and Interactions with Humans in the Coastal Zone PI: R.R. Carthy; Personnel: R. Scarpino; Completion Date: August 2006

223. Southeastern Adaptive Management Group (SEAMG) PI: H.F. Percival, R. Dorazio, F. Johnson; Completion Date: June 2006

224. Development of Unmanned Aerial Vehicles for Assessment Wildlife Populations and Habitats Phase 2 PI: H.F. Percival, B. Dewitt, P. Ifju, L. Pearlstine; Personnel: J. Duberstein, D. Grant; Completion Date: December 2006

225. Toho V-A Proposal to Document Floral and Faunal Succession Following Alternative Habitat in a Large Central Florida Lake PI: W.M. Kitchens; Personnel: J. Brush, M. Desa, C. Enloe, J. Reyes; Completion Date: June 2006

226. Population Structure of a Loggerhead Turtle (*Caretta Caretta*) Nesting Colony in Northwestern Florida as Determined Through Mitochondrial DNA Analysis PI: R.R. Carthy; Personnel: R. Scarpino; Completion Date: April 2006

227. Conservation, Ecology and Propagation of Florida *Orchidacea Eulophia Alta* (*Linnaeus*) FA WCWRR and RENDLE PI: M. Kane; Completion Date: December 2006

228. Rapid Delineation of Provenance for Florida Sea Oats Used for Beach and Dune Stabilization PI: M. Kane; Personnel: N. Philman, P. Sleszynksi, S. Stewart, D. Dutra; Completion Date: September 2006

229. Radio Telemetry and Mark Recapture Studies of Demographic, Movement and Population Dynamics of Endangered Snail Kites (RWO 221) PI: W.M. Kitchens; Completion Date: March 2006

230. Wading Bird Colony Local, Sizing, Timing, & Wood Stork Nesting Success Cost & Accuracy PI: P. Frederick; Completion Date: October 2006

231. Development of Unmanned Aerial Vehicles for Assessment of Wildlife Population and Habitat Phase 2 PI: H.F. Percival; Personnel: A. Watts, S. Bowman; Completion Date: December 2006

232. Assessing Belowground Consequences of Forest Dieback and Climate Change in Coastal Cypress Swamps PI: H.F. Percival; Completion Date: July 2006

233. Vegetative Habitat Responses to Hydrological Regimes in Everglades Water Conservation Area 3A PI: W.M. Kitchens; Personnel: C. Zweig, E. Powers, T. Hotaling, S. Fitz-William; Completion Date: September 2006

234. Gopher Tortoise Population Estimation Techniques PI: R.R. Carthy; Personnel: E. Langan, J. Wooding, S. Nomani; Completion Date: May 2006

235. Floral and Faunal Succession Following Alternative Habitat Restoration Techniques in a Large Central Florida Lake (PJ50773) PI: W.M. Kitchens; Personnel: Melissa Desa, C. Enloe, B. Shoger, A. Schwarzer; Completed: June 2007

236. American Alligator Distribution, size, and Hole Occupancy and American Crocodile Juvenile Growth and Survival (RWO225) PI: H.F. Percival, Frank Mazzotti; Personnel: M Cherkiss; Completion Date: April 2007

237 Radio Telemetry & Mark Recapture studies of Demography, Movement & Population Dynamics of The Endangered Snail Kite (53729) PI: W.M. Kitchens; Personnel: C.Cattau, A.Bowling: Completed December 2006

238. Continued Snail Kite Monitoring Studies: Population Growth, Extinction, and Movement Patterns. (RWO231) PI: W.M. Kitchens; Completion Date: November 2007

239. Status, Ecology, Propagation Science & Recovery of Imperiled FL Orchidaceous: Habenaria Distans. PI: M. Kane: Completed Date: November 2007

240. Update Marsh Succession Model & Provide Technical Assistance Savannah Harbor Expansion (60411) PI: W.M. Kitchens; Completion Date: April 2006

241. St. George Island Lighting Project. PI: R.R. Carthy; Completion Date: July 2006.

242. Vegetation Habitat Responses to Hydrologic Regimes In Everglades Water Conservation Area 3A PI: W.M. Kitchens, C. Zweig; Personnel: T. Hotaling, P. Wetzel, S. Fitz-Williams Completion Date: March 2008 (53972)

243. American Alligator Distribution, Size, and Hole Occupancy & American Crocodile Juvenile Growth and Survival. PI: H.F. Percival, F.J. Mazzotti; Completion Date: June 2007 (50174)

244. Conservation, Ecology & Propagation of Florida Orchidaceae-Eulophia alta and Cyrtopodium punctatum. PI: M. Kane; Personnel: T. Johnson, D. Dutra Completed: December 2007

2008 Publications:

Darby, P.C., R.E. Bennetts, and H.F. Percival. 2008. Dry down impacts on apple snail (Pomacea pauludosa) demography: implications for wetland water management. Wetlands 28(1):204-214.

Haas, Sara, Rebecca Kimball, Julien Martin, and Wiley Kitchens. 2008. Genetic divergence among Snail Kite subspecies: implications for the conservation of the endangered Florida Snail Kite. Ibis (In press).

Hotaling Althea S., Julien Martin, W. M. Kitchens. Estimating Transition Probabilities among Everglades Wetland Communities using Multistate Models. (submitted) 2008.

Martin, Julien, Wiley M. Kitchens, Madan K. Oli, Christopher E. Cattau. 2008. Exploring the importance of natural disturbances and habitat degradation on Snail Kite population dynamics. Endangered Species Research. (In press).

McMichael, E., J.A. Seminoff and R.R. Carthy. Growth rates of wild green turtles, Chelonia mydas, at a temperate foraging habitat in the northern Gulf of Mexico: assessing short-term affects of cold stunning on growth. Journal of Natural History. (in press). 2008.

Nomani, S.Z., R.R.Carthy and M.K. Oli. 2008. Comparison of methods for estimating abundance of gopher tortoises. Applied Herpetology. 5:13-31

Watts, A. C., W. S. Bowman, A. H. El-Rahman, A. Mohamed, B. E. Wilkinson, J. Perry, Y. O. Kaddoura, and K. Lee 2008. Unmanned Aircraft Systems (UASs) for ecological research and natural-resource monitoring. Ecological Restoration, 26:13-14.

Waddle, J. H., K. G. Rice, F. J. Mazzotti, and H. F. Percival. 2008. Modeling the effect of toe clipping on treefrog survival: beyond the return rate. Journal of Herpetology 42:467-473

Zweig, C. and W.M. Kitchens. 2008. Effects of landscape gradients on wetland vegetation communities: Information for large-scale restoration. Wetlands (In press).

Zweig, C. and W.M. Kitchens. 2008. Multi-state succession in wetlands: A novel use of state and transition models. Ecology (Submitted manuscript).

2008 Presentations:

Brinn, L. and R.R. Carthy. 2008. Assessment of beach compaction and associated effects on loggerhead sea turtle (Caretta caretta) nesting on natural and nourished beaches in Northwest Florida. Poster presentation at the 27th Annual International Symposium on Sea Turtle Biology and Conservation, Loreto, Mexico

John H. Perry, A. Mohamed, A. Abd-Elrahman, W. S. Bowman, Y. O. Kaddoura, A. C. Watts . Precision Directly Georeferenced Unmanned Aerial Remote Sensing System: Performance Evaluation. Institute of Navigation National Technical Meeting. San Diego, CA, 13-15 May 2008.

Peter C. Frederick, A. C. Watts, M. Burgess. Prospects of the use of unmanned aircraft systems for assessing the size of wading bird populations in the Everglades. Presentation, South Florida Water Management District, West Palm Beach, FL, 5 September 2008.

Senko, J., R. Mayoral, V. Koch, R. Carthy, M. Nickerson, W. Megill, and W.J. Nichols. 2008. Preliminary results on the ecology and conservation of immature black turtles, Chelonia mydas, at a coastal foraging area in Baja California Sur, Mexico. Poster presentation at the 27th Annual International Symposium on Sea Turtle Biology and Conservation, Loreto, Mexico

Adam C. Watts, P. C. Frederick, W. S. Bowman, H. F. Percival, J. C. Simon, P. G. Ifju. Unmanned Aircraft Systems for Wading Bird Surveys in the Everglades. Greater Everglades Ecosystem Restoration Planning, Policy and Science Meeting, 28 July-1 August 2008, Naples, FL.

Adam C. Watts, W. S. Bowman, M. Morton, J. H. Perry, H. F. Percival, P. G. Ifju, S. E. Smith, A. Mohamed, B. A. Dewitt. University of Florida Unmanned Aircraft Systems 2008 Program Update. Poster, Florida Cooperative Fish and Wildlife Research Unit Coordinating Committee Meeting, 22 April 2008.

2008 Technical Reports:

Brush, J. and A. C. Watts. An assessment of autonomous unmanned aircraft systems (UAS) for avian surveys. Final Report, Wildlife Research Section, Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, 2008.

Peter C. Frederick, A. C. Watts, H. F. Percival. An Assessment of the Use of Unmanned Aircraft Systems for Surveys of Wading Birds in the Everglades. Final Report for the South Florida Water Management District, 2008.

Percival, H.F., and F.A. Johnson, 2008. Adaptive habitat management for Florida scrub-jays at Merritt Island National Wildlife Refuge. Final Report. USGS Cooperative Agreement No. 1434-05HQRU1544 Research Work Order No. 232. FL Cooperative Fish and Wildlife Research Unit. University of Florida, Gainesville, FL

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