

## **A pilot study of the extralimital West Indian Manatee population in Mobile Bay, AL**

### **Statement of need**

Distribution of the endangered West Indian manatee (*Trichechus manatus*) has changed through time as the population has declined throughout its range (Powell and Rathbun 1984, Lefebvre et al. 2001). Once common along the Gulf of Mexico coast, manatee populations are now confined largely to peninsular Florida and southeastern Georgia in the winter, with poorly defined migrations north and east during summer (Powell and Rathbun 1984, Fertl et al. 2005). In recent years, there have been a greater number of manatee sightings in areas west of Florida, suggesting increased use of fringe habitats (Fertl et al. 2005). The number and frequency of individuals using fringe habitats, including areas in AL, MS, LA, and TX, is poorly understood and has relied primarily on chance sightings (Fertl et al. 2005). Furthermore, the spatial and temporal extent of habitat and food resources used by these extralimital populations is unknown.

Manatees in all areas of their range require more study to inform recovery efforts, but knowledge of fringe populations and habitats may become increasingly important in coming years (USFWS 2001, Fertl et al. 2006). First, fringe habitats may experience more use if manatee recovery efforts increase populations in peninsular FL, but habitat and food resources continue to decline (USFWS 1993, 2001, Rathbun et al. 1990, Bonde and Lefebvre 2001, Fertl et al. 2005). For example, urbanization and anthropogenic use of the watershed alter water quality (prompting eutrophication, seagrass shading, and loss of invertebrates that are foods for manatees) and increase human interactions with manatees (resulting in accidental boat strikes and damage to seagrasses) (USFWS 1993, Haubold et al. 2006). Second, manatees may rely on fringe habitats and food resources when influenced by large-scale change and natural disasters. For example, increased prevalence of severe storms, red-tides, or global climate change and sea level rise may prompt avoidance migration or emigration from disturbed habitats and altered food sources (EPA 1989, Rizzo and Neckles 1998, Haubold et al. 2006). Third, manatees occupying fringe areas may be more susceptible to loss because of greater fluctuations in water temperature that cause cold stress and death (Fertl et al. 2005). Determining how and why manatees frequent specific extralimital locations, is essential to guide development of management programs throughout the range.

Mobile Bay, AL provides an excellent location in which to begin directed studies on the use of fringe habitats by extralimital manatee populations. First, the Bay supports habitat and food resources known to attract manatees. The Bay is relatively shallow and warm, with a mean water depth of 1.3m. The Bay is characterized by salinities below 20ppt and receives substantial natural and anthropogenic freshwater inputs, favored by manatees (Schroeder et al. 1992, Ortiz et al. 1998, Fertl et al. 2006). The Bay supports a number of animals, algae, and seagrass known to be food for manatees (Powell 1978, Smith 1993, Lefebvre et al. 2000, Vittor 2004, Valentine et al. 2006), with seagrass beds in relatively close proximity to allow regular foraging in marine waters and return to fresher refuge (Ortiz et al. 1998, Byron and Heck 2006). Furthermore, Mobile Bay may be an important and undefined habitat boundary for manatees since abundances of seagrasses, *Thalassia* and *Halodule*, are limited west of mobile Bay (Handley 1995, Vittor 2004). Second, the Bay has a history of manatee sightings, with an increased number of reports in the past several years (Fertl et al. 2006; J. Dindo, Dauphin Island

Sea lab, pers. Comm.). Despite this documented use of Mobile Bay by manatees, there has been no directed study of manatee distribution and ecology in the Bay. Third, the Bay supports relatively intense anthropogenic activities on the adjacent watershed. These activities are credited with increasing nutrient loads and eutrophic conditions in the Bay (Schreiber and Pennock 1995, Rabalais et al. 2001), which potentially threaten habitat and food resources for manatees. Hence, not only is Mobile Bay known to attract and have capacity to support extralimital manatee populations, but there is a demonstrated need for data to guide management of manatee habitat and food resources in the Bay.

### Objective

Increased awareness of the

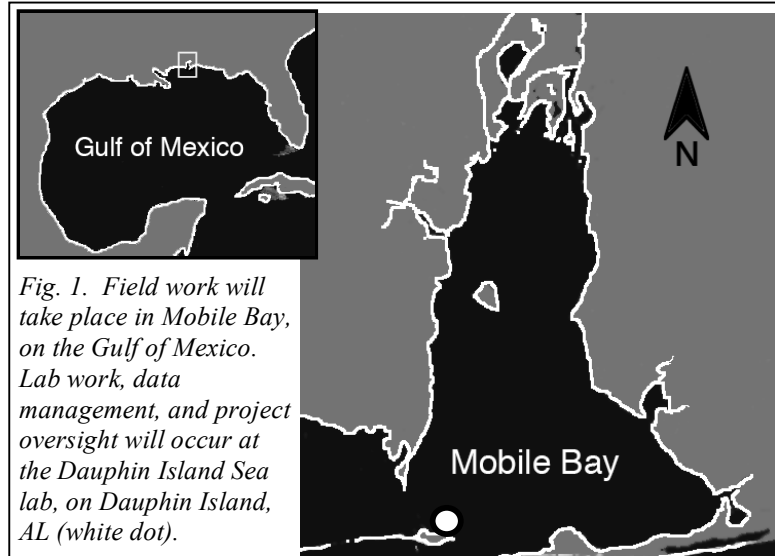
importance of fringe habitats such as in Mobile Bay has prompted demand for studies to guide development of management programs outside areas covered under the Florida Manatee Recovery Program (to date, the only approved guidance document to protect manatees as a federally listed Endangered Species in the continental U.S.; USFWS 1993, 2001 Fertl et al. 2006). In accordance with this need, the objective of this project is to determine when and how extralimital manatees use habitat in Mobile Bay by:

- 1) defining habitat use in terms of distribution and abundance of manatees within Mobile Bay,
- 2) measuring the frequency of habitat use at discrete locations in the Bay,
- 3) determining relationships to other manatee populations,
- 4) defining and distinguishing available and utilized food resources in the Bay,
- 5) recording and sharing data with other researchers, managers, and the public.

### Expected Results or Benefits

This project will provide baseline data on distribution and ecology (use of habitat and food resources) of manatees in Mobile Bay that will be useful immediately to inform land-use planning and watershed activities. In the longer term, these data will provide a first step to guide development of management, conservation, and recovery programs for manatees in Mobile Bay and other extralimital populations.

Through our outreach, education, and data management components we will improve the frequency and reliability of reported sightings in Mobile Bay, foster continuity of data reporting, and provide for data preservation. These steps will enhance research efforts world-wide by providing long-term data storage capabilities and improved dissemination of data to local, regional, national and international endusers. By translating our data into understandable information and making it readily available,



we will enhance public education and interest in manatee management efforts (arguably a first step toward reducing anthropogenic-driven degradation of manatee habitat and food resources).

Most importantly, our data support objectives of the Florida manatee Recovery Plan (USFWS 2001), including: 1) conducting programs to inform and educate the public for manatee conservation and research, with a goal of minimizing human-caused harassment, injuries, and mortalities to manatees, 2) identifying and monitoring areas of special significance to manatees and collecting data to enhance habitats used by manatees, with a goal to minimize alteration, degradation, and destruction of habitat used by manatees, and 3) determining and monitoring status of manatee populations and aspects of life history and ecology.

Furthermore, our intent is to use Section 6 funds and knowledge gained from this first year of study to leverage additional funds for expanded study of manatee migration, distribution, and ecology in Mobile Bay in three ways: by 1) quantitatively assessing manatee movements in the bay via radio telemetry tagging, 2) performing more detailed assessments of manatee diet using stable isotopes and non-lethal biopsy of multiple tissues samples, and 3) confirming relationships to larger populations in Florida and/or Mexico by assessing genetic composition of individuals in the Bay. These additional tasks require resources (technical equipment, time, and manpower for capture and handling of manatees) that are beyond the budget and time allowed from funds available through the current RFP. Data from the proposed project, however, are essential to support development of a more extensive proposal.

## **Approach**

In this study, we take a three-tiered approach to determine when and how manatees utilize habitat in Mobile Bay, focusing on 1) data collection, 2) data management and dissemination, and 3) public outreach and education in all aspects of the work. We opted for this approach because it allows collection of baseline data needed to begin to inform manatee management and recovery programs, meets funding requirements defined by the DWFF, and provides maximum output for available resources.

### ***Data collection***

*Assessing abundance and distribution*—To define habitat use in terms of abundance and distribution of manatees within Mobile Bay, we will first identify where manatees occur in the bay by gathering available data on historical and current manatee sightings. We will collate data from the primary literature (Fertl et al. 2006) and groups known to receive current sighting reports, including the Southeast Region Marine Mammal Stranding Network, local experts such as Dr. Gerald Regan, USFWS in Daphne, AL and Jacksonville, FL (charged with daily management and recovery of regional manatee populations).

Second, to increase our dataset and engage public participation, we will establish a 24 hour toll-free sightings phone line through which anyone can report a manatee sighting in the Bay. Currently, sighting reports are received by a number of groups without consistent or directed response, and the public often is not certain whom to contact (Fertl et al. 2005, G. Crozier, Director, DISL). We will use existing outreach infrastructure at the Dauphin Island Sea lab (DISL) and work with Community Relations

Director, Lisa Young, to locally publicize our community outreach effort. This approach enabled DISL researchers to successfully establish and conduct the first ever jellyfish monitoring program in the region (FL, AL, MS) (<http://dockwatch.disl.org/>).

Third, to begin to collect data on abundance and distribution of manatees that can be used to define habitat area and make quantitative comparisons through time, we will conduct two modified strip-transect aerial surveys (Lefebvre et al. 2001). Survey coverage will be stratified to include areas of most likely manatee habitat. Hence, we will run transects along each major river (including Dog, Fowl, Tensaw, and Mobile Rivers, where manatees previously were reported) and the Bay edges, with at least two transects (~250 m wide) running the length of the Bay (~ 52 km). Surveys will be conducted near the estimated beginning (mid-June) and end (late Aug) of the period during which manatees are typically reported in the Bay (Fertl et al. 2006). Manatee locations will be marked on a hardcopy map of the study area and plotted with a handheld Garmin GPS (corrected relative to altitude) and photographed.

*Measuring frequency of use and habitat attributes*—To determine the locations in Mobile Bay most frequently used by manatees, we will plot GPS coordinates of each historic and currently reported sighting to within 5 meters, depending on available data. We will combine these data with spatial data from aerial surveys and prepare GIS data layers using ArcView software and publicly available aerial photographs and USGS topomaps. We will create Bay-wide composite images, showing manatee distributions in the Bay through time.

To refine our understanding of the duration of habitat use in the Bay, we also will respond to reported sightings by visiting locations (to the extent possible) within 24 hours. To define habitat attributes at each sighting location, we will record weather conditions, photograph the site, and measure DO, temperature, and salinity in surface and near-bottom waters using a handheld YSI meter. We will then revisit sites daily at the same time of day until the animals are no longer present. We will continue to revisit these locations and areas within a five mile radius weekly for one month from the time of reporting or until the next reported sighting. We will engage the public and volunteers (through the DISL Discovery Hall Programs) to assist with these monitoring efforts as needed to manage multiple sightings.

*Determining relationships to other manatee populations*—To determine the population of origin and whether manatees in Mobile Bay return from year to year, we will photo-identify individuals as they are sighted. To the extent possible, we will obtain images from reported sightings and aerial surveys. We will share our photographs with the USGS Sirenia Project, which developed and maintains the primary photo-identification catalog for FL manatees. We will compare our images with those in the catalog to help determine the history and origin of manatees in Mobile Bay.

*Defining food resources*—To better define available and utilized food resources, we will identify and collect samples of available foods including seagrass, algae, suspended particulate matter, and pelagic invertebrates at sighting locations. Seagrass and algae will be collected with a benthic grab, particulate organic matter will be sampled by collecting one liter of mid-depth water using a Wildco horizontal water sampler (200  $\mu\text{m}$  pre-filtered), and pelagic invertebrates will be sampled using a 500 $\mu\text{m}$  dip-net.

To distinguish available foods from those actually utilized by manatees, we will supplement field observations by comparing N and C stable isotope ratios in available foods to ratios in manatee tissue and feces. Stable isotopes have proven a valuable tool to determine food web linkages and define nutritionally important diets (Peterson and Fry 1987, McClelland and Valiela 1998, Carmichael et al. 2004). These linkages are possible because N and C from different sources have different isotopic ratios (for example, allowing seagrasses to be distinguished from algae). Further, physiological processes consistently fractionate (shift) isotope ratios so that consumers such as manatees can be readily distinguished from their food sources, even if their diet is mixed (Carmichael et al. 2004, Reich and Worthy 2006). Comparison of foods, tissues, and feces, allow a more complete understanding of differences between available and assimilated diet (Carmichael et al. 2004). Hence, we will take advantage of the daily and weekly visits to sighting locations to reconnoiter the area for sloughed skin and fecal samples. When found, these samples will be collected by hand with a net, modified sieve, or other modified skin scraper (Carney et al. in press). All samples will be cleaned with DI water, treated to remove lipids, dried to a constant weight at 60°C, ground to a fine powder, and sent to the U. C. Davis stable isotope facility for analysis.

***Data management and dissemination***—To record and disseminate data, we will engage in a number of activities. All spatial data will be entered into GIS data layers showing past and current sightings, identifying food resources, and providing a template for future data such as from radio tagging. Second, we will maintain a publicly accessible webpage hosted by DISL and linked to R. Carmichael's faculty webpage, where endusers may track our progress and access data during the project. This website will have links to GIS data layers, photo-identifications, and raw data collected in the field. We additionally will share photo-identification images with the USGS and provide meta-data and links to the National Coastal Data Development Center (NCDDC). In this way, we will expand our reach by contributing data to an established long-term, searchable, archive that can be regularly updated with results of ongoing research.

***Public outreach and education***—We will reach out to the public as described through DISL media relations and establishing a toll-free phone line to report sightings. Further, we will work with the DISL Discovery Hall programs to host at least one educational presentation to a K-12 or adult education group near the end of the study and we will share aspects of the project during DISL's annual Discovery Day open house. We also will author at least one public outreach article for the DISL newsletter, *Tidings*.

***Project management***—This project will be a collaboration between the Dauphin Island Sea lab and Florida Wildlife Trust. PI Carmichael, Senior Marine Scientist with DISL, will serve as project manager and student advisor. She will coordinate all aspects of field, laboratory, and outreach work. She also will lead the stable isotope studies, data analysis, and writing. Three Wildlife Trust personnel will actively participate in the project by 1) training the student in approach and sampling in proximity to manatees, 2) providing direction and mentorship for photo-identification, and 3) assisting with aerial surveys, data analysis, and aerial photo interpretation. Wildlife Trust collaborators include, C. Taylor, Director of Aquatic Programs, M. Ross, Research Scientist, and L. Keith, Research Scientist. Taylor has over 15 years of research and management experience working with manatees and other endangered marine mammals. She oversees

marine mammal projects throughout the southeast U.S. Ross has over 15 years of experience working with manatees and coordinates and implements field aspects of the Manatee Rehabilitation Partnership at Wildlife Trust. Keith has 19 years of marine mammal research experience, and 9 years of research experience with manatees, including live captures, deployment and tracking, photo identification, and aerial surveys. Wildlife Trust also holds a Federal Fish and Wildlife Permit to research and work with manatees at any location within their natural range in the U.S.

***Schedule***

Activity	Month											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Establish/monitor phone line	X	X	X	X	X	X	X	X	X	X	X	X
Publicity	X					X	X	X	X	X	X	
Gather sightings data	X	X	X					X	X	X	X	X
Prepare GIS layers		X	X	X				X	X	X	X	X
Fieldwork prep./ training						X	X	X				
Respond to sightings								X	X	X	X	X
Aerial surveys									X		X	
Isotope sampling/analysis								X	X	X	X	X
Website development/ updating	X			X	X	X				X		X
Mid-term & final reports						X						X
Newsletter								X				
Presentation											X	
Photo analysis										X		X
Data sharing						X	X	X	X	X	X	X

## References

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## **Wildlife Trust Organizational Background**

Wildlife Trust empowers local conservation scientists worldwide to protect nature and safeguard ecosystem and human health. Wildlife Trust scientists in the U.S. and over 20 countries in Latin America, the Caribbean, Africa, and Asia discover innovative ways for people and wildlife to share human-dominated landscapes for their mutual survival. As the only conservation organization that highlights links to human health as a core issue, Wildlife Trust confronts the health consequences of habitat fragmentation, human-wildlife conflicts, and coastal zone development. Dr. James “Buddy” Powell leads the Aquatic Conservation Program which conducts long-term manatee projects in Belize and Brazil as well as in Florida. He is a leading authority on manatee conservation with over 30 years experience studying all species of manatees including the West African manatee. The Aquatic Conservation Program is dedicated to addressing urgent conservation issues in coastal areas. The program promotes better management of coastal habitats to help ensure that ecosystems remain intact, endangered species survive, and coastal people benefit from their lives at the edge of the sea.

Wildlife Trust collaborators include, C. Taylor, Director of Aquatic Programs, M. Ross, Research Scientist, and L. Keith, Research Scientist. Taylor has over 15 years of research and management experience working with manatees and other endangered marine mammals. She oversees marine mammal projects throughout the southeast U.S. Ross has over 15 years of experience working with manatees and coordinates and implements field aspects of the Manatee Rehabilitation Partnership at Wildlife Trust. Keith has 19 years of marine mammal research experience, and 9 years of research experience with manatees, including live captures, deployment and tracking, photo identification, and aerial surveys. Wildlife Trust also holds a Federal Fish and Wildlife Permit to research and work with manatees at any location within their natural range in the U.S.

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### EDUCATION

Master of Science, Biology - December 1996  
University of North Carolina at Wilmington, Wilmington, NC  
Thesis: Aerial survey of coastal bottlenose dolphins (*Tursiops truncatus*) along the east coast of Florida.  
GPA: 4.0/4.0.

Bachelor of Science, Marine Science/Biology - May 1993  
Long Island University/Southampton Campus, Southampton, NY  
GPA: 3.3/4.0 (*cum laude*)

### HONORS AND AWARDS

Duke University Melanie Elizabeth Lynn Memorial Scholarship: 1996  
UNCW Teaching Assistantships: 1995 - 1996  
Institute for Professional Education Scholarship: 1995  
Full-tuition University Scholar: 1989 - 1993  
Syntex Corporation Scholarship: 1989 - 1993  
Dean's List and Honors Program: 1989 - 1993

### RESEARCH/WORK EXPERIENCE

*Wildlife Trust. Sarasota, FL*

**Director of Aquatic Programs; Senior Research Scientist.** May 2003 – present

**Conservation Biologist.** November 2002- May 2003

~Research Coordinator for manatee and North Atlantic right whale research projects, including developing proposals; designing studies; obtaining funding; obtaining permits; supervising and participating in data collection, analysis, and report/publication writing; budget tracking; overall logistics and coordination of projects; and participation in meetings/presentations to distribute results to the scientific and management communities, as well as the general public.

~Involved with the development and oversight of international aquatic research projects.

~Support and development of the Aquatic Program through participation on recovery and implementation teams, investigating new funding opportunities and developing proposals, working closely with state and federal government and private organizations to ensure proper collaboration on projects and issues, and continuing and developing good working relationships with colleagues in the aquatic conservation field.

~Member: Manatee Recovery Plan Habitat Working Group

~Member: IUCN Sirenia Specialist Group

~Alternate Member: NOAA Atlantic Large Whale Take Reduction Team

~Alternate Member: Manatee Recovery Plan Warm Water Task Force

*The Ocean Conservancy. Washington, DC*

**Marine Mammal Specialist.** June 2001 – July 2002

~Advocated to secure policies to prevent overexploitation and directed/incidental takes of marine mammals.

~Focused on the conservation of numerous species including northern right whales, Hawaiian monk seals, Florida manatees, and various Alaskan marine mammal stocks.

~Provided accurate scientific and policy information to assist in appropriate management and legislative decisions regarding marine mammal conservation issues.

~Developed a right whale public sighting network for recreational boaters along the eastern seaboard, and a right whale educational program designed to focus on commercial vessels calling on mid-Atlantic ports.

***Florida Department of Environmental Protection/Endangered and Threatened Species Section - Jacksonville Field Laboratory. Jacksonville, Florida***

**Marine Research Associate.** December 1997 – May 2001

- ~Responsible for daily operation of the Jacksonville Field Laboratory, including budgets, purchasing, obtaining and managing grants, hiring and supervising employees, and analysis and publication of data.
- ~Principal Investigator for the Northern Right Whale Conservation Project responsible for research and management initiatives concerning the right whale in Florida waters.
- ~Chairperson – Southeast U.S. Implementation Team for the Recovery of the Northern Right Whale; Member of the Atlantic Large Whale Take Reduction Team
- ~Conducted and supervised various research projects including manatee and right whale distribution and abundance, movements, and photoidentification.
- ~Responsible for the rescue and recovery of injured and dead marine mammals in northeast Florida.
- ~Worked closely with local, state, and federal governments as well as private organizations and industry in regards to various marine mammal issues along the east coast of the U.S.
- ~Conducted educational outreach to the general public, military, scientific and industrial communities regarding status and trends of marine mammals in the southeast U.S.

**Research Staff.** December 1996 – December 1997; December 1995 - May 1996 (seasonal).

- ~Team leader and observer for the right whale aerial survey program along the east coast of Florida, responsible for coordinating, supervising, and flying 3-4 aerial surveys per week.
- ~Management and organization of survey budget and purchase orders
- ~Responsible for downloading Global Positioning System data files into dBase files, compiling and entering survey data into dBase files and organization and verification of survey data for the past five survey seasons.
- ~Regularly dealt with the public and media in regards to right whale issues.
- ~Organization and analysis of right whale photographs to determine identification.

***University of North Carolina at Wilmington. Wilmington, North Carolina***

**Teaching Assistant.** January 1995 - December, 1996.

- ~Responsible for teaching college freshmen - seniors "Biology for Nonmajors", two semesters of "General Ecology" and "Principles of Biology".
- ~Taught three laboratories per semester including planning lessons, organizing field trips and experiments, developing assignments and assigning grades.

***National Audubon Society/University of North Carolina. Wilmington, North Carolina***

**Field Assistant.** Summer 1995.

- ~Performed a census of all known colonies of colonial waterbird nests along the entire coast of North Carolina, including 18 different species.
- ~Dealt with data entry and analysis of all census numbers into dBase.
- ~Participated in tern and pelican banding projects.

***Florida Department of Environmental Protection/Endangered and Threatened Species Section. St. Petersburg, Florida***

**Biological Scientist II.** May 1994 - December 1994.

- ~Participated in the telemetry research project tracking VHF and satellite-tagged West Indian manatees in order to determine habitat use, social structure, migration routes and behavior.
- ~Photographed and analyzed manatee scars for placement in the photo identification catalog.
- ~Responsible for purchasing, maintaining and constructing essential tracking gear.
- ~Responsible for entry and organization of all telemetry data into dBase III and IV.

**Field and Laboratory Technician III.** April 1993 - May 1994.

- ~Assisted with the retrieval and necropsy of deceased manatees, cetaceans and sea turtles in order to determine cause of death and to collect tissue samples, organ size and weight, scar patterns and other pertinent information.
- ~Assisted in the rescue of injured manatees, stranded cetaceans and release of rehabilitated animals.
- ~Responsible for entry and organization of necropsy data into the mortality database and the organization and distribution of tissue samples.
- ~Weekend 24 hour on-call status.

**Lowry Park Zoological Gardens.** Tampa, Florida

**Assistant Zookeeper Intern.** August 1992 - December 1992

- ~Responsible for the daily care of 7-10 West Indian manatees including feeding, administering vitamins monitoring behavior, and cleaning tanks. Assisted with transports and releases.
- ~Assisted the zoo veterinarian with the treatment of recovering manatees at the manatee hospital, including taking blood, stomach tubings cleaning wounds, and recording findings in medical charts.
- ~Performed a research project on the behavior of captive manatees.

**Mote Marine Laboratory.** Sarasota, Florida

**Laboratory and Field Intern.** May 1991 - August 1991

- ~Assisted the sea turtle conservation program in locating nests and releasing hatchlings.
- ~Worked in the aquaculture laboratory culturing phytoplankton and rotifers, performing dietary and growth experiments on larval snook, and raising grouper for decompression studies.
- ~Assisted in the building and organization of a new aquaculture laboratory.

**SEAmester.** "Spirit of Massachusetts"

**Crew Member.** September 1990 - December 1990

- ~Successfully completed a full academic load in addition to the responsibilities of sailing a full-rigged 125' schooner from Boston, Massachusetts to Puerto Plata, Dominican Republic.
- ~Participated in all aspects of sailing, working and living in close quarters with 20 other crew members.
- ~Performed field studies of flora and fauna indigenous to the east coast of the United States and the Caribbean.

**SKILLS AND ABILITIES**

- ~Computer Experience: MS Word, Wordperfect 5.1 & 6.0, dBase III & IV, Pathfinder GPS, Excel, SigmaStat, Arcview 3.0, Harvard Graphics, Delorme MapExpert & Street Atlas, Powerpoint and some knowledge of Bioscan Optimas image analysis software.
- ~Experience trailering and handling boats up to 25'; State and federal boating skills certification.
- ~Over 1000 hours of marine mammal aerial survey experience, including aerial tracking.
- ~Exceptional scientific writing skills, data analysis and public speaking experience.
- ~Extensive photographic experience, including manatee, dolphin and right whale photos used for identification purposes.
- ~Professional Member – Society for Marine Mammalogy

**PRESENTATIONS/PUBLICATIONS**

Taylor, C.R., J.A. Powell, K.J. Frisch, and E. Argo. 2003. Evaluation and Monitoring of Newly Regulated Manatee Sanctuaries and Refuges. Presented at the 14<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, Greensboro, N.C. December 2003.

Powell, J.A., C.R. Taylor, and L.V. Aragoes. 2003. Manatee Habitat Interactions and Carrying Capacity Near Selected Warm Water Sites. Presented at the 14<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, Greensboro, N.C. December 2003.

Keller, C.A., L.I. Ward-Geiger, W.B. Brooks, C.K. Slay, C.R. Taylor and B.J. Zoodsma. 2006. North Atlantic Right Whale Distribution in Relation to Sea Surface Temperature in the Southeast United States Calving Grounds. *Marine Mammal Science* 22(2): 426-445.

- Taylor, C.R. and W.B. Brooks. 2002. Dissemination of northern right whale (*Eubalaena glacialis*) sighting information to the Southeast U.S. maritime community. *Marine Technology Society Journal* 36(2).
- Taylor Thomas, C., W.B. Brooks, and C.K. Slay. 2001. Mark-Recapture study of northern right whales (*Eubalaena glacialis*) from tandem aerial surveys in the Florida/Georgia calving area. Presented at the 14<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, Vancouver, B.C. December 2001.
- Taylor Thomas, C. and W.B. Brooks. 1999. Aerial surveys of the coastal waters of Florida to monitor occurrence of the northern right whale (*Eubalaena glacialis*), 1991-1999. Presented at the 13<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, Wailea, HI. November 1999.
- Taylor Thomas, C. 1999. Aerial surveys of the coastal waters of Florida to monitor occurrence of the northern right whale (*Eubalaena glacialis*), 1998-1999. Presented at the North Atlantic Right Whale Consortium Annual Meeting, Boston, MA. October 1999.
- Oravetz, C.A., M.J. Harris, K.R. Wang, B.J. Zoodsma, C.T. Thomas, W.B. Brooks. 1999. Right whale conservation management actions in the southeast U.S. Presented at the 13<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, Wailea, HI. November 1999.
- Schumacher, K., L. Ward, C.T. Thomas, B.J. Zoodsma. 1999. Development of spatial methods to map right whale habitat use in the Florida/Georgia calving ground. Presented at the ESRI Southeast Regional Users Group Meeting, Orlando, FL. October 1999. Received "Most Innovative Poster" award.
- Zoodsma, B.J., C.T. Thomas, and L. Conger. 1999. Determination of right whale spatio-temporal distribution in waters outside currently designated critical habitat. Final report to the National Marine Fisheries Service, 1999.
- Zoodsma, B.J., C.T. Thomas, K.R. Wang, L.A. Conger, W.B. Brooks, and B. Mase. 1999. Offshore distribution of northern right whales (*Eubalaena glacialis*) in the southeast U.S.: Implications for conservation management. Presented at the 13<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, Wailea, HI. November 1999.
- Taylor Thomas, C., B.J. Zoodsma, and L. Conger. 1998. Investigation of right whale use of areas offshore of the southeast U.S. calving area critical habitat, 1997-1998. Final report to the National Marine Fisheries Service, 1998.
- Taylor Thomas, C., W.B. Brooks, and D. Webster. 1997. Aerial survey of the bottlenose dolphin (*Tursiops truncatus*) along the east coast of Florida. Presented at the 1997 American Society of Mammalogists Meeting, Stillwater, OK. July 1997.
- Taylor Thomas, C. 1996. Aerial survey of coastal bottlenose dolphins (*Tursiops truncatus*) along the east coast of Florida. M.S. thesis, University of North Carolina, Wilmington. 35 pp.
- PUBLICATIONS  
IN PROGRESS**
- Taylor, C. R. and B.B. Ackerman. *In prep.* Seasonal manatee distribution and relative abundance in Brevard County, Florida, 1997-1999. Florida Marine Research Institute Technical Report.
- Taylor, C. R., W.B. Brooks, and C.K. Slay. *In prep.* Mark-recapture study of northern right whales (*Eubalaena glacialis*) from tandem aerial surveys in the Florida/Georgia calving area.
- Taylor, C. R., W.A. McClellan, A.H. Glass, M. Zani, and D.H. Pabst. *In prep.* Occurrence of North Atlantic Right Whales (*Eubalaena glacialis*) in North and South Carolina Coastal Waters.
- Taylor, C.R. A Survey of Florida Springs to Determine Accessibility to Florida Manatees (*Trichechus manatus latirostris*): Developing a Sustainable Thermal Network.



# LUCY WARD KEITH

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## EDUCATION

**Boston University Marine Program** Woods Hole, MA  
Master of Science degree in Marine Biology, May 1999.  
Thesis research examined haul-out behavior of weaned pup and juvenile Hawaiian Monk Seals at Midway Atoll.

**University of California at Santa Cruz** Santa Cruz, CA  
Coursework in Organic Chemistry and Physics to prepare for graduate school.

**St. Lawrence University** Canton, NY  
Bachelor of Science degree in Biology, May 1987.  
Member of Beta Beta Beta, Biology Honorary Society.  
Photography Editor, St. Lawrence Yearbook, 1987.

## PROFESSIONAL EXPERIENCE

**Wildlife Trust, Inc.** St. Petersburg, FL  
Research Scientist. January 2005 – present.  
Responsible for organizing and implementing manatee research projects in south Florida including developing proposals, designing studies, organizing logistics, collecting data from air, water and land, entering, editing, verifying and analyzing manatee-related data, participating in study-related meetings with collaborators and producing final reports and publications.  
Principal Investigator for the following ongoing studies in Florida: Manatee Habitat Interactions and Carrying Capacity Near Selected Warm Water Sites, Evaluation and Monitoring of Proposed Manatee Sanctuaries and Reserves, Manatee Photo Identification in the Everglades.  
Principal Investigator for the following ongoing international studies: Status and Conservation of the West African Manatee (*Trichechus senegalensis*) in Gabon, Marine Mammal and Sea Turtle Surveys in the Soyo Region, Angola.  
Wrote and coordinated Wildlife Trust's federal permit application for manatee scientific research and FL State DEP permit for seagrass collection.  
Prepare and track project budgets, expenditures and reports. Purchase and maintain project related equipment and supplies.  
Assist with development, organization and implementation of other aquatic conservation research projects in the U.S. and internationally. Manatee field research in Costa Rica, Belize, Gabon and Angola advising and assisting local researchers.  
Investigate new research and funding opportunities.

**Manasota Key Sea Turtle Patrol** Englewood, FL  
Volunteer, May 2000 – present.  
Mark all new nests, relocate nests for conservation purposes, excavate and document hatching success of all nests in a two mile zone.  
Monitor beach for illegal lighting and turtle entanglement hazards.

**University of New England** Biddeford, ME  
Biological Technician for EPA STAR Demonstration Grant, April – December 2004.  
Grant project compared pathogen loads, general health and survival of wild-caught healthy harbor seal pups with stranded harbor seal pups brought in for rehabilitation through biomedical sampling, satellite tagging and tracking upon release.  
Conducted routine blood draws, serum/plasma extraction, administered medications, bacterial swabbing, fecal analysis, feeding and care. Performed seal necropsies and taught necropsy techniques.  
Organized logistics and all equipment for wild pup captures, all biomedical sampling and rehabilitated pup tagging and release.  
Analysis of Argos satellite location and dive histogram data using SatPak and Arcview software.

Tracked expenditures, sample shipping and receipt of biomedical sample results.  
Cetacean stranding response: pager coverage, rescue, carcass recovery and necropsies. Coordination with other NE Region stranding network members and NMFS.  
Assistance with grant writing, fundraising activities and webpage for the Marine Animal Rehabilitation Center.

### **Florida Fish and Wildlife Conservation Commission**

Port Charlotte, FL

Marine Research Associate, January 1999 – April 2004. OPS Research Staff, May 1998 - January 1999.

Manatee and Cetacean Salvage, Rescue and Research Program, Southwest Field Lab.

Coordinated and accomplished manatee and cetacean rescue and carcass salvage for ten counties in southwest Florida. Transported carcasses to Pathobiology Lab. Assisted Pathobiology Lab with necropsies. Performed field necropsies as needed. Assistance with stranded sea turtle rescue and carcass recovery.

Managed daily field lab. operations including hiring, training and supervising of three staff positions, writing mortality, rescue and quarterly reports, purchasing, budget writing and tracking, recruiting and training all interns and volunteers, completing FWC forms for purchases, travel, and time sheets, handling media and public requests for information, upkeep of all equipment, 4 trucks, 2 boats, 4 trailers and office. Conducted outreach presentations on manatee biology and research to local groups.

Principal Investigator for Warm Mineral Springs manatee habitat use study. Coordinated and accomplished manatee captures, health assessments, tagging, and tracking. Set up and maintained automatic VHF datalogging station. Data analysis.

Built, maintained, deployed and recovered manatee PTT/VHF/sonic/GPS tags, peduncle belts and tethers.

Coordinated and participated in releases of rehabilitated manatees. Monitored re-acclimation to the wild, changed out tags and re-captured for health assessments.

Collaborated with USGS Sirenia Project and Mote Marine Laboratory in tracking of all tagged manatees in southwest Florida. Downloaded and plotted daily Argos satellite locations.

Photographed wild manatees for scar photo identification. Labeled and cataloged slides.

Deployed, maintained and downloaded Onset Temperature Loggers collecting water and air temperature data from manatee use sites. Exported, archived and disseminated temperature data files.

Participated in manatee aerial surveys.

### **Boston University Marine Program**

Woods Hole, MA

Teacher's Assistant for Marine Mammals of the Caribbean travel course. December 2002, Spring 1997.

Chaperoned 20 college students in Dominica, graded tests and papers, supervised independent student research, organized all travel logistics and ordered all printed material.

### **National Marine Fisheries Service**

Northwestern Hawaiian Islands

Researcher and Field Camp Leader for Protected Species Investigations, Hawaiian Monk Seal Project.

January-August 1994, April-August 1995, February-August 1996, March- December 1997.

Monitored seal populations at Kure and Midway Atolls and Laysan and Lisianski Islands. Conducted routine beach counts and identified all animals in populations. Data collection and computer entry of all identifications, births, injuries, and deaths.

Flipper and PIT (Passive Integrated Transponder) tagged all weaned pups and immature seals. Replaced lost flipper tags on adults and juveniles. Collected tissue samples from weaned pups and select adult males for genetic analysis.

Released entangled seals and seabirds, collected and destroyed all marine debris capable of entangling and performed necropsies on dead seals.

Collected scat and spew samples and sorted contents for prey species identification.

Assisted with captive monk seal husbandry and research projects on Oahu.

Midway 1997: Conducted haul-out study of all weaned pups and resident juveniles using radio telemetry.

Set up and maintained five automatic radio receiver stations to cover all beach haul-out locations within atoll, applied 17 radio transmitter flipper tags to seals, conducted additional visual and hand-held radio surveys, and analyzed all data. Assisted with green sea turtle flipper tagging.

Kure 1994 and 1995: Released and monitored success of rehabilitated and relocated juvenile female seals.

Laysan 1994: Monitored mating and mobbing activities and maintained all adult identities for mobbing research. Participated in construction of 100'x50' temporary holding pen, capture of 22 adult males, and relocation of them to the main Hawaiian Islands.

Performed rat eradication at Kure Atoll and removal of an introduced sand burr at Laysan.

**New England Aquarium**

Boston, MA

Biologist / Veterinary Services Technician. February-April 1995.

Monitored rehabilitation of stranded Atlantic white-sided dolphin and calf.

Conducted feeding, medication, blood sampling, weighing, and ethograms.

Constructed transport box for mother and calf and assisted with their release back to the wild.

Assistance with stranded seal and sea turtle rehabilitation. Performed seal necropsies.

**The Raptor Trust**

Millington, NJ

Volunteer, Spring 1993.

Built and renovated enclosures for rehabilitating hawks, owls, and songbirds.

**Dr. Wayne Trivelpiece, NSF Grantee**

Antarctic Peninsula, Antarctica

November 1992-February 1993. Research Assistant for ongoing reproductive and foraging studies of

Adelie, Gentoo and Chinstrap penguins, Brown and South Polar Skuas, Kelp Gulls, and Giant Petrels at King George Island and Palmer Station. Tracked reproductive success. Banded adults and fledglings.

Obtained penguin diet samples through lavage. Analyzed fish and krill content. Collected and analyzed skua fecal samples to identify fish species in diet.

Applied and monitored radio telemetry equipment on Adelie penguins. Implanted PIT tags in Gentoos and Adelies as part of band loss study.

Maintained penguin predator sightings and marine mammal census records.

**New England Aquarium**

Boston, MA

Staff January 1990-October 1992, Volunteer January 1987 and October-December 1989.

Aquarist and Staff Diver. Daily maintenance and animal husbandry of 200,000 gallon Caribbean coral reef and 150,000 gallon penguin exhibits.

Personal responsibilities included writing bi-weekly exhibit status reports for coral reef tank, maintaining individual animal records, African Blackfooted Penguin chick rearing, recruiting and training all volunteers, local specimen collecting, assistance with stranded sea turtle rehabilitation program, and assistance with marine mammal stranding program.

**Greg Early, Senior Biologist, New England Aquarium**

Boston, MA

Teacher's Assistant for Marine Mammals class. Spring 1991.

Assisted with laboratory dissections, class note-taker, responsible for distribution of all printed material to students.

**The Marine Mammal Center**

Sausalito, CA

Volunteer, September 1987-June 1989.

Assisted in stranded seal and dolphin rescue, feeding, medication, cage cleaning, and maintenance.

Observed surgeries.

**National Dental Insurance**

San Francisco, CA

Client Service Representative. January 1988-January 1989.

Recruited dentists for mutual insurance program. Supervised telemarketing, gave presentations at dental conventions, and assisted in underwriting policies.

**Sandrian Camera**

Morristown, NJ

Salesperson. Summer 1985, January 1986, Spring 1993.

Sold camera equipment and supplies, handled bank deposits and correspondence to manufacturers.

Customer Service Representative for professional photographer clients.

**Dr. Kenneth Crowell, St. Lawrence University**

Canton, NY

Teacher's Assistant for Comparative Vertebrate Morphology Course. Fall 1986.

Conducted laboratory instruction and individual tutoring, set up weekly lab displays, and managed mailings of professor's published work.

**HONORS AND AWARDS**

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2003 Manatee Conservation Award, U.S. Fish and Wildlife Service

2003 Crisis Response Team Award, Florida Marine Research Institute

2002 Effective Team Award, Florida Marine Research Institute

2001 Supervisor Award, Florida Marine Research Institute

2001 Cooperative Science Award, Florida Marine Research Institute

1996 First recipient of Richard Ablon Fellowship, Boston University

#### GRANTS

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- 2006 Manatee Habitat Interactions and Carrying Capacity Near A Selected Warm Water Site; Principal Investigators: Lucy W. Keith, Cynthia R. Taylor and James A. Powell; Source: U.S. Fish and Wildlife Service (\$34,929)
- 2006 Evaluation and Monitoring of Proposed Manatee Refuges and Protection Zones; Principal Investigators: Lucy W. Keith, Cynthia R. Taylor and James A. Powell; Source: U.S. Fish and Wildlife Service (\$47,907)
- 2006 Manatee Photo Identification in the Everglades; Principal Investigator: Lucy W. Keith; Source: U.S. Fish and Wildlife Service (\$9,833)
- 2003 Facilitation of Southwest Florida Cetacean Rescue and Recovery; Principal Investigator: Lucy Keith; Source: John H. Prescott Marine Mammal Rescue Assistance Grant (\$90,800)
- 2003 Sarasota County Warm Mineral Springs Creek Protection Program; Principal Investigator: Daniel Sullivan; Source: U.S. Fish and Wildlife Service Recovery Land Acquisition Grant (\$2.5 million). Lucy Keith serves as an advisor to Sarasota County for this grant.

#### PROFESSIONAL AFFILIATIONS

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Sirenian International, Board of Directors 2006-2008.  
Florida Marine Mammal Stranding Network, Southwest Region. President 2001-2004.  
Society for Marine Mammalogy  
International Sea Turtle Society  
Peer Reviewer for *Oryx*, the International Journal of Conservation

#### PUBLICATIONS

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- Becker, B.L., H.L. Johnston, L.W. Keith and C.A. Vanderlip. The Hawaiian Monk Seal at Laysan Island, 1994. U.S. Dept. Commerce, NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-229, 13 p.
- Craig, M.P., L.W. Keith, and C.A. Vanderlip. The Hawaiian Monk Seal at Kure Atoll, 1994. U.S. Dept. Commerce, NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-229, 12 p.
- Eberhardt, L.L., K.V. Eberhardt, W.G. Gilmartin, L.W. Keith, and R.L. Jeffery. The Hawaiian Monk Seal at Midway Atoll, 1995. U.S. Dept. Commerce, NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-241, 10 p.
- Keith, A.R. and L. W. Keith. 2003. More Pelagic Bird Sightings off Dominica. *Journal of Caribbean Ornithology*, 16: 26-30.
- Keith, L.W. 1999. Haul-out Behavior of Weaned Pup and Juvenile Hawaiian Monk Seals at Midway Atoll. M.S. Thesis, Boston University Marine Program. 67 pp.
- Keith, L.W. and R.L. Jeffery. The Hawaiian Monk Seal at Kure Atoll, 1995. U.S. Dept. Commerce, NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-241, 12 p.
- Keith, L.W., R.L. Jeffery and J.D. Pettinger. The Hawaiian Monk Seal at Kure Atoll, 1996. U.S. Dept. Commerce, NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-259, 12 p.
- Keith, L.W., H.R. Smith, H.J. Auman, S.M. Canja and C.A. Vanderlip. The Hawaiian Monk Seal at Midway Atoll, 1997. U.S. Dept. Commerce, NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-262, 12 p.
- Seymour, J.A., L.W. Keith, K.W. McFadden, K.A. Blake, and B.L. Becker. The Hawaiian Monk Seal at Lisianski Island, 1996. U.S. Dept. Commerce, NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-259, 12 p.

#### PUBLICATIONS IN PREPARATION

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- Keith, L.W. and M.E. Barlas. *In prep.* Manatee Winter Use of a Natural Warm Water Site at Warm Mineral Springs, Florida.
- Keith, L.W. and T. Collins. *In prep.* Surveys for the West African Manatee in Gabon, 2006.

## CONFERENCE PARTICIPATION

Bertrand, M.R., Ono, K.A., Keith, L., Zeeman, S.I., Estrada, E.L. 2005. Influence of Oceanographic Variables on Movements of Harbor Seal Pups (*Phoca vitulina concolor*) in the Gulf of Maine. Presented at the 16th Biennial Conference on the Biology of Marine Mammals, San Diego, CA. December 2005.

Bonde, R.L., L.W. Keith, L.I. Ward, J.P. Reid, T.D. Pitchford, C.J. Deutsch, M. Ross, J.A. Valade, and N.M. Adimey. 2003. Evaluating the Post-Release Success of Rehabilitated Manatees in Florida, 1973-2002. Presented at the 15th Biennial Conference on the Biology of Marine Mammals, Greensboro, N.C. December 2003.

Garrett, A., T. Pitchford and L. Keith. 2002. Rescue Criteria for Florida Manatees. Presented at the Florida Marine Mammal Health Conference I, Gainesville, FL. April 2002.

Haubold, E.M., K. Arrison, M. Barlas, A. Costidis, L. Flewelling, M.M. Foley, A. Garrett, L. Keith, J. Landsberg, T. Pitchford, T. Pulfer, S. Rommel, L. Ward. 2003. An Unusual Mortality Event of Florida Manatees Is Related To Brevetoxin Exposure Through Ingestion of Seagrass. International Association of Aquatic Animal Medicine, Hawaii, May 2003.

Haubold, E.M., K. Arrison, M. Barlas, A. Costidis, L. Flewelling, M.M. Foley, A. Garrett, L. Keith, J. Landsberg, T. Pitchford, T. Pulfer, S. Rommel, and L. Ward. 2003. Investigations into Manatee Red Tide Mortality Events in Southwest Florida During the Past Two Years. Presented at the Charlotte Harbor Conference, Mote Marine Laboratory, Sarasota, FL. October 2003.

Keith, L.W. 1998. Haul-out Behavior of Juvenile Hawaiian Monk Seals (*Monachus schauinslandi*) at Midway Atoll. Presented at the World Marine Mammal Science Conference, Monaco. January 1998.

Keith, L.W. 1999. Haul-out Behavior of Weaned Pup and Juvenile Hawaiian Monk Seals (*Monachus schauinslandi*) at Midway Atoll. Presented at the 13th Biennial Conference on the Biology of Marine Mammals, Maui, HI. November 1999.

Keith, L.W., M.E. Barlas and M.M. Peterson. Manatee Winter Use of a Natural Warm Water Site at Warm Mineral Springs, Florida. 2003. Presented at the 15th Biennial Conference on the Biology of Marine Mammals, Greensboro, N.C. December 2003.

## OTHER SKILLS

Comprehensive experience with Mac and PC computer systems and software, including Microsoft products (Word, Excel, Power Point, Photo Editor and Access), Arcview, SAS and Oracle.

Excellent scientific writing skills, data analysis and public speaking experience.

USCG Boating Skills and Seamanship Certificate, small boat and engine maintenance. Boat and flatbed trailering.

PADI Advanced Openwater Diver certification.

First Aid, CPR and Wilderness First Aid certified.

Knowledge of marine mammal capture and restraint techniques including use of herding boards, hoop nets and net deployment from boats and shore. Experience training others in marine mammal restraint techniques.

Extensive experience in PIT tagging, construction and attachment of manatee belts, tethers, VHF, satellite and GPS tags, seal satellite and flipper tagging, sea turtle flipper and satellite tagging, and bird banding.

Highly experienced in the use of VHF and HF radio and Inmarsat equipment, including construction and maintenance of automatic receiver / datalogging stations.

Regularly perform blood draws, serum/plasma separation, trained in use of laboratory equipment to run CBC and blood chemistry.

Experienced with ultrasound for measuring manatee blubber thickness.

Fully trained in marine mammal aerial survey techniques and video data recording from air.

Ability to work and live well in remote field locations.

**MONICA ROSS**  
**13013 Jesup Woods Court**  
**Orlando, FL 32824**  
**(407) 826-9260**

**EDUCATION**

1/2000 to current  
**University of Central Florida**  
**Orlando, Florida**  
Pursuing M.S. Degree in Biological Science

8/1988 to 12/1990  
**Florida State University**  
**Tallahassee, Florida**  
B.S. Degree in Biological Science

4/1986 to 4/1988  
**Florida Community College at Jacksonville**  
**Jacksonville, Florida**  
A.A. Degree

7/1984 to 4/1986  
**University of North Florida**  
**Jacksonville, Florida**

**PROFESSIONAL EXPERIENCE**

2/2002-current **WILDLIFE TRUST, St. Petersburg, FL**  
**Aquatic Program, Manatee Rehabilitation Partnership**

**Conservation Biologist:** Coordinate and supervise all field activities including specific logistics and staffing for the Manatee Rehabilitation Partnership (MRP) project which conducts post-release monitoring of rehabilitated manatees. Procure, build and maintain tagging and tracking equipment. Create and process telemetry data into corrected GIS coverages. Perform data evaluation and analysis to enhance successive manatee releases. Participate in production and distribution of press releases for project enhancement. Maintain yearly budget reports and assist with grant applications and reports. Advise on decisions and protocols affecting all aspects of research, release and capture of MRP animals. Communicate regularly with all state, federal and other non-profit members of the MRP to facilitate decision-making and planning. Attend professional meetings and conferences and provide presentations to the general public.

4/1998-current **WALT DISNEY WORLD RESORTS, DISNEY'S ANIMAL KINGDOM,  
Orlando, FL. Conservation Station/Colors**

**Animal Keeper:** Responsible for husbandry care, enrichment and training for a variety of small North American animals. Established and implemented new training plans for various behaviors performed in a show environment and for husbandry to reduce handler/animal stress during medical procedures. Developed protocols to specify maximum animal use frequency and environmental limitations for shows. Implemented disinfectant and daily duties schedules to increase area efficiency. Trained new employees on area policies and procedures. Routinely conducted area tours for entertainment, custodial and maintenance personnel to provide general animal biology and behavior information, while also encouraging input on enrichment ideas/items. Developed a species contingency plan for current and future animal staffing. Participated in the Daily Report Task Force and Ray Wallace's Circle of Excellence Board. Appointed entertainment liaison for animal care staff. Served as TSA Zoological Manager during supervisor's absence.

2/2001-4/2001 **WALT DISNEY WORLD RESORTS, DISNEY'S ANIMAL KINGDOM,  
Orlando, FL. Conservation Station/Colors**

**TSA Zoological Manager for Conservation Station:** Facilitated the animal care daily operations at the "Pocahontas and Her Forest Friends" show. Partnered with entertainment, operations and Equity to maintain show quality through scheduling, show modifications or show enhancements. Provided assistance to staff in the development of animal husbandry and enrichment programs. Encouraged new training methods and ideas using DAK training philosophies to enhance the behavior well-being of staffed animals. Facilitated new cast training while also providing established cast with developmental support for performance goals. Responsible for hiring of new personnel, animal acquisitions and special area work project completions. Routinely worked with veterinary, maintenance, horticulture and decorating departments for operational support.

1/1993-4/1998 **FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION,  
St. Petersburg, FL. Ecosystem Assessment & Restoration/Endangered and  
Threatened Species**

**Biological Scientist II:** Conducted field research for the West Coast Manatee Telemetry Project by gathering, entering and analyzing telemetry data on manatee distribution, habitat utilization, and behavioral and environmental parameters. Created and processed telemetry data from raw format to corrected Geographic Information System (GIS) coverages. Analyzed collected data for presentations and publications. Contract manager for outside agency telemetry projects. Routinely assessed health and potential rescue needs of reported sick or injured manatees. Trained new personnel on field protocols, data entry and analytical techniques. Experienced boat handler responsible for personnel safety, equipment maintenance and purchases. Regularly participated in multi-agency cooperative efforts to enhance research and management needs. Routinely provided lectures to community organizations for public education and awareness.

8/1991-1/1993 **FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION,  
St. Petersburg, FL. Juvenile Fish Assessment**

## **Experimental Culture and Physiology**

**Biological Scientist I:** Assessed the release of hatchery-reared red-fish (*Sciaenops ocellatus*). Enhanced survival during rearing by monitoring water quality, maintenance of equipment for optimum water aeration flow and analysis of water quality data. Conducted sampling in Tampa Bay to evaluate relative stock abundance using various equipment deployed from 20-24ft boats. Implemented research project to compare different tag types for mortality due to tag placement/presence, growth rate and tag shedding. Responsible for safety and scheduling of dive personnel, supervision of equipment maintenance, purchasing and budgeting.

10/1990-12/1997 **WALT DISNEY WORLD, THE LIVING SEAS AT EPCOT,  
Orlando, FL. Marine Mammal Department**

**Senior Aquatic Assistant:** Provided husbandry care and training for West Indian Manatees and Atlantic Bottlenose Dolphins. Member of ongoing research projects with bottlenose dolphins including echolocation, mimicry, and keyboard communications. Responsible for food preparation and feedings to fish and marine mammals. Manatee information sessions were presented daily to the public. SCUBA diving for tank maintenance, feedings and research session were performed daily. Observed animal behavior, food intake and research activities were recorded and entered for analysis.

### **TECHNICAL SKILLS**

- Microsoft Word, Excel, Access, PowerPoint, dBase, SPSS
- Geographical Information System (GIS) ARC/INFO, ARCVIEW
- Proficient boat handling of deep or flat hauls 12-24ft
- Certification in U.S. Coast Guard Boating Skills and Seamanship
- PADI Certification in Advanced Open Water SCUBA diving

### **ACHIEVEMENTS / PUBLICATIONS / PRESENTATIONS**

- Currently pursuing Masters in Biology at University of Central Florida
- Adimey, N., Ross, M. 2005. The Release of a Long Term Captive Manatee. Presented at the 16<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, San Diego, CA. December 2005.
- Flamm, R.O., Weigle, B.L., Wright, I.E., Ross, M., Aglietti, S. 2005. A Spatially Explicit Model for Mapping Manatee Places and Corridors from Telemetry Data. *Ecological Applications* 15(4): 1415-1426.
- Bonde, R.L., L.W. Keith, L.I. Ward, J.P. Reid, T.D. Pitchford, C.J. Deutsch, M. Ross, J.A. Valade, and N.M. Adimey. 2003. Evaluating the Post-Release Success of Rehabilitated Manatees in Florida, 1973-2002. Presented at the 15th Biennial Conference on the Biology of Marine Mammals, Greensboro, N.C. December 2003.
- Weigle, B.L., Wright, I.B., Ross, M., and Flamm, R.O. 2001. Movements of Radio-tagged Manatees in Tampa Bay and along Florida's West Coast from 1991-1996. *Florida Fish and*

Wildlife Conservation Commission, FMRI Technical Report TR-7, St. Petersburg, FL

- Ross, M., Weishampel, J.F., and Flamm, R.O. 2001. Seasonal and Diel Patterns of Manatee Habitat Selection. Presented at the Workshop on GIS/Remote Sensing for Marine Mammal Scientist, Vancouver, Canada. 2001
- Ross, M., Flamm., R.O. and Weigle, B.L. 1997. Movement Patterns of Radio-Tagged Female Manatees. Presented at the 4<sup>th</sup> Annual Conference on The Wildlife Society, Snowmass Village, CO. September 1997.
- Ross, M., Flamm., R.O. and Weigle, B.L. 1997. Movement Patterns of Radio-Tagged Female Manatees. Presented at the 4<sup>th</sup> Annual Conference on The Wildlife Society, Snowmass Village, CO. September 1997.
- Recipient of the Florida Department of Environmental Protection 1996 Team Award
- Fitzgerald, M.R., Flamm., R.O. and Weigle, B.L. 1996. Movement Patterns of Radio-Tagged Female Manatees. Presented at the 1<sup>st</sup> Annual Florida Department of Environmental Protection GIS Workshop, Tallahassee, FL 1996.
- Fitzgerald, M.R., Flamm., R.O. and Weigle, B.L. 1995. Movement Patterns of Radio-Tagged Female Manatees. Presented at the 11<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, Orlando, FL December 1995.
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**Publications in Preparation:**

- Ross, M., Weishampel, J.F., Flamm, R.O. Seasonal and Diel Patterns of Manatee Habitat Selection
- Adimey, N., Ross, M., Reid, J.P., Bonde, R.L., Reed, C. Rehabilitation Success for Florida Manatees