

# Baywide Little Penguin Monitoring Program



Quarterly Report 1 (Jan.-June 2008)

July 2008

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## Introduction

The Channel Deepening 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 outside expected variability. The key variable being measured is the body weight of Little Penguins. Weight is an indicator of body condition and overall health, 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 2007).

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 2007), for the period January – June 2008.

## 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).

The direction of travel is inferred from the time of day that the penguin crosses the weighbridge. Approximately 40% of the penguins in the study area have RFID tags. Data from the sensors are transmitted to a control cubicle, where data processing and storage occurs. The data is 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 data on most of the penguins in the study site as they enter and leave the colony. 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 irrelevant 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 arriving at the colony are not relevant. Records were removed from the raw data if they included:

- weight readings of 700g or less, or 1700g or more (i.e. outside the normal adult weight range at Phillip Island of 760-1650g);
- a time stamp of between 1am local time and sunset the following night (indicating penguins leaving the colony).

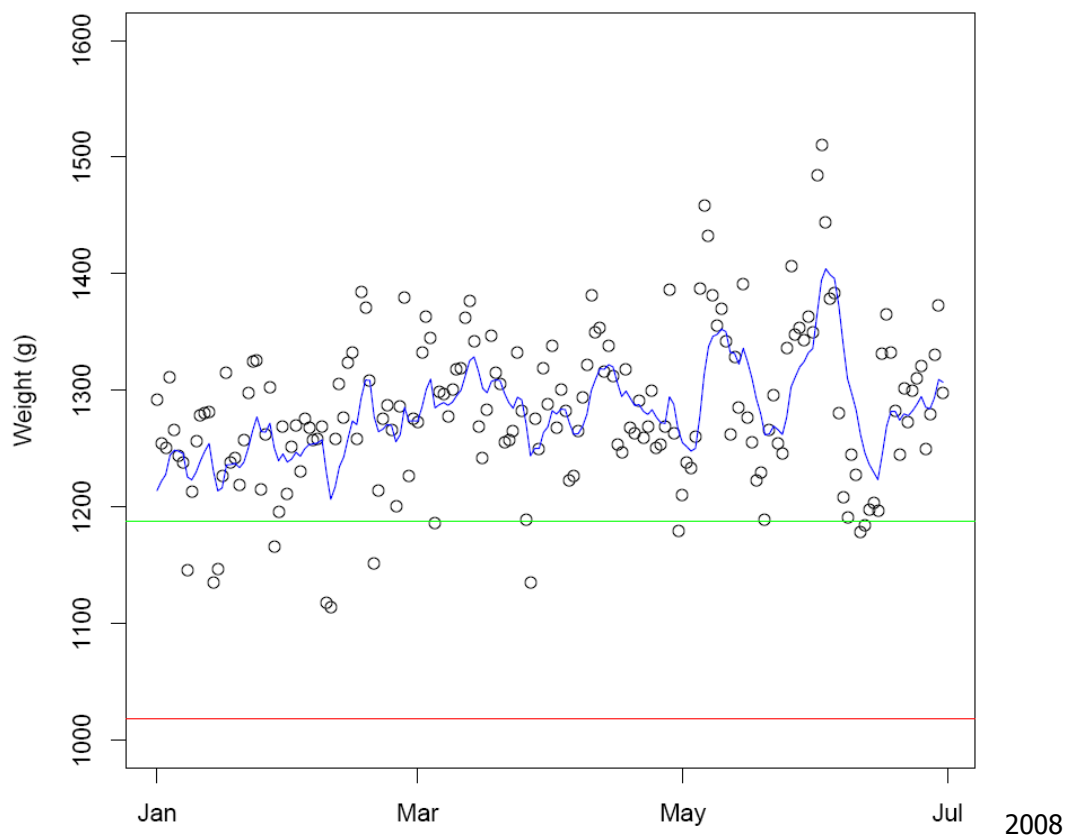
The filtered data were then de-seasonalised to adjust for known seasonal variation in Little Penguin weight at the study site. This was achieved by taking each daily average for the study period and adding the difference between the long-term overall average and long-term average for the relevant week of the year. Using these data, a control chart was constructed to compare the modified Exponentially Weighted Moving Average (EWMA) of the de-seasonalised weight to a control limit (set at  $2.5 \sigma$  below the 2001-2007 average) (PoMC 2007). When the EWMA crosses the control chart limit, the weight is considered to have changed beyond natural variability.

Little penguins are dimorphic, as adult male penguins are heavier than female penguins of equivalent age, and relative activity of males and females varies with the time of the year. Variation in measured body weight caused by variation in sex ratio of active penguins could therefore mask changes in mean penguin body weight, so sex of penguins is an additional consideration when interpreting mean body weight changes. In addition to the total weight data, the individually RFID-marked penguins were used to provide separate control chart analyses for male and female birds. These analyses are based on a smaller overall sample size, but the sensitivity of the test is similar to that for the overall population, and the analysis is considered useful (Emphron 2008).

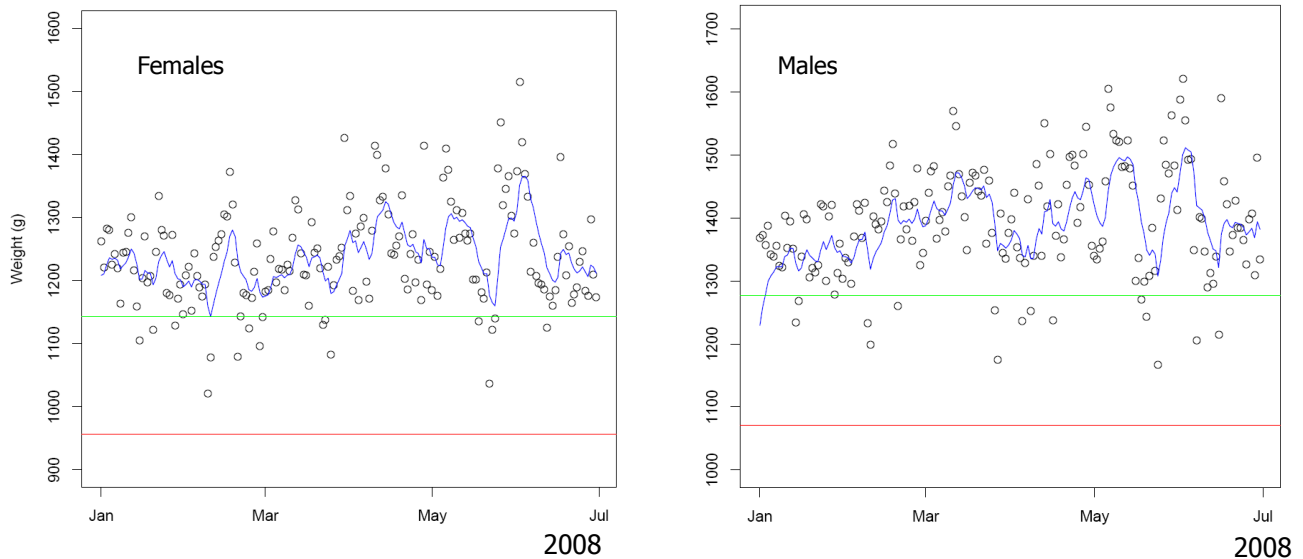
In summary, EWMA's for the present study are calculated for mean body weight for i) whole population (1021g), ii) male penguins only (1069g) and iii) female penguins only (955g).

## Results and Discussion

For the reporting period January-June 2008, there was a high degree of fluctuation in the daily average weight of penguins coming ashore. The EWMA of the de-seasonalised weights remained above the long-term average for the entire period (Figure 1). The EWMA fluctuated above the long-term average weight of both male (1283g) and female (1148g) Little Penguins, indicating that both sexes were experiencing favourable feeding conditions (Figure 2). The calculated EWMA of daily average weight for the entire penguin population, and for males and females separately, was recorded well above the respective EWMA control chart limits, further confirming the generally good condition of the birds throughout the reporting period.



**Figure 1.** EWMA of de-seasonalised daily average weight for the entire population of Little Penguins at PINP, 1 January-30 June, 2008; open circles indicate the average daily weight; blue line is the EWMA; green line is the target value (long-term average); red line is the EWMA control limit of 1021g (analysis prepared by Emphron Informatics Pty Ltd).



**Figure 2.** EWMA of de-seasonalised daily average weight for female and male Little Penguins from PINP, 1 January-30 June, 2008; open circles indicate average daily weight; blue line is the EWMA; green line is the target value (long-term average); red line is the control limit of 955g for females and 1069g for males (analysis by Emphron Informatics Pty Ltd).

## Factors affecting penguin weight

Body weight fluctuates with the stage of the Little Penguin’s annual breeding cycle. At Phillip Island, adult penguins were raising chicks in January to March. After the chicks fledged, birds spent a period away from the colony, during which they generally increase their body weight significantly. Moulting occurs in March/April and during this process birds are confined to land for two to three weeks during which time they lose weight. Renovating of burrows and courtship behaviour follow in May/June, and during this period birds may gain weight lost during moulting. These variations in weight were removed from the data by de-seasonalisation, so they are not apparent in the figures. The good condition of the penguins throughout the study period can be attributed to an abundant food supply in their foraging areas. During chick rearing, birds generally forage within 30 km of the colony. At other times, penguins may forage further away, spending multiple days at sea and travelling up to hundreds of kilometres. In June, the PINP commenced a winter tracking study of 14 satellite tagged penguins which showed that 80% of the tagged birds travelled into PPB on trips lasting at least several weeks. A few birds travelled to western Victoria or made short trips in the vicinity of Phillip Island.

Overall, the results to date indicate no evidence of a reduction in de-seasonalised body weight, and all EWMA values were well 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 (APMS\_month\_year).

## Exceptions

- An exception for this study period according to the Detailed Design - CDP\_ENV\_PR\_020 Rev 0. (PoMC 2007) has been documented separately, and relates to the absence of interpretation of results for Jan-March 2008 in a previous report.

## References

Emphron 2008. Channel Deepening Project Bay-Wide Monitoring Program: Little Penguins. Report 2007.0035. Emphron Informatics Pty Ltd

Kernerbone, P. 2000. APMS Operators Manual. Australian Antarctic Division, Kingston, Tasmania.

PoMC 2007. Little\_Penguins\_Detailed\_Design CDP\_ENV\_PR\_020. Port of Melbourne Corporation. Published on [www.channelproject.com/environment/monitoring.asp](http://www.channelproject.com/environment/monitoring.asp)