SERDP
Strategic Environmental Research and Development Program

Predictive Modeling of Marine Mammal Density from Existing Survey Data and Model Validation Using Upcoming Surveys

Conservation
CS-1391

Background:

The U.S. Navy needs to estimate the density of marine mammals within its operational areas in order to conduct Environmental Assessments (EA) and to comply with environmental regulations. Using traditional methods of analysis (e.g., line-transect modeling), quantitative estimates of marine mammal density are available for only very broad regions of the world's oceans. Recently, new methods of analysis have been developed that allow finer-scale estimates of density from the same type of survey data. This new approach, called geospatial habitat modeling, uses information about the relationship between marine mammals and their habitat to estimate density on a geographic map.

Objective:

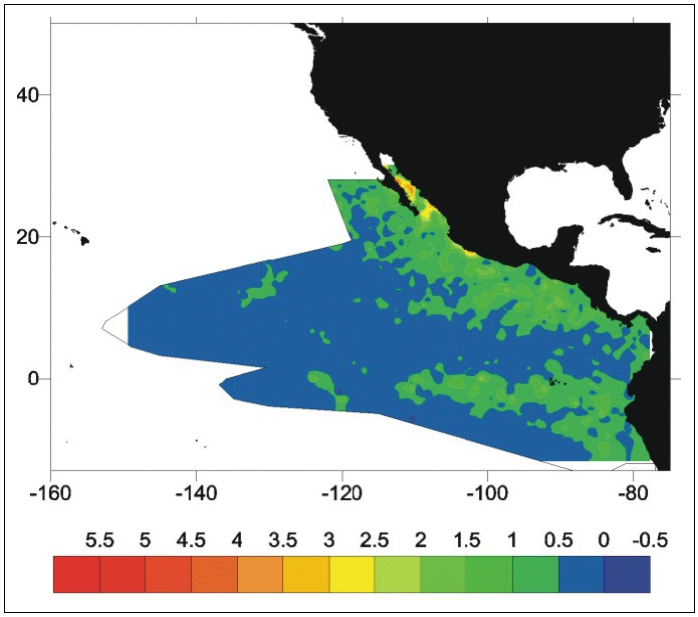
The objective of this project is to improve the ability to estimate cetacean (i.e., dolphin and whale) abundance in small geographic areas in order to better guide the location of Navy activities.

Process/Technology Description:

Survey and environmental data from 1986 to 2002 will be used to build spatially explicit models that predict cetacean density in the eastern North Pacific based on geographically fixed factors and environmental variables. Fundamentally, habitat modeling allows cetacean density to be interpolated between transect lines and between the relatively rare sightings of each species. Generalized Additive Models (GAM) will be used to define habitat relationships for cetaceans seen on past surveys in the eastern Pacific. The spatially explicit models will be validated using new survey and environmental data to be collected along the west coast of the U.S. and in the eastern tropical Pacific. The predictive power of these models will be evaluated across seasons using aerial survey data collected in the California Current region. It is anticipated that this research will develop and validate density models for approximately 20 species of toothed whales and 4 species of baleen whales. Further environmental variables will be added that trophically are closer to cetaceans by analysis of existing net-tow samples and acoustic backscatter data. Finally, a software interface will be written for the spatially explicit models and made accessible to the Navy.

Expected Benefits:

The software tool can be used to estimate the seasonal cetacean density for the majority of species within any region of the study area if given the measured or predicted field of environmental variables for that region. This product will allow the Navy to make more accurate and defensible estimates of cetacean abundance within Navy ranges and operational areas. These estimates will improve the quality of EAs to enable more accurate appraisal of the potential impact of military activities on dolphins and whales. (Anticipated Project Completion - 2008)



Predicted densities of dolphins (number per square kilometer) from preliminary models.

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