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Investigating Leach's storm-petrel (Oceanodroma leucorhoa) body condition over the incubation period

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Introduction

Breeding Biology Overview

•Incubation is probably the most energetically demanding period of reproduction for seabirds(1).
•A single egg is laid each year and each partner takes shifts incubating for a 37-50 day period.
•Incubation bouts last 1-7 days, during which the parent fasts, losing 4-7% body mass each day(2).

Life History Theory

•For species with a single annual breeding attempt there is a trade-off between investment in self-maintenance and investment in offspring(3).

•In long-lived species parental body condition should be maintained over offspring condition.

•Resources allocated to one aspect of an organism's physiology or behavior cannot be used for other functions.

•Variation in parental investment and self-maintenance reflect individual phenotypic responses to environmental stresses(4).

Antioxidants

•Free radicals are produced as a consequence of metabolism. Oxidative damage is likely the major endogenous source of damage to DNA, lipids and proteins.

Assessing Body Condition

Body condition and energetic stress can be measured by induced feather regrowth rates (ptilochronology) and antioxidant levels.

•Ptiolochoronolgy provides an index of nutritional condition over a given period of time.

•Measurement of antioxidant levels provides instantaneous insight on the cost of metabolism in terms of cellular damage and the health of an individual.

Predictions

A. As energetic costs accumulate during the incubation period, energetic stores cannot meet all demands. If true:

1. Antioxidant levels will decline over the incubation period, as stores are depleted from combating radicals.

2. Feather regrowth rates will decline due to competing demands from other systems, and should be inversely related to incubation length.

B. If antioxidant levels and feather regrowth rates do not decline over incubation, parents must be allocating available resources primarily to maintaining body condition.

Methods

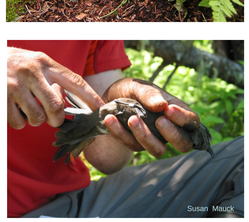
•All data were collected on the first day of an incubation bout.

•Data were collected during the beginning, middle and end of the incubation period from 52 actively breeding individuals.

•The outer right retrix was pulled at the start of incubation.

•Blood samples, for analysis of antioxidant concentration, and feather regrowth measurements were taken at each sampling interval.

•Total antioxidant capacity was measured in the plasma using a spectrophotometric technique (Cayman Chemical).



Results

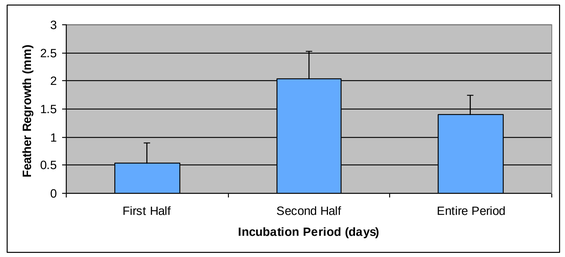


Figure 1: Mean Feather regrowth over the incubation period. (Error bars=SD)

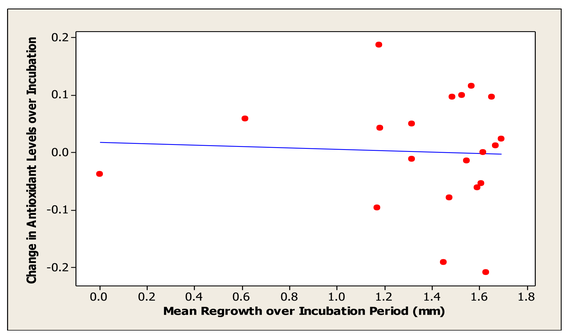


Figure 2: Antioxidant levels from the first two sampling intervals were not correlated with feather growth (0.0178 - 0.0118 x, R^2 =0.2%, p =0.840)

•Mean feather regrowth over the entire incubation period was not correlated to the length of incubation (R^2=0.1% ANOVA p=0.911).

•Antioxidant levels did not change significantly over the first half of the incubation period (paired t-test, t = 0.08, p = 0.939).

Discussion and Future Work

•**About 60% of collected blood samples remain to be analyzed, including all of those from the end of incubation.** The relationship between antioxidant and feather growth may fully reveal itself when all data has been analyzed.

•**Our results thus far have been in agreement with prediction B and life history theory**, in general, which predicts long-lived species will protect their own body condition even at the expense of current reproductive success.

•**Incubational stresses could be disproportionately shared by one sex.** Initial energetic allocation into a breeding attempt is not equally shared between the sexes. Females must invest resources into producing an egg egg 20-25% of her body weight.

We hypothesize initial female body condition, and thus antioxidant levels and feather regrowth rates, will be correspondingly lower than values for males, and might show a slight increase between the first and second sampling intervals as their initial energetic investments are recovered.

Male body condition, conversely, would be expected to decrease much more rapidly during this interval as they would have to shoulder increased incubational stresses. We plan to perform molecular sexing on collected samples to test this hypothesis.

Acknowledgments

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