

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

- **Project No.** – 12-01
- **Title** - Maintaining the monitoring of pup production at key Australian sea lions at colonies in South Australia
- **Chief Investigator** – A/Prof Simon Goldsworthy
- **Organisation** – SARDI Aquatic Sciences

Activity Period – March 2013 – August 2014

Table of contents

1. Activity Summary
2. The Outcomes/Objectives
3. Appropriateness
4. Effectiveness
5. Financial Account of the Activity

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)

This project maintained pup production monitoring of a number of key Australian sea lion (ASL) breeding colonies within South Australia between March 2013 and August 2014. This included direct counts and mark-recapture surveys at Seal Bay and the Seal Slide on Kangaroo Island, Lilliput and Blefuscu Islands in the Nuyts Archipelago, Olive and Nicolas Baudin Islands off the west Eyre Peninsula, and Dangerous Reef in the Spencer Gulf. The breeding status and pup production were also determined for Nuyts Reef and a number of islands off the western and lower Eyre Peninsula including Jones, Ward, Pearson, West Waldegrave, Dorothee and Lewis Islands.

Pup production for the 2013 breeding season at Seal Bay was estimated to be 268 (range 259-277), based principally on twice-weekly surveys of new pup births and deaths, and on Petersen estimates in most of the colony, as well as direct counts of pups in Pup Cove. This estimate is similar to those from the previous four breeding seasons (2010: 267-276; 2008-09: 268-275; 2007: 254-256; 2011-12 249-256).

Pup production at the Seal Slide was estimated to be 10 for the 2013 breeding season using cumulative mark and count procedures. Estimates of pup abundance with a high level of confidence at the Seal Slide are now available for the last eight breeding seasons (since 2002-03), and range between 9 and 15 over this period. No trends are apparent at this stage.

Pup production estimates at Lilliput and Blefuscu Islands in 2013, based on the Petersen and cumulative pup production method, were 78 (95% CL, 73-83) and 81 (95% CL, 74-88) from two mark-recapture sessions, respectively. These are the sixth pup abundance surveys undertaken at these colonies, the fourth using the Petersen method and the first using the Petersen and cumulative pup production method.

Estimated pup production at Olive Island based on the Petersen method with cumulative pup

production was 131 (95% CL 120-140). Estimates of pup production are available for six consecutive breeding seasons at Olive Island using combined Petersen and Cormack Jolly Seber methods or Petersen and cumulative pup production estimates. These data show a pattern of alternate high and low pup production for the 2006 (206 pups), 2007 (161), 2008/9 (221), and 2010 (173) seasons, with a further decline for the 2011/12 (129). Estimates of pup production were similar in the 2013 breeding season (137).

A single ground survey was undertaken on Jones Island on 17 June 2013 when a total of 15 pups were sighted. Two mark-recapture sessions were undertaken at Nicolas Baudin Island in June and August 2013, with a Petersen estimate of live pups after the first session of 57 (95% CL 54-60).

Estimates of pup-production for the 2014 breeding season at Dangerous Reef are ongoing as breeding at this colony started later than expected. Two mark-recapture sessions were undertaken at Dangerous Reef in June and July 2014. Estimated pup-production from these two sessions was 397 (95% CL 389 – 406). A single ground count was undertaken at English Island on 4 July 2014, and a total of 64 pups were counted, including one brown pup that had previously been marked on Dangerous Reef during the first mark-recapture trip. Given this and the large number of pup seen relative to other season suggest that many were in fact from Dangerous Reef.

Ground surveys were also undertaken at a number of islands in the Great Australian Bight and off western and southern Eyre Peninsula. In March 2013 a ground survey at Lewis Island counted 79 pups. In August 2013, ground counts were undertaken at Ward Island (46 pups), Pearson island (27 pups) and West Waldegrave Island (91 pups). A ground survey was also conducted at Dorothee Island but there was no evidence of breeding. In December 2013 a ground survey of Nuyts Reef counted a total of 54 pups on the two main reefs. This represented the third ground count undertaken at this colony.

2. The Outcomes/Objectives

List of the Project Objectives

1. Undertaking pup production surveys at key monitoring sites for the 2013 and 2013/14 period. This will include Olive and Jones Island, Lilliput and Blefuscu Islands; Seal Bay and Sea Slide, and Dangerous Reef and English Islands, and the first quantitative survey at Nicolas Baudin Island.
2. Undertaking single surveys at sites where pup numbers have not been surveyed comprehensively for some years, and where breeding status remains uncertain (Nuyts Reef, Ward, Pearson and Dorothee Islands, and Curta Rocks).
3. Analysing existing mark-recapture data using mutli-event capture-recapture models to assess the influence of individual detection heterogeneity (IDH) in biasing estimates of pups production and trend analyses.
4. Continuing trial of remote camera systems to monitor breeding chronology to improve survey optimisation and resourcing.

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

Pup production surveys were completed at all key monitoring sites with the exception of Dangerous Reef as the breeding season started later than expected (March 2014) and is currently ongoing.

Single survey sites were successfully conducted at additional sites.

Existing mark-recapture data has been analysed using multi-event capture-recapture models and is reported below.

The continuing trial of remote cameras has been hampered by ongoing difficulty in identifying a surveillance camera that can transmit images through the Next G phone network.

3. Appropriateness

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

A range of survey methods were used to achieve pup production estimates. These varied relative to the size of populations and the number of repeat surveys undertaken. A full report of the methods and results of surveys will be provided to the AMMC shortly. This will be a fully peer reviewed SARDI report as has been provided to the AMMC in previous years.

The report will also contain full methodology and results of the analysis of existing mark-recapture data and full details of the remote camera trial.

4. Effectiveness

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

The project has met all its stated objectives (with the exception of completing surveys at Dangerous Reef). This study has provided additional estimates of pup abundance and production for a number of key Australian sea lion monitoring sites in South Australia between March 2013 and March 2014.

It also provides single survey pup counts for a number of sites which have not been surveyed comprehensively in some years.

Analyses have been undertaken to examine if inter-year individual detection heterogeneity (IDH) may contribute to biasing estimates of pups production and trend analyses from larger ASL colonies, such as Dangerous Reef. Dangerous Reef results indicated marked inter-season variation in the performance of the cumulative pup production and mark-recapture methods; alternating between seasons where the results appears consistent with the assumptions of mark-recapture (2006 and 2010) between season where they may violate these assumptions (2008 and 2011). Data from these four seasons were analyses using for the capture-mark-recapture (CMR) program MARK to estimate survival and capture probabilities using the Cormack-Jolly-Seber (CJS) model. Results indicate no difference in resight probability (essentially equal to 1) across all season; however, survival (across the period of surveys) varied marked years, with no apparent relationship between survival in the conforming (2006 = 0.77, 2010 = 0.22) and non-conforming seasons (2008 = 0.35, 2011 = 0.48).

The remote field camera trials have not been able to progress as the cameras trialled during this project were not able to connect to the Next G network, although we had been assured by the supplier that they could.

A full SARDI peer reviewed report detailing on the results and outcomes of this project is currently in review, and will be provided to the AMMC shortly.

5. Financial Account of the Activity

Detailed in Statement of Income and Expenditure below