

Biological and Behavioral Response Studies of Marine Mammals in southern California ('SOCAL-10')

~ Project Summary ~

~ Marine mammals around the world, including along the U.S. west coast, face many challenges due to interactions with people, from overfishing and entanglement to vessel strikes and disturbance from human sounds. Most of these issues remain poorly known and carefully conducted science is needed to manage and protect marine animals ~

~ SOCAL-10 is a research project integrated with ongoing studies of basic diving, foraging, social behavior, and sound production of marine mammals in important biological areas near southern California. It extends previous studies of whether and how animals change their behavior when they hear different sounds ~

~ SOCAL-10 is an interdisciplinary collaboration of experts in marine mammal biology and behavior with extensive field experience in safely and ethically measuring responses to controlled sound exposures ~

~ This project will take place during August and September 2010 in coastal areas from San Diego to Santa Barbara and the Channel Islands, as well as an offshore area on and around the U.S. Navy's training range near San Clemente Island ~

Additional information about the project is available in the more detailed description that follows. You can also find out more (and follow our progress this summer) at:

<http://www.sea-inc.net/SOCAL10>



[photo credits: L. Mazucca; A. Friedlaender (obtained under U.S. NMFS permit #1121-1900)]

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~ Project Description ~

Introduction

SOCAL-10 is the first phase of a multi-year effort (~2010-2015), called SOCAL-BRS (Behavioral Response Study). This research collaboration is designed to increase understanding of marine mammal behavior and reactions to sound. Direct, scientific information about these responses to different human sounds is very limited, but critically needed by both regulatory agencies to support informed conservation management decisions and requirements and militaries for effective operational planning to minimize environmental risk.

This project extends previous BRS efforts conducted in the Bahamas and Mediterranean Sea in 2007-2009¹ and is being coordinated with related and successful field efforts (*e.g.*, population surveys of Navy range areas, satellite tagging before active sonar operations) underway in southern California. SOCAL-10 will use controlled exposure experiments (CEE) to carefully measure behavioral responses of individual animals to sound exposure. It is part of an integrated, international effort using similar experimental approaches and observational tracking of animals during real activities. Each method has pros and cons, but a comprehensive approach is proving useful in addressing difficult questions.

SOCAL-10 includes collaborations among scientists, acousticians, and engineers from NOAA, academic and private research laboratories, and U.S. Navy-supported organizations (see below).



¹ see additional material at: <http://www.sea-inc.net/science/#brs>

This collaboration is designed to advance our understanding of southern California marine mammals and gain information about their responses to sound. The results are critically important to entities who produce sounds for a particular purpose (e.g., military sonar to find submerged objects) that may have unintended negative consequences on marine species, as well as for regulatory agencies responsible for managing protected species. SOCAL-10 is being supported by several organizations within the U.S. government (below) facing these issues and seeking better data to inform decision-making.



Background



Photo courtesy of NOAA National Marine Mammal Laboratory

Marine mammals use sounds for many important things, such as finding food, raising their young, finding mates, avoiding predators, and finding their way around the large, generally dark ocean. They are primarily acoustic animals whereas we are primarily visual. Consequently, sounds in their environment may interfere with communication or significantly alter their behavior.

Global concern about noise impacts relates mainly to interference (or “masking”) of important sounds from industrial sounds such as large ships. However, some intense sounds may harm marine mammals; extreme examples are marine mammal



Photo courtesy of NOAA, National Marine Fisheries



Photo courtesy of NOAA, National Marine Fisheries

strandings following a few naval sonar training exercises. These events, which seem to be rare given the frequency of operations, share some similarities in geography, environmental conditions, and the species involved (beaked whales most commonly). However, we lack basic understanding of what causes these events, how frequent they may be, and most importantly what can be done to reduce the risk of subsequent events. Better data are sorely needed.

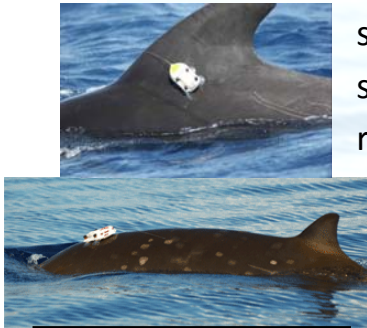
Related Behavioral Response Studies

During 2007 and 2008, marine mammal behavioral response studies (called “BRS 07-08”) took place in the Bahamas with similar focus and collaboration as SOCAL-10; a related effort (“MED-09”) followed in the western Mediterranean Sea. Using techniques and tools from related international projects, an interdisciplinary team of scientists used specialized listening sensors on a Navy training range and movement/acoustic tags to measure individual behavior and responses to sound in controlled exposure experiments (CEEs).



The UNOLS research vessel *Roger Revelle* was used in BRS-08

Prior to BRS 07-08 there were no direct studies of how seemingly sensitive species such as beaked whales react to sounds like military sonar. Researchers wanted to measure baseline behavior and reactions to these kinds of signals in order to better predict impacts and reduce the risk of future strandings. However, researchers did not want to harm animals while studying them and precautionary safety procedures, shut-down criteria, and monitoring methods were successfully used.



[photo credits: A. Friedlaender, obtained under U.S. NMFS permit # 1121-1900]

In addition to a large amount of visual and acoustic detection data, a total of 16 acoustic tags were attached to individuals of four cetacean species. Significant advances in understanding basic diving and vocal behavior were made and nine CEEs were conducted using simulated military, mid-frequency sonar sounds, killer whale calls, and “control” noise. While the CEE sample sizes are relatively small owing to the challenges of these kinds of field experiments, the resulting data are extremely detailed in terms of individual movement and acoustic behavior of tagged animals before, during, and after sound exposure. Beaked whales appeared to respond categorically differently and at much lower sound exposure levels than other cetaceans². These data are significant in being the first direct measurements of cetacean responses to simulated mid-frequency sonar signals. Despite concerns about possible negative impacts, important

² for more details see: www.sea-inc.net/science/#brs

results were successfully obtained without harming subject animals or others in the area.

Additional studies are needed to identify whether these initial observations are generally applicable in other circumstances, and to extend studies to previously untested species such as the large baleen whales and seals/sea lions. The desire to expand studies to additional species that may be affected by human sounds, including military sonar, was a primary motivation for concentrating a dedicated BRS effort in southern California, beginning with SOCAL-10.

SOCAL-10 Objectives

- (1) Tag a variety of species and obtain baseline behavioral data;
- (2) Conduct CEEs using similar exposure methodology from previous BRS;
- (3) Determine optimal BRS configuration for scaled playback configurations and in realistic/actual military sources in subsequent (2012-15) years;
- (4) Obtain basic biological, behavioral, and foraging ecology data for marine mammals to support range monitoring efforts and/or habitat models.

Timing and Operational Areas

SOCAL-10 will take place from late August through September in three primary operational areas shown here: inshore north; inshore south; and offshore areas. The exact timing and location of SOCAL-10 within these operational areas will be determined largely by finding the right combinations of good weather and animals.



SOCAL-10 Multidisciplinary Teams

SOCAL-10 will include highly experienced scientists and engineers, as well as state-of-the-art tools and technologies to tag and track marine mammals and

carefully and safely conduct controlled exposure experiments. These assets are organized into specialized teams, each serving specific, inter-related functions.

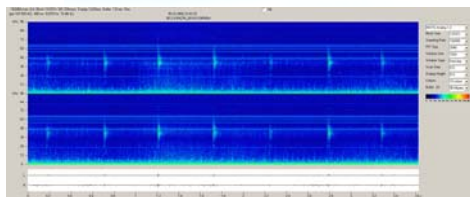


Visual observers are experienced in sighting marine mammals up to several miles away with powerful binoculars. They will search for subjects and, once they are tagged, monitor animals during CEEs.

Photo identification will be used to catalog and keep track of individuals and groups sighted and involved in CEEs.



Passive acoustic observers will use different listening systems, in certain

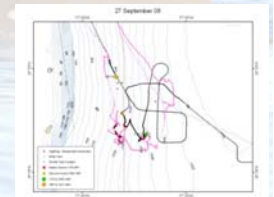


conditions, from the U.S. Navy SCORE range as well as those deployed from SOCAL-10 vessels to detect vocalizing whales and monitor sound exposures and animal responses during CEEs.

Tagging teams will carefully approach and deploy acoustic monitoring tags with non-invasive suction cups; tag teams will also provide visual monitoring of focal groups that have been tagged during baseline dives and CEEs and will report all behavioral observations.



Geographical Information Systems (GIS) engineers will integrate information, including vessel position, visual sightings, and environmental data, for real-time presentation on maps and synchronized archive of all SOCAL-10 activities and measurements.



Sound source technicians will operate the specialized underwater speaker that will be used to play experimental sounds during CEEs.

Safety and Stranding Protocols

SOCAL-10 will make every effort to ensure the safe operation of all research vessels and the safety of all personnel. SOCAL-10 will comply with all state and federal international laws and coordinate with state and federal agencies (*e.g.*, California Coastal Commission). The project also includes specific precautionary

measures to ensure the safety and welfare of marine mammal subjects³. These include criteria for avoiding certain marine mammals (*e.g.*, neonate calves), safety measures for close approaches and tagging, and specific conditions for sound transmissions during CEEs (*e.g.*, terminating sound transmissions if animals are within 200 m or when any abnormal behaviors are detected).

There is little reason to believe that SOCAL-10 will result in harm to marine mammals, based on safe and successful efforts in BRS 07-08, but it is only responsible to have stranding response protocols. Strandings are common in California and could occur in the same area, even if there is no correlation with SOCAL-10. In coordination with stranding networks, response contingencies are in place to ensure rapid reporting of any stranded marine mammal, facilitate response and investigation, and assess any possible relationship to SOCAL-10.

SOCAL-10 Scientific and Public Impact

SOCAL-10 is committed to openness and transparency of the project and to the timely and effective transmission of results. Open discussions, both in public meetings and through exchange of questions and responses, with conservation interests and other scientists has been a healthy and constructive aspect of the planning of SOCAL-10 and is a process that will continue throughout this project.

Scientific data generated by SOCAL-10 will contribute to a greater understanding of biologically important areas off southern California, as well as how marine mammals dive, communicate, and respond behaviorally to different sounds. These data will be made available to educational, government, and conservation organizations to increase public awareness and appreciation of these valuable areas and species. The results will also be integrated with ongoing, international efforts to better understand behavioral responses of marine mammals to sound. SOCAL-10 data will also be made available through scientific presentations and publications in a timely manner, and through various other public outlets to maximize their utility and impact.

³ Each of these safety protocols has been detailed in a U.S. NMFS scientific research permit application (#14534)

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~ Frequently Asked Questions ~

What are the ultimate objectives of SOCAL-10?

Answer: SOCAL-10 seeks to provide direct measurements of baseline diving and sound production and to identify behavioral responses in marine mammals to different sounds. These data are critically needed in management decisions regarding, among other things, the planning of sonar training exercises in ways that reduce potential negative impacts on marine mammals.

How can you justify exposing animals, including beaked whales, to sounds that may be or are known to cause particularly aversive responses?

Answer: From previous work (BRS 07-08) we believe we have identified a precautionary method for obtaining important data in ways that are not harmful to focal animals, including the particularly-sensitive beaked whales. SOCAL-10 seeks only to identify the onset of significant behavioral responses rather than more severe reactions that may occur if exposures were sustained or modified.

How can SOCAL-10 identify an appropriate response in real-time to cease CEEs?

Answer: We will use either visual monitoring of animals that are likely to be seen at the surface (*e.g.*, large whales, social groups of dolphins) or passive acoustic monitoring of animals that are unlikely to be seen at the surface but that can be monitored reliably in specific conditions under water (*e.g.*, beaked whales). SOCAL-10 will use precautionary protocols to stop sound exposure if any animals are detected within 200m, if any abnormal behavior is detected visually, or if echolocation clicks are terminated in focal beaked whales. There will be no CEEs for beaked whales outside of the specialized U.S. Navy SCORE range.

Will SOCAL-10 provide definitive answers regarding military sonar and marine mammals?

Answer: Amazingly little is known directly about this issue and SOCAL-10 will contribute to the initial findings made in BRS 07-08. It will be part of a multi-disciplinary, inter-related paradigm of opportunistic and experimental studies to measure how these animals respond and the exposures required to elicit these responses. The ultimate goal is to reduce uncertainty about how and why animals respond to certain sounds and how to minimize negative,

unintended effects. Additional studies will be needed, eventually including realistic sound sources, but these must be informed by lower-level exposures such as in SOCAL-10.

Why can't the data on marine mammal responses to sonar simply be obtained by tagging marine mammals around on-going military training operations?

Answer: The opportunistic kinds of measurements are ongoing in several areas, including at AUTECH in the Bahamas and at SCORE in southern California. They provide useful information, largely because they involve real sources rather than scaled-down exposures through speakers. They are limited, however, in lacking control over the type and kind of exposure on a focal animal. It is very difficult to use more sophisticated acoustic tags to measure acoustic dose and behavioral responses in these settings. Eventually, these approaches may converge on one another with controlled exposures using realistic sources.

Will SOCAL-10 results be limited in some way because of small sample size?

Answer: Yes, primarily because this kind of work is quite difficult to conduct. Beaked whales are arguably the most difficult large mammals on the planet to study, and a limited number of subjects is to be expected in these kinds of studies. However, we expect to have greater success in some of the other species in SOCAL-10 such as large whales, based on tagging probabilities in other efforts with these species by members of our team. Additionally, while caution must be taken in interpreting results from small numbers of samples, the BRS data have shown that even limited new information can radically improve our understanding given the utter void of knowledge that previously existed.

How will the results from past BRS efforts and SOCAL-10 influence conservation/policy decision making?

Answer: Data from previous BRS efforts has been presented in various scientific meetings and publications. Additionally, these data have been conveyed and discussed directly to regulatory agencies in the U.S. and other countries and to various conservation interests. While our team cannot prescribe whether and how the data are directly integrated into management decisions, SOCAL-10 will similarly ensure that the results of our work are transparent and publically available in a timely and appropriate manner and that they are provided directly to relevant sound-producing entities and regulatory agencies.