

Improving Large Cetacean Implantable Satellite Tag Designs to Maximize Tag Robustness and Minimize Health Effects to Individual Animals

Alexandre N. Zerbini
Cascadia Research Collective
218 ½ 4th Ave W
Olympia, WA 98501, USA

or

National Marine Mammal Laboratory / Alaska Fisheries Science Center
7600 Sand Point Way NE
Seattle, WA 98115-6349, USA

phone: (206) 526-4511 fax: (206) 526-6615 email: alex.zerbini@noaa.gov

Michael J. Moore
Biology Department
Woods Hole Oceanographic Institution
Woods Hole, MA 02543, USA
phone: (508) 289-3228 email: mjmoore@whoi.edu

Award Number: N00014-13-1-0653
<http://www.cascadiaresearch.org/>
<http://www.whoi.edu/page.do?pid=22715>

LONG-TERM GOALS

Develop robust satellite tags that can compensate for shearing forces at the blubber-muscle interface and minimize physical and physiological effects of body penetrating tags to individual animals.

OBJECTIVES

- (1) Design, build, and test robust blubber and/or muscle penetrating tags, which will (a) resolve structural limitations of existing designs (e.g. those found during the Gulf of Maine humpback follow-up study) and (b) minimize tissue trauma while extending retention time;
- (2) Evaluate structural integrity of designs created in Objective (1) during laboratory experiments and in cetacean carcasses;
- (3) Examine structural tissue damage in the blubber, sub-dermal sheath and muscle caused by penetrating dummy implantable tags in cetacean carcasses, including manipulation to simulate live motion;
- (4) Assess performance of the new tags in populations of large cetaceans where extensive follow-up studies can be performed (e.g. Gulf of Maine humpback whales and eastern Pacific gray whales).

APPROACH

This study is carried out by scientists and engineers from eight organizations: Cascadia Research Collective (CRC), Woods Hole Oceanographic Institution (WHOI), the Alaska Sea Life Center (ASLC), the Australian Marine Mammal Centre (AMMC), the National Marine Mammal Laboratory (NMML), the Provincetown Center for Coastal Studies (PCCS), Texas A&M University (TAMUCC) and Wildlife Computers (WC).

The main goal of this project is to develop robust large cetacean satellite tags that will provide equal or greater duration than existing designs but will minimize health impacts to individual whales. We will evaluate the magnitude of tissue trauma caused by shearing when implantable tag devices penetrate the sub-dermal sheath at different parts of a cetacean body. This assessment will be conducted in carcasses and its results will, along with existing information on tag vulnerability, inform the development of new tags. Impact tests on new designs will be performed in the laboratory as well as in fresh carcasses to ensure new tags and retention devices are robust to the forces to which they are subject during and after deployment. Tags will be deployed in free ranging humpback whales in the Gulf of Maine (n=20) and in eastern Pacific gray whales (n=12) in the spring/summer 2014 and 2015, respectively. Tag performance will be assessed during follow-up studies. These populations were chosen because they have been subject to intensive, fine temporal scale follow-up studies, and because implantable satellite tags have been deployed to some of their individuals. Therefore, existing information on tag performance and potential health effects will be compared with results from the deployment of new tags. Final tag designs will be made publicly available to the marine mammal community after the conclusion of the project. We expect that our results will have broad-reaching impact within the scientific community by increasing the applications of satellite tagging while reducing possible impacts to tagged whales.

Technical aspects of the project will be coordinated by Dr. Alexandre Zerbini (CRC/NMML), Dr. Michael Moore (WHOI), John Calambokidis (CRC) and Dr. Michael Double (AMMC). M. Moore, Dr. Andreas Fahlman (TAMUCC), and Terry Hammar (WHOI) will be responsible for experiments to assess shearing forces on cetacean carcasses. T. Hammar, Dr. Russ Andrews, Dr. Virginia Andrews-Goff (AMMC), Dr. Mark Baumgartner (WHOI), M. Double, A. Fahlman, Melinda Holland (WC), and A. Zerbini will direct and collaborate on the designs of new tags. A. Zerbini, R. Andrews, V. Andrews-Goff, M. Baumgartner, J. Calambokidis, M. Double, T. Hammar, Amy Kennedy (NMML), M. Moore and Greg Schorr (CRC) will carry out testing of tags and delivery systems in the laboratory as well as in large cetacean carcasses. Deployment of tags in free ranging animals and follow-up studies in the Gulf of Maine will be coordinated by Dr. Jooke Robbins (PCCS), Dr. Phillip Clapham (NMML), A. Kennedy, and A. Zerbini (Gulf of Maine humpback whales) and in the Eastern Pacific by J. Calambokidis, G. Schorr and A. Zerbini.

WORK COMPLETED

This project has recently started and first results are expected in the upcoming months. Paperwork is currently being prepared to transfer funding for sub-awardees. PIs and co-investigators are planning on meeting in October or November to discuss an experiment to assess tissue trauma and procedures to test robustness of satellite tags in carcasses and, in the case of robustness testing, in the laboratory. During this meeting, initial ideas for the design of an articulated tag anchor will also be discussed.

RESULTS

No results have been produced yet.

IMPACT/APPLICATIONS

Satellite tagging is increasingly being used world-wide to study large cetacean movements, habitat use patterns, vulnerability and responses to anthropogenic activities with direct applications to conservation and management. One of the great advantages of this method is tracking individuals in near real time and sampling their environment for a lower cost than most observational studies. Therefore, attempts to improve technology to maximize tag performance and minimize risks to target animals have the potential to improve data collection and make the use of satellite telemetry more cost-effective. One of the main contributions of this study will be the development of a tag that integrates new and effective anchoring systems to the electronic packages that should allow tagging to be performed with less physical and physiological effects to individual whales. Perhaps as important, these tag designs will be made publicly available to the marine mammal community shortly after the conclusion of the project. Currently, private companies manufacture satellite transmitters but the anchoring systems are usually developed by individual researchers, with whom one must partner in order to deploy tags. We expect that the collaboration among the proponents of the present study, which include researchers, veterinarians, engineers and the industry, will allow us to produce robust and less traumatic tags that can be readily made available to the community.

RELATED PROJECTS

This study will be integrated with ongoing assessments of physical/physiological tag effects and tag robustness in Gulf of Maine humpback whales (Project Evaluating Potential Effects Of Satellite Tagging In Large Whales: A Case Study With Gulf Of Maine Humpback Whales) funded by NOAA and Exxon through the National Fish and Wildlife Foundation/National Oceanographic Partnership Program). In this study, led by PCCS, implantable satellite tags have been deployed to known individuals to assess their short-term behavioral responses to tagging and potential physiological effects of tags to individual animals. This study has also provided valuable information on the robustness of tag designs. Gulf of Maine humpback whales are an ideal candidate to investigate effects of tags because known individuals are readily identified in the field and because their sex, reproductive history and health has been monitored for over three decades. New satellite tags produced with the present ONR project will be deployed in GOM humpback whales to assess the performance of new designs in comparison with the existing technology from the point of view of animal welfare as well as tag duration.

The present ONR project will also build into long-term photo-identification studies on Eastern Pacific gray whales conducted by CRC in the west coast of the United States. This will provide a basis to assess tag performance in a different large whale species and will allow for comparison with humpback whales. In addition, because these whales have also been subject to tagging with existing technology, there will be an opportunity to evaluate performance of different types of tags.