

STUDY TITLE: Examination of Health Effects and Long-Term Impacts of Deployments of Tags on Large Whales in the Eastern North Pacific

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BACKGROUND: Despite extensive use of implant tags for more than 30 years, only limited studies have been conducted of the health effects and long-term consequences of tag deployments on whales. This field is rapidly expanding and increasingly uses deep penetration tags on many populations. Although post tag observations of tagged individuals have been reported previously, these reports have involved only some species and often involved a limited follow up. This information is needed to help evaluate the consequences of this growing research method.

OBJECTIVES: Our objective was to examine site healing, health, and any long-term consequences of tag deployment on reproduction, health, or survival, with a focus on blue and gray whales, two baleen whales in the Eastern North Pacific that provided an ideal test case to study.

DESCRIPTION: Our study used both photographic identification (photo-ID) and genetics to conduct the first systematic and complete reconciliation of the animals tagged with the long-term photo-ID datasets. Photographs and video taken from deployments were used to catalog both the photo-ID identities and the markings immediately around the tag site of whales to add to those where a match between tagged animal and photo-ID had already been made and those gathered of during the study. Additional determinations of identity were made based on genetic matches between samples taken from about 100 implant-tagged whales and those collected from animals

in these populations. Assessment of health impacts were conducted using several primary methods:

1. Sighting histories were examined to test whether there were any differences in survival rates between tagged and untagged whales and also alterations in resighting rates.
2. Tag site healing and condition were examined through photographs taken of tag site areas and samples collected and reviewed by an expert veterinary/pathology team.
3. Visual health assessments were conducted of blue and gray whales encountered to compare health of whales that had been tagged.

SIGNIFICANT CONCLUSIONS: Our study provided some of the most powerful analyses conducted to date testing tag effects and demonstrated quantitatively the incidence of different tag site conditions. This study showed the value and promise of identifying individuals and tracking them long term as a part of tagging and associated efforts. It also demonstrated the challenges of these types of studies and the need for good sample sizes, populations with high rates of resightings, and photo-ID of tagged animals to allow follow up observations. The study showed the high prevalence of swelling and depressions as after-effects of tag deployments and showed that more extensive swelling appeared to be the result of some pieces of older tags that remained in the whale. We also found less swelling when tags were placed higher on the body of whales. Although there was some suggestion of lower resighting rates of tagged PCFG gray whales compared to non-tagged control animals, this finding could not be unequivocally demonstrated statistically.

STUDY RESULTS: The focus of the proposed study was follow up on the 185 OSU-deployed tags on blue whales from 1993 to 2008 of several tag designs and 29 tags deployed on PCFG gray whales in 2009 and 2012. From these, we were able to photographically identify the individual whale for all 29 PCFG gray whales and 85 blue whales. Sighting histories of these tagged and identified PCFG gray whales and blue whales were examined and compared to non-tagged whales that were seen in the same area and time as the tagging but which were not tagged to test whether there were any differences in survival rates between tagged and untagged whales and also alterations in resightings of individuals. The high resighting rates of PCFG gray whales made them ideal for both follow up and evaluation of tag site healing and resighting and survival rates. All 28 (18 in 2009 and 10 in 2012) tagged PCFG gray whales were individually identified, allowing examination for follow up. Tagged PCFG gray whales were not resighted post-tagging as frequently as for our control animals. From the 2009 tag deployments 3 of 18 (17%) tagged gray whales were not resighted more than a few months post-tagging or, in one case, are known to have died about 2 years post-tagging. This compared to only 2 of 39 (5%) of the non-tagged whales from the same period. Models of survival with and without tag effects were approximately equally supported by the data. Models with an QAIC weight ranging from 0–2 presented all possible combinations of effects proposed in the analysis (no effect, chronic effect, time trend effect, acute effect), suggesting that it is not possible to unequivocally conclude there is an effect of tagging in survival probability. Blue whale resighting rates were lower and had less power to detect a tag effect, but there was no indication of a difference in resighting rates or survival rates that suggested a tag effect. Suitable photographs were available to evaluate the physical condition of the tag site and healing characteristics in 34 gray (2009, 2012, and 2013) and 63 blue (1993–2008) whale tagging events. Swelling and depressions were the most

common conditions noted during tag follow-up: 74% of gray and 33% of blue whales, and 82% of gray and 71% of blue whales, respectively. Inter-rater agreement analysis demonstrated strong agreement between scores of the two reviewers. Depressions were more medium to high in gray whales compared to low to medium in blue whales. Veterinary subjective assessment showed a high degree of variation by reviewer, but four or more reviewers concurred that at least a possible health risk was indicated for half the gray whales but only 11% of blue whales. Species differences were likely influenced by the longer but sparser history on blue whales versus the more frequent but short-term follow-up of gray whales, and the progression of conditions post tagging. In general, swellings observed on tagged gray whales were more evenly distributed relative to severity (low, medium, high), whereas swellings tended to be more moderate in blue whales. Two blue whales had large persistent swellings that were outside the range of observations seen in other tagged animals. One of these was described in a recent publication based partly on the results from this study and demonstrated an apparent impact on reproduction (Gendron et al. 2015). In both cases these appeared to be the result of earlier generation tags, where the main tag was external and attached with two prongs and where one of these broke off and remained in the whale for an extended period, causing the large and prolonged swelling.

STUDY PRODUCT(S):

Calambokidis, J, A Zerbini, K Flynn, A Douglas, S Norman, B Mate, C Hayslip, D Gendron, R Sears, J Jacobsen, and D Goley. 2015. Quantitative examination of long-term impact of implant tagging on survival of gray and blue whales. Abstract (Proceedings) 21st Biennial Conference on the Biology of Marine Mammals, San Francisco, California, December 14–18, 2015.

Gendron, D., I.M. Serrano, A.U. de la Cruz, J. Calambokidis, and B. Mate. 2015. Long-term individual sighting history database: an effective tool to monitor satellite tag effects on cetaceans. *Endangered Species Research* 26:235–241.

Norman, S., J. Calambokidis, K. Flynn, B. Mate, C. Hayslip, F. Gulland, M. Moore, S. Raverty, D. Rostein, A. Zerbini, A. Douglas, D. Gendron, and R. Sears. 2015. Quantitative assessment of wound healing based on long-term follow up of tagged gray and blue whales. Abstract (Proceedings) 21st Biennial Conference on the Biology of Marine Mammals, San Francisco, California, December 14–18, 2015.

Norman S.A., K. Flynn, A.N. Zerbini, F.M.D. Gulland, M. Moore, S. Raverty, D. Rotstein, B.R. Mate, C. Hayslip, D. Gendron, R. Sears, A. Douglas, and J. Calambokidis. 2017. Assessment of wound healing of tagged gray (*Eschrichtius robustus*) and blue (*Balaenoptera musculus*) whales in the eastern North Pacific using long term series of photographs. *Marine Mammal Science* 34:27–53