

## Developing a blubber-implanted satellite tag for right whales

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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.



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# Developing a blubber tag for right whales

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*(presented by Paul R. Wade<sup>1</sup>)*

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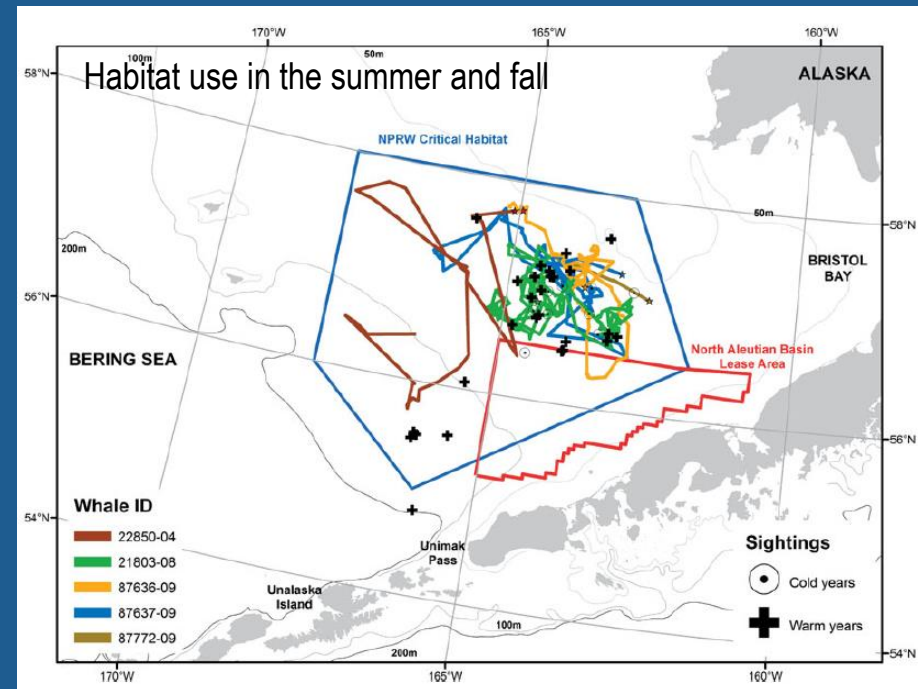
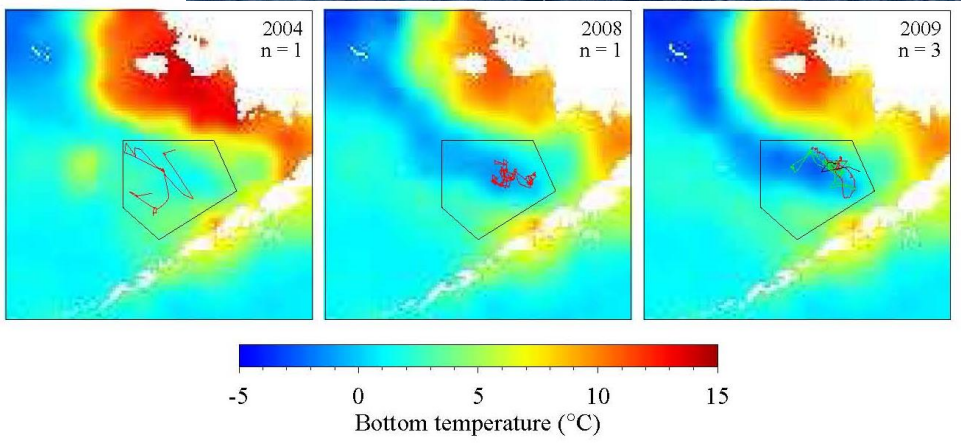
# Background

- 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

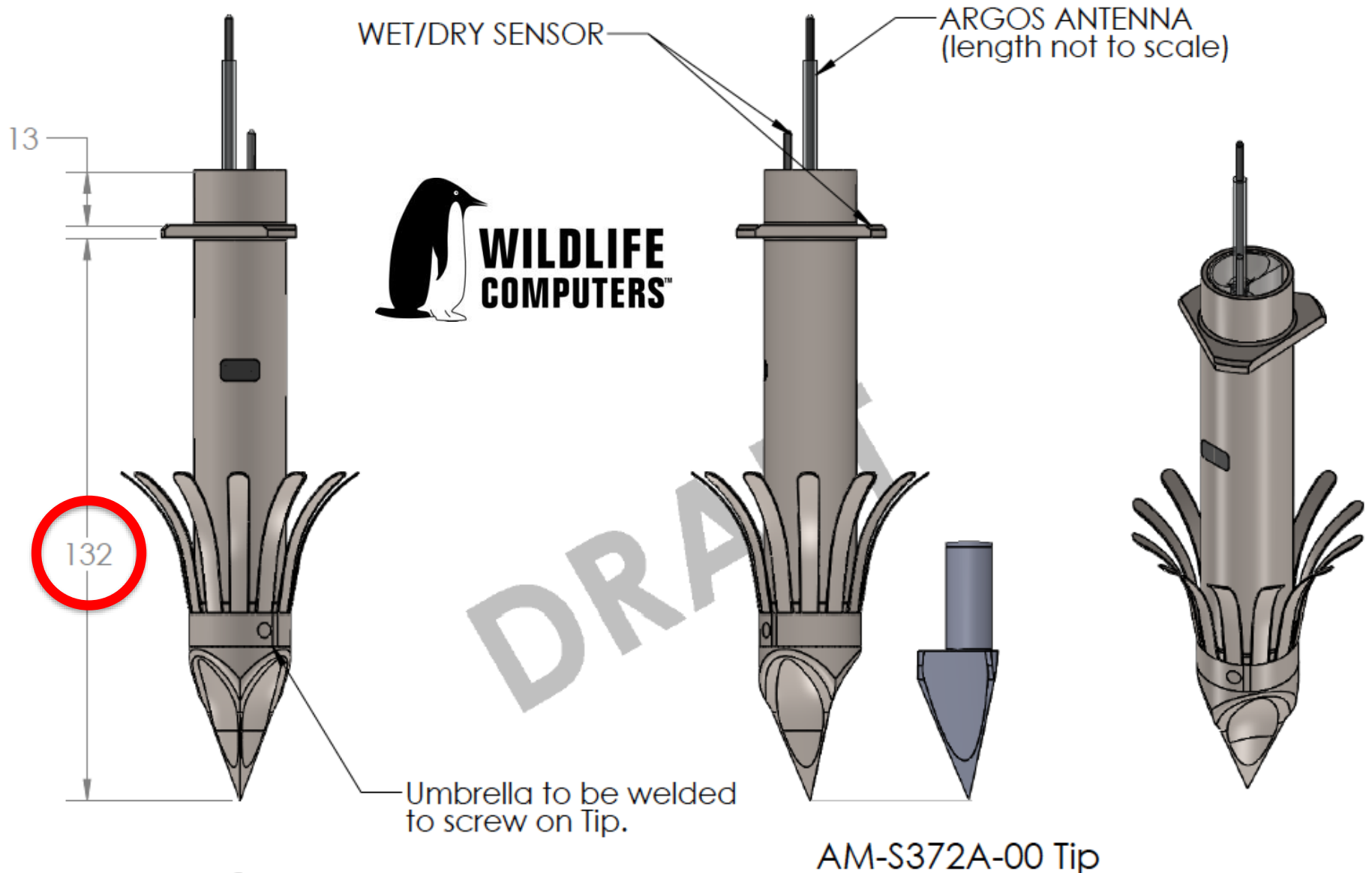
- Satellite telemetry is a powerful tool to understand movements, migration and habitat use.
- Two types of invasive tags have been deployed on whales in recent years:
  - ✓ Dart (LIMPET) tags (Type A/Anchored): penetrating darts, external electronics.
  - ✓ “Implantable” Tags (Type C/Consolidated): 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

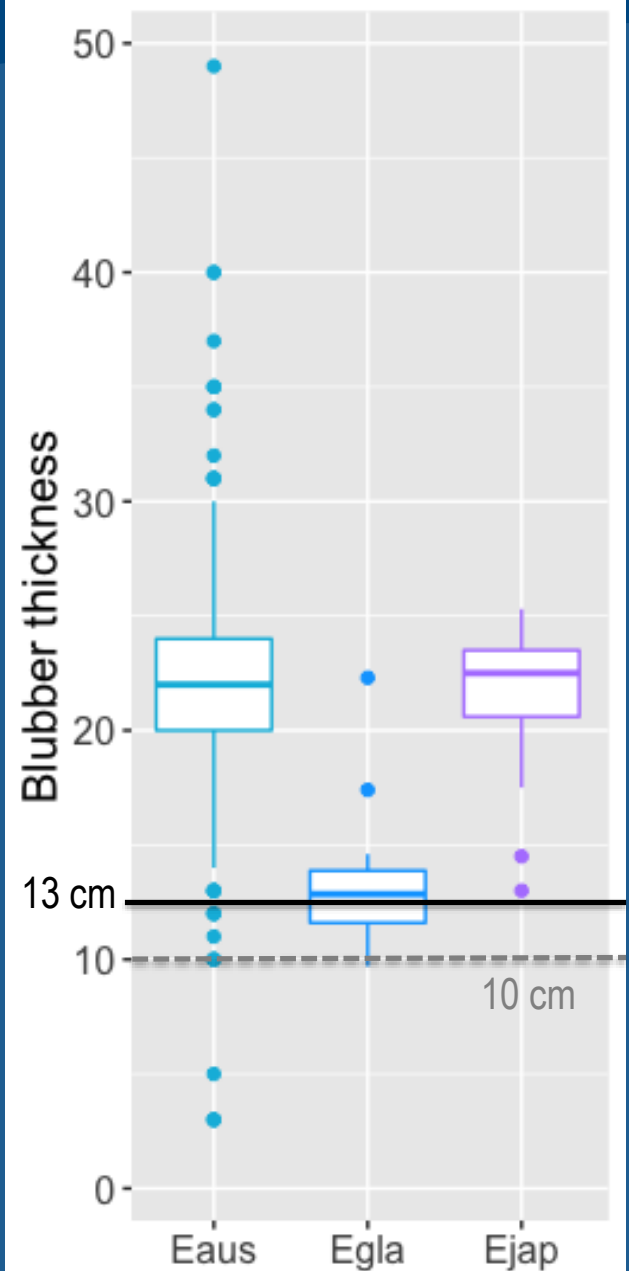
- Develop a right whale tag that could fill a gap between LIMPET and implantable tags:
- Planned tag features:
  - Embedded electronics
  - Deployment in the blubber (minimize invasiveness)
  - Addition of new tag elements (e.g., anti-microbial coating, new surface architecture)
  - Medium term-duration (~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



# Rationale for tag length

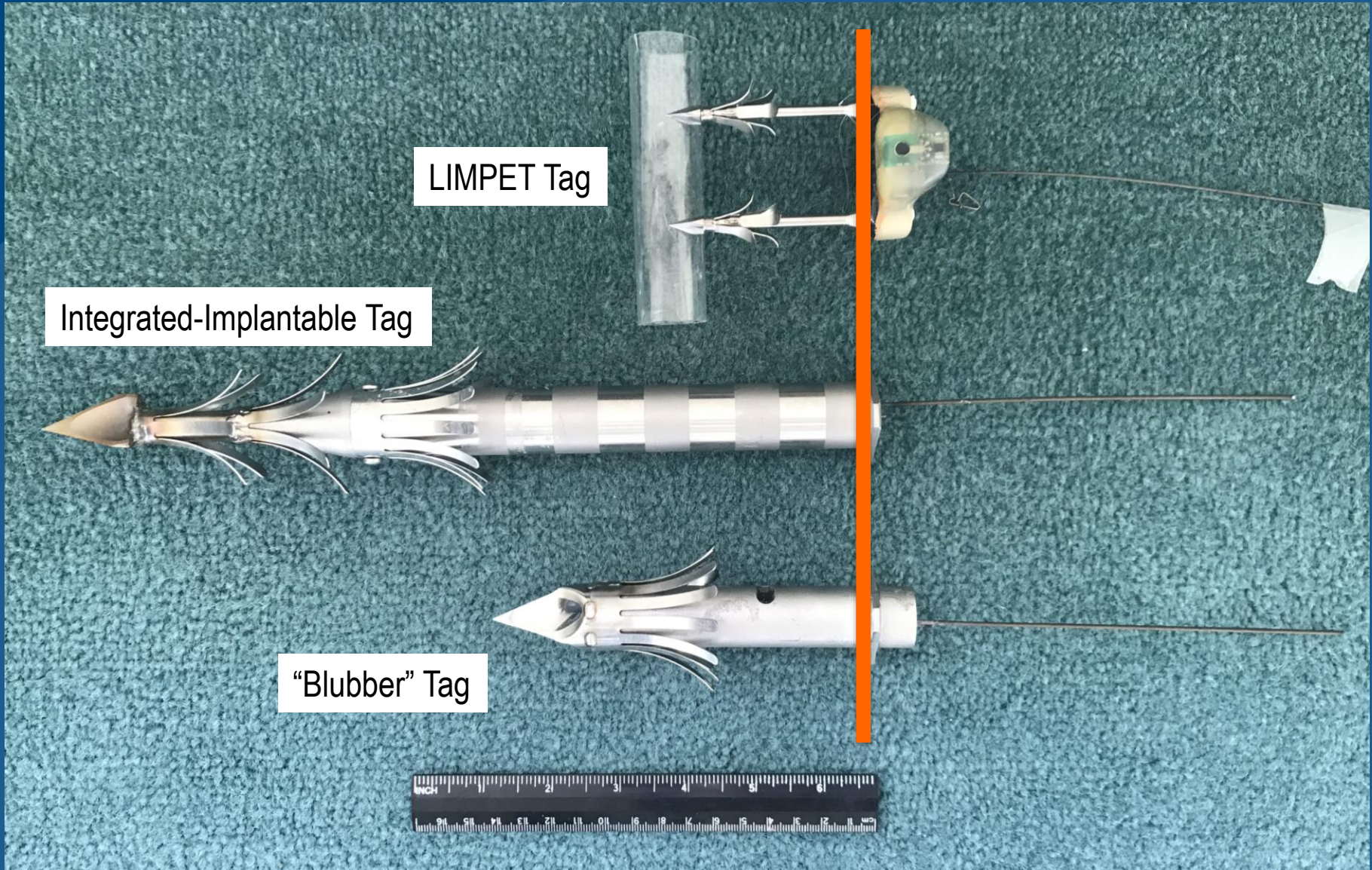
- Limitations on the size of the electronics.
- Ensure that there was a high probability of implantation only in the blubber of right whales.



Source: Miller et al., 2011; Clapham, Ivashchenko and Zerbini, unpublished



# Phase 1: short tag with tested features



# Impact testing

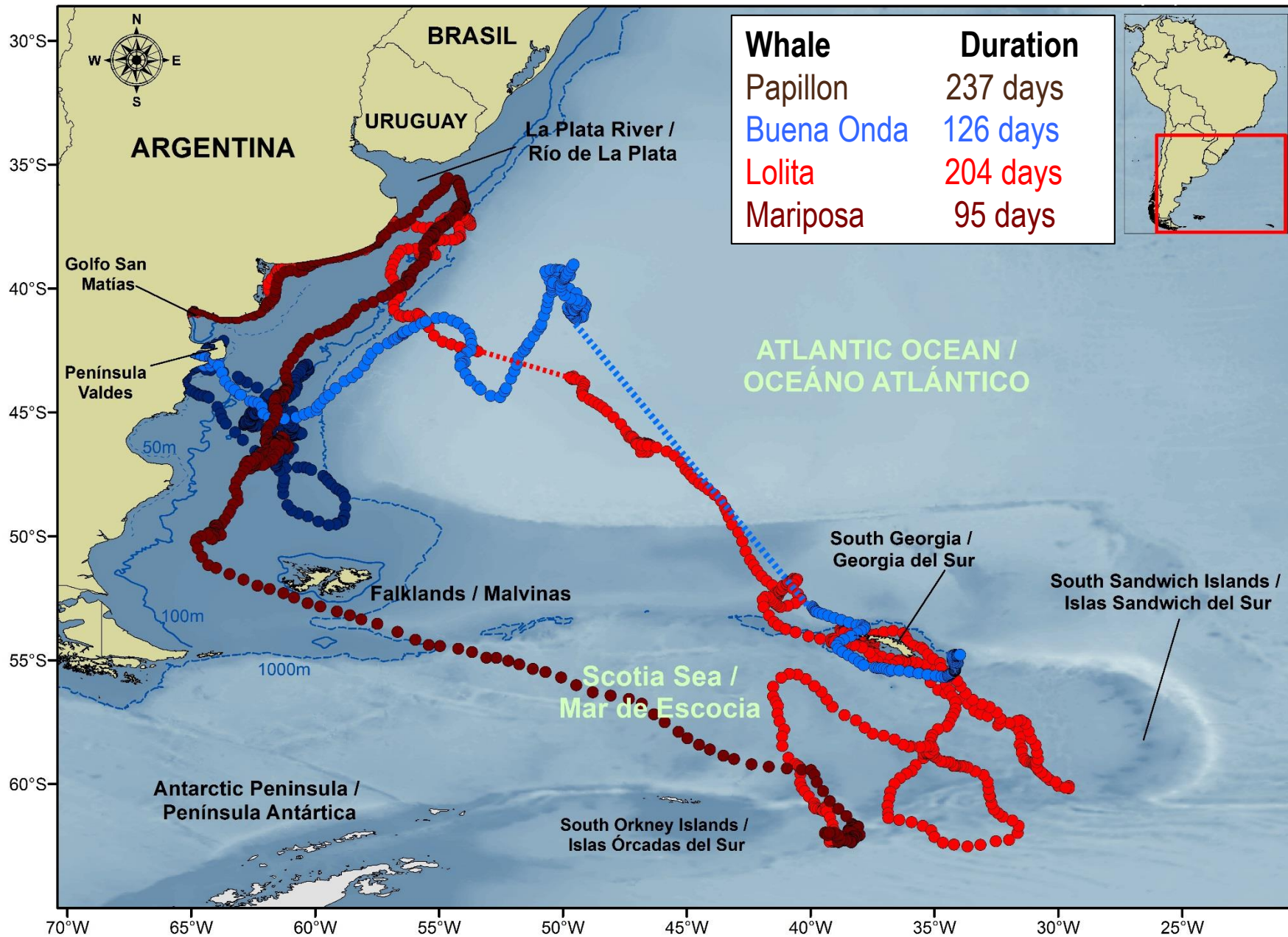
- Hard durometer rubber belts



# 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.

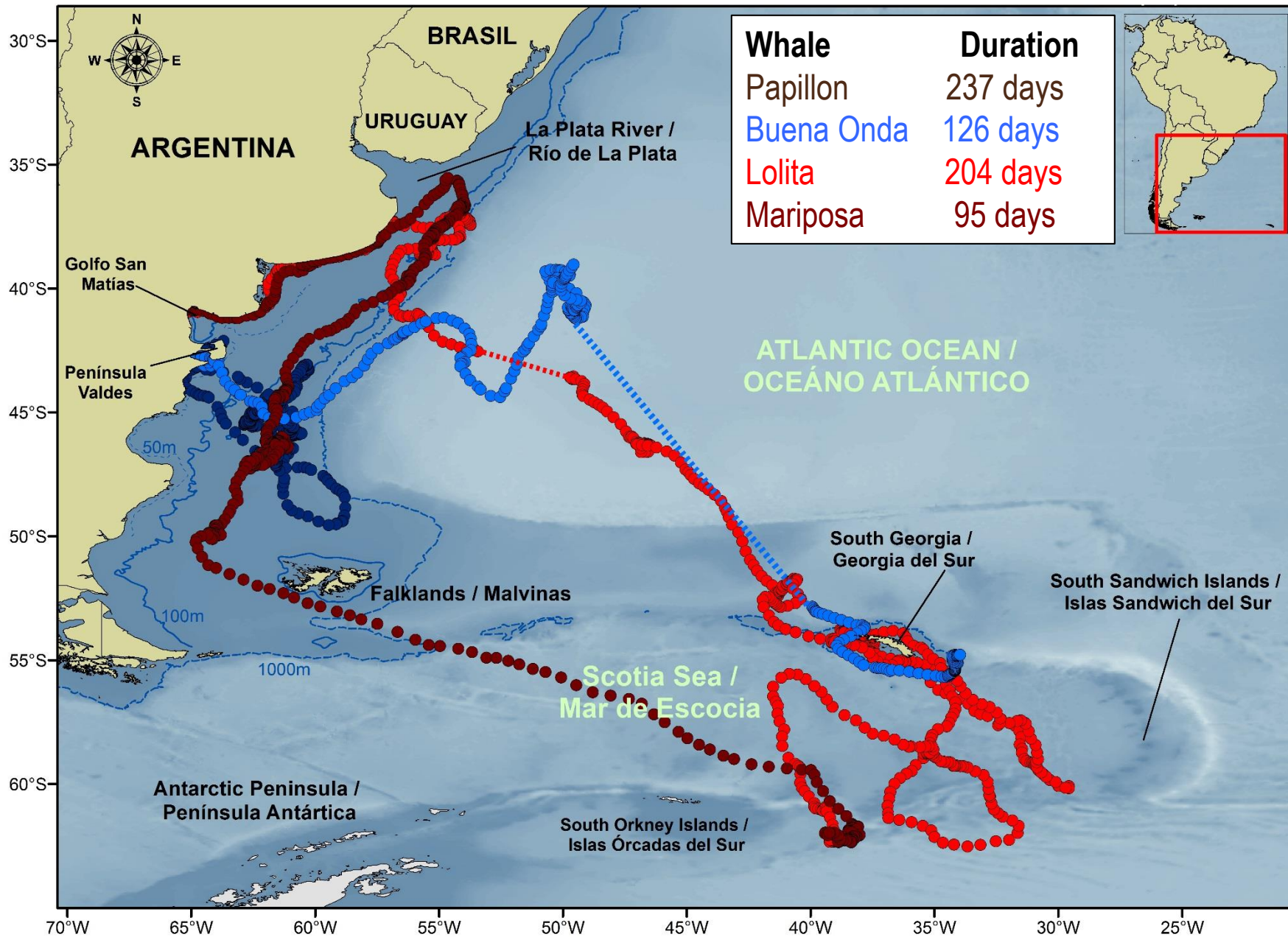


Whale	Duration
Papillon	237 days
Buena Onda	126 days
Lolita	204 days
Mariposa	95 days



ATLANTIC OCEAN /  
OCEANO ATLANTICO

Scotia Sea /  
Mar de Escocia







# Deployment

- 2019 Season: 9-25 September.
- 8 “blubber” tags (also 15 integrated-implantable).



# Deployment

PTT ID	Whale name	Age Class	Sex	Group Composition	Duration (days)
194583	Campeona	Adult	F	Mother calf	13.5
194584	Rapidito	Juvenile	M	Pair	15.6
194585	Robustito	Juvenile	-	Solitary	12.6
194586	Rintone	Adult	F	Mother calf	30.4
194587	Pancho	Juvenile	-	Solitary	28.8
194588	Pulgarcita	Adult	F	Mother calf	35.3
194589	Almuerza	Adult	F	Mother calf	15.9
194590	Flash	Adult	M	Competitive group	15.4

## 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)



Rapidito (juvenile male)



# Future Work

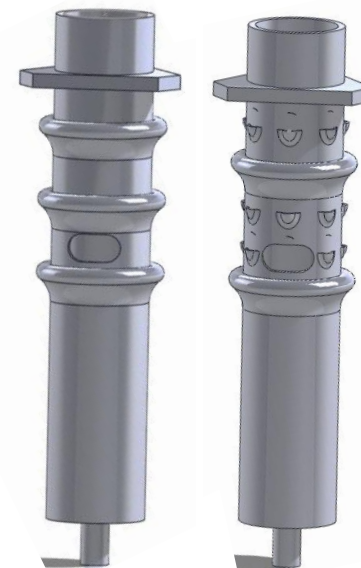
- Short term goals (Phase 2, 2020 deployment)
  - Anti-microbial coating
  - Modified surface architecture
  - Improve follow-up

## Development and Characterization of an Antimicrobial Polydopamine Coating for Conservation of Humpback Whales

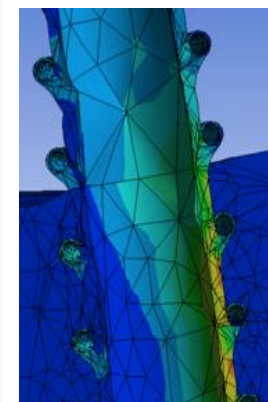
Ariana Tyo<sup>1</sup>, Sonja Welch<sup>1</sup>, Maureen Hennenfent<sup>1</sup>, Pegah Kord Fooroshani<sup>2</sup>, Bruce P. Lee<sup>2</sup> and Rupak Rajachar<sup>1\*</sup>



Base-tag



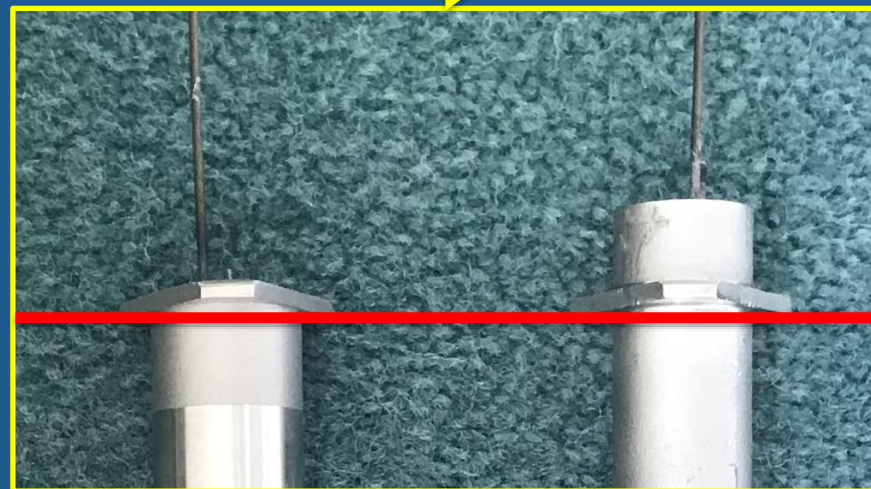
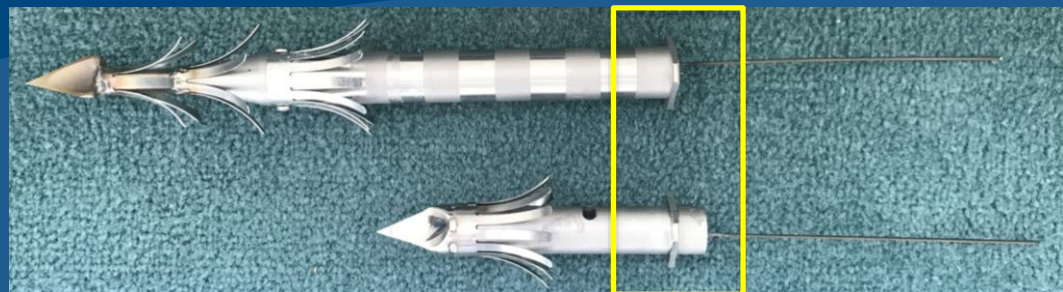
Modified surface architectures



Stress analysis at tag-tissue interface

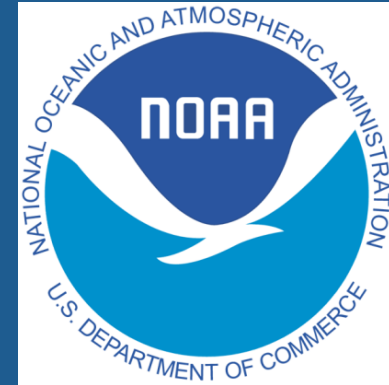
# Future Work

- 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

Funding:



Deployment and Follow-up:

