

Movements and Habitat Requirements of Radio Tagged Manatees in Southwest Florida; Implications for Restoration Assessment

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INTRODUCTION

A study on West Indian manatees (*Trichechus manatus*) in southwestern Florida is being conducted to determine the relative abundance, distribution, movements, and habitat use of manatees associated with coastal waters and rivers. As part of the study, an individual-based ATSS model is being developed to predict manatee response to changes in hydrology caused by the Comprehensive Everglades Restoration Plan (CERP).

A large proportion of the southwest Florida manatee population occurs throughout the Everglades National Park (ENP) and northwest into the Ten Thousand Islands (TTI). On-going research in this region shows that manatees make frequent movements up tidal creeks to obtain freshwater for drinking and to find thermal refugia during cold weather.

Alteration of the freshwater and estuarine ecosystems associated with restoration of the Everglades and Southern Golden Gate Estates (SGGE) is likely to affect this manatee population. We hypothesize that manatee distribution, relative abundance, habitat use, and movement patterns will change because of altered water management regimes and resulting changes in near shore salinity.

Aerial surveys and radio tracking tagged manatees provide valuable means of documenting the response of manatees to natural and human-induced fluctuations in freshwater inflow. This information, combined with water-quality data obtained from monitoring stations, is being incorporated into the manatee ATSS model, which will be used to better understand and predict manatee response to different restoration scenarios.

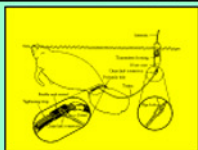
This project also fills a significant void in our knowledge of manatee ecology, as there is very little existing information on manatee population biology and habitat use in southwestern Florida. Recent advances in tracking technology have made this project logistically feasible and cost-effective. This is the first detailed radio tracking study conducted to identify manatee use patterns in this region.

METHODS

During the initial phase of this study, three captive, rehabilitated adult manatees were tagged and released in July 2000.



Eight wild manatees were captured and radio-tagged at Port of the Islands in February and March 2001. During summer 2001, three manatees tagged by Mote Marine Lab near Charlotte Harbor moved into the Ten Thousand Islands, and one rehabilitated manatee was released at Port of the Islands. Manatees were also captured and radio-tagged at Port of the Islands in January 2002 (N=5) and December 2002 (N=5), bringing the total number of manatees tagged and tracked in this study to 25 individuals.



Satellite-based & Field Radio Tracking

- Satellite-monitored Argos tag for remote monitoring
- VHF and ultrasonic tags for field tracking & tag recovery
- Application of GPS technology



Aerial observation of tagged manatee with three untagged individuals (also shown magnified in inset). Periodic aerial radio tracking (by BIP personnel) and field monitoring provides data on location, behavior and group size. (Photo by Lori Oberhofer)

We relied on several technologies to acquire geographic locations from tagged manatees.

- Most manatees were fitted with satellite-based Argos transmitters, which have a serviceable battery life of six months and provide locations along with data on temperature and transmitter activity. A location class (LC) designating the accuracy of each position is also recorded; quality locations include LC 1 <1000m, LC 2 <350m, and LC 3 <150m. Tagged manatees relayed an average of six quality locations per day, with a frequency of approximately two per day from each location class.

In addition to the Argos satellite-monitored tags, we opportunistically attached datalogging and Argos-linked GPS tags to obtain detailed short-term tracks of tagged manatees.

- GPS tags provide locations which are much more accurate than the Argos data (approx. 30 m vs. ≥ 150 m) every 15-30 minutes, but the battery life expectancy is much shorter (8 weeks vs. 6 months). In combination, the Argos data provided region-wide, long-term coverage suitable for revealing general patterns of habitat use, while the GPS data showed fine details of travel pathways and time spent in specific areas.

- Newly developed Argos-linked GPS tags were recently deployed on individuals. This tag relays GPS locations as sensor data through the Argos satellite link, enabling detailed tracking data to be acquired remotely.

Argos-monitored radio tag

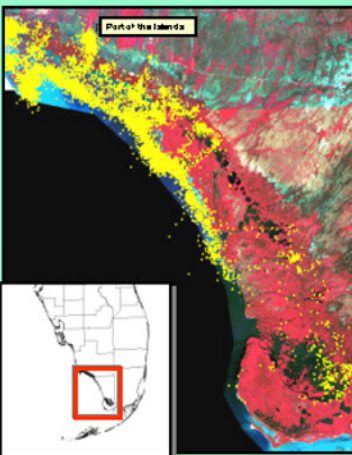


Argos-linked GPS tag

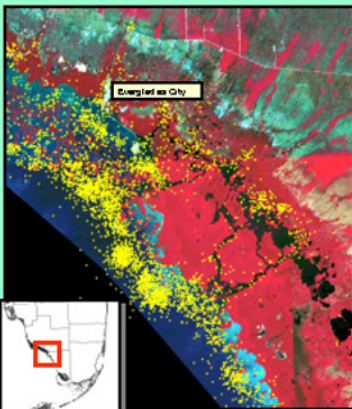
All tagged manatees were periodically located and observed in the field using standard VHF tracking techniques. All location data were formatted using the SAS statistical software for error checking, analyses, and display in ArcView. Databases were correlated with temperature, salinity, and tidal data collected throughout the region.

RESULTS and DISCUSSION

From 2000 through July 2002, a total of 4,563 tracking days were recorded from 36 tag deployments on 20 manatees. Two of the males traveled to areas more than 100 km north of the Ten Thousand Islands. Most remained within the study area, however, providing the first detailed movement data collected across seasons from wild manatees in the region.

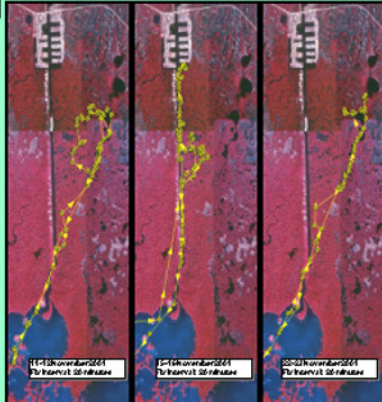


Warm season use areas for some individuals included seagrass beds off Cape Romano and the canals of Marco Island. Other manatees moved southeast into the northwest region of Everglades National Park, relying on inland creeks for fresh water. These data provide the first details on manatee use patterns in the TTI/ENP region.

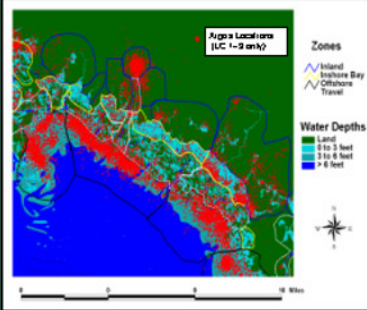


Locations in the TTI/ENP favor seagrass beds along the outer islands. The Faka Union canal at Port of the Islands, Barron River at Everglades City, Turner River, and other inland creeks/canals provide access to freshwater as well as passive thermal refuge for manatees during brief cold winter weather.

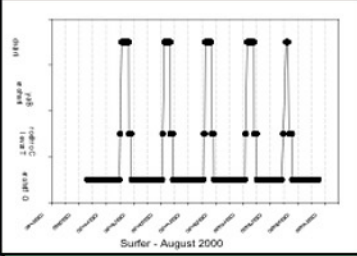
Movement patterns for all individuals suggest a preference for foraging on seagrass beds in marine areas with brief trips to inland creeks and canals, which provide a source of fresh water. These inland trips, undertaken approximately four to eight times per month, reveal the reliance of these marine animals on accessible freshwater.



GPS tracks for TNP-04 Megan show details for three individual movements into the Faka Union area. Most moves to this region by tagged manatees were to drink fresh water in the Port of the Islands canals (top of figure), however Megan's track shows two round trips to fresh water areas deep in the historic Faka Union River channel. Tracks using GPS tags are revealing precise manatee use patterns, which often include areas not previously recognized as typical manatee habitat.



Delineated habitat zones are used to classify Argos satellite locations for comparisons of areas occupied. Argos satellite locations, GPS Tracks, and autonomous VHF data-logging stations are detailing the frequency and duration of inland moves to access freshwater.



CONCLUSIONS

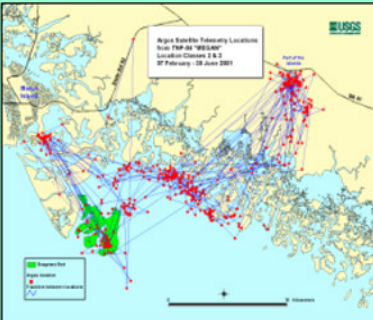
Tracking data and field observations of tagged manatees revealed that the spatial distribution of submerged aquatic vegetation, availability of freshwater, and bathymetry influenced manatee movements and use patterns within the TTI and northern Everglades. Manatees routinely traveled from offshore seagrass beds to inland freshwater areas. We expect that altered water management regimes and resulting environmental changes may affect manatee habitat use and movement patterns within the region. These data are being integrated into the ATLSS model that will attempt to predict manatee responses to management actions.

ACKNOWLEDGMENTS

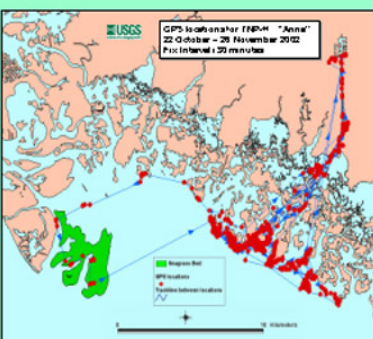
Manatee research is guided by the objectives of the Florida Manatee Recovery Plan. The studies summarized here are a cooperative effort with one or more federal, state, and private partners, including: Everglades National Park, U. S. Fish and Wildlife Service, Big Cypress National Preserve, Rookery Bay National Estuarine Research Reserve, Florida Fish and Wildlife Conservation Commission, Mote Marine Laboratory, and Save the Manatee Club.

The Sirenia Project at the Center for Aquatic Resource Studies conducts long-term research on the life history, population dynamics, and ecological requirements on the endangered West Indian manatee (*Trichechus manatus*). This research provides managers with information that is essential to recovery assessment and planning.

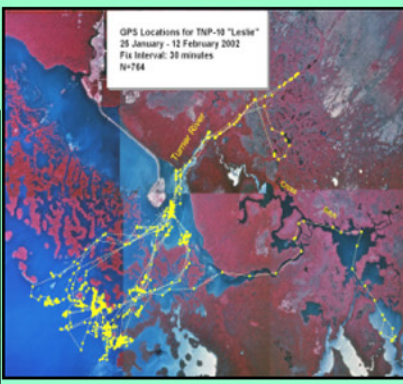
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Individual movements were linked to a network of travel corridors connecting seagrass beds and sources of freshwater, identified by manatee locations during GPS tag deployments. Movements were often rapid and direct. Individual site fidelity for some manatees varied with season and calving events.



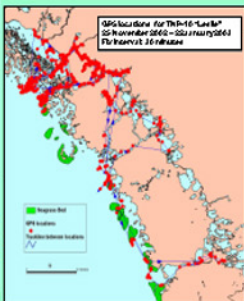
Feeding areas were documented within *Thalassia*, *Syringodium*, and *Halodule* seagrass beds along the outer islands. Spatial distribution of submerged aquatic vegetation, temporal fluctuations in freshwater areas, and bathymetry influenced movement and use patterns of manatees within the region.



Salinity of inshore waters fluctuated with winter dry periods and summer rains. Abundance and species composition of submerged vegetation within inland bays may vary with these seasonal changes, thus influencing manatee feeding patterns.

Tracks of several individuals that moved south and inshore during cold winter weather may reflect historic manatee movement patterns prior to the availability of artificial warm water refugia.

Additional studies are planned to assess manatee habitats including characterizing and mapping the distribution of submerged aquatic vegetation in areas used by tagged manatees for foraging.



Poster presentation at the Joint Conference on the Science and Restoration of the Greater Everglades and Florida Bay Ecosystem, April 13-18, 2003, Palm Harbor, Florida

