

Southern Right Whale Photo Identification and Population Census at Head of Bight, South Australia and;

Southern right whale abundance at Fowlers Bay and connectivity to adjacent calving ground at Head of Bight, South Australia



**Australian Marine Mammal Centre Grants Program
Final Funding Report**

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The southern right whale photo identification and population census at Head of Bight, SA and assessment of connectivity of southern right whales between Fowlers Bay and Head of Bight is supported through funding from the Australia Government's Australian Marine Mammal Centre, Australian Antarctic Division.

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1. Project Summary

A clear, plain English summary of approximately 500 words outlining the work undertaken and any significant findings (for publication on the Department's web site). Include what was done, why and the key findings resulting in recommendations summarised from the sections below.

The Southern Right Whale Photo Identification and Population Census Study has been completed annually at the Head of Bight, South Australia between 1991 and 2013. The Head of Bight (HOB) is a major aggregation ground for southern right whales, within the Great Australian Bight Marine Reserve. This Study provides information on recovery, demographics and biological parameters required for detection of threats or impacts to the population. The study also provides information for population modelling, which rely on long term unbroken data collection. Population monitoring is essential for species conservation and management and this study directly addresses objectives in the Commonwealth Government Conservation Management plan for the southern right whale (2011-2021).

This study contributes to understanding the recovery of the wider Australian right whale population. It has contributed to research examining the coastal habitat preference of right whales (Pirzl 2009) and the genetic structure of the population (Patenaude & Harcourt, 2006). Furthermore, it is an integral part of international efforts to undertake a more comprehensive comparison of southern hemisphere right whales (Anon 2002; Anon 2004b; Pirzl and Watson 2011).

The shore based fieldwork is completed annually in August during the period of peak coastal residence from cliff top vantage points, along a 15km stretch of the 40-60m high Bunda Cliffs. Daily census and photo ID data are collected each year and provide an unbroken data series on abundance trends and life histories of southern right whales at HOB. The HOB photo ID catalogue includes life history data for over 1250 individual whales, including calving females, unaccompanied adults and calves. Up to 174 individuals including 63 calves are sighted at the study site annually (max count 2011). Longitudinal abundance data shows triennial peaks in abundance representing cohort structured breeding cycles. Data shows that whilst the Australian population is recovering at approximately 7% per annum, the HOB compound annual growth rate is 5.5% (1991-2013).

Funding was provided by AMMC for completion of the twenty-second and twenty-third consecutive years of research at the HOB breeding aggregation (2012 and 2013), update of the long term photo ID catalogue (for contribution to AMMC repository) and reporting of internal trends derived from cumulative data (Charlton *et al.*, 2014a).

In addition, AMMC funding was provided for assessment of the abundance of southern right whales at Fowler Bay and connectivity to adjacent calving ground at HOB. Investigation involved cross-matching aerial photos from Fowlers Bay in recent years (contributed by John Bannister of the Western Australian Museum (WAM)) with the HOB photo ID

catalogue. This work directly leverages the collective value in the long-term WAM aerial surveys and the comprehensive dataset of known individuals at HOB to address conservation and management questions. Findings of this study are presented in Charlton *et al.*, 2014b.

Fowler Bay was one of the well-known 'open-boat' whaling sites and aerial surveys recorded very few sightings of southern right whales at Fowler Bay between 1993 and 2005. Whale numbers have increased at Fowler Bay since 2005 (including calving females). A maximum count of 55 individuals, including 39 unaccompanied adults and 16 female calf pairs was recorded in 2011.

The results from the photo ID cross matching exercise showed connectivity of individuals between Fowler Bay and HOB. Approximately 40% (22/57) of individuals photo identified at Fowler Bay were matched to the HOB catalogue. Furthermore, females are shown to alter selected calving habitat in years of high abundance at HOB. Of the resighted females in both aggregation areas, approximately 75% (16/22) were sighted with a calf at both locations. As the population continues to recover and resource pressures increase, there is a need to understand the degree of movement between coastal aggregations and the variables driving calving site selection.

The HOB southern right whale monitoring study has expanded in 2012 and 2013 to include research on population dynamics and site occupancy of southern right whales at Fowlers Bay. This study will continue in subsequent years with the aim to quantify the significance of the area for southern right whales by assessing population dynamics and coastal movements. The Fowlers Bay vessel based study also includes collection of acoustic data for characterisation of southern right whale vocalisations, with the aim to be used in future offshore acoustic monitoring.

2. The Outcomes and Objectives – Key Findings

List the Project Objectives and address each one, noting the degree to which the objective was achieved through the research and issues that may have hampered its success. Describe the key findings as they relate to the objectives and the management questions identified in the initial application.

AMMC funding was provided in 2012 and 2013 for completion of the following research objectives:

Objective 1: to improve understanding of abundance trends and population biology of southern right whales at the HOB through completion of 2012 and 2013 field monitoring, and; update and reporting of the long term photo identification dataset (Charlton *et al.*, 2014a).

Objective 2: to assess the abundance of southern right whales at Fowler Bay and connectivity to adjacent calving ground at HOB. Investigation involved cross-matching aerial photos from Fowlers Bay in recent years (provided by John Bannister, WAM), with the HOB photo ID catalogue (Charlton *et al.*, 2014b).

Full details and findings of research studies are presented in the following reports to AMMC (delivered as attachments to this funding report):

1. Charlton C.M., S.N. Guggenheimer, S.R. Burnell. 2014a. Long-term Southern Right Whale Population Monitoring at the Head of the Great Australian Bight, South Australia (1991-2013). *Final report to the Department of Environment, Australian Antarctic Division- Australian Marine Mammal Centre*

2. Charlton C., S. Guggenheimer., S. Burnell. S., J. Bannister. 2014b. Southern right whale abundance at Fowler Bay and connectivity to adjacent calving ground, Head of Bight, South Australia. *Final report to Commonwealth Government, Australian Antarctic Division, Australian Marine Mammal Centre*

Research activities undertaken include:

1. Completion of 2012 Southern Right Whale Population census and Photo ID Study at Head of Bight- between August 14th and September 1st, 2012;
2. Completion of 2013 Southern Right Whale Population census and Photo ID Study at Head of Bight- between August 15th and 30th, 2013;
3. Update and maintenance of the long term photo ID database for entry into national repository with AMMC - including cross matching against the entire catalogue and inclusion of photo identified individuals and population census data from 2008 to 2013;
4. Collation and reporting of the long term population trends and photo ID data of southern right whales at the Head of Bight (1991-2013);
5. Desktop study to cross-match aerial photos from Fowlers Bay in recent years (Bannister-Western Australian Museum (WAM)), with the HOB photo ID catalogue, including preparation of publication on southern right whale abundance at Fowler Bay and connectivity to HOB.

Funding outputs and status of completion are outlined in table below.

Output	Status	Details
Completion of 2012 and 2013 southern right whale photo ID and population census Study at HOB	Complete	Two field studies were undertaken over two weeks between mid to late August. Within season photo ID analysis was completed in the field. Outcomes are presented in Charlton <i>et al.</i> , 2014a Associated tasks include field planning and preparation, sourcing permits, organising volunteers, logistics and management.
Maintenance and update of the long term HOB photo ID catalogue, for delivery of dataset to AMMC repository	Complete	Cross matching of over 400 photo identified individuals (2008-2013) with the HOB catalogue (1991-2013) was completed. All matches and new individuals were validated by a second person prior to being uploaded to catalogue. Population census data, mortality and other sightings data from 2008 to 2013 was also inserted to catalogue. This exercise took over 8 weeks FTE for two people.
Cross matching photo identified individuals from Fowler Bay (2007-2013) provided by John Bannister from WAM, with the HOB catalogue (1991-2013)	Complete	This involved numerous meetings with John Bannister, preparation of data by John, sorting of data, cross matching of Fowler Bay photographs with HOB catalogue update of HOB catalogue with re-sight data. This exercise took approximately three weeks FTE, divided between three people.

Final report to AMMC	Complete	<p>Reporting on 'Southern Right Whale Photo ID and Population Census at Head of Bight, SA and; assessment of Fowler Bay as a calving ground and connectivity between Fowler Bay and HOB.'</p> <p>This report includes: project summary, status of funding outputs and objectives, management implications, benefits, problems and budget.</p>
Collation of long term southern right whale photo ID and population trends data from Head of Bight, SA	Complete	<p>See Charlton <i>et al.</i>, 2014a.</p> <p>Reports on AMMC funding grant 21/12: the 2012 and 2013 field seasons; provides update on the status of the photo ID catalogue, and; population trends derived from cumulative data, such as recovery, distribution and abundance at HOB, SA. Time was a limiting factor for analysis of life history data for inclusion in funding deliverable.</p>
Paper assessing the abundance of southern right whales at Fowler Bay and connectivity with the adjacent calving ground at HOB.	Complete	<p>See Charlton <i>et al.</i>, 2014b.</p> <p>Paper submitted to AMMC including results and interpretation of photo ID cross matching exercise to assess abundance of southern right whales at Fowler Bay and connectivity to HOB.</p> <p>Deliverable involved significant pro-bono time contributed by authors, including 2+ days of John Bannister's time plus Curtin University reviewer's time.</p>

Describe the key findings as they relate to the objectives and the management questions identified in the initial application.

Key Findings

For full description of study outcomes, please refer to attached reports (Charlton *et al.*, 2014a and 2014b).

Broadly, key findings include:

- The compound annual growth rate for southern right whales at Head of Bight between 1992 and 2013 is 5.44% and the highest abundance recorded at the aggregation area was 172 total individuals and 67 female and calf pairs, in 2011.
- The HOB catalogue is up to date (1991-2013) and includes over 1250 individuals, providing information population trends and life histories including: calving intervals, migration intervals, age of sexual maturity and site fidelity.
- Fowler Bay was one of the well-known 'open-boat' whaling sites and aerial surveys recorded very few sightings of southern right whales at Fowler Bay between 1993

and 2005. Whale numbers have increased at Fowler Bay since 2005 (including calving females). A maximum count of 55 total individuals, including 39 unaccompanied adults and 16 female calf pairs was recorded in 2011.

- The Results from photo ID cross matching exercise shows connectivity of individuals between Fowler Bay and HOB. Approximately 40% of individuals photo identified at Fowler Bay were matched to the HOB catalogue. Furthermore, females are shown to alter selected calving habitat in years of high abundance at HOB. Of the resighted females in both aggregation areas, approximately 75% were sighted with a calf at both locations.

3. Implications for Management

What are the key recommendations for management based on the findings.

The following interim recovery objectives in the Conservation Management Plan for the Southern Right Whale (2011-2021) are addressed by this study:

- Demonstration that the number of southern right whales occurring off south-west Australia (nominally south-west Australian population) is increasing at or near the maximum biological rate.
- Current levels of legal and management protection for southern right whales are maintained or improved and an appropriate adaptive management regime is in place.

Key Recommendations:

1. Continue fine scale population monitoring at key aggregation grounds that are comparable to long term dataset, for contribution to population demographics and modelling studies which address conservation objectives.
2. Analysis and publication of the long term HOB photo ID and population trends dataset to assess population demographics: life history parameters, site fidelity, site occupancy and recovery. Data should be merged with the WAM long term photo ID catalogue for completion of population modelling to inform conservation management.
3. Quantify significance of calving grounds outside of marine protected areas to establish management framework for conservation of the species.

4. Other Benefits

How has this project advanced the field of research? (e.g. scientific discoveries, new methodologies)

The Southern Right Whale Population Census and Photo ID monitoring study has been ongoing at HOB since 1991. 2013 was the twenty-third consecutive year of the monitoring study. The study leverages from existing data, established collaborations and cost effective research. Through annual reports to the Commonwealth Government and publications it has provided data on aggregation use trends, reproductive rates, age at sexual maturity, age at independence, site fidelity, visitation rates, residency periods, coastal and long range movements, calf mortality, genetics, predation, interactions with conspecifics and other species and health of recovering population. The study monitors key biological parameters which are essential for monitoring recovery of the species.

Population biology information useful for stock assessment models has been derived from the

study. It has served as the basis for research in identified priority areas and contributed substantially to management and conservation efforts, including: the design and ongoing management of the Great Australian Bight Marine Park (now reserve) (Anon, 1998a; Anon, 1998b; Anon, 2005b Charlton & Burnell 2011), preparation of Australian Government's southern right whale recovery plans (Anon, 2005a, DEWPaC 2012), and numerous impact assessments and management planning initiatives.

The project contributes to the understanding recovery of the wider Australian right whale population. It has contributed to research examining the coastal habitat preference of right whales (Pirzl 2009) and the genetic structure of the population (Patenaude & Harcourt, 2006). Furthermore, it is an integral part of international efforts to undertake a more comprehensive comparison of southern hemisphere right whales (Anon 2002; Anon 2004b, Pirzl and Watson 2011).

In collaboration with Fowlers Bay Eco Tours and Curtin University, the GAB right whale study expanded in 2012 and 2013 to include research into the population dynamics and site occupancy of southern right whales in Fowlers Bay. Fowlers Bay is an expanding aggregation ground outside of the GAB marine reserve. This study will continue in subsequent years to quantify the significance of the area for southern right whales by providing valuable data on population dynamics and coastal movements. The vessel based Fowlers Bay study also includes collection of acoustic data for characterisation of southern right whale vocalisations, with the aim to be used in future offshore acoustic monitoring of migration pathways.

Data availability

Data from the long term Head of Bight Southern Right Whale Photo ID and Population Census Study is publically available on request from the Australian Antarctic Division, Australian Marine Mammal Centre (AMMC). Photographic data from this long term project will be contributed to the Australian Right Whale Photo Identification Catalogue curated by the AMMC. The catalogue and long term dataset continues to be analysed by the authors and research collaborations are welcomed.

5. Problems Encountered (if any)

Describe any major problems encountered during the Activity and how they were addressed.

Delay in notification of award of funding meant that field costs were covered out of researcher's pocket for 2012.

John Bannister's WAM photo ID catalogue is undergoing maintenance and photo ID images from 2011-2013 were not crossed matched against the WAM catalogue. Therefore, life histories from the WAM catalogue were not available for these sightings. The analysis was completed without life history data for these individuals and study objectives were not affected.

6. Communication

How will results be communicated to management

Results will be communicated to management through reports, publications, conference presentations and meetings. Outcomes from this study are directly delivered to management via the following outlets:

- AMMC reports
- Scientific Papers

- IWC annual cetacean sightings reports
- SA Government Scientific Research Permit reports
- Contribution of metadata to South Australia State Government biological database,
- Contribution of sightings data to: South Australian Museum, IWC and Department of Environment.

Researchers welcome collaborations with management and other researchers.

Stakeholder engagement feedback (plain English for feedback to stakeholders)

See project summary above.

Students supported (if any)

Claire Charlton begun her PhD with Curtin University in February 2014

PhD Theses and dissertations (if any)

Burnell, S.R. (1999) The population biology of southern right whales in southern Australian waters PhD thesis University of Sydney, Sydney

Pirzl, R. (2008) Spatial ecology of *Eubalaena australis*: habitat selection at multiple scales Ph.D. thesis, School of Life and Environmental Sciences, Deakin University, Melbourne

Claire Charlton (PhD Candidate) Southern right whale population demographics, movements and recovery in southern Australia- Centre for Marine Science and Technology, Curtin University, Western Australia

Publications (other than theses and dissertations)

Burnell, S. R. (2008) Estimates of demographic parameters of southern right whales off Australia Report to the International Whaling Commission SC/60/BRG12

Burnell, S.R., Pirzl, R. & Lawton, K. (2007) Life history and population biology of southern right whales, Head of Bight, South Australia, 2007 Final Report to Commonwealth Department of Environment and Heritage, Canberra

Burnell, S.R. (2001) Aspects of the reproductive biology, movements and site fidelity of right whales off Australia Journal of Cetacean Research and Management (Special Issue) 2: 89–102

Burnell, S.R. & Bryden, M.M. (1997) Coastal residence periods and reproductive timing in southern right whales, *Eubalaena australis* Journal of Zoology 241: 613–621

Burnell S.R., C.M. Charlton. 2011. Southern right whales - 2009 Population Census and Photo Identification at Head of Bight, South Australia. Report to Australian Marine Mammal Centre

Charlton C.M., S.R. Burnell, 2014. Southern right whales- 2012-2013 Population census and Photo Identification at the Head of Bight, South Australia. Final Report to Australian Marine Mammal Centre (in preparation).

Charlton C.M., S.R. Burnell, J. Bannister., 2014. Southern right whale connectivity between major calving ground at Head of Bight and emerging calving ground at Fowlers Bay, South Australia using long term photo identification for assessment of the significance of the emerging calving ground (in preparation).

Charlton C.M., S.R. Burnell, 2011. Southern right whales- 2010 Population census and Photo Identification at the Head of Bight, South Australia. Final Report to Great Australian Bight

Marine Park

Pirzl, R., Patenaude, N.J., Burnell, S.R. & Bannister, J.L. (2009) Movement of southern right whales (*Eubalaena australis*) between Australian and subantarctic New Zealand populations *Marine Mammal Science* 25: 455–461

Pirzl, R., Thiele, D., Bannister, J.L. & Burnell, S.R. (2008) ENSO and SAM affect reproductive output in southern right whales Report to the Department of Environment, Water, Heritage and the Arts, Canberra

Pirzl, R., Lawton, K. and Murdoch, G. (2007) Development of a data management system for southern right whale monitoring at Head of Bight, South Australia Final Report to South Australian Department for Environment and Heritage, Adelaide (unpublished)

Pirzl, R. & Burnell, S.R. (2006) Population biology of southern right whales (*Eubalaena australis*) at Head of Bight, South Australia, 2005 Final Report to the Australian Government Department of Environment and Heritage, Canberra

Pirzl, R. & Burnell, S.R. (2005) Population biology of southern right whales (*Eubalaena australis*) at Head of Bight, South Australia in 2004 Final Report 18 to the Australian Government Department of Environment and Heritage, Canberra

Planned publications

Charlton C.M., S.N. Guggenheimer, S.R. Burnell. 2014a. Long-term Southern Right Whale Population Monitoring at the Head of the Great Australian Bight, South Australia (1991-2013). *Final report to the Department of Environment, Australian Antarctic Division- Australian Marine Mammal Centre*

Charlton C., S. Guggenheimer., S. Burnell. S., J. Bannister. 2014b. Southern right whale abundance at Fowler Bay and connectivity to adjacent calving ground, Head of Bight, South Australia. *Final report to Commonwealth Government, Australian Antarctic Division, Australian Marine Mammal Centre*

Charlton *et al.*, 2014. Update on recovery, distribution and abundance of southern right whales at Head of Bight (HOB) 1991-2013 (*in prep*)

Charlton *et al.*, Update of life history parameters using photo ID 1991-2013 at HOB

Charlton *et al.*, Assessment of site fidelity within season and across season for breeding females and unaccompanied adults at Head of Bight, using photo identification

Charlton *et al.*, Assessment of plausible rates of recovery using biological parameters from photo ID i.e. Zerbini *et al.*, 2010

Charlton *et al.*, Re-assessment of population estimates, using updated life history parameters and abundance data (collaboration with Bannister)

Charlton *et al.*, Visual health assessment using health index developed for southern right whales in the North Atlantic (Pettis *et al.*, 2004) to develop baseline understanding of health of Australian southern right whales, compared to global populations of right whales.

Presentations – last 5 years only

Charlton 2011- AMSA SA 2011 Symposium- The Great Australian Bight: Ecosystem & Resource Management . Presentation on Southern right whale population census and photo Identification at Head of Bight, South Australia.

Charlton 2013- 20th Biennial Conference on Marine Mammals, Otago University, Dunedin, New Zealand, 9-13 December 2013, Right whale conservation workshop. Presenting southern right whale studies at Head of Bight and South Australia.

Burnell 2008- IWC Meeting. Southern right whale population biology at Head of Bight, South Australia (presented by Bannister).

7. Project Outputs

A list of the actual outputs of the research including milestones, progress reports and data products such as models etc.	Proposed date of completion	Actual date of completion	Complete
Undertake 2012 photo-identification and population census at HOB (CC)	09/12	09/12	✓
Undertake 2013 photo-identification and population census at HOB (CC)	09/13	09/13	✓
Catalogue matching and database maintenance 2012 (CC/SB)	12/12	02/14	✓
Catalogue matching and database maintenance 2013 (CC/SB)	12/13	03/14	✓
Cross matching Fowlers Bay photographs with HOB catalogue (CC)	04/14	04/14	✓
Reporting (CC/SB/JB)	05/14	05/14	✓

8. Financial Account of the Activity

Include reasons for any variation to the budget, underspends and difficulties

There are no variations or underspends to the budget. It is noted however, that proposed research activities and deliverables were ambitious and exhaustive and the completion of funding outcomes was achieved with additional financial and time contributions from researchers. This project was undertaken with contribution of over 2000 volunteer and pro bono hours and in-kind support from numerous organisations and collaborators.

The GAB Right Whale Study operates with support and collaboration from many institutes and researchers including: South Australian Museum (Steve Burnell and Catherine Kemper), Western Australian Museum (John Bannister), Curtin University (Rob McCauley and Chandra Salgado Kent) and NOAA/ University of Santa Cruz (Robert Brownell). Over the years, the Study has received funding from State and Commonwealth Government including the Australian Antarctic Division- Australian Marine Mammal Centre and the Great Australian Bight Marine Park (now Reserve), and from industry (Woodside and BHP in the 1990s). The study operates with in-kind support from the Great Australian Bight Marine Park, South Australian Department of Water and Natural Resources, Alinytjara Wilurara Natural Resource Management Board, Aboriginal Lands Trust, Environmental Resources Management and Fowlers Bay Eco Tours. The Study is completed on Yalata Aboriginal lands with permission from Yalata Land Management and Aboriginal Lands Trust and with support from the community. The HOB and Fowler Bay studies were completed under South Australian Scientific Research Permit number M26085-2.