

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

- **Project No.** – 13/48
- **Title** - Offshore migratory movement of southern right whales: addressing critical conservation and management needs.
- **Chief Investigator** – Prof Simon Goldsworthy
- **Organisation** – SARDI Aquatic Sciences

Activity Period – April 2014 to 30 April 2015

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1. Activity Summary

A clear summary of approximately 500 words outlining the work undertaken and any significant findings (for publication on the Department's web site)

The characterisation of migratory movement patterns of individual southern right whales is identified as a High Priority Action of the Conservation Management plan for the Southern Right Whale 2011-2021. This project provides the first data on the offshore migratory routes of southern right whales (*Eubalaena australis*) from the south-western Australian population using satellite telemetry.

All aspects of the project were conducted under relevant State and Commonwealth permits and with Animal Ethics Committee approval.

In total, nine satellite tags were deployed on adult southern right whales at the Head of Bight (HOB) aggregation in South Australia from 6 - 8 September, 2014. Satellite transmission performance and longevity was mixed, however, three of the tags, deployed on adult females accompanied by calves, transmitted for a sufficient amount of time to provide the first data on the offshore migratory movements of this population.

Although three tags failed to transmit after deployment, short to medium term responses to tagging could be investigated for the other 6 individuals. Telemetry data show that in the 12 hours following tag deployment, all individuals remained on average within 2.8 km of the location where they were tagged. Although most tags stopped transmitting within five days of deployment, four of the nine individuals were resighted with their calves during a dedicated aerial survey conducted by the South Australian Research and Development Institute (SARDI) and the Department of the Environment, Water and Natural Resources (DEWNR) on 29 September 2014. These individuals were resighted within 0.42 – 3.35 km of the original location where they were tagged.

Of the three individuals whose tags transmitted for the longest periods, two migrated directly offshore in a southerly direction from HOB. The first female continued to move southerly

until the tag ceased transmitting at approximately 35°S, while the second female showed consistent southerly direction until approximately 41°S when it began to move in a westerly direction. Investigation of average sea surface temperatures around this latitude during this period are indicative of the subtropical front.

The tag deployed on the third female did not begin regular transmission until the individual was approximately 1,320 km west of HOB, just east of Albany, Western Australia. This individual moved in a generally westerly direction and its track line was associated with a low pressure eddy, features associated with localised upwelling.

These data on the offshore movements and migration patterns of southern right whales are essential for informed management of potential interactions with human activities and to assist in mitigating potential impacts from coastal or offshore development, shipping and fisheries.

Biopsy samples were also collected from 19 adult right whales during this project and have been provided to a global southern right whale research project that aims to increase our understanding of the role of behaviour in shaping population structure and connectivity in this species.

2. The Outcomes/Objectives

List of the Project Objectives

1. To collect baseline satellite telemetry data on the offshore migratory routes of unaccompanied adult SRW from two breeding aggregations (Head of Bight and Fowler's Bay) in South Australia.
2. To monitor the short, medium and long-term effects of satellite tagging on whales.
3. To develop a national capacity to perform telemetry studies on southern right whales, in order to establish an ongoing multi-year tagging and monitoring project.

The degree to which the Activity has achieved each of the objectives

1. To collect baseline satellite telemetry data on the offshore migratory routes of unaccompanied adult SRW from two breeding aggregations (Head of Bight and Fowler's Bay) in South Australia.

All research activities were conducted from 6 – 8 September 2014 at the Head of Bight, South Australia. Implantable satellite tags were deployed remotely from a small research vessel on 9 adult southern right whales (SRWs - *Eubalaena australis*) of which 6 were concurrently biopsy sampled. 13 additional biopsy samples were collected from adult right whales. Biopsy samples were collected under permit AU-COM2014-248.

2. To monitor the short, medium and long-term effects of satellite tagging on whales.

All approaches to whales were video recorded from the inflatable vessel either by a helmet mounted camera and/or a camera mounted on a pole attached to the centre console. ID's were obtained for six of the nine tagged individuals. Three of the tags failed to transmit post deployment. Telemetry data from the remaining six tags show that in the 12 hours following deployment, all individuals remained on average within 2.8 km of the location where they were tagged. Four of these individuals were also resighted during an aerial survey conducted by SARDI and DEWNR on 24 September 2014, 22 days after tags were deployed. The AMMC funded the cost of the helicopter for this survey. Additional individual resight data was collected by the Curtin University Great Australian Bight Right Whale Study

(GABRWS) which encompasses the long term cliff based photo identification and population census (Eubalaena Pty. Ltd. and South Australian Museum).

A final SARDI report on the telemetry project will be submitted shortly.

3. To develop a national capacity to perform telemetry studies on southern right whales, in order to establish an ongoing multi-year tagging and monitoring project.

The field work was conducted by 6 researchers from four organisations (SARDI, AMMC/BPM, Macquarie University and Flinders University), with all tagging undertaken by Dr Simon Childerhouse. The videos recorded during all approaches to whales, and during satellite tag deployment provide a useful training resource. Although the weather window to perform the field work was shorter than anticipated, this study showed that the Head of Bight is a suitable area to conduct such research. In particular, the ability to identify tagged individuals through aerial and cliff-top surveys (see report from GABRWS) provides a unique opportunity to assess short-mid and long term monitoring of those individuals. Two of the three individuals, whose tags transmitted the longest, migrated directly offshore in a southerly direction passing through, or close to, current offshore exploration permits. These data show the importance of a better understanding of the offshore movement patterns, distribution and habitat usage of this population, particularly with regards to assessing and mitigating any potential impacts from future offshore developments.

3. Appropriateness

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

This project was developed and implemented in accordance with AMMC procedures for tagging large whales and relevant permit conditions.

The project benefited greatly from a highly experienced tagger and boat driver. All approaches to whales were videoed and will be provided with the full SARDI report on this activity. Photo-IDs were successfully collected for 6 of the 9 individuals and will be submitted to the Australasian Right Whale Photo-ID Catalogue (ARWPIC) thereby allowing long-term monitoring of these individuals.

Low numbers of unaccompanied adult whales in the study area meant that 8 of 9 tag deployments were on adult females accompanied by calves. While this is the portion of the population of most interest with regards to managing and mitigating human impacts, it is possible the low tag transmission success rate was due to the strong thigmotactic behaviour of calves to their mothers that may have resulted in tag damage.

Weather conditions limited the time in the field available to conduct dedicated short term follows of tagged individuals. However, telemetry data, and visual resight data collected during a dedicated aerial survey (in part funded by AMMC) has provided information on the short term movement of individual whales within 12 hours and up to 22 days after tag deployment.

Satellite telemetry tracks were filtered using standard methodology, as the duty cycle used to prolong battery meant that classical methods of track analysis were not possible.

4. Effectiveness

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

1. To collect baseline satellite telemetry data on the offshore migratory routes of unaccompanied adult SRW from two breeding aggregations (Head of Bight and Fowler's Bay) in South Australia.

All nine functioning satellite tags provided to this project by the AMMC were successfully deployed on adult SRW between 6 September and 8 September at Head of Bight. It was initially planned that the activities would be undertaken over a ten day period, however due to inclement weather conditions; the fieldwork period was greatly reduced.

Originally five tags were to be deployed on unaccompanied adult whales and then another five on adult females with calves. However, numbers of unaccompanied adult whales were much lower than anticipated for that time of the season. Cliff-top counts undertaken by the Great Australian Bight Right Whale Study (GABRWS) on 6 September recorded a total of four unaccompanied adults. No tagging was attempted at Fowlers Bay as only one female-calf pair was present in that area at the time field work was undertaken.

Of the nine implantable tags deployed, eight were deployed on adult females accompanied by a calf and one was deployed on an adult whale without a calf – although another individual's calf was with the adult at the time that the tag was deployed. The 13 individuals that were biopsied only were all adult females with calves.

There was mixed performance in satellite transmissions from the nine tags deployed. No transmissions were received from three of the tags post deployment while the six other tags transmitted for between 2 hours and 2 months post deployment. The three tags which transmitted for the longest periods (14, 31 and 50 days) all had periods without any transmission being received, ranging between 10 and 48 days. The reasons for these gaps in transmission are unknown. At least one of the tags did not implant properly and had shed from the individual within ten days of being deployed.

Satellite transmissions from three tagged individuals (all females accompanied by calves) were of sufficient length to describe offshore migratory movement patterns.

Two individuals migrated in a southerly direction from the Head of Bight (HOB) which occurred between 1 and 5 October 2014. The coastal residency period of these adult females at the Head of Bight aggregation area post tag deployment were 24 and 28 days respectively. It was not possible to determine the date that the third individual left the HOB aggregation area, as no transmissions were received from the tag between 9 September and 6 October. When transmissions of this tag restarted, the individual was approximately 1,320 km west of the HOB aggregation area, just east of Albany, Western Australia. This individual displayed a wider range of directional travel, although overall the predominant direction of travel was west-south-westerly.

Filtered offshore migratory tracks were analysed to see if individual movements can be related to environmental characteristics and to investigate time spent in current petroleum exploration leases which may be developed in the future.

One of the three tagged individuals consistently moved in a southerly direction after departing from HOB until the tag ceased transmitting at approximately 35°S. The transmitted data was not of sufficient length to investigate any associations with environmental variables. A second individual also showed consistent southerly direction after leaving the HOB aggregations until approximately 41°S at which point directionality became more westerly. This latitude, and an investigation of average sea surface temperature at the time show that this change in directional movement appears to be associated with the sub-tropical front.

The third individual travelled westward within the area of latitude 35° - 37° S and its movement patterns were found to have strongest associations with sea level height and current data. Low sea level height and high currents occur at low pressure eddies which result in areas of localised upwelling. While the geographic location of these two individuals differed, both are associated areas of high productivity. It is possible that the changes in directional movement associated with oceanographic features indicative of higher productivity indicate foraging by these individuals.

There are currently a number of petroleum exploratory permit lease sites in the Great Australian Bight area. The total amount of time spent within permit areas was calculated for each of the three female-calf pairs. The two females who followed a southerly migration from the HOB aggregation spent 2.04 and 1.08 days respectively, transiting through current exploration permit lease areas. The third female-calf pair spent 1.69 days travelling through an exploration permit area in Western Australia. However, this female-calf pair could have potentially spent an additional 6.12 days in the lease area based on linear interpolation between the HOB aggregation and the position where that individuals tag resumed transmissions.

Information on movement patterns of individual right whales through areas of potential offshore development is important for both threatened species managers and industry in order to assess and mitigate potential impacts. Anthropogenic activities which have been shown to impact the behaviour of right whales, or lead to mortality include acoustic disturbance (from seismic surveys or increased vessel activity) and vessel collisions. As SRW numbers recover in Australasian waters the risk of vessel collisions will increase, particularly in areas where the intensive development of coastal or offshore activities lead to changes in vessel distribution and intensity of vessel traffic.

SRW are also at risk of entanglement in fishing gear and the risk for such interactions to occur is likely to increase as the south-western Australian population continues to recover.

A total of 19 biopsy samples were also collected during this study. These samples will be used in a global SRW research project to increase our understanding of the role of behaviour in shaping population structure and connectivity in this species. This work is led by Dr E. Carroll and Prof O. Gaggiotti of the University of St Andrews, Scotland and includes a global collaboration of right whale researchers. As part of this project, Dr Carroll and Prof Gaggiotti have generated high-resolution DNA profiles comprising 5-10 thousand genetic markers, termed single nucleotide polymorphisms, sequenced the mitochondrial control region and assayed stable isotopes for each sample. To date, such profiles have been created for 180 right whales from around the species' global distribution. The projected final dataset of 260 samples will be completed mid-2015 and will be used to investigate population structure and adaptation. In addition, standard genetic profiles, comprising genetically-identified sex and multi-locus microsatellite genotype (up to 17 loci) have been constructed for the HOB samples. This will be compared against DNA profiles from 800 New Zealand SRW and 80 Australian right whales to investigate regional movement and population structure.

2. To monitor the short, medium and long-term effects of satellite tagging on whales.

Originally it had been planned to assess the behavioural response of individuals prior to an approach by the small vessel, during tag deployment and post-deployment of the tag. However, the weather conditions and limited time period available to work from the small inflatable vessel meant it was not possible to collect these detailed behavioural observations. All approaches to whales were video recorded from the inflatable vessel either by a helmet mounted camera and/or a camera mounted on a pole attached to the centre console.

For safety reasons the total number of personnel on the inflatable vessel was restricted to three (tagger, biopsy sampler and driver). All tagging was undertaken by Dr Simon Childerhouse. As it was not possible to have a dedicated photo-ID person on the small vessel, individual whale IDs were collected instead from GoPro footage where possible. ID's have been obtained for six of the nine tagged individuals. Four of these individuals were resighted during an aerial survey conducted by SARDI and DEWNR on 24 September 2014. AMMC funded the cost of the helicopter for this survey.

In total 45 approaches to suitable whales were made, resulting in nine successful satellite tag deployments (with six concurrent biopsy samples) and a further 13 biopsy samples collected from non-tagged adult SRWs. A biopsy sample record has been provided to the Director Executive Coordination, Parks Australia as per permit reporting requirements (permit AU-COM2014-248). An approach was defined as the time the small inflatable vessel was first within 20 m distance from the whale(s) until the time the vessel left the whale(s). Approaches lasted 4.6 minutes on average (range 1 - 13 minutes). Specific details of approaches and tagging events will be provided in the SARDI report for this project.

Three tags failed to transmit after deployment; however, short to medium term responses to tagging could be investigated for the other six individuals. Telemetry data show that in the 12 hours following tag deployment, all individuals remained on average within 2.8 km of the location where they were tagged. Although most tags stopped transmitting within five days of deployment, four of the nine individuals were resighted with their calves during the dedicated aerial survey conducted by SARDI and DEWNR on 29 September 2014, at least 22 days after tag deployment, at distances between 0.42 – 3.35 km from the location where they were tagged. Additional resight data on these individuals collected from cliff-top surveys will be provided to AMMC shortly by the GABRWS in a separate report.

3. To develop a national capacity to perform telemetry studies on southern right whales, in order to establish an ongoing multi-year tagging and monitoring project.

The field work was conducted by six researchers from four organisations (SARDI, AMMC/BPM, Macquarie University and Flinders University), with all tagging undertaken by Dr Simon Childerhouse. The videos recorded during all approaches to whales, and during satellite tag deployment provide a useful training resource. Although the weather window to perform the field work was shorter than anticipated, this study showed that the Head of Bight is a suitable area to conduct such research. In particular, the ability to identify tagged individuals through aerial and cliff-top surveys provides a unique opportunity to assess short-term and long term monitoring of those individuals.

All three individuals, whose tags transmitted the longest, spent time transiting current petroleum exploration, permit leases. Data like these are essential in order to improve our understanding of the offshore movement patterns, distribution and habitat usage of this population, particularly with regards to assessing and mitigating any potential impacts from future offshore developments. A full SARDI peer reviewed report detailing all results and outcomes of this project will be provided to the AMMC shortly.

5. Financial Account of the Activity


An income and expenditure statement for the period April 2014 to March 2015 is attached. Note, remaining unspent money will be fully expended by the time the peer reviewed SARDI report is submitted to the AMMC.

Legal Commitments

A statement of how much the Organisation needs to meet current liabilities under legal commitments entered into for the purposes of the Activity and pursuant to the Funding Agreement.

I certify that:

- (a) all Funding received was spent for the purpose of the Activity and in accordance with the Funding Agreement and that the Organisation has complied with the Funding Agreement;
- (b) salaries and allowances paid to persons involved in the Activity are in accordance with any applicable award or agreement in force under any relevant law on industrial or workplace relations;
- (c) unless the Activity Period has expired or the Agreement has been terminated, the unspent portion of the Funds (if any) is available for use within the next Reporting period;
- (d) the financial information is presented in accordance with any other financial Reporting requirements the Department may notify to the Organisation;
- (e) where an Asset has been acquired with the Funds, paragraphs 7.5(d) and (g) (where applicable) have been complied with in respect to the Asset.

Signature of Responsible Person (as defined by subclause 9.6 of the Funding agreement)	
Name	Prof Gavin Begg
Position	Research Chief, SARDI Aquatic Sciences
Date	30-April - 2015

6. Income and expenditure statement

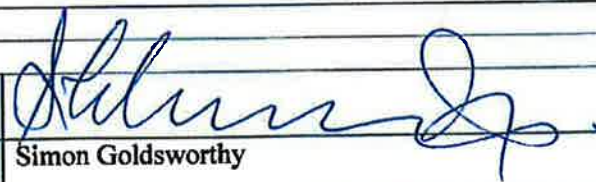
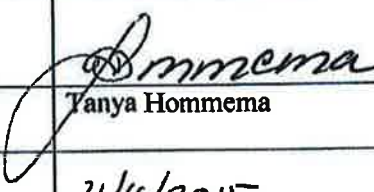
An income and expenditure statement for the Funds to date (and as compared with the Budget)

FUNDING AGREEMENT BUDGET			
Amount of Grant	Exclusive of GST	GST	Total Including GST
Commonwealth Government Contributions	105,878.50	10,587.85	116,466.35
Organisation Contributions	79,717.00	7,971.70	87,688.70
Other Contributions	53,256.57	5,325.66	58,582.23

EXPENDITURE TO DATE - Commonwealth Government Contributions

A. Item	B. Expenditure (\$ GST incl)	C. Committed (\$ GST incl)	D. Unspent (\$GST incl)
Labour Costs	43,135.00		107.10
Operating Costs	63,883.83		9,340.42
Total expenditure	107,018.84		9,447.51

Comments

Signature of Chief Investigator	
Name	Simon Goldsworthy
Date	30/4/15
Signature of Organisation Representative	
Name	Tanya Hommema
Date	21/4/2015

Please forward 3 hard copies, and one electronic Word document of this report to:

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