Core Biological Model

- Population Viability Analysis
  - Age- and sex-structured
  - Stochastic
    - Demographic
    - Environmental
  - Catastrophic
  - Density-dependent
  - Parametric and structural uncertainty
- Custom-built

Modeling Threats

- Watercraft, WCS, Marine debris
  - To simulate removal of these threats, reduce mortality by fraction due to the threat (increases avg survival)
- Red tide
  - To simulate removal of this threat, we set the probability of a severe occurrence to 0 (background rates remain)
- Warm-water loss
  - To simulate removal of this threat, hold warm-water capacity constant at current levels (no drop)
- The effects of the rescue/rehab program are assumed to continue indefinitely

Population Projection
Regional Projections

Strength of Threats

- Probability of the adult population falling below 500 animals on either the Gulf or Atlantic coast over 150 yr
- "Status quo"—all threats remain at current levels (with anticipated loss of WW)
- Consider full removal of threats 1-at-a-time

Demographic Status

- Compared to 2007, our perception of the demographic status of Florida manatees has increased
  - Estimates of survival rate have increased (and become more precise)
  - Estimates of carrying capacity have increased
  - Estimates of the current population size have increased

Discussion

Forecasting

- But the status of manatees also depends on our inferences about future trends
  - Will red-tide mortality become more frequent?
  - Will cold-related mortality increase?
  - Will watercraft-related mortality remain at current rates?

Limitations

- 2012 Analysis did not account for
  - Severe cold events, 2009-10, 2010-11
  - Southwest red tide, 2012-2013
  - Loss of seagrass in Indian River Lagoon, 2011-12
  - Photo-ID data were only available through 2008-09
  - Initial population size was based on 2011 synoptic (4834); recent estimates are even higher (6350)
  - Does not include effects of climate change
Next Steps

- 2012 CBM results will be published in the next several weeks (May 2015)
- Updates to the model and the parameter estimates are underway. Results expected early 2016