



LIVING MARINE RESOURCES PROJECT 31

DenMod: Working Group for the Advancement of Marine Species Density Surface Modeling

NEED

The Navy is responsible for compliance with a suite of Federal environmental laws and regulations that apply to marine mammals and other marine protected species, including the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA). As part of the regulatory compliance process associated with these acts, the Navy is responsible for implementing a marine species monitoring program to assess potential impacts from Fleet and Systems Command military readiness activities involving active sonar and the use of explosives and explosive munitions.

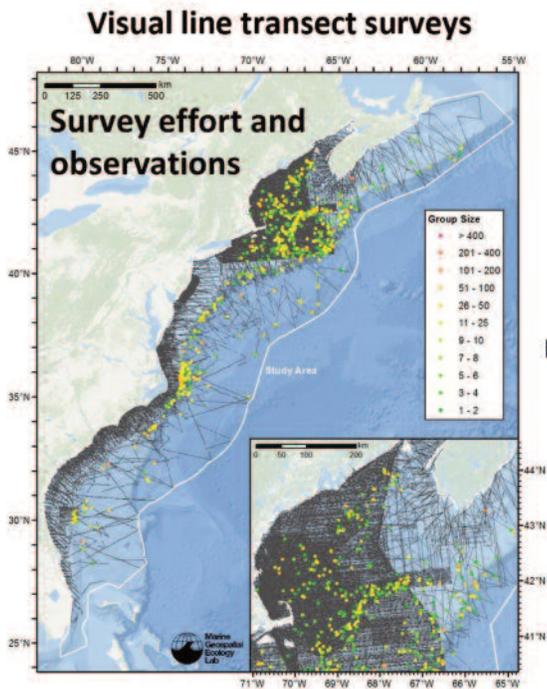
Among other information needed to support compliance efforts, the Navy needs both reliable estimates of density for many marine species in areas where training and testing occurs and information about how these densities vary in space and time. This type of information is especially needed for the Navy's quantitative impact assessment for training and testing activities involving active sonar and explosives.

Statistical modeling methods employing data from biological population surveys can be used to estimate species density. One such model type is called a density surface model (sometimes called spatial or habitat-density model). It describes animal population

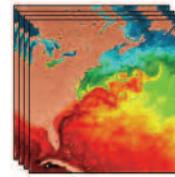


North Atlantic right whale.
Georgia Department of Natural Resources, permit 15488

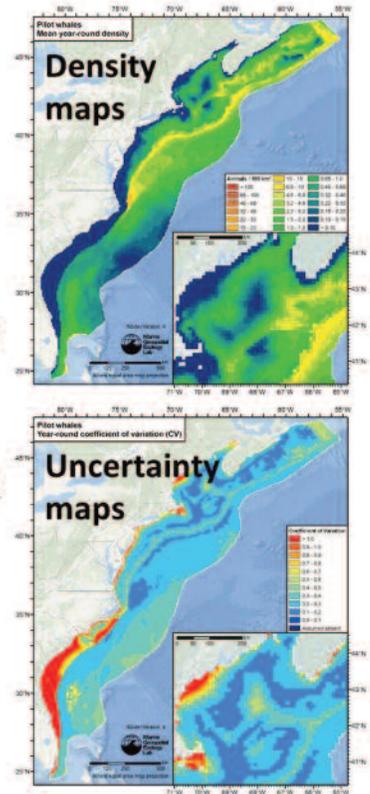
density as a function of spatially- and, in some cases, temporally-referenced physiographic, physical oceanographic and biological variables. Appropriate variables vary between species and locations, but examples are bathymetry, distance to ocean fronts, sea surface temperature and chlorophyll. Many approaches have been proposed and applied to density surface models used by the U.S. Navy and others, which could affect the reliability of model estimates. This is partly due to the variety of datasets available for each geographical area of interest to the Navy. Improvements to density estimates, including an increased understanding of the uncertainty inherent in combining multiple datasets, are needed to refine the Navy's quantitative impact assessments.



Covariates



Statistical models



In density surface modeling, marine mammal survey data (typically from visual line transect surveys) is combined with spatially-referenced explanatory variables ("covariates") such as bathymetry, bottom slope and sea surface temperature using sophisticated statistical models that account for variation in sighting conditions as well as animal density. The models can be used to produce density maps, as well as maps showing uncertainty in the estimates.

Jason Roberts, Duke University

SOLUTION

This project is focused on coordinating a working group of scientists who work in density surface modeling to address the varied approaches and coordinate advances on using the models. These experts are working to develop and implement innovative approaches to improve spatial modeling methods to characterize seasonal abundance and distribution of marine species, particularly in areas of U.S. Navy activities.

Goals for the group include producing software tools that implement new approaches and providing statistical support to those tasked with undertaking density surface modeling for Navy's quantitative impact assessments. The team will develop concrete guidance on best practices in this type of modeling.

METHODOLOGY

The project is a collaboration among organizations that lead in the development and application of the survey and analysis methods used—the University of St Andrews, Duke University and the four regional NOAA Fisheries labs—and includes the parties largely responsible for collection and analysis of transect data used in Navy impact assessments. To broaden the range of participants in the process, this group is conducting three public workshops, planned for just before or after three successive Society for Marine Mammalogy (SMM) conferences.

The project will address different sources of data and available analytical methods for estimating species population and distributions. In addition to transect survey data (a more traditional approach to collecting data on number of animals in an area), two other data sources for discussion will include acoustic monitoring and unmanned aerial vehicles.

The working group format builds upon previously successful models, such as National Center for Ecological Analysis and Synthesis and those of Navy-funded working groups coordinated and/or chaired by the University of St Andrews team. During annual meetings, the DenMod working group will share information, establish and update priorities, discuss potential solutions and receive feedback on solutions being implemented. Initial meetings will focus on solving issues most relevant to the Navy's quantitative impact assessments.

SCHEDULE

The first public workshop was held prior to the SMM's 22nd Biennial Conference in October 2017. Subsequent public workshops will be held as part of the SMM conference workshop series in 2019 and 2021. Team/workgroup meetings to discuss workshop recommendations and team progress will be held annually until the project concludes in 2021.

NAVY BENEFITS

The project will lead to a substantial improvement in the reliability of the Navy's impact assessments and the Navy's ability to undertake population monitoring in training and testing areas. The Navy will benefit from having a collaborative approach in advancing density surface modeling methods that are applied in developing population estimates for the Navy impact assessments.

In addition to making best use of current data, part of the project is focused on how to include alternative data collection approaches that are likely to be more available in the future (e.g., passive acoustic data and unmanned aerial vehicle monitoring).

TRANSITION

Project outcomes will include user-friendly, no-cost software tools that incorporate recommended techniques; statistical support to the Navy's density surface modeling for the next phase of impact assessments; accessible guidance for practitioners in the form of public reports or scientific publications; and recommendations of priority areas for future research.

ABOUT THE PRINCIPAL INVESTIGATOR

Len Thomas, the current director of the University of St Andrews Centre for Research into Ecological and Environmental Modeling (CREEM), specializes in developing statistical methods to apply to ecological problems. Dr. Thomas has a Ph.D. in Forestry from the University of British Columbia.



Key collaborators include David Miller and Catriona Harris from the University of St Andrews and Pat Halpin, Jason Roberts and Rob Schick from Duke University.

About the LMR Program

The Living Marine Resources (LMR) program seeks to develop, demonstrate, and assess data and technology solutions to protect living marine resources by minimizing the environmental risks of Navy at-sea training and testing activities while preserving core Navy readiness capabilities. For more information, contact the LMR program manager at exwc_lmr_program@navy.mil or visit <http://greenfleet.dodlive.mil/lmr>.

