

# Baywide Little Penguin Monitoring Program



Quarterly Report 4 (Jan-Mar 2009)

April 2009

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Prepared by the Victorian Government Department of Sustainability and Environment  
Melbourne, April 2009.

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## Introduction

The Channel Deepening Project Baywide Monitoring Program (CDBMP) for Little Penguins examines the body weight of Little Penguins (*Eudyptula minor*) at the Phillip Island Nature Park (PINP) colony. These penguins are known to make foraging trips of up to several weeks duration, sometimes travelling hundreds of kilometres from the colony. Approximately 40-70% of the birds from the colony enter Port Phillip Bay (PPB) to forage during the winter months.

The objective of this program is to detect changes in Little Penguin body mass (an indicator of health) outside expected variability. The key variable being measured is the body weight of Little Penguins. Weight is an indicator of body condition, and is closely related to the bird's food supply and foraging behaviour. Where changes occur outside expected variability, further investigation will be undertaken (PoMC 2008).

This report provides an analysis and ecological interpretation of data collected on the body weight of Little Penguins for the CDBMP as described in the Detailed Design (PoMC 2008), for the period January – March 2009.

## Methods

Data for this program are collected using an Automated Penguin Monitoring System (APMS, Australian Antarctic Division) located in the Summerland Beach penguin colony, PINP. This system uses two main sensors:

- A weighbridge to measure the animal's weight as it crosses
- A Radio Frequency Identification (RFID) system to detect the identity of the animal via an implanted passive transponder (Kernerbone 2000).

Approximately 40% of the penguins in the study area currently have RFID tags. Data from the sensors are transmitted to a control cubicle, where data processing and storage occurs. The data are uploaded periodically to a computer via a local connection.

The population monitored by the weighbridge is a subset of the total population at Phillip Island. Penguins in the study site mostly use the same path across the foreshore to reach their nests. The weighbridge across this path captures the data on most of the penguins in the study site as they enter and leave the colony. The direction of travel is inferred from the time of day that the penguin crosses. The penguins at this site have been monitored using the weighbridge since 2001, providing a historical baseline dataset against which any changes can be assessed.

## Statistical analysis

The raw data were compiled and filtered to remove non-target or spurious records. Spurious records included excessively high weights which generally result from two penguins crossing the weighbridge simultaneously or excessively low weights, which generally result from one bird stepping on as the other steps off. The analysis was confined to records of penguins entering the colony, in order to minimise variation introduced by weight loss during extended stays within the colony, therefore records of birds leaving the colony are not relevant. Records were removed from the raw data if they included:

- Weight readings of  $\leq 700\text{g}$  (indicates one bird stepping off as the following bird steps onto the platform)
- Weight readings of  $\geq 1700\text{g}$  (indicates two birds on the weighing platform at the same time)
- A time stamp of between 1am local time and sunset the following night (indicating penguins leaving the colony).

There are 2979 individual weight records from January through March 2009. Daily average weights were calculated from the filtered data, and were then de-seasonalised to adjust for known seasonal variation in Little Penguin weight at the study site. The de-seasonalised average daily weight  $W_i^*$  was calculated by taking each daily average weight for the current study period  $W_i$  and adding the difference between the historical overall average  $\bar{W}$  and the historical average for the relevant week of the year  $\bar{W}_{k(i)}$ , i.e:

$$W_i^* = W_i + \bar{W} - \bar{W}_{k(i)}$$

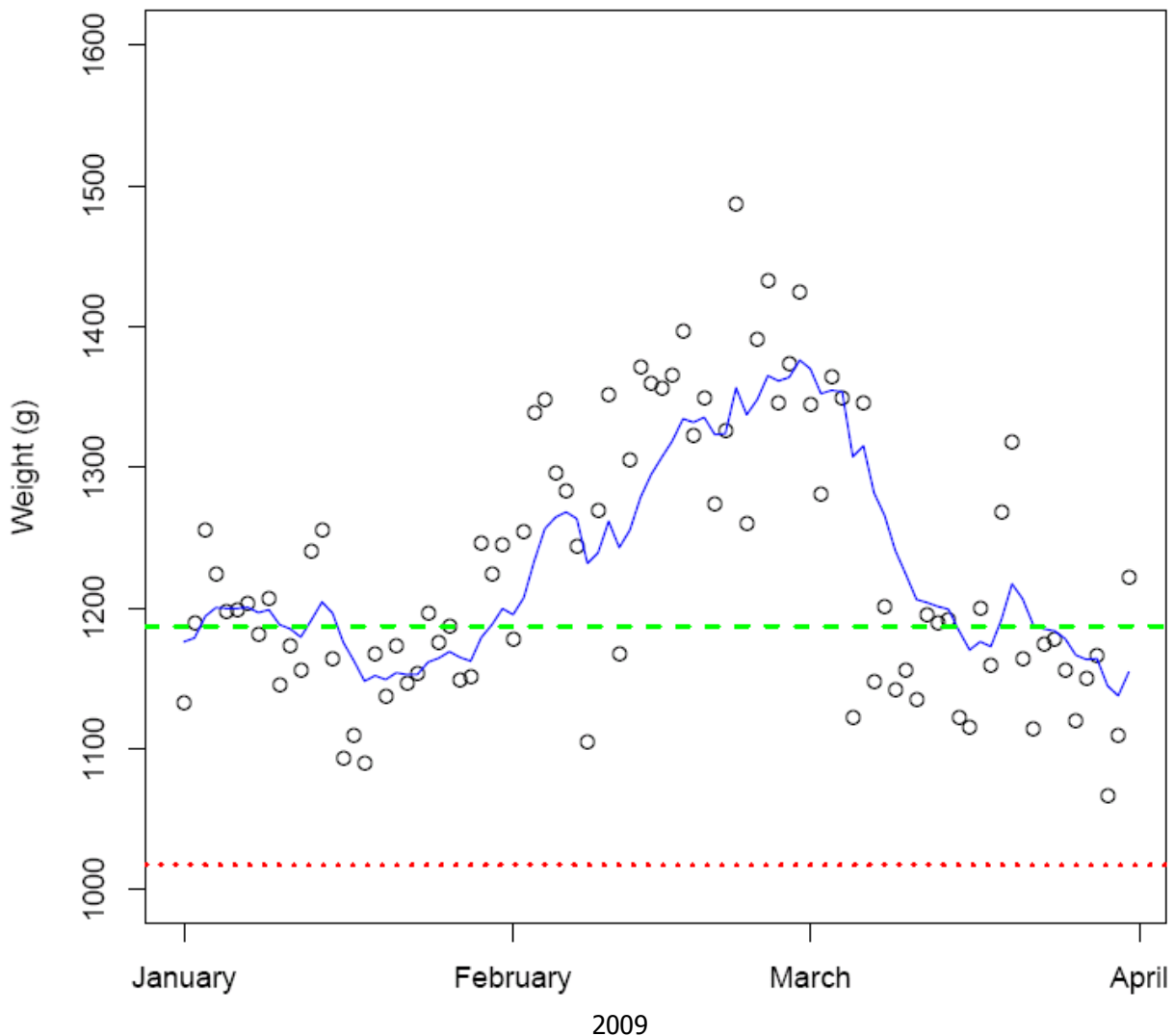
The historical average weights (weekly and overall) were calculated from data collected between June 2001 and early February 2008. A control chart was constructed to compare the Exponentially Weighted Moving Average (EWMA) of the de-seasonalised weight to a control limit, set at 2.5 standard deviations below the long-term average, which equates to 1018g (PoMC 2008). If the EWMA crosses the control chart limit, the average weight of birds in the colony is considered to have changed beyond natural variability.

In addition to the total weight data, the individually RFID marked penguins were used to provide separate control chart analyses for penguins known to be male (739 records) and female (676 records). These analyses are based on a smaller overall sample size, nevertheless the sensitivity of the test is similar to that for the overall population, and the analysis is considered useful (Emphron 2008). Control limits for females and males are 955g and 1069g respectively.

## Results

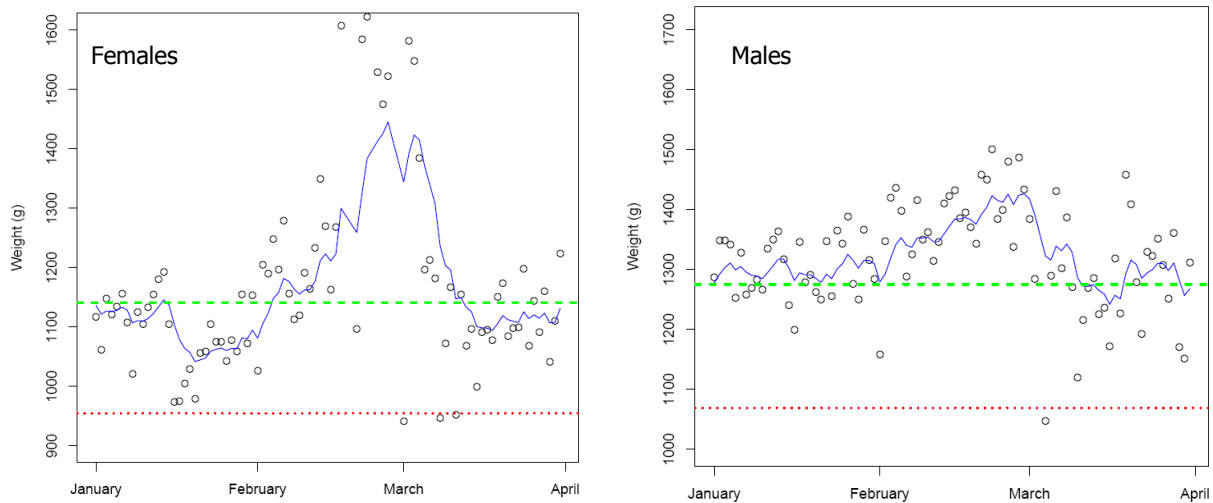
For the reporting period January through March 2009, there was a high degree of fluctuation in the daily average weight of penguins coming ashore, however these weights are within expected variability based on historical data.

The EWMA of the de-seasonalised weights fluctuated around the long-term average of 1187g for January and March, but were much higher for most of February (Figure 1). No average weights were recorded below the EWMA control chart limit (1018g), further confirming the generally good condition of the birds throughout the reporting period.



**Figure 1.** EWMA of de-seasonalised daily average weight of Little Penguins at PINP, 1<sup>st</sup> January to 31<sup>st</sup> March, 2009. The open circles indicate the mean daily weight; the blue line (solid) is the EWMA; the green line (dashed) is the target value of 1187g; and the red line (dotted) is the control limit of 1018g (analysis prepared by Emphron Informatics Pty Ltd).

The patterns between males and females differed (Figure 2). The EWMA fluctuated above the long-term average weight of male (1275g) Little Penguins for January and February, and around the average during March. The EWMA for females was slightly lower than the long-term average (1141g) for most of the reporting period, but much higher during late February/early March.



**Figure 2.** EWMA of de-seasonalised daily average weight for female and male Little Penguins from PINP, 1<sup>st</sup> January to 31<sup>st</sup> March, 2009. The open circles indicate the mean daily weight; the blue line (solid) is the EWMA; the green line (dashed) is the target value (long-term average) of 1141g for females and 1275g for males, the red line (dotted) is the control limit of 955g for females and 1069g for males (analysis prepared by Emphron Informatics Pty Ltd).

## Discussion

Body weight fluctuates considerably according to the stage of the Little Penguin's annual breeding cycle (Dann *et al.* 1995). The variations in weight due to this annual cycle were removed from the data by de-seasonalisation, so they are not apparent in the figures.

During January, the breeding season was coming to an end, with most remaining burrows with breeding activity in the post-guard stage (i.e. both parents feeding at sea during the day, returning at night to feed the chicks). Chick weights were generally poor compared to previous years, with many chicks dying of starvation. As was mentioned in Quarterly Report 3, this is most likely due to a lack of food in close proximity to the penguin colony (Hoskins *et al.* 2008). Furthermore, low chick survival is not unexpected. Previous research shows that average survival rates at PINP are around 17% for little penguins in their first year of life (Sidhu *et al.* 2005). At the end of January only 5% of burrows had some kind of breeding activity.

By the middle of February, the breeding period had finished, with chicks having fledged, and adults beginning to return to the colony to moult. The moulting period for individual little penguins is around 17 days. Before the moulting period, adults spend a large amount of time at sea gaining significant amounts of weight in order to survive the fast ashore.

The moulting period this year was relatively synchronous compared to previous years due in part to an earlier end to the breeding season. During the latter part of February, the number of birds with RFID tags crossing the APMS was very small (e.g. 1-5 crossings for females per day), and these small numbers contributed to the high variability in data recorded at this time. Accordingly, the sex specific data for that part of the reporting period is probably unreliable. The low numbers crossing the APMS during the latter part of February, and the higher weights of those that did cross, were likely to be a consequence of the synchronous moulting period this year i.e. the birds

coming ashore were mainly those with high weights returning to moult. This is in contrast to those years that have a later breeding season and an asynchronous moult, which generally results in a mix of high and low weights.

Overall, the results for this reporting period indicate no evidence of a reduction in the de-seasonalised body weight of Little Penguins from PINP. All EWMA values are above the control limit, indicating no change in average weight outside of natural variability for Little Penguins from the PINP.

## Raw Data

- Missing data: nil
- Raw data are provided with this report electronically.

## Exceptions

- None

## References

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