

NMFS PROTECTED SPECIES TOOLBOX PROJECT DESCRIPTION

Title: Quantitative Tools to Assess Impact of Anthropogenic Activity on Sea Turtle Populations

Project Goals:

- Build on our spatially-explicit matrix model that simulates loggerhead (*Caretta caretta*) population dynamics
- Meet with GARFO managers to discuss management needs related to the assessment of the regional loggerhead population (Northwest Atlantic DPS)
- Use simulations to evaluate the relationship between population monitoring metrics and population trend under different levels of population growth and sampling variability
- Simulate at least one assessment tool, using Heppell (2005) as a starting point, also considering Curtis and Moore (2013)
- Perturb the simulated sea turtle populations to represent anthropogenic impacts, and evaluate the performance of candidate assessment tool(s) under potential management scenarios

Background and Significance:

Section 7 of the Endangered Species Act (ESA) dictates that federal agencies must consult with the National Marine Fisheries Service (NMFS) on proposed actions that may jeopardize the continued existence of an ESA-listed species under NMFS jurisdiction. NMFS regional offices prepare Biological Opinions containing the jeopardy determinations. Currently, jeopardy decisions must rely on an insufficient scientific framework for protected species stock assessments (NMFS 2004). This project will develop and evaluate quantitative tools for consistently assessing the impact of anthropogenic activity on marine turtles. The tools can then be used in jeopardy analyses and Section 7 consultations.

In addition to improving the quality of protected species stock assessments and the science products that may be used in management decisions such as jeopardy analysis, this research will help identify data elements that are most influential in impact assessments. This will highlight areas of needed data collection, which is vital for informing the ongoing development of long-term assessment and monitoring plans for marine turtles.

Project Description:

This research is in year two of a five-year program for developing and evaluating risk assessment tools for protected species. Our approach is one of management strategy evaluation, a simulation technique recommended in the NRC review (NRC 2010). As our first step of the project, we built a spatially explicit matrix model to simulate the Northwest Atlantic loggerhead sea turtle population. Published results from the first step (Warden et al. 2015) emphasized the importance of specifying and monitoring incidental take by life stage or by adult equivalents whenever the intent is to monitor population-level impacts on loggerhead turtles. Our current step will inform the selection of favored monitoring schemes for impact assessment. We are simulating population monitoring schemes (e.g., nest counts, in-water abundance surveys) to investigate which index, given current levels of uncertainty, best reflects the trend in the population growth rate under our model. Future steps will be to apply and evaluate impact assessment tools, using what we learned about population monitoring in the first two years of the project. Under a suite of simulated scenarios (e.g., different population sizes, population trends, anthropogenic or environmental threats, management actions, and levels of sampling error), we will use various impact assessment approaches to estimate removal thresholds. As a starting point, we will consider using approaches outlined in Heppell (2005), Reproductive Value Loss Limit (RVLL per Curtis

and Moore 2013), as well as at least one approach from the existing NOAA Fisheries Toolbox. We will evaluate how well the assessment approaches perform by examining recovery in the simulated populations given the estimated thresholds. Depending on the scope of our partnerships, this step may involve expanding our focus to other turtle species and possibly other taxa, such as marine mammals.

Our vision is to be part of a national team that collaborates to build alternative models and assessment tools. Preferred assessment tools would be robust across models.

Major Products:

- Peer-reviewed publication evaluating population monitoring schemes through simulation of perturbations to sampling variability and life-stage-specific survival rates
- Peer-reviewed publication comparing the pros and cons of different assessment approaches under different population scenarios. The assessment tools presented will provide a robust basis for diagnosing trends and evaluating the impact of anthropogenic activity.
- Integration of assessment tools into NMFS-wide protected species toolbox repository

Science Centers/PI's and collaborators:

NEFSC: Heather Haas (PI), Melissa Warden
SEFSC (Paul Richards), Louisiana State University (Kenneth Rose)

Timeline/duration and major milestones:

- Draft ms for peer-reviewed publication on population monitoring metrics: FY16
- Develop candidate tools for impact assessment: FY16
- Draft ms for peer-reviewed publication on impact assessment tools: FY17
- Finalize ms on impact assessment tools and expand scope: FY18

Literature Cited:

Curtis, KA, and JE Moore. 2013. Calculating reference points for anthropogenic mortality of marine turtles. *Aquatic Conservation: Marine and Freshwater Ecosystems*. 23:441-459.

Heppell SS. 2005. Development of alternative quantitative tools to assist in jeopardy evaluation for sea turtles. Final report to SEFSC.

NMFS. 2004. A requirements plan for improving the Understanding of the Status of U.S. Protected Marine Species. Report of the NOAA Fisheries National Task Force for Improving Marine Mammal and Turtle Stock Assessments. U.S. Dep. Commerce, NOAA Tech. Mem. NMFS-F/SPO-63, 112 p.

NRC (National Research Council). 2010. *Assessment of Sea-Turtle Status and Trends: Integrating Demography and Abundance*. The National Academies Press. Washington, D.C., 162 p.

Wade PR. 1998. Calculating limits to the allowable human-caused mortality of cetaceans and pinnipeds. *Marine Mammal Science*. 14:1-37.

Warden ML, Haas HL, Rose KA, Richards PM. 2015. A spatially explicit population model of simulated fisheries impact on loggerhead sea turtles (*Caretta caretta*) in the Northwest Atlantic Ocean. *Ecological Modelling*. 299:23-39.