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

L. E. Michael '17, R. A. Mauck, Department of Biology, Kenyon College

## 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*
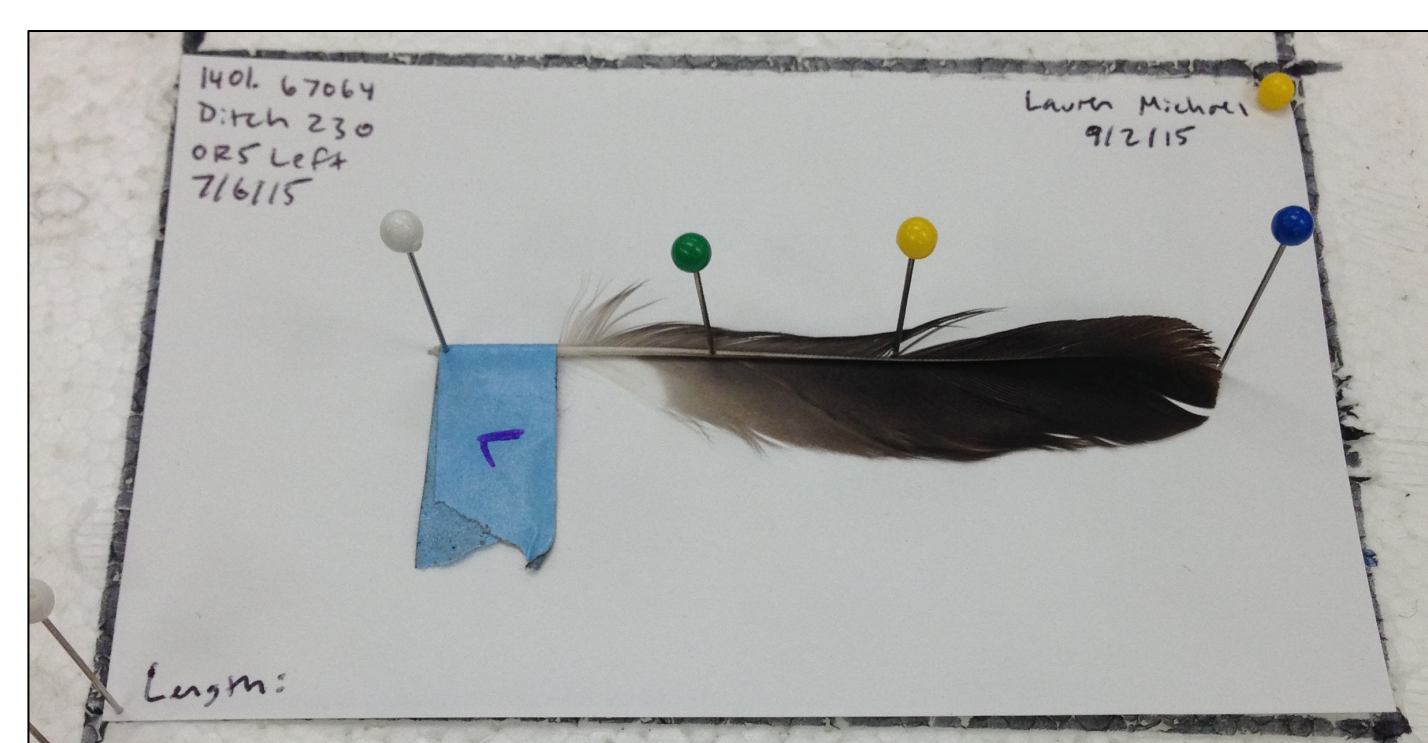


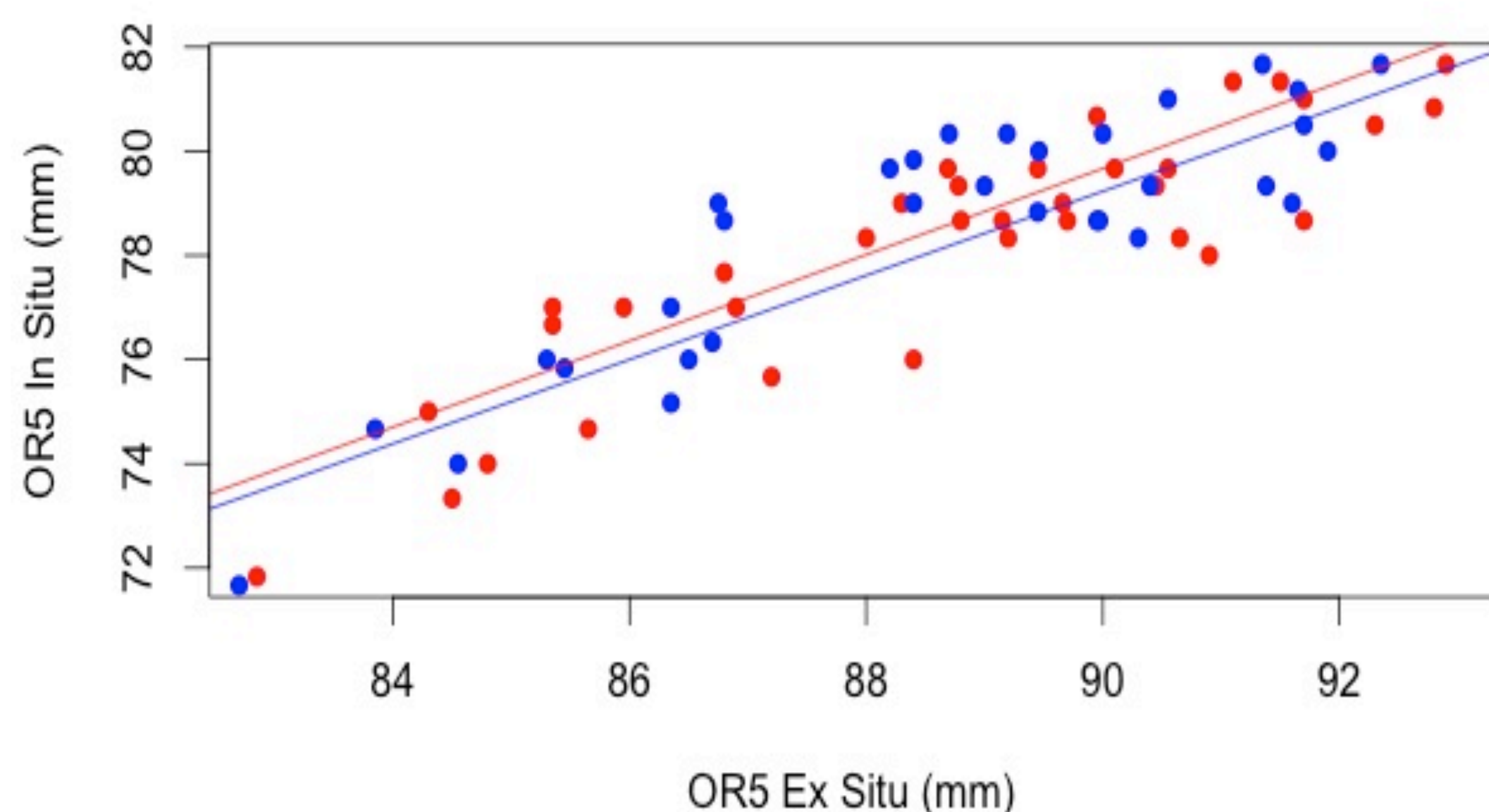### Feathers measured *in situ* accurately reflect actual feather length



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.

### Storm-Petrels show asymmetry in both original and induced feathers



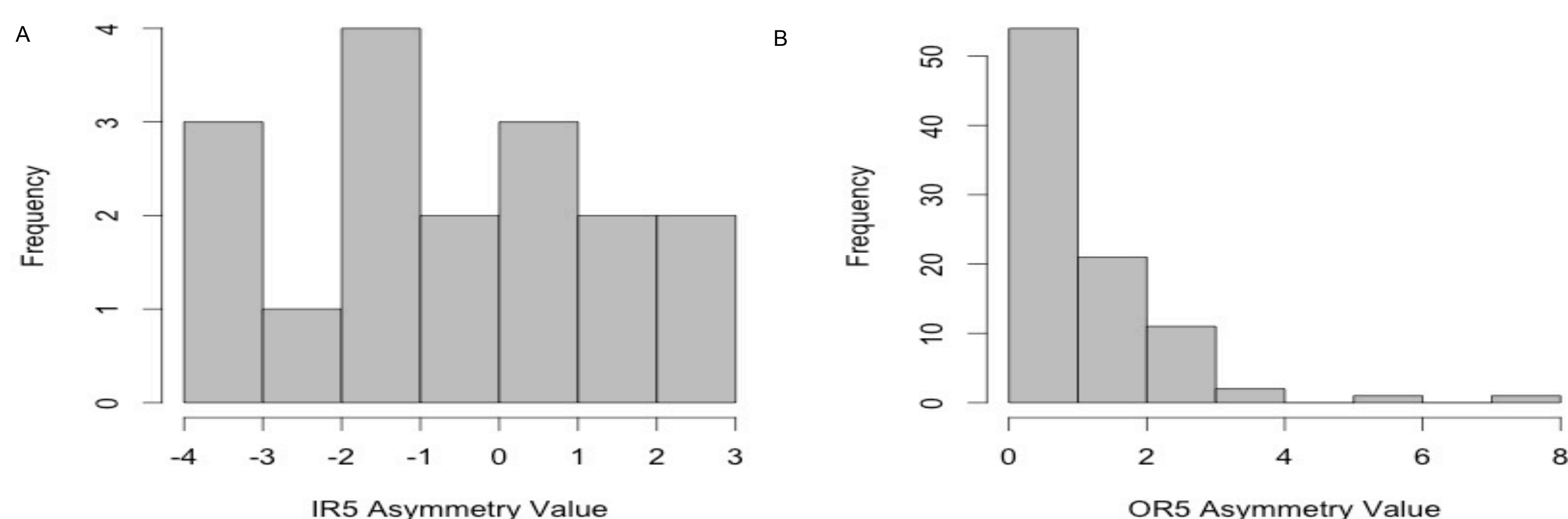Figure 2. Distribution of asymmetry values of (A) raw induced tail feather measurements and (B) the absolute value of original tail feather.

## 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.

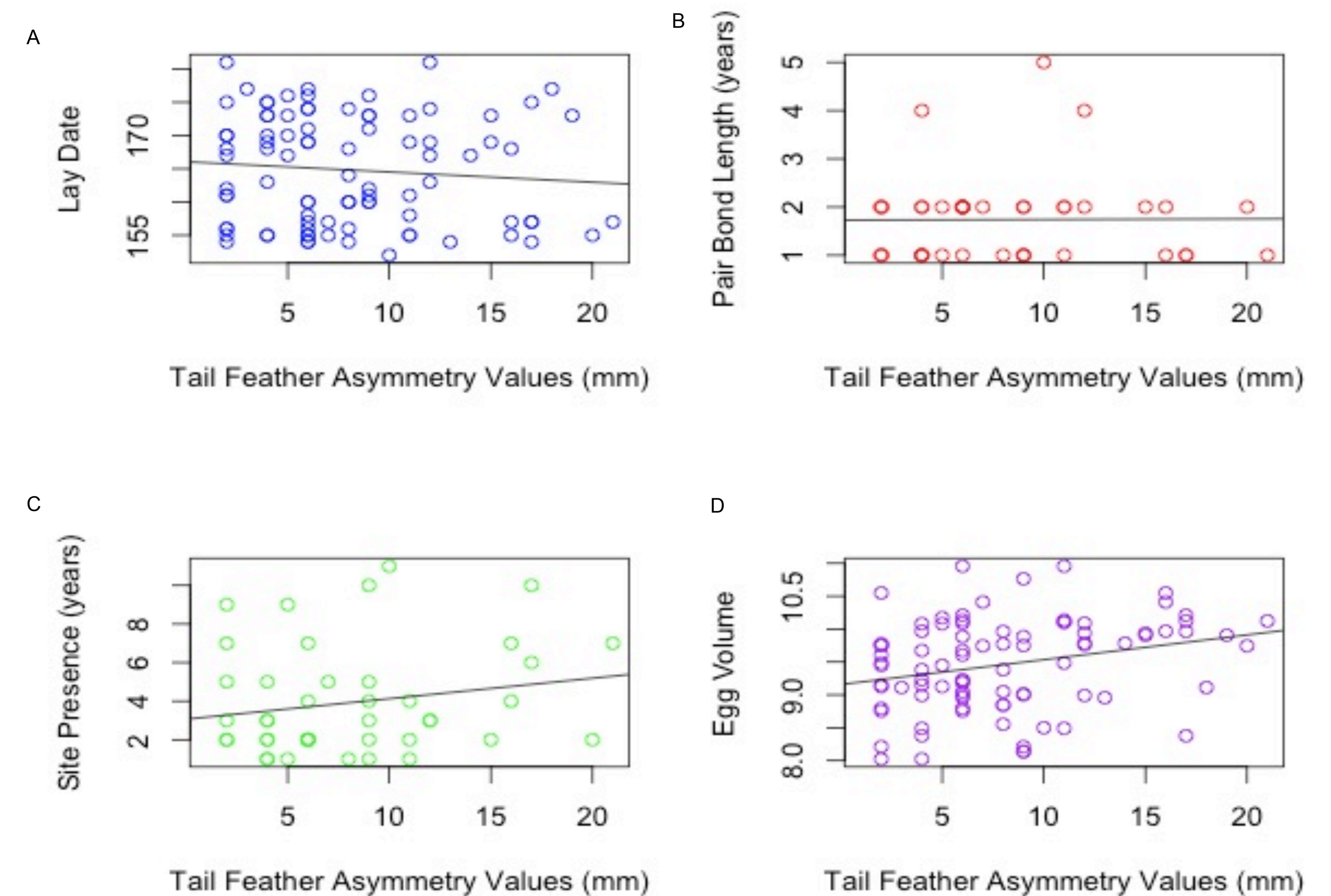### Weak evidence that FA reflects reproductive effort in storm-petrels



Figure 3. The relationship between *in situ* tail feather asymmetry values and (A) egg lay date (Pearson's correlation test, r=0.093, df= 86, p=0.39), (B) pair bond length (Pearson's correlation test, r=0.0069, df= 40, p=0.96), (C) years of petrel site presence (Pearson's correlation test, r=0,19, df= 41, p=0.21) and (D) egg volume (Pearson's correlation test, r=0.26, df= 85, p=0.012).

**Literature Cited:**
- Galban, I. 2011. Journal of Ornithology. 152:2:223-230.
- De Coster, G., Van Dongen, S., Malaki, P., Muchane, M., Alcantara-Exposito, A., et al.. 2013. Plos One. 8:3.
- Swaddle, J. P. 2003. Advances in the Study of Behavior. 32:169-205.
- Erikstad, K. E.et al. 1997. Behavioral Ecology and Sociobiology. 40:95-100.