Do short-term reproductive trade-offs vary with life-history strategy in an Arctic seabird?

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Introduction

Annual breeders may experience short-term reproductive trade-offs:

Invest more resources in breeding in year *t* → Invest less in self-maintenance → Reduced chance of breeding success in *t*+1

Expression of these trade-offs may vary depending on whether an individual has a fast or slow life-history strategy:

Fast ⟷ **Slow**

Frequent reproduction over short lifespan

Less frequent reproduction across long lifespan

This study will explore how these trade-offs vary in the black-legged kittiwake (*Rissa tridactyla*), a long-lived annual breeder:

- Interpopulation life-history variation: Atlantic black-legged kittiwakes appear to have a faster life history than Pacific populations[1, 2].
- Data available to measure among-individual variation → necessary for detecting trade-offs.

Prediction:

1. **If trade-offs visible, negative relationship: breeding success in year *t* → breeding success less likely in year *t*+1.**
2. **Atlantic kittiwakes (fast life history) should invest heavily in breeding most years and allow costs to accumulate → no short-term trade-offs visible. Pacific kittiwakes (slow life history) should reduce investment frequently to favour self-maintenance → trade-offs visible.**

Methods

Long-term breeding success data → two populations (Fig. 1).

- GLMMs: effect of breeding success (0 = no chicks fledged, 1 = ≥1 chicks fledged) in year *t* on breeding success in year *t* + 1, with fixed effects of sex and random intercepts of year and Bird ID. Random slopes for Bird ID added to measure among-individual differences in the strength of trade-offs at Middleton.
- ANOVA model comparison tests to test for significance of terms.

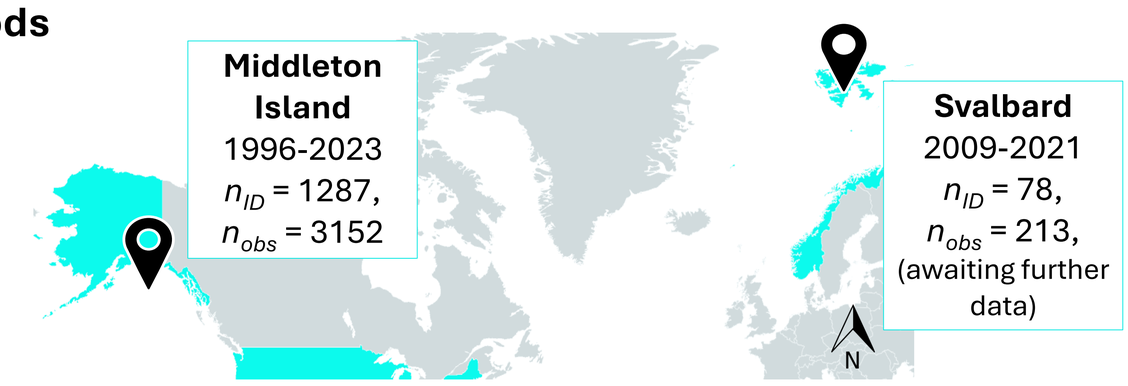


Figure 1. Study population locations

Preliminary results

Population-level differences

Table 1: GLMM results.

Result	Middleton Island	Svalbard
Mean breeding success (SE)	0.44 (±0.01)	0.59 (±0.03)
Among-individual variation in breeding success (SD)	0.22 (±0.47)	<0.01* (±<0.01*)
Among-year variation in breeding success (SD)	0.67 (±0.82)	4.3 (±2.1)

*low variation likely due to low number of individual repeats, more data expected.

Positive relationship between breeding success in year *t* and breeding success in *t* + 1 → only significant at Middleton (Fig. 2).

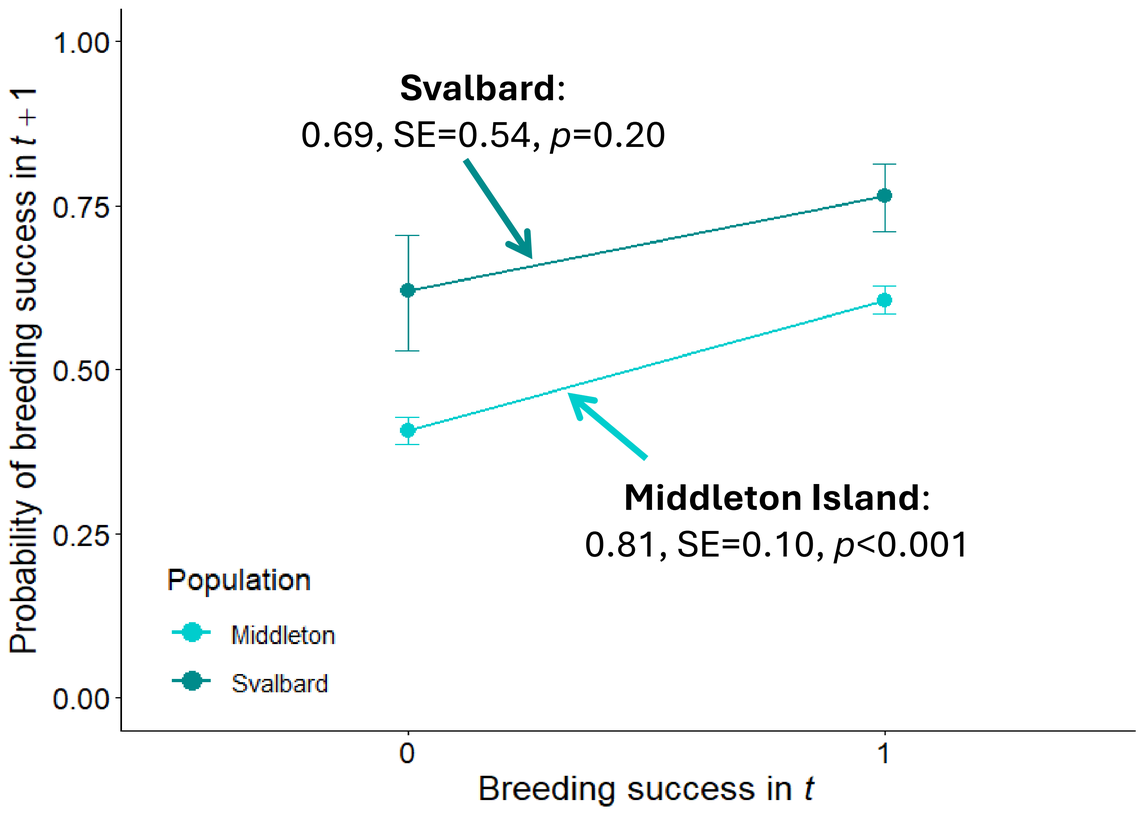


Figure 2. Breeding success in year *t* (0/1) and the probability of successfully breeding in year *t* + 1. Error bars = 95% CIs.

Among-individual variation

Among individual variation in trade-off strength at Middleton Island = 0.61 ±0.78 (Fig. 3).

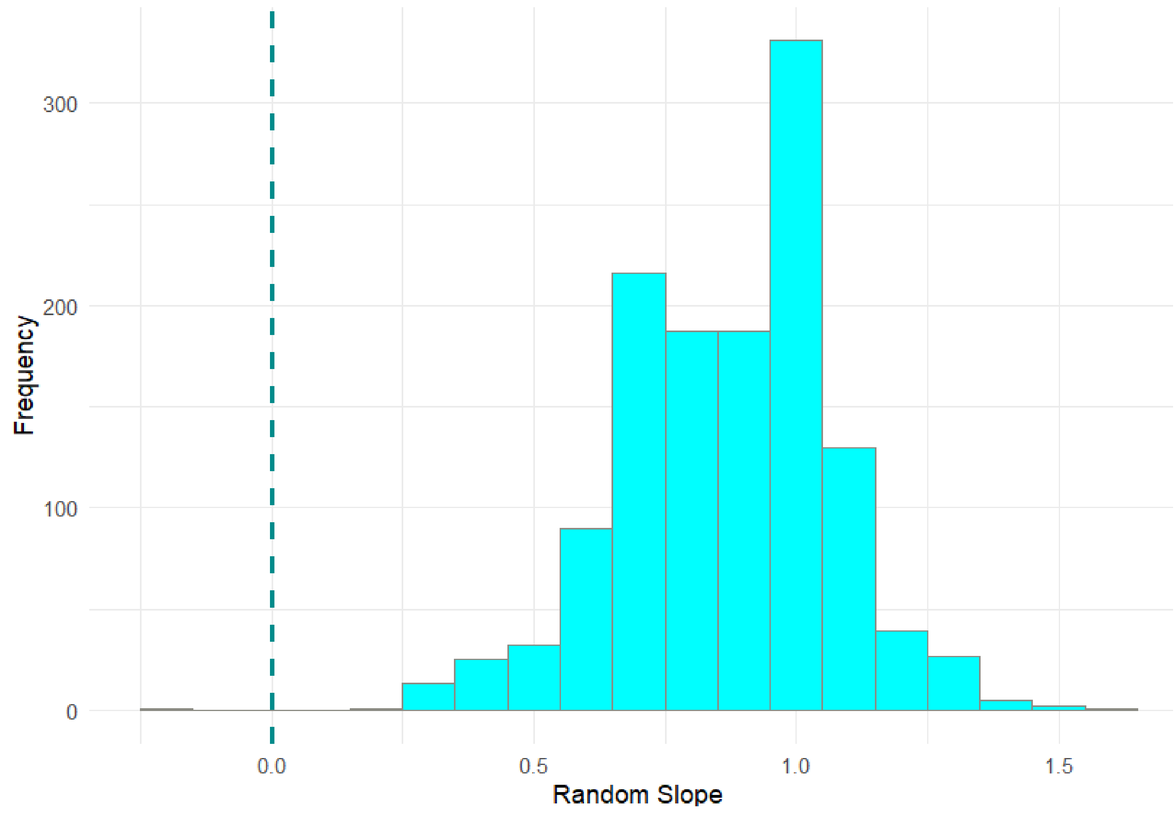


Figure 3. The distribution of random slopes for individuals at Middleton Island.

Conclusion

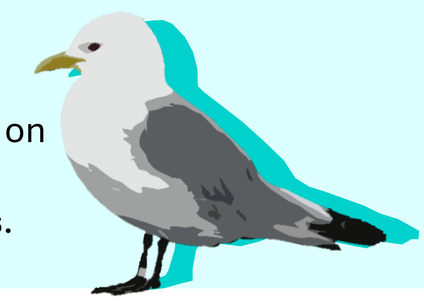
On a population level, trade-offs were not detected → relationships were positive or non-significant → likely masked by individual quality (high-quality birds gather more resources than low-quality birds so have better success every year).

Next steps

Quantify among-individual variation in Svalbard population.

Decouple effect of differences in individual quality on trade-off expression.

Analyse trade-offs over different temporal scales.



References

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