Developing a blubber-implanted satellite tag for right whales

Zerbini, A.N.1,2, Rajachar, R.3, Uhart, M.4,5, Clapham, P.J.6, Crandall, N.7, Leask, A.7, Holland, M.7, Zoodsma, B.8

1 Marine Mammal Laboratory, Alaska Fisheries Science Center, NOAA, Seattle, WA, USA
2 Marine Ecology and Telemetry Research, Seabeck, WA, USA.
3 Engineered Biomaterials Laboratory, Department of Biomedical Engineering, Michigan Tech University, Houghton, MI, USA.
4 Karen C. Drayer Wildlife Health Center, School of Veterinary Medicine, University of California, Davis, Davis, CA, USA
5 Southern Right Whale Health Monitoring Program, Puerto Madryn, Chubut, Argentina.
6 Seastar Scientific, Vashon, WA, USA.
7 Wildlife Computers, Redmond, WA, USA.
8 NOAA Southeast Regional Office, Fernandina Beach, FL, USA.

Right whales (genus *Eubalaena*) were severely reduced by whaling. While recovery has been observed in the Southern Hemisphere, populations of North Pacific and North Atlantic right whales (NARW) are still small and listed as endangered. The status of the NARW is of particular concern due to declining health and fecundity and high mortality rates associated with ship strikes and entanglements. Effective management depends on knowledge about how right whales are using their habitats, the extension of overlap of these habitats and anthropogenic activities, and how distribution and behavior are shifting in response to changes in the environment. Satellite tagging is an effective method to describe movements, habitat use and migration of whales and to understand how animals overlap with and respond to anthropogenic threats. Long-term tags applied to large whales typically require anchoring below the blubber/muscle interface, but these tags are not currently allowed for use with some endangered populations because of concerns about their effects on the health of the animals. The goal of this study is to develop a new, shorter, and less invasive satellite tag with electronics embedded in the blubber for use with right whales. A total of eight implantable “blubber” tags (130mm in length and 24mm in diameter) were deployed in Southern right whales near Península Valdés, Argentina in September 2019. Tag duration ranged from 12.6 to 30.4 days, with an average of 19.8 days (SD = 7.3 days). These numbers are still preliminary because one tag was still transmitting by the time this abstract was prepared. Follow-up of tagged animals is ongoing to assess potential effects of tags to individual whales and should continue until whales depart from their wintering grounds in Argentina by late November/early December. Future modifications of this tag for deployment on the same population in 2020 should include an anti-microbial coating and a new texture for the surface of the tag housing, which are expected to improve tag duration.
Developing a blubber tag for right whales

Alexandre N. Zerbini\textsuperscript{1,2}, Rupak Rajachar\textsuperscript{3}, Marcela Uhart\textsuperscript{4,5}, Phillip Clapham\textsuperscript{6}, Natalie Crandall\textsuperscript{7}, Andy Leask\textsuperscript{7}, Melinda Holland\textsuperscript{7} and Barb Zoodsma\textsuperscript{8}

\textit{(presented by Paul R. Wade\textsuperscript{1})}

\textsuperscript{1}Marine Mammal Laboratory AFSC-NOAA
\textsuperscript{2}Marine Ecology and Telemetry Research
\textsuperscript{3}Engineered Biomaterials Lab, Michigan Tech University
\textsuperscript{4}University of California Davis
\textsuperscript{5}Southern Right Whale Monitoring Program
\textsuperscript{6}Seastar Scientific
\textsuperscript{7}Wildlife Computers
\textsuperscript{8}NOAA Southeast Regional Office
Background

- Populations of North Atlantic and North Pacific right whales remain critically endangered.
- Main threats: ship strikes, entanglement in fishing gear, and noise.

Background

- Effective management: knowledge about distribution, movements, habitat use, and their overlap with anthropogenic activities.
- Understand potential changes in behavior in response to changes in the environment.
Background

• Satellite telemetry is a powerful tool to understand movements, migration and habitat use.

• Two types of invasive tags have been deployed on whales in recent years:
  ✓ Dart (LIMPET) tags (Type A/Anchored): penetrating darts, external electronics.
  ✓ “Implantable” Tags (Type C/Consolidated): attachment elements and electronics embedded in the body.

• North Atlantic right whales:
  ✓ LIMPET tags: poor duration and concerns with breakage of attachment elements.
  ✓ Implantable tags: longer duration, concerns about health effects due to possible penetration of the blubber/muscle interface.
Project goal

• Develop a right whale tag that could fill a gap between LIMPET and implantable tags:

• Planned tag features:
  • Embedded electronics
  • Deployment in the blubber (minimize invasiveness)
  • Addition of new tag elements (e.g., anti-microbial coating, new surface architecture)
  • Medium term-duration (~30 days on average)
  • Added benefit: possible application in other smaller whale species (e.g., Bryde’s and sei whales)
Phase 1: short tag with tested features

- WET/DRY SENSOR
- ARGOS ANTENNA (length not to scale)

Umbrella to be welded to screw on Tip.

AM-S372A-00 Tip
Rationale for tag length

- Limitations on the size of the electronics.
- Ensure that there was a high probability of implantation only in the blubber of right whales.

Source: Miller et al., 2011; Clapham, Ivashchenko and Zerbini, unpublished
Phase 1: short tag with tested features

- LIMPET Tag
- Integrated-Implantable Tag
- “Blubber” Tag
Impact testing

- Hard durometer rubber belts
Deployment

- Ongoing program to tag Southern Right Whales in Argentina since 2014 (integrated-implantable tag).

- Goals: understand movements, habitat use and migratory destinations.

- In 2019/20 ONR Funds were received to deploy new robust, integrated implantable tags and follow-up tagged animals.

- Deployment of “blubber” tags would allow for assessment of tag performance (in comparison with the longer implantable tags) and obtain information on tag effects from follow-up.
Whale Duration
Papillon       237 days
Buena Onda    126 days
Lolita        204 days
Mariposa      95 days
Deployment

• 2019 Season: 9-25 September.

• 8 “blubber” tags (also 15 integrated-implantable).
<table>
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<tr>
<th>PTT ID</th>
<th>Whale name</th>
<th>Age Class</th>
<th>Sex</th>
<th>Group Composition</th>
<th>Duration (days)</th>
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<td>Flash</td>
<td>Adult</td>
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<td>Competitive group</td>
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</table>

**DURATION**
- mean: 21 days
- median: 16 days
- min: 12.6 days
- max: 35.3 days
Follow-Up

• Started immediately after the first tag was deployed.
• It is continuing until the whales leave (Nov/Dec).
• Data:
  • Behavior (focal follow from boats)
  • Documentation of the tag site (from boats and UAVs)
  • Photo-identification data (from boats and UAVs)
  • Attempt to collect photogrammetry data (UAVs) to assess body condition over time
Follow-Up: 6 whales resighted 3-15 days

Pulgarcita (adult female with a calf)

Tagging

Day 6

Rapidito (juvenile male)

Tagging

Day 14
Future Work

• Short term goals (Phase 2, 2020 deployment)
  • Anti-microbial coating
  • Modified surface architecture
  • Improve follow-up
Future Work

• Short-term goals (Phase 2, 2020 deployment)
  • Anti-microbial coating
  • Modified surface architecture
  • Improve follow-up

• Long-term goals
  • Reduce size of the exposed section of the posterior end of the tag
  • Degradable tip/retention elements
  • Use of more tissue-compliant biomaterials
  • Miniaturization of electronics
Acknowledgements

Deployment and Follow-up: