NOPP FY2012 Report: CHARACTERIZATION & POTENTIAL IMPACTS OF NOISE PRODUCING CONSTRUCTION & OPERATION ACTIVITIES ON THE OUTER CONTINENTAL SHELF (OCS)

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LONG-TERM GOALS

The primary objective of this proposal is to design, implement and exercise an analytical approach that combines acoustic modelling approaches with historical and newly collected empirical field data to measure, characterize and evaluate the influences of construction and operation noises from offshore wind construction activities on seasonally resident and migratory, acoustically active marine vertebrates. We will use an approach that quantifies and evaluates the influences of windfarm-generated sounds on the habitat surrounding the planning site. The resulting acoustic field is calculated relative to the dependency of a species on a particular acoustic-ecological habitat and the changes in that habitat as a result of the windfarm activity. For example, effective acoustic communications between North Atlantic right whales (NARW) are dependent on an acoustic habitat in which they can communicate over long-distance (e.g., 20 km) using a 165 dB (re 1µPa), 1-2 second call in the 71-224 Hz frequency band. The potential influence of a noise-generating, communication masking offshore wind energy development on a particular species' acoustic habitat is referred to as an acoustic ecological footprint, and is defined by the intersection of the species acoustic communication requirements and the spatial-temporal-spectral (i.e., space-time-acoustic) characteristics of the OAE activity. Therefore, our conceptual approach for evaluating potential impact does not rely solely on the older paradigm of trying to count the number of individuals exposed to a particular sound level (e.g., 120 dB re 1 µPa), but rather evaluates impact for low-frequency species (<1000 Hz) by quantifying the loss of acoustic habitat as a function of the behavioral-ecological context (e.g., feeding, mating, long-range communication) where the impact metric is calculated relative to a standardized ambient noise conditions.

OBJECTIVES

For this project, we will use acoustic data samples from previous recordings that BRP along the Atlantic coast and use existing analysis tools to implement and exercise an analytical-evaluative system to demonstrate the protocols, processes and metrics by which to characterize the potential impacts from offshore wind construction and operation. This approach allows us to immediately develop an integrated system and apply it to analysis and evaluation of new site-specific data from this

or other future projects. We will collect new field recordings collected at two specific wind planning areas (off of NC and GA) and apply the analytical-evaluative system for the analysis. We will deploy MARUs at locations near each of the proposed construction sites, and conduct noise monitoring. The original intention of the project was to collect recordings before, during, and after windfarm construction to assess changes in animal calling patterns related to turbine construction and operation. However, after extensive consultation with our BOEM program officer, because no windfarm construction is immediately planned in either of these areas, the scope of the project has been officially changed to focus on baseline data collection and analysis as part of the site assessment. The data generated during this project can be used if and when construction begins at either of these locations.

APPROACH AND WORK PLAN

1) *Proposed Scientific & Technical Approach:* For the first year of the project, the goal was to analyze historical datasets near the project locations for the acoustic presence and seasonal patterns of the focal species of interest.

2) *Key Individuals:*

Name	Organization	Project Role
Christopher Clark	Cornell	PI
Aaron Rice	Cornell	Co-PI
Michael Feinblatt	ESS, Inc.	Habitat Assessment
Jeff Nield	ESS, Inc.	Habitat Assessment
Adam Frankel	Marine Acoustics, Inc.	Sound Propagation Modelling

3) *Work Plans for the Upcoming Year:* In FY2013, we will analyze the newly collected data at the NC and GA wind planning sites, and determine seasonality of the focal species.

WORK COMPLETED

Historical data have been analyzed at several locations around the wind planning areas (approximately half of the intended historical data), and the seasonal activity of the focal species at these locations has been determined. Starting in May 2012, six recorders (three at each project site) were deployed to collect a year of acoustic data specific to each site.

Additionally the project partners at ESS, Inc. have conducted a habitat assessment of the wind planning areas based on available data from the scientific literature. These results will be incorporated into the acoustic analysis to provide further detail and context of the ecology of animals occurring at these locations.

RESULTS

From examination of previously collected historical data, we have identified recurring seasonal patterns in calling activity of three of the target species for the project: North Atlantic right whales, black drum and oyster toadfish. The calling patterns of these two fish species dominate the acoustic environment in the low frequency bandwidth. Additionally, we have found a correlation between changes in seasonal calling activity of the two fish species associated with sea surface temperature,

which will be important in the longer term goal of understanding external influences driving animal acoustic activity.

IMPACT AND APPLICATIONS

Economic Development

The methodologies developed and applied under this project can provide a highly efficient mechanism of environmental impact assessment for offshore wind planning areas. Surveys conducted using other methods prove to be more expensive (both in time and labor costs), and result in fewer data. The use of acoustic monitoring here can both assess baseline conditions of key animal groups, acoustic habitat conditions, and possible changes from baseline during and after construction of construction activities.

Quality of Life

This approach has a substantial impact on coastal resource management in that it provides the ability to understand long-term and wide-spatial scale patterns of population-level occurrence and behavior of focal species (including protected species), and possible changes in the ecology of these organisms related to offshore energy development.

Science Education and Communication

Data from this project will help increase further scientific and public awareness of both the importance of sound in the marine environment, and how acoustic technologies can be used to census animals.

RELATED PROJECTS

The Bioacoustics Research Program is engaged in a similar project relating to site assessment for offshore wind planning areas in Massachusetts and Rhode Island (funded by the Massachusetts Clean Energy Commission and BOEM).

REFERENCES

Clark, C. W., W. T. Ellison, B. L. Southall, L. Hatch, S. M. Van Parijs, A. Frankel, and D. Ponirakis. 2009. Acoustic masking in marine ecosystems: intuitions, analysis, and implication. Marine Ecology Progress Series 395:201-222.

Madsen, P. T., M. Wahlberg, J. Tougaard, K. Lucke, and P. Tyack. 2006. Wind turbine underwater noise and marine mammals: implications of current knowledge and data needs. Marine Ecology Progress Series 309:279-295.

Møller, H., and C. S. Pedersen. 2011. Low-frequency noise from large wind turbines. Journal of the Acoustical Society of America 129:3727-3744.

Petersen, J. K., and T. Malm. 2006. Offshore windmill farms: threats to or possibilities for the marine environment. Ambio 35:75-80.

Thompson, P. M., D. Lusseau, T. Barton, D. Simmons, J. Rusin, and H. Bailey. 2010. Assessing the responses of coastal cetaceans to the construction of offshore wind turbines. Marine Pollution Bulletin 60:1200-1208.

Tougaard, J., J. Carstensen, J. Teilmann, H. Skov, and P. Rasmussen. 2009. Pile driving zone of responsiveness extends beyond 20 km for harbor porpoises (*Phocoena phocoena* (L.)). Journal of the Acoustical Society of America 126:11-14.

Tougaard, J., O. D. Henriksen, and L. A. Miller. 2009. Underwater noise from three types of offshore wind turbines: estimation of impact zones for harbor porpoises and harbor seals. Journal of the Acoustical Society of America 125:3766-3773.

Tougaard, J., P. T. Madsen, and M. Wahlberg. 2008. Underwater noise from construction and operation of offshore wind farms. Bioacoustics 17:143-146.
Wahlberg, M., and H. Westerberg. 2005. Hearing in fish and their reactions to sounds from offshore wind farms. Marine Ecology Progress Series 288:295-309.