

Australian Marine Mammal Centre
Final Report
(subclause 9 and Schedule Item 5 of the Funding Agreement)

Season 2006/07

- **Title** - Monitoring medium and large-scale movements of baleen whales using satellite telemetry
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- **Organisation** – Australian Antarctic Division; and Centre for Whale Research (Western Australia)

Activity Period – July 2006 to Dec 2007

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1. Public Summary

A clear summary of approximately 500 words outlining the work undertaken and any significant findings (for publication on the Department's web site)
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This project is part of a long-term research program to develop a safe and reliable method to track the movements of large baleen whales with radio satellite tags. While the satellite tracking technology is well established, methods to attach the tags to whales that have no significant impact on animal welfare, but provide sufficient attachment time have proven difficult. During this project, which focused on humpback whales and blue whales, substantial problems with electronic failure and short attachment times were experienced. These failures resulted in very little whale movement data being acquired. Subsequent assessment of points of failure and the ensuing design changes have now resulted in a tag that works predictably for several weeks post deployment. Further improvements in tag design and function are expected in future deployments.

2. Project summary

Project activity from July 2006 to December 2007
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This project aimed to develop a minimally invasive method to track large baleen whales with radio satellite tags. The challenge in this endeavour is principally one of achieving a reliable, safe method to attach the tag to the whale that provides predictable attachment duration. Tags that anchor deep in the muscle are known to provide the longest attachment times, but also present a greater welfare risk to the whale. This project is the continuation of endeavours to design a tag with minimal
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penetration depth, but sufficient attachment times. Humpback whales and blue whales are used as subject animals due to:

- The importance of measuring the movement patterns of both species in Australia,
- The accessibility of both species for tagging, and
- Known differences in the two species in tag attachment times (blue whales retain tags for longer than humpback whales).

A number of field trips have been conducted for this project. These were partially funded by the ACAMMS grant, and partially by the Australian Antarctic Division. As described in our ACAMMS Progress Report (May 2007), three rounds of deployments were undertaken over the 2006/07 season. Since May 2007 three further deployment rounds have been conducted with funding from the AAD and another ACAMMS grant (0708/20). A summary of these subsequent deployments is also presented in below in order to provide an up to date summary of the status of tagging efforts.

A summary of fieldwork undertaken for this project (and subsequently) and the progression of tag design is as follows:

- November 2006- two tags deployed at Geographe Bay, WA.
 - One tag was deployed on a humpback whale and was implanted 75% of the length of the tag. Video footage revealed that the new head design may interfere with flight. While this deployment was successful in implanting the tag, no data was received from this tag. Humpback whale sightings were rare at this time and those humpbacks sighted were extremely evasive.
 - A deployment was also attempted on a blue whale; however on deployment the tag bounced off the flank of the animal and was lost.

Action: The design of the tag head was modified to allow the prongs on the head to be held against the body of tag before and during deployment, to improve flight.

- December 2006- One tag was successfully deployed on a humpback whale in Tasmania. This tag was fully implanted. No data was received from the tag.
- March 2007- Seven tags deployed at Perth Canyon, WA. All seven tags were deployed on blue whales. All deployments were successful and ranged from 50% to fully implanted. However only one tag transmitted, providing location information for 10 days. Such extreme and immediate failure of a large group of tags has not been encountered on tagging trips to date.

Action: The method of tag attachment via pneumatic line thrower (used since 2005) had proved highly successful and reliable and we did not feel the need to modify the deployment technique or equipment. However, due to an unknown cause of tag failure data acquisition was minimal. A testing regime was constructed, whereby 'dummy' and 'live' tags were tested under as close to deployment conditions as we could orchestrate.

Initially, two 'dummy' tags with basic circuitry were impact tested and pressure tested to 1000 m in water. One tag survived the testing, one failed. These trials

suggested the waterproofing of the tag may not be optimal; as a precautionary measure the housing of the tag was then modified to completely seal the electronics and surrounding epoxy. In order to imitate deployment conditions as close as possible, two 'live' tags underwent both impact and pressure testing to 1000 m, one 'live' tag was impact tested only and an additional seven 'live' tags were pressure tested only. All tags survived the testing.

This testing gave a reliable indication that these particular tags could withstand field conditions prior to being deployed.

The tags were manufactured slightly longer (20cm) than previous tags, in an attempt to improve the duration of attachment.

- October 2007- Ten tags (funded by the AAD) deployed on humpback whales at Exmouth gulf, WA. Eight of the ten tags returned data, with a range of transmission durations between 1 and 8 days. Receiving a maximal transmission duration of 8 days indicated the small lengthening of this iteration of the tag did not improve tag retention.

Action: As these tags had undergone rigorous testing, the problem appeared to occur after deployment; the tags may be ejected from the blubber faster than anticipated. In an attempt to promote tag retention without significantly lengthening the tag, three different head designs were manufactured, each with a slightly different mechanism for anchoring the tag into the fascial layer. The body of the tags remained the same as the October deployment. These tags were slightly smaller (18-20 cm depending on the head design) than October's tags.

- April 2008- five tags deployed on blue whales (see project 0708/20). Maximum transmission duration was 11 days.

Action: A sixth tag that was not deployed in April was subsequently impact tested and left running in a damp, earthed environment, to ensure the electronics of this tag iteration were robust. This tag survived the impact and continued to run until switched off one week later.

After discussions with other international research groups who have achieved some success in this field, we decided to lengthen the AAD tag to 26cm. This will anchor the tag into the upper muscle layer of the whales, and is hoped to improve tag retention and thus transmission duration. At 26cm the tag only implants in the outer component of the muscle mass and is still determined to present a minimal welfare risk to the whale. This tag has been approved for use on whales by the Australian Antarctic Division Animal Ethics Committee.

- August 2008 - six tags were deployed on Humpback whales in Broome, WA (tags funded by the AAD and project 0708/20). These tags all transmitted post-deployment with tag durations of 5, 17, 23, 25, 26 and 28 days respectively.

2. The Outcomes/Objectives

The degree to which the Activity has achieved the objectives

This project has achieved the objective of further refinement of tag design, but within

the timeframe of the project itself the results have been frustrating and disappointing. Two problems confounded our efforts; issues of early tag expulsion due to sub-optimal design and multi-factorial electronic failure issues. Whenever a tag ceases to transmit post-deployment it is generally not possible to disentangle these two points of failure.

The deployment of safe and reliable tags on whales is still developmental, and an approach that minimises the length of the tag (as our approach does) leads to the greatest risk of early tag failure. While the tag failures in this project have meant that only limited data on whale movement has been acquired, the work undertaken in this project has enabled us to solve the electronic failure issue and to extend the tag life on the whale – this has been demonstrated by the most recent tag deployment. The electronic failure issue was resolved through substantial redesign of the electronics and by switching suppliers (we changed from Sirtrack Ltd, New Zealand to Wildlife Computers, USA). Our subsequent success in increasing tag attachment duration to close to 4 weeks has been achieved by further improvements in design and through increases in tag length.

In summary, while the data outcomes of this project are disappointing the troubleshooting and design actions have resulted in substantial improvements in tag design to the point where we now have a tag that transmits predictably after deployment and can acquire location data for several weeks. Further improvements in tag longevity are anticipated in future deployments.

3. Appropriateness

The appropriateness of the approaches used in the development and implementation of the Activity

Each modification of tag design has been well considered, with a focus on animal welfare. The researchers endeavoured to minimise any potential effects on the whales at all times.

The testing regime has proved extremely useful for considering and discounting potential causes of tag failure.

We feel we have exhausted the avenues for a wholly blubber-implanted tag and are now developing slightly longer tags that anchor in the outer muscle mass. These changes are already yielding improved results. This decision has not been made lightly and was reached over time through our experience and through many discussions with other research groups experienced in this field.

4. Effectiveness

The degree to which the Activity has effectively met its stated objectives

As noted earlier, the objective of acquiring whale movement data was not effectively achieved, but the project has resulted in substantial progress in tag design and function that has led to an enhanced capacity to track whales for useful durations.

5. Financial Account of the Activity (refer to subclause 9.6, and Schedule Item 5.10 of the Funding Agreement)

This activity was funded jointly by ACAMMS and by the Australian Antarctic Division.