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Fluctuating Asymmetry as an Indicator of Reproductive Effort in the Leach’s Storm-Petrel (Oceanodroma leucorhoa)

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Background

- Fluctuating asymmetry (FA) is defined as an organism’s deviation from bilateral symmetry in a morphological trait, usually as a consequence of an environmental stressor (Galban 2011, De Coster et al. 2013).
- Fluctuating Asymmetry has been used as a phenotypic measurement of developmental instability (Swaddle 2003).
- Parents balance the energetic investment in young against their own condition. Because significant health deterioration can decrease their chances of survival and future reproduction (Erikstad et al. 1997).
- The Leach’s Storm-Petrel (LHSP) is a pelagic seabird that forms long-term pair bonds and lays one egg per year for up to 38 years.
- We measured FA in a population of Leach’s storm-petrels at the Bowdoin Scientific Station that has been studied continuously since 1953.

Do storm-petrels show FA and can we measure it?

**Inducing Feather Growth**
- Plucking a feather induces growth of a replacement feather
- Rate of growth shown reflects nutritional condition while grown
- We plucked right and left rectrices from 35 breeding individuals.
- This allowed us to:
  - compare our measurements of feathers in situ against the same feather ex situ.
  - assess our ability to accurately measure in situ morphology.

**Measuring Feathers in situ**
- With a wing ruler, we measured both original and induced right and left 5th rectrices.

**Measuring Feathers ex situ**
- Feathers measured in situ accurately reflect actual feather length

![Image 1](link)

Figure 1. Ex situ measurements were correlated with in situ measurements. The red line represents measurements for the right side of the bird; the blue line represents measurements for the left side of the bird. Correlation test, r(red) = 0.89, df = 33, p < 0.01; r(blue) = 0.89, df = 33, p < 0.01.

Weak evidence that FA reflects reproductive effort in storm-petrels

**Assumption:** FA of induced feathers reflect stress from molt (immediately following previous breeding season).
- FA of original feathers reflect stress since original feather was plucked.

Does FA in storm-petrels reflect reproductive effort?

**Measuring FA in the field**
- Asymmetry measurements were taken on 91 storm-petrels.
  - The induced fifth rectrix (tail feather) was measured on the birds from which an original rectrix was plucked.
  - Measurements were taken on left and right wing length, tarsus length, and fifth rectrix length in situ.
- Assumption: FA of original feathers reflect stress during molt (immediately following previous breeding season).
- Assumption: FA of induced feathers reflect stress since original feather was plucked.

**Measures of Reproductive Effort**
- Assumption: egg size positively correlated with energy allocated to the egg
- Assumption: egg lay date negatively correlated with nutritional condition entering breeding season.
- Assumption: Age and pair bond length may affect energetic demands of incubation due to benefits of experience.

**Predictions**
- If FA reflects Reproductive Effort, then FA will be:
  - Correlated (+) with egg size and lay date.
  - Correlated (-) with pair bond length and years of site presence.

![Image 2](link)

Figure 2. Distribution of asymmetry values of (A) raw induced tail feather measurements and (B) the absolute value of original tail feather.

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**Literature Cited:**