

# Marine Environment & Ecology

## Population demography of the *threatened* Australian sea lion: understanding the causes of decline in the Seal Bay population



Photo: R McIntosh

Report to the South Australian Nature Foundation

Simon D Goldsworthy, Rebecca R McIntosh,  
Peter D Shaughnessy, Brad Page and Bill Haddrill

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## 1 EXECUTIVE SUMMARY

Seals are the premier international tourism attraction on South Australia's coastline and they underpin a regional multimillion dollar tourism industry. Its centrepiece is the Australian sea lion population at Seal Bay Conservation Park on Kangaroo Island.

The population at Seal Bay has been in decline for at least 20 years. This decline is continuing. To better understand this decline, an improved monitoring program was implemented in 2002 with more pups marked each season and greater effort placed on obtaining vital demographic rates.

This report provides a summary of the project "Population demography of the *threatened* Australian sea lion: understanding the causes of decline in the Seal Bay population". The aims of the project were to maintain the demography research program of the Australian sea lion population at Seal Bay, Kangaroo Island, which involves the microchipping of pups and resighting of marked animals.

In the 2008/09 breeding season, 161 pups were micro-chipped (60 % of pup births), comprising 88 males and 73 females. Re-sights using hand-held and flat-bed aerials totalled 2417, including 694 individuals from five cohorts marked as pups. Twelve mother-pup pairs were identified. These data are being used to develop population demographic models for the species to assist in assessing the impacts on subpopulations from bycatch interactions with fisheries, and to better understand the decline at Seal Bay. Maintenance of this program into the future is essential to monitor population vital rates, such as age-specific and cohort survival and recruitment. These will be important in the ongoing management of the Seal Bay population as such measures provide an assessment of longer-term demographic vulnerability and a means to forecast population trajectories.

## 2 INTRODUCTION

The population of Australian sea lions, *Neophoca cinerea*, at Seal Bay is an iconic tourism attraction for Kangaroo Island and South Australia (SA), and underpins a regional economy. The species was listed as a threatened species under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* in February 2005. In South Australia, it was listed in February 2008 as vulnerable under the *National Parks and Wildlife Act 1972*. In October 2008 the International Union for the Conservation of Nature (IUCN) upgraded its listing of Australian sea lions to endangered.

A recent report on the status of the Seal Bay Australian sea lion population indicates that the population decline detected by Shaughnessy et al. (2006) over a 17 year period (1985-2002/03) has continued, with the population currently estimated to be declining by between 3.3-4.5% per breeding season (Goldsworthy & Page 2007, McIntosh 2007). This rate of decline would see the population more than halve within 24-32 years or over 16-21 breeding seasons (Goldsworthy et al. 2008).

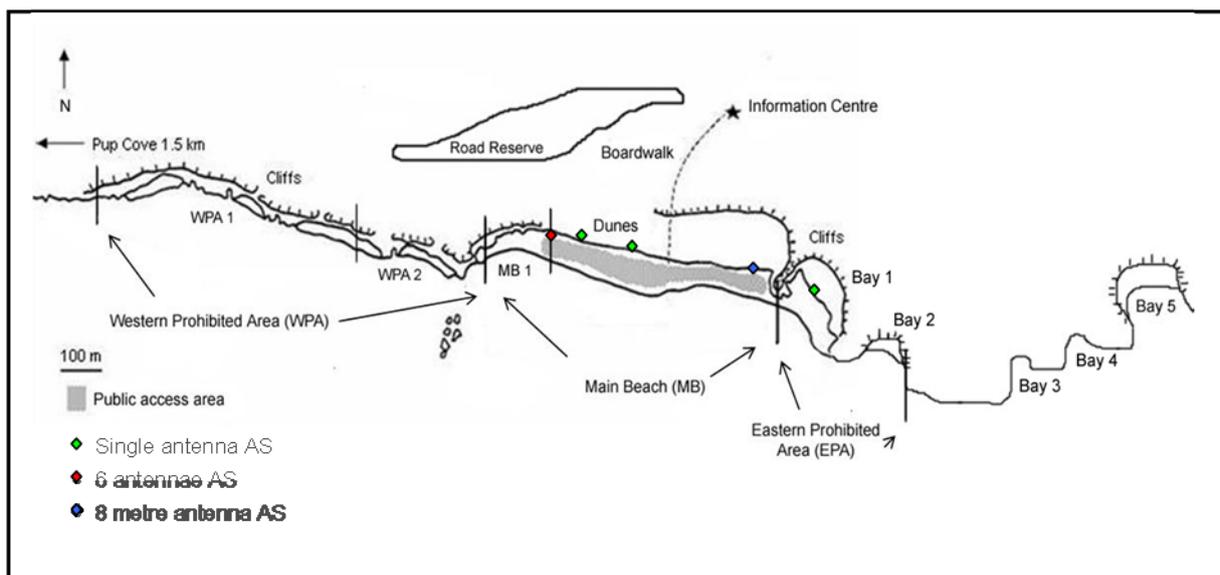
Uncertainty surrounds the causes of the population decline detected at Seal Bay due to limited, reliable long-term demographic data for the population. Changes in population vital rates, such as age-specific and cohort survival and recruitment are likely to provide the best measures of long-term demographic vulnerability of populations, and provide a means to forecast population trajectories.

The aims of this study were to maintain the micro-chipping and demography program for the Australian sea lion population at Seal Bay, Kangaroo Island by:

- Radio frequency identification (RFID) tagging (micro-chipping) all live pups in the 2008/09 cohort,
- continuing the active re-sighting program using a hand-held RFID aerial, especially for females and mother-pup pairs during each breeding season in order to monitor fecundity and maternity, and
- maintaining passive re-sighting of tagged animals using a network of flat-bed aerials and data-loggers.

### 3 METHODS AND RESULTS

Seal Bay is part of the Seal Bay Conservation Park situated on the south coast of Kangaroo Island, centred on 35.996° S, 137.327° E. The Australian sea lion colony comprises four main areas (Figure 1) that are referred to as Pup Cove (2 km west of the visitor centre), the Western Prohibited Area (WPA), Main Beach, including the sand dunes and swales inland from Main Beach and the scrub behind the swales (referred to as the Road Reserve), and the Eastern Prohibited Area (EPA). Limestone promontories separate the WPA and EPA from Main Beach. The WPA and EPA are closed to tourism; they were declared in 1972 under the *National Parks and Wildlife Act, 1972* (SA Government Gazette, December 7, 1972, pp. 2543-2544) for the “purposes of conserving the native animals on that portion of the Seal Bay Conservation Park described”. Micro-chip hand-held scanning and pup micro-chipping were conducted throughout the entire colony, with the exception of Pup Cove, where sheer limestone cliffs prevented access.



**Figure 1.** Map of Seal Bay breeding colony, Kangaroo Island, extended to Bay 5, east of the Eastern Prohibited Area. The main areas of the site are the Western Prohibited Area, Main Beach and Eastern Prohibited Area. Positions of the automated scanners (AS) and the antenna type are noted by the coloured diamonds.



**Figure 2.** Photo of researcher using a hand-held scanner to read the microchip of an Australian sea lion pup.

Pups older than two-months of age and un-attended by an adult female were captured by hand, weighed (kg) in a canvas bag using a spring balance to the nearest 0.1 kg; sexed and measured (standard length - nose to tail to the nearest 0.5 cm). Each pup was marked externally by clipping fur on the rump and by implanting a Passive Integrated Transponder tag (PIT tag: TIRIS™ RFID 23mm) subcutaneously with a sterile single-use needle. PIT tags (referred to as micro-chips) were inserted in the clipped area, parallel to the spine and close to the tail to minimise gravitation.

Throughout the breeding season (October 2008 until June 2009), hand-held scanning of animals was undertaken regularly throughout the colony (Figure 2). In June, July and December 2009, and after the breeding season, scanning surveys were conducted at least 4 days a week to increase the re-sight effort. To successfully identify seals with a micro-chip, the RFID reader was held up to 10 cm from the insertion site. Mother-pup pairs were also targeted through the breeding season to assess the tagged status of pups and the identity (if micro-chipped) of their mothers.

In addition to hand-held scanning, four automated recording stations comprising RFID flat-bed aerials were located throughout the colony along major sea lion paths between the beach and dune areas (Figure 3). Each had its own data-logger and was powered by a solar

panel. Regular maintenance (clearing of sand, check of cables), and monthly downloading of the scanners was performed.



Photo by R. McIntosh

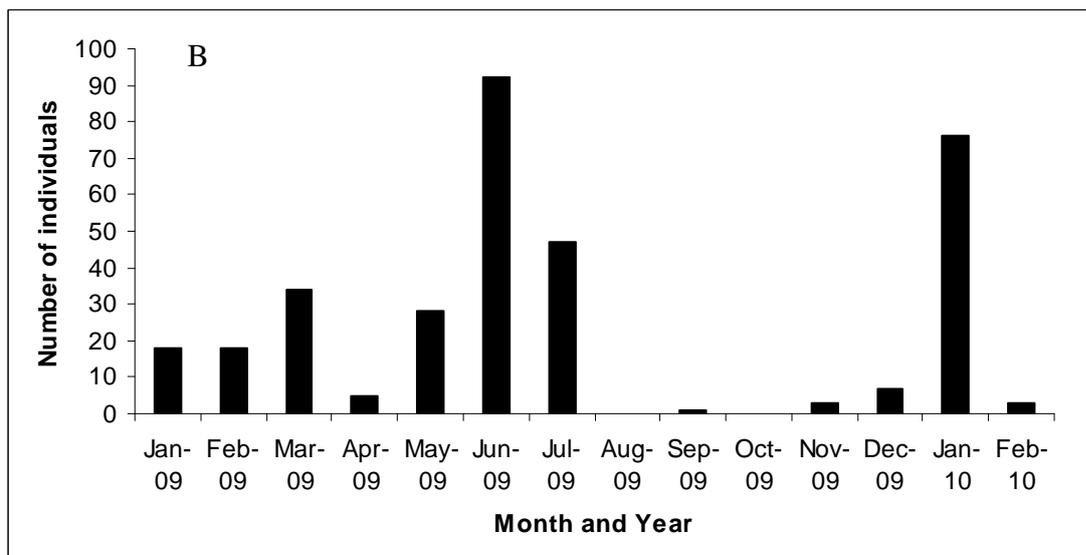
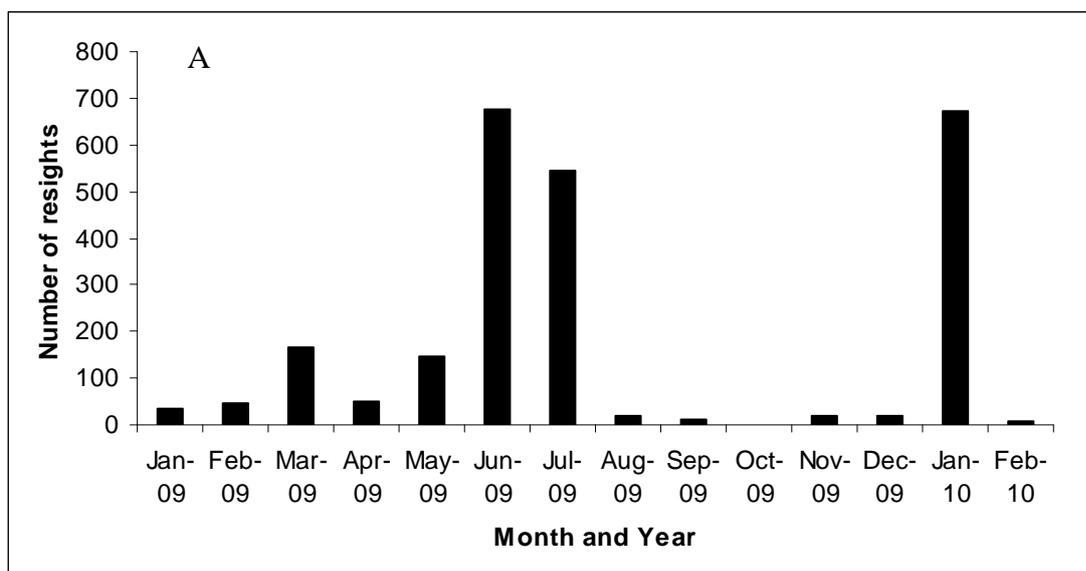
**Figure 3.** Photo of solar panel and flat-bed antenna situated on a sea lion pathway in the dunes at Seal Bay. The data logger is hidden beneath the solar panel.

In the 2008/09 breeding season, 268 pups are estimated to have been born at Seal Bay. Approximately 33% of these pups died during or shortly after the breeding season. Of the estimated 180 pups available for marking with micro-chips, 161 (88 male and 73 female), or 89% were micro-chipped, representing about 60% of all pup births for the 2008/09 season.

Re-sights using hand-held and flat-bed aerials totalled 2417, including 694 individuals from five cohorts that were marked as pups (Table 1). Hand-held scanning produced more re-sights than passive flat-bed antenna, but the antennas detected a higher percentage of individuals in their re-sights (62% compared with 22%), or fewer multiple sightings of the same individual (Table 1). There were more re-sightings and more individuals re-sighted in June and July 2009, and in January 2010 (Figure 4), which coincided with increased effort. Twelve mother-pup pairs were identified this breeding season.

**Table 1.** Resight records and the methods of resighting Australian sea lions. Data includes individuals marked with microchips as pups from five cohorts (between 2002/03 and 2008/09).

| Method of data capture (resight) | Total number of re-sights | Number of individuals resighted | % Individuals resighted from total number of re-sights |
|----------------------------------|---------------------------|---------------------------------|--|
| Date of chipping                 | 161                       | 161                             | 100  |
| Hand-held scanning               | 2151                      | 467                             | 21.7   |
| Flat-bed antennas                | 103                       | 64                              | 62.1   |
| Date of death                    | 2                         | 2                               | 100  |
| <b>Total</b>                     | <b>2417</b>               | <b>694</b>                      |  |



**Figure 4.** Number of re-sights of Australian sea lions each month in 2009 (A) and the number of individuals re-sighted each month in 2009 (B) from all methods of data capture (re-sights).

## **4 CONCLUSIONS AND RECOMMENDATIONS**

The marking and monitoring of pups at Seal Bay in the 2008/09 breeding season was very successful. In order to meet the long-term management needs of Seal Bay and ensure that the sea lion population remains viable and economically sustainable as a tourism destination into the future, the population monitoring and research program should be continued to monitor changes in the status, health and trends of the population. Such a program provides critical performance measures to assess whether or not the population is being appropriately managed, and to assess the success of management measures to reduce the impacts of fishery bycatch on the population (Goldsworthy et al. 2010).

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