Effectiveness of marine mammal monitoring and mitigation during seismic surveys using modern PSO software (Mysticetus™) across multiple observation platforms

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Summary
The Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA) both prescribe the use of mitigation and monitoring of marine mammals during seismic surveys. Traditionally, Protected Species Observers (PSOs) stationed on seismic source vessels are used to (a) detect marine mammals; (b) initiate mitigation procedures (e.g. shutdown, zone clearing, ramp up, etc.) and (c) record monitoring information to adhere to the scientific advancement provisions of the laws. Our team has recently implemented numerous procedural and technological advances that (1) dramatically increase both detection accuracy and efficiency– and hence protection – of marine mammals, as well as (2) increase the accuracy and timeliness of scientific data and subsequent data assimilation and required report writing. Much of the improvement is due to the deployment of a new PSO software and hardware system named Mysticetus, currently the most state-of-the-art PSO data collection, analysis and reporting program tailored to application during seismic marine mammal mitigation and monitoring programs.

Introduction
Rules related to the mitigation and monitoring of effects of anthropogenic sound on marine mammals continue to rapidly evolve. As the regulatory agency responsible for the MMPA, NMFS (National Marine Fisheries Service) continues to require more types of PSO-related actions, including PAM and PSOs deployed across multiple platforms (aerial, scout vessel, land when appropriate, etc.), depending on the distance to NMFS-regulated seismic exposure isopleths. The Mysticetus™ system is a custom-designed tool developed specifically for PSO operations and reporting, including across multiple synchronized platform types (aircraft, vessel, land). Mysticetus™ automates animal localization, data recording, improves PSO situational awareness, provides real-time displayed (shutdown) decision support, and automatically generates reports for clients and regulatory agencies. During a seismic survey, Mysticetus™ allows PSO managers and survey clients to watch the operation on a map in real time from anywhere on the planet, and coordinates between optional multi-platform operations (e.g. PSOs on different platforms such as helicopter or boat automatically and instantly share animal sighting data). Post-survey, Mysticetus™ automatically uploads data to cloud storage for backup and subsequent analysis. Mysticetus™ features have been developed in close association with in-field scientists, clients and managers to meet the currently combined needs for improved and effective PSO mitigation and monitoring field programs and reporting requirements.

Method
We will describe how we deployed this new technology across multiple seismic surveys in 2013 and 2014, and its prior and ongoing use as a baseline monitoring tool in for various agency requirements (e.g., BOEM, U.S. Navy, NMFS, etc.). Our presentation will describe in detail the dramatic advances this technology provides in accuracy, timeliness and reporting.

Examples
We will illustrate and focus on examples from 2013 and 2014 PSO marine mammal mitigation and monitoring survey seasons. For example, Mysticetus was deployed during a long-term seismic survey in Cook Inlet, AK in the spring, summer and fall of 2014. Mysticetus coordinated animal localizations from two vessels (source and scout), one to two land stations and an aircraft. We will show: (a) sample maps of sightings from one station instantly showing up on other PSO PC map displays - e.g. land sightings showing up on the PSO map on the source vessel; (b) how reports (for both clients and regulatory agencies) are automatically generated with the push of a button; (c) how data are automatically backed up to cloud storage and made available to clients (if desired); and (d) examples of computerized marine mammal mitigation decision support.

Conclusion
Advances in computer technology – including the Mysticetus System - are facilitating and driving rapid increases in accuracy and effectiveness of Protected Species Observer (PSO) programs in the field and during post-process reporting and analysis phases. Marine life is better protected and studied, clients are more adequately assured of legal compliance, and regulatory agencies are better and more rapidly receiving required reports.