



LIVING MARINE RESOURCES PROJECT 25

A Blainville's Beaked Whale Behavioral Risk Function for Hawaiian Populations

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 permitting process arising from these acts, Navy planners use behavioral risk functions to estimate how marine mammals, and particularly beaked whales, respond to real world sonar exposure situations.

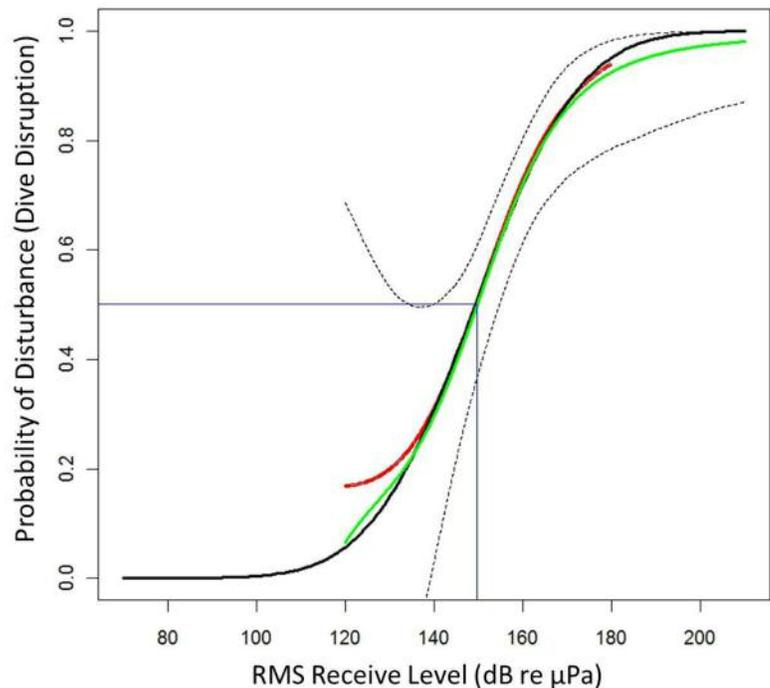
For its Phase III Environmental Impact Statement (EIS) analyses, the Navy used behavioral risk functions developed for Blainville's beaked whales at the Atlantic Undersea Test and Evaluation Center (AUTEK). This species also has been found on the Pacific Missile Range Facility (PMRF) undersea acoustic range. The Navy needs to determine the appropriate behavioral risk function for the Hawaiian populations of this species.

SOLUTION

The primary goal of this program is to publish a risk function for Blainville's beaked whale (*Mesoplodon densirostris*) at PMRF that can be used to inform future Navy and National Marine Fisheries Service (NMFS) compliance decisions and to help determine if there is a significant difference in the Blainville's beaked whale risk function for distinct populations in different ocean basins.

This will provide a direct comparison of risk functions derived for the same species, exposed to the

same source types, in disparate ocean basins and an extensible methodology that can be applied in other locations.



The AUTEK Blainville's beaked whale behavioral risk function that provides the probability of disturbance (Drms) as a function of sonar RLrms. The GAM fit to the recorded data is shown in red with the bootstrap mean shown by the green with the point-wise 95% confidence limits indicated by dotted lines from the bootstrap. The parametric GLM approximation is shown in black. There is a 0.5 probability of disturbance at a RLrms of 149.8 dB; this is indicated in blue.

METHODOLOGY

This project will adapt the methods used at AUTEK to animals detected on the PMRF range. The movement of beaked whales in response to sonar is being documented using a combination of passive acoustic monitoring, recording tags and visual observation.

Blainville's beaked whale groups were acoustically detected on the AUTECH range before and during a Submarine Command Course, which included an intensive three to four day multi-ship mid-frequency active sonar (MFAS) operation. The dive start time and hydrophone central to each group both before and during the operation were extracted. Precise ship-track data for each MFAS platform were provided by AUTECH. Passive acoustic detection data were recorded during the operation. From these data the emission times of sonar pings from each MFAS platform were determined. These data were used as input to a propagation model derived from the Navy Acoustic Effects Model (NAEMO) to estimate the received level on each range hydrophone. Statistical models used the data to generate a behavioral risk function.

PMRF provides a similar set of hydrophones, providing the opportunity to adapt the methods developed for the Blainville's beaked whale at AUTECH to the same species in a separate ocean basin. Several differences between the two locations—including lower species abundance and distribution, ship and range use scenarios, and hydrophone spacing—will require additional long term data and some variation in the statistical approach.

The team will begin by applying available PMRF data, using the method developed for AUTECH, to evaluate how well the data fit the AUTECH model and to identify additional data needs. Following a Submarine Command Course on PMRF, the team will apply the additional data to a refined statistical model to derive a PMRF Blainville's beaked whale risk function.

SCHEDULE

During 2016, the team will begin initial evaluation of the risk function fit and variations using available data. In 2017, additional data will be applied and statistical analyses conducted to evaluate the fit of the PMRF data to the AUTECH model. The final model will be completed in 2018 and submitted for peer-review.



Blainville's beaked whale.

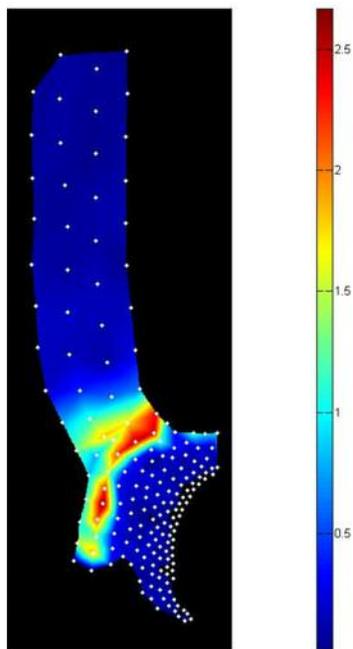
Mark Deakos, permit 14451

NAVY BENEFITS

This project will provide the first behavioral risk function for Blainville's beaked whales in the Pacific. The risk function will be based on real source data over a broad scale and will include a large number (more

than 100) of beaked whale dive starts from multiple groups to provide insight into levels at which these animals react in the Hawaii environment.

Having this dataset and risk function for Blainville's beaked whales in the Pacific, at another Navy range, will provide invaluable information on the potential similarity of responses by these whales across populations and in different propagation environments. This analysis will help improve future behavioral risk functions developed by the Navy, and may ultimately be utilized by other regulators (e.g. NMFS), as has been done for other acoustic criteria developed by the Navy.



Distribution of Md Click Counts on the PMRF, July 2012 M3R.

TRANSITION

The peer-reviewed risk function derived from this project will be directly available to NMFS to inform compliance standards and to help the Navy evaluate its environmental compliance. The methodologies developed by this program will be published in a peer-reviewed journal and for extension to additional species and locations.

ABOUT THE PRINCIPAL INVESTIGATORS

David Moretti is the principal investigator for the Naval Undersea Warfare Center's Marine Mammal Monitoring Program. Dave has 30 years of experience in acoustic signal processing and directs a diverse team of engineers and scientists as part of the Navy's effort to develop and apply passive acoustic signal processing tools to the study of the effect of anthropogenic disturbance, including MFAS, on marine mammals and developing related long-term monitoring algorithms and systems.



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, including for analysis of behavioral response specifically for Blainville's beaked whales at AUTECH.



Elizabeth Henderson has extensive experience with collecting and analyzing PMRF hydrophone data for various species of marine mammals, including beaked whales, and is applying marine mammal passive acoustic detection, classification and localization algorithms at PMRF to study the effect of sonar on cetaceans.



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 www.lmr.navy.mil.

