

**EVALUATING POTENTIAL EFFECTS OF SATELLITE TAGGING
IN LARGE WHALES: A CASE STUDY WITH
GULF OF MAINE HUMPBACK WHALES**

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LONG-TERM GOALS

This project is a study of satellite tag retention and health impacts among Gulf of Maine humpback whales (*Megaptera novaeangliae*). Its overall goal is to better understand short- and medium-term physical and physiological effects of Type 1 tags and to investigate the processes involved in tag rejection, failure and loss. This work is expected to inform future tag design and deployment, and particularly seeks to minimize impacts on whales while maximizing methodological performance.

OBJECTIVES

The specific objectives of this project are as follows: 1) to characterize the range of physical and physiological responses to the tag through the measurement of physical and physiological parameters; 2) to provide data to optimize tag performance, as well as to minimize tag loss and impact; 3) to quantify the effect of tagging on individuals and to attempt to correlate that to sex, age, reproductive condition, and tag location. The focal population is well-studied and expected to facilitate repeated re-sightings of tagged individuals with or without tags. We therefore expect to evaluate possible post-tagging shifts in habitat use of tagged whales relative to their known preferred habitat and other non-tagged individuals with similar habitat use patterns. We also hope to gather data on movements and habitat use of humpback whales in the Gulf of Maine to improve scientific understanding and management of this population.

APPROACH AND WORK PLAN

Up to 20 satellite tags will be placed on individually identified Gulf of Maine humpback whales annually, 2011 through 2013. The satellite tags being used in this study are the Wildlife Computers (Redmond, WA, USA) SPOT 5 transmitters custom-designed in an implantable cylinder housing (Mold 177). Tags will be deployed during a two-week period annually, as early as practicable in the feeding season. Project staff will identify individual humpback whales in the field and select them for tagging based on extensive data on individual age and/or age class, sex, reproductive histories and known residency patterns. Follow-up cruises are then performed on a weekly or bi-weekly basis through December of the tagging year. Monitoring is also facilitated by a collaborating network of commercial whale watching vessels. Wound size and healing are to be assessed from high resolution photographs, and changes in tag site appearance will be combined with re-sighting data to assess the impact of tagging on individuals.

The project is a collaboration of scientists from several institutions: the Australian Marine Mammal Centre (AMMC), Cascadia Research Collective (CRC), the Marine Mammal Center, (TMMC), the National Marine Mammal Laboratory (NMML) and the Provincetown Center for Coastal Studies (PCCS). PCCS is responsible for grant management and technical aspects of the project are coordinated by Dr. Robbins (PI, PCCS) and Dr. Zerbini (co-PI, CRC/NMML). Drs. Zerbini and Gales (Co-PI AMMC) are responsible for the preparation and deployment of satellite tags. Telemetry data will be managed and analyzed by Drs. Zerbini, Gales and Clapham (co-PI, NMML). Dr. Robbins leads efforts to select individuals for tagging and to document tagged whales. Assessments of physical and physiological responses to tagging will be led by Drs. Gales and Gulland (co-PI, TMMC). Other data analysis and report writing are led by Drs. Robbins and Zerbini in collaboration with all co-investigators.

As described below, the first round of satellite tagging was performed in July 2011 and follow-up monitoring will continue through December 2011. The second tagging round will commence in the late spring or early summer of 2012. Vessel-based follow-up monitoring will be performed from April through December, 2012.

WORK COMPLETED

Nineteen satellite tags were deployed on North Atlantic humpback whales in the Gulf of Maine in July 2011 (Figure 1). The whales selected for tagging represented a demographically balanced sample of well-known catalogued adults. Focal follows after tagging produced detailed data on the immediate response to tagging, the duration of the behavioral response, tag placement and egress in the short-term. We also identified 61 other individual humpback whales in the vicinity of tagging operations to serve as a point of comparison for subsequent tagged whale behavior and residency characteristics. Dedicated follow-up cruises have been performed on 28 days since the end of tagging operations. We have successfully re-located and documented all but one of the tagged whales. Re-sighted individuals have been documented on an average of 10.6 days (min=4, max=22) since tag deployment, with observations spanning 46.0 days on average (min=6, max=136). Tags deployed in this study transmitted for 23.8 days on average, with a maximum of 97 days in one case. Over 4,350 images of implanted tags/tag sites have been obtained to date as part of the follow-up monitoring process. This includes approximately 300 opportunistic images of tagged whales submitted by commercial whale watch naturalists collaborating with the project. In 10 cases, the whale and tag site had been successfully documented within one day of the final tag transmission, and all but four tagged whales have already been observed at least once since tag transmissions ceased. Detailed analyses of these and other data obtained during the project are still underway. They provide an unprecedented window into the causes of tag failure, behavioral disturbance and health effects, as described below under results.



Figure 1: Satellite tagging operations in the Gulf of Maine in July 2011. Research performed under NOAA permit#14245.

RESULTS

The first tagging season was highly successful in terms of deployment and follow-up monitoring. The latter was particularly successful during the first two months of the project, when tag egress and physiological responses were most dynamic. Our ability to regularly re-encounter and document tagged individuals has generated an unprecedented amount of information on both the tags and the

individual whales over a range of time periods. These data are still being collected and analyzed, but preliminary observations already suggest productive avenues for tag and anchor modification, preferred sites for tag placement and better understanding of the range of short-term effects of tags on individuals. The combined use of measured etched rings on the tags (Figure 2), distance range finders and high resolution images has played an important role in our ability to make accurate assessments of tag egress, wound size and physiological responses to the tags. Finally, our observations of tagged whales (within one day of transmission failure in more than half of the cases) have provided timely data with which to evaluate the possible causes of tag failure. Although those results are still preliminary, they have already informed humpback whale tagging efforts off New Caledonia and Brazil in 2011.



Figure 2: Satellite tagged humpback whale showing etched rings on the body of the tag used to evaluate tag egress. Research performed under NOAA permit#14245.

IMPACT AND APPLICATIONS

National Security

Satellite tagging is an invaluable tool for quantifying the movements, range and habitat use patterns of cryptic large whale species. Making this technology as effective and benign as possible will increase the number of individuals, populations and species to which this technology can be applied. Better understanding of movements and critical habitat has the potential to benefit the national security by identifying areas where at-sea activities by the Navy and Coast Guard may be least likely to be interrupted or result in impacts to marine mammal populations.

Economic Development

The intent of this collaborative research is to evaluate currently used tagging technologies and to make recommendations to improve effectiveness and minimize impacts. We plan to make our results openly available to individuals and companies who develop and/or use this technology. Efforts to improve tagging should provide greater and broader applications and sales.

Quality of Life

As noted above, satellite tagging produces data that can be critical for identifying migratory corridors, connections and critical habitats. This information is vital for conserving species, managing populations and reducing conflicts with humans. Thus, improvements to this technology should have a positive effect on the management and conservation of large whale species.

Science Education and Communication

The humpback whale is well-loved by the public and so an ideal species to foster interest and facilitate understanding of aspects of science and conservation. Humpback whales exhibit the largest recorded movements among mammals (Stevick et al. 2010, Robbins et al. 2011) and migration is a topic of particular fascination for students and the public. Yet, for many populations the specific routes and connections between areas are poorly understood. Tagging has the ability to both improve this knowledge but to also express it in a way that can be grasped visually by a wide audience. As such, we expect improvements in tagging technology to facilitate teaching and outreach.

TRANSITIONS

Economic Development

Representatives of the tag manufacturer (Wildlife Computers) joined us for tag deployments in 2011 as part of efforts to improve and enhance tag design.

Science Education and Communication

This tagging project involves a significant outreach component, as the population under study supports a robust whale watching industry. Tagging activities are performed in the vicinity of private and commercial whale watchers and we have also engaged whale watching naturalists to provide sightings and images of tagged whales. These naturalists have already used this project as a tool for educating their passengers at sea and we have made movement data available to them and the wider public to facilitate understanding of humpback whale movements and habitat use. Links to these sites are provided under “Outreach”, below.

RELATED PROJECTS

Although not part of this project, co-investigators carried out satellite tagging in several other areas in 2011, including the Bering Sea, New Caledonia and Brazil. These projects will provide useful data for comparison with information collected in the Gulf of Maine.

REFERENCES

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Stevick, P.T., M.C. Neves, F. Johansen, M.H. Engel, J. Allen, M. C. C. Marcondes and C. Carlson. 2010. A quarter of a world away: female humpback whale moves 10000km between breeding areas. *Biology Letters* 7:299-302.

OUTREACH MATERIALS

Details about this project and near real-time tracks of tagged whales have been made publicly available at the following websites:

PCCS: <http://www.coastalstudies.org/what-we-do/humpback-whales/satellite-tagging.htm>

OBIS-SEAMAP: <http://seamap.env.duke.edu/dataset/781>

Seaturtle.org: http://www.seaturtle.org/tracking/?project_id=660&dyn=1322583518