

Baywide Little Penguin Monitoring Program



Quarterly Report 2 (July-Sept. 2008)

October 2008

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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 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 July – September 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).

Approximately 40% of the penguins in the study area currently have RFID tags. Data from the sensors is 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 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 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 leaving the colony are not relevant. Records were removed from the raw data if they included:

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

There are 3020 individual weight records from July to September 2008. 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 $\bar{W}_{k(i)}$:

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

The historical average weights (weekly and overall) were calculated from data collected between June 2001 and December 2007 inclusive. 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 2001-2007 average, which equates to 1021g (PoMC 2007). 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 male and female birds. These analyses are based on a smaller overall sample size (596 males, 661 females), but 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 959g and 1071g respectively.

Results and Discussion

For the reporting period July to September 2008, there was a high degree of fluctuation in the daily average weight of penguins coming ashore, but the EWMA of the de-seasonalised weights remained above the long-term average of 1195g for the entire period (Figure 1). The EWMA fluctuated above the long-term average weight of both female (1148g) and male (1283g) Little Penguins, indicating that both sexes were experiencing favourable feeding conditions during this period (Figure 2). No average weights were recorded below the EWMA control chart limit (1021g), further confirming the generally good condition of the birds throughout the reporting period.

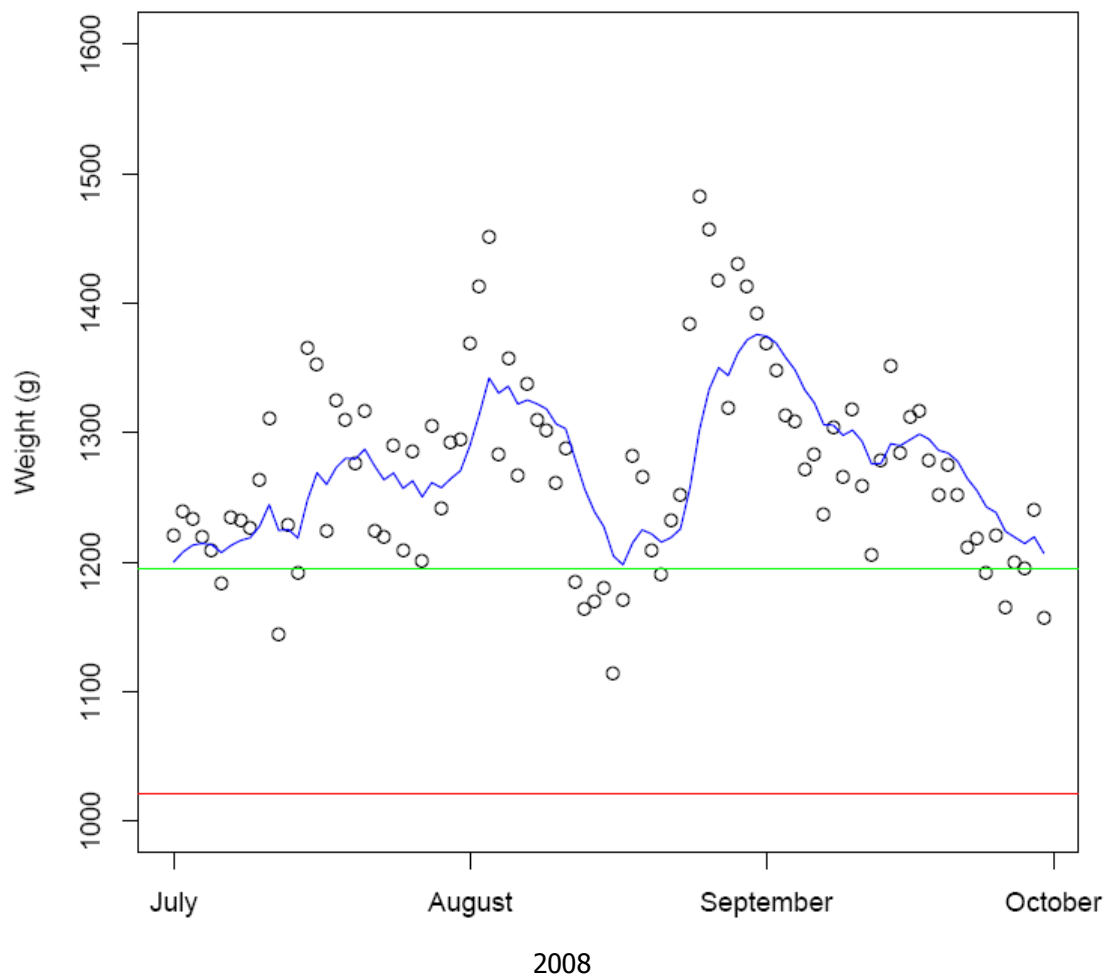


Figure 1. EWMA of de-seasonalised daily average weight of Little Penguins at PINP, 1 July to 30 September, 2008; open circles indicate the average daily weight; blue line is the EWMA; green line is the target value (long-term average) of 1195g; red line is the EWMA control limit of 1021g (analysis prepared by Emphron Informatics Pty Ltd).

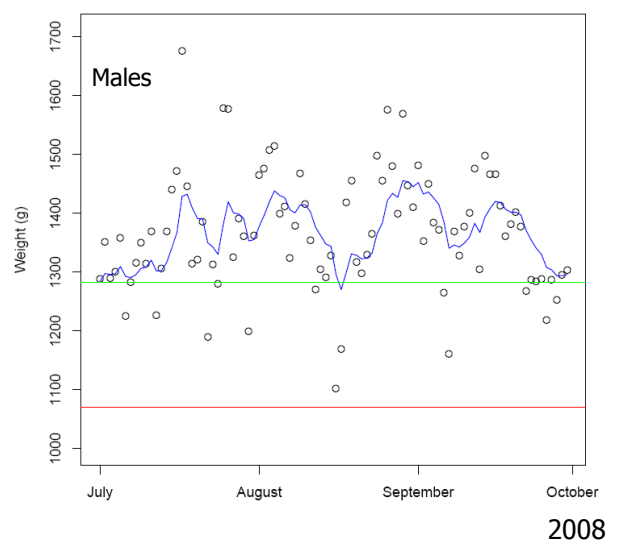
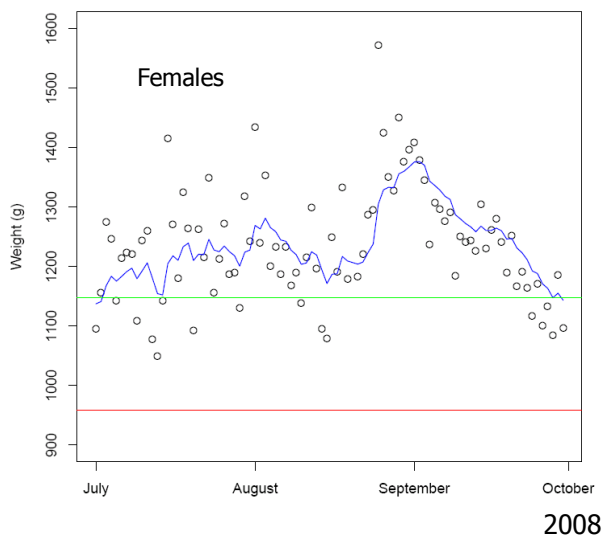


Figure 2. EWMA of de-seasonalised daily average weight for female and male Little Penguins from PINP, 1 July to 30 September, 2008; open circles indicate average daily weight; blue line is the EWMA; green line is the target value (long-term average) of 1148g for females and 1283g for males; red line is the control limit of 959g for females and 1071g for males (analysis by Emphron Informatics Pty Ltd).

Factors affecting penguin weight

Body weight fluctuates according to the stage of the Little Penguin's annual breeding cycle. At Phillip Island, adult penguins were renovating burrows and engaged in courtship behaviour during May-July. During this period, birds forage at sea for long intervals and typically gain weight that was lost during the March/April moulting period. Mating generally occurs from August to October, with egg laying beginning as early as September. Penguin weights tend to continually increase until the chick feeding period beginning in December. 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.

The good condition of the penguins throughout the study period can be attributed to an abundant food supply in their foraging areas. During the winter foraging period, penguins can spend multiple days at sea and travel up to hundreds of kilometres. In June, the PINP commenced a three month winter satellite tracking study of penguins. During June, 14 birds were tracked with trips lasting an average of 10.4 days. During July, 19 birds were tracked with trips lasting an average of 10.9 days. During August, 20 birds were tracked with trips lasting an average of 5.4 days. Of the tracked birds, 14%, 58% and 5% entered PPB on foraging trips during June, July and August respectively. Others made short trips in the vicinity of Phillip Island, with a few birds travelling as far as western Victoria. The location of penguins during June and July suggests a partial overlap with the distribution of anchovy in PPB as determined from a trawl survey between 26th June and 12th July (Parry 2008).

Overall the results to date indicate no evidence of a reduction in de-seasonalised body weight, and all EWMA values were 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

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.

Parry, G.D. (2008) Baywide Anchovy Study Sub-Program. Progress Report No. 1 (2008). Technical Report No. 17. Fisheries Victoria, October 2008. Department of Primary Industries, Queenscliff, Victoria, Australia. 24 pp.

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