

The 2004 Hurricanes—Storm Attributes, Impacts to Manatee Survival Rates, and Scenarios for Population and Ecosystem Models

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In a 2003 published analysis of 19 years of mark-resighting data for Florida manatees (Langtimm and Beck, 2003), we detected significantly lower adult apparent survival probabilities in the northwest panhandle of Florida in the three years with major hurricanes (Category 3 and above on the Saffir-Simpson scale) or a severe winter storm (Fig. 1). In 2004, four hurricanes impacted manatee habitat for three of the four Florida manatee subpopulations managed by the U. S. Fish and Wildlife Service. These storms had the potential for similar effects on apparent manatee survival that we observed in our 2003 study, and could affect manatee population dynamics and recovery of the species. Our hypothesis is that the magnitude of impact on the manatee subpopulations should vary with the destructiveness of the storms, which depends on wind intensity, storm surge height, size, speed of forward motion, proximity to the coast, track direction relative to the coast, and coastal and ocean bottom topography. Other factors can then exacerbate or ameliorate apparent survival risk, such as density of manatees in the strike area, multiple storms within a season, or coincidence with other mortality factors (i.e., cold stress, red tide, or changes in watercraft mortality).

The primary objectives of this research are to (1) assess the magnitude of impact to apparent manatee survival rates relative to storm characteristics, (2) identify and test hypotheses concerning the mechanisms operating to produce these impacts; and ultimately (3) develop predictive and risk assessment models to describe impact under different storm scenarios and the consequences to manatee population dynamics and persistence.

Data necessary to estimate regional manatee survival probabilities during the 2004 storm year are already being collected as part of an ongoing study by the USGS Sirenia Project (CARS), Florida's Fish and Wildlife Research Institute, and Mote Marine Laboratory to assess manatee population status and trends. Prior to the survival analysis, we are developing predictions of the relative magnitude of change in survival rates expected in each subpopulation, based on known manatee distribution patterns and analysis of storm-specific characteristics hypothesized to affect apparent survival. Our analyses of data and models describing physical storm characteristics currently focus on surface wind fields, wave action and impact to coastal erosion, storm surge, and sea surface temperature changes.

As this research develops we anticipate incorporating hurricane effects and manatee population data into various manatee management models and FISC ecosystem models. Currently a set of nested hydrodynamic models are being developed as part of the Tampa Bay Integrated Science Project. The Gulf of Mexico model, forcing the pre-conditions of the Tampa Bay model, may have sufficient resolution and specificity to provide gross constraints on conditions that may affect apparent manatee mortality. Incorporating these nested hydrodynamic models to models of manatee population dynamics could provide valuable information to managers assessing the long-term stability of the Florida manatee and its habitat along the Florida shoreline.

Reference

Langtimm, C. A., and C. A. Beck. 2003. Lower survival probabilities for adult Florida manatees in years with intense coastal storms. *Ecological Applications* 13:257-268
http://cars.er.usgs.gov/Center_Publications/Publications/Langtimm_Beck_Ecol_Apps.pdf