

Frequently Asked Questions

USGS Updates Survival Estimates for Florida Manatees

Background

- Survival analysis of Florida manatees is based on the photo-documented sighting histories of known individuals in the Manatee Individual Photo-identification System (MIPS). Scientists photograph manatees annually when they return to warm-water aggregation sites to find refuge from winter cold.
- Scientists use capture-recapture statistical models to estimate manatee survival rates. These models are used by scientists to estimate survival rates for wildlife species.
- Previous manatee analyses have focused on four regions in Florida: Northwest, Southwest, Upper St. Johns River, and Atlantic Coast.

1. What did the USGS do in this study?

This study updated adult survival rate estimates for Florida manatees in the Atlantic Coast and Northwest regions. The last such estimates were published in 2004. That research reported an apparent decline in survival estimates for the Atlantic Coast that could be attributed either to a real decline or a statistical bias due to annual changes in manatee use of warm-water monitoring sites.

During warmer winters, cold stress is less of a factor for manatees, and some individuals do not visit the monitored high-quality, primary refuges. Instead they rely on unmonitored lower quality secondary refuges nearer to seagrass beds, freshwater, or other resources. Thus, some individuals are not available to be identified by researchers and can be considered “temporary emigrants” during those years. Statisticians have warned researchers that survival estimates from capture-recapture models may be biased under some types of temporary emigration.

This study was conducted to determine the cause of the apparent decline reported in 2004 and develop more robust unbiased estimates of survival rate. The scientist modeled the temporary emigration, accounting for its effect on estimates of manatee survival, and the updated estimates were incorporated into the U.S. Geological Survey (USGS) threat assessment model for the U.S. Fish and Wildlife Service listing review process.

2. Why is this important?

Models have shown that for large, long-lived mammals, population growth can be influenced by small changes in adult survival rates. So a small bias in adult survival rate could result in biased estimates of population growth rate and biased models of population dynamics.

Population models are critical to state and federal assessments of status and assessments of effects due to planned management actions. Consequently it is important for modelers, decision-makers, and resource planners to have accurate estimates of adult survival rates.

3. What are the overall results?

The previously published decline in survival rates for Atlantic Coast manatees was a spurious effect due to annual changes in manatees' use of warm water aggregation sites (i.e., non-random temporary emigration). This analysis showed the decline to be an artifact rather than a real decline, and the bias only appeared at the end of the time series.

The new survival estimates for Atlantic Coast and Northwest manatees are higher because bias was minimized.

Atlantic region 0.963 (previous estimate 0.937)

Northwest region: 0.959 (previous estimate 0.956)

- The new estimates described in the Threat Analysis Report differ from previous published estimates, because a new statistical approach was applied to minimize bias, additional years of data were available for analysis, and the mean survival rates were taken over a longer period (1986-2000 compared to 1990-1999).

The simulation study showed greater bias when annual survival estimates were high, as is common for long-lived species. This study suggests a source of bias that managers and researchers should consider when modeling status and recovery of any long-lived species.

4. Can these methods be improved?

This new approach was not applied to data for the Southwest and Upper St. Johns River, because the photo-identification monitoring database is undergoing a digital and technological upgrade. When data are available, estimates will be updated with this approach.

The Core Biological Model (CBM), the Threat Analysis Report, and the 2005 Manatee Biological Population Assessment by the Recovery Team's Manatee Population Status Working Group all identify the need to continue to refine survival estimates and estimates of temporal variability for more robust models of manatee population dynamics. USGS research will continue to focus on developing new methods to reduce bias and uncertainty in survival estimates.

5. Because individual manatees are identified primarily by their healed scars from injuries in collisions with watercraft, is there an inherent bias in survival rates because most of the individuals monitored have previously been injured?

The effects of this experience on their risk of mortality and the consequent potential bias to the survival estimates are unknown. Several interpretations are possible:

- 1) scarred and unscarred individuals do not differ with regard to risk, so the estimates of survival are unbiased;
- 2) scarred individuals' behavior reduces the risk of future watercraft encounters, so the estimates are positively biased relative to survival in the whole population;

3) scarred individuals recover with conditions that reduce their future survival and reproduction, so the survival estimates are negatively biased relative to the survival of the whole population; or

Scarred individuals, however, make up a significant fraction of the population in each region so the magnitude of the bias, if it exists, cannot be large.