A Comparison of Northern Bobwhite Demographic Sensitivity between a Mid-Atlantic and a National Population Model

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Population Modeling

- Numerous field studies have estimated vital rates.
- Early population models have used simulations, time-series, and structured models based on age ratios to model population dynamics. *(Roseberry 1979, Guthery 1997, Guthery et al. 2000, Thogmartin et al. 2002, Williams et al. 2003)*
- Our recent effort provides a structured population model with a framework for investigating the impacts of underlying demographic parameters on the population viability of northern bobwhites. *(Sandercock et al. 2008)*

Sandercock, B. K., B. E. Jensen, C. K. Williams, R. D. Applegate. 2008. Demographic sensitivity of population change in the northern bobwhite. Journal of Wildlife Management 72:970-982.

% yearly population growth: Lambda

=

Proportion of **adult** birds that survive between consecutive breeding seasons

Summer survival (Apr-Sep)

X

Winter survival (Oct-Mar)

+

Population gains due to reproduction: product of seasonal fecundity and winter survival of **juveniles**

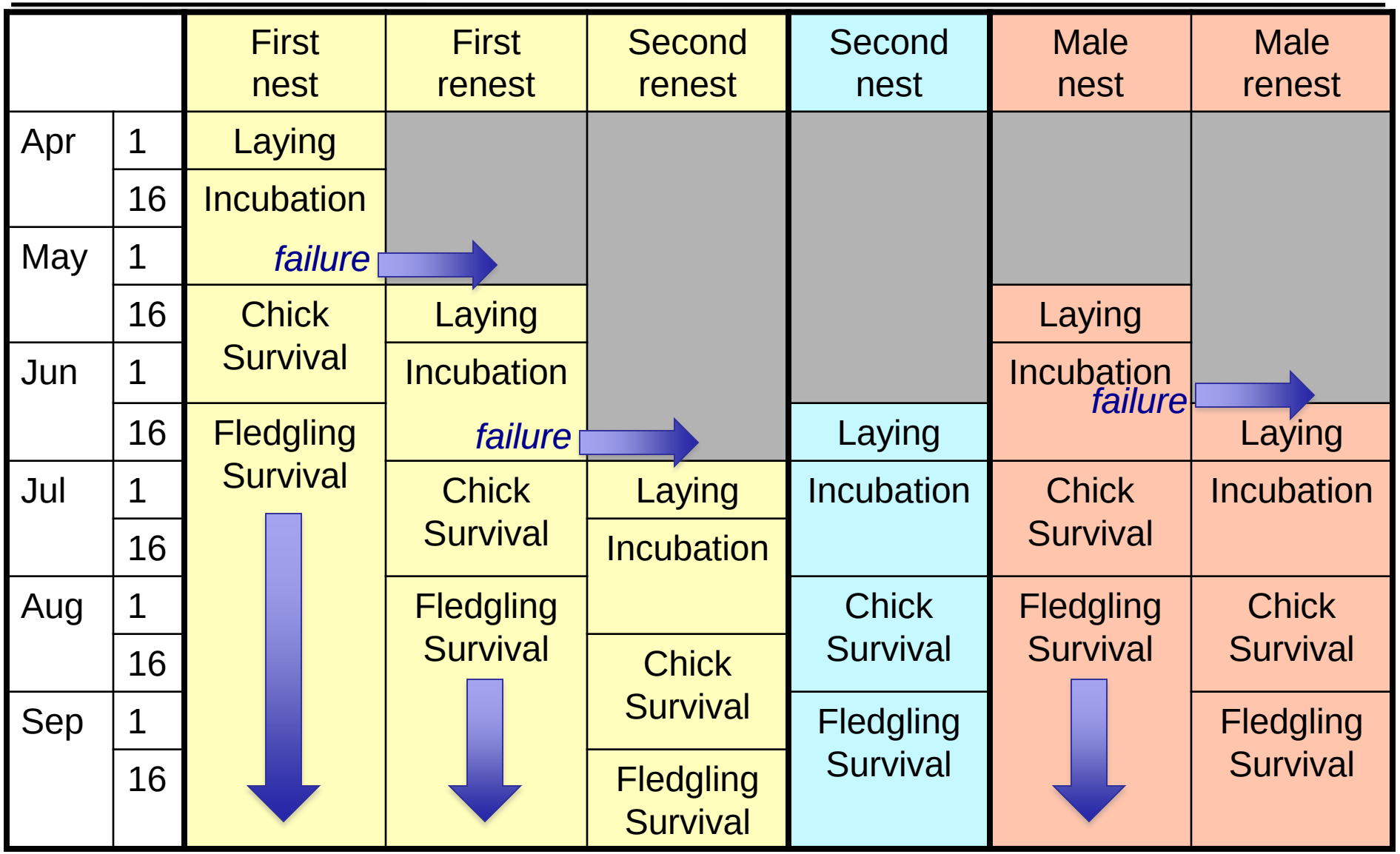
# of young produced by end of summer

X

Winter survival (Oct-Mar)

How are young produced?

Need to know 1) clutch size, 2) nest success, 3) hatchability, 4) chick survival, 5) renesting rate, 6) second nesting rate, 7) male nesting rate



Life-stage simulation analysis

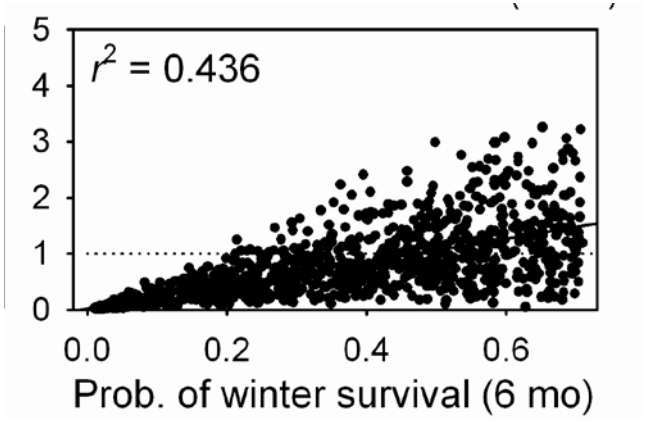
1. Random draw for each of 9 parameters

2. Calculate λ

3. Repeat 1000 iterations

4. Regress λ on simulated variation in each demographic parameter

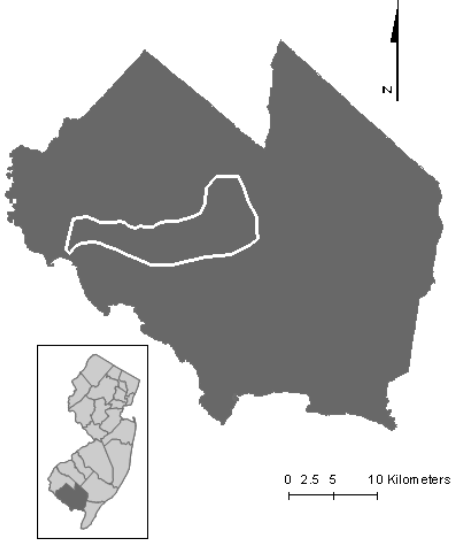
5. Coefficients of determination (r^2) identify parameters with greatest contribution to Var(λ)



Can be built with limited demographic data and uniform distributions

Research Goals

- NBCI recommends increased efforts to increase scientific rigor and develop an information framework for regional planning.
- Compare local Mid-Atlantic and national population to provide an example of the effectiveness of life-stage simulation analysis for local/regional bobwhite populations to guide future management throughout other regions of the country.



May 2006 – April 2008

152 radio collared birds

23 nesting attempts

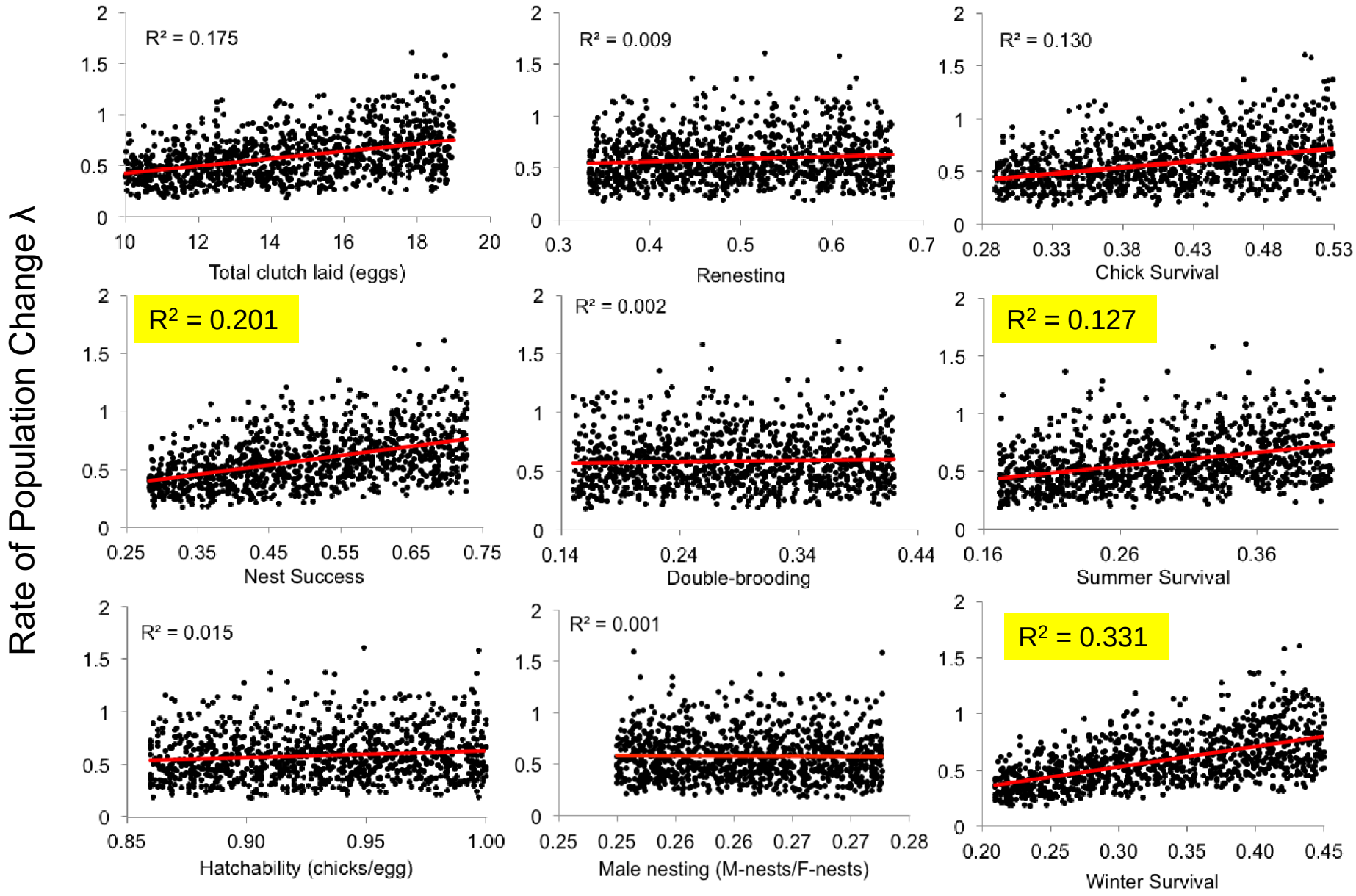
Modeling/Statistical Methods

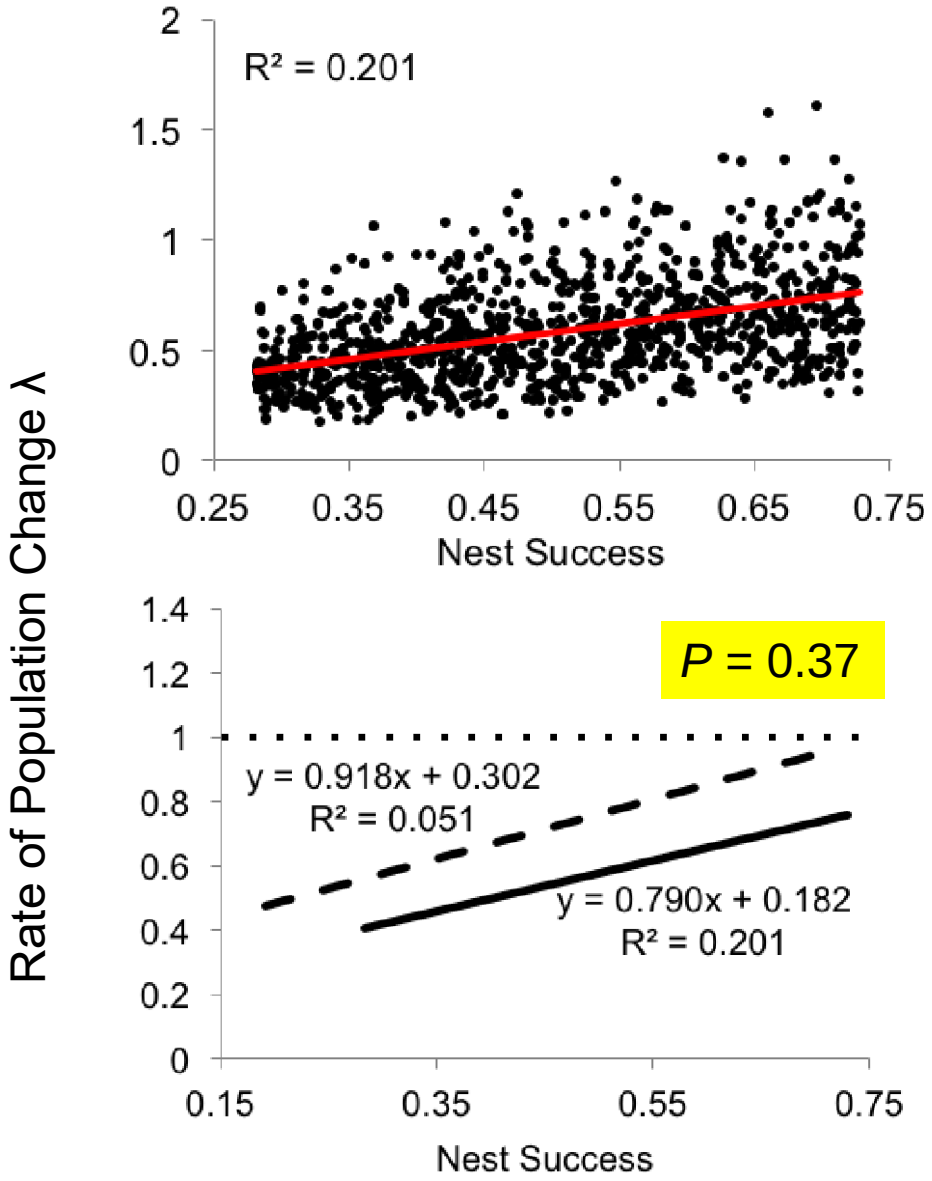
- Run LSA on New Jersey data and national
- Compare regression parameter estimates β for each parameter between NJ and US using a paired t-test (although recognize robustness compromised due to uniform distribution.
  Clogg et al. 1995

Vital rates determined in NJ

Demographic parameter	New Jersey Mean (range or 95% CI)	Range-wide Median (range)
Total clutch laid (eggs)	14.2 (10–19)	12.8 (11.2–15.6)
Renesting	0.44 (0.33–0.67)	0.50 (0.0–1.00)
Nest survival	0.454 (95% CI = 0.282–0.728)	0.42 (0.19–0.70)
Double-brooding	–	0.25 (0.15–0.42)
Hatchability (chicks/egg)	0.96 (0.86–1.00)	0.92 (0.80–0.96)
Male nesting (M-nest/F-nest)	0.27 (0.25–0.27)	0.28 (0.06–0.51)
Chick survival (1 month)	–	0.41 (0.14–0.72)
Total young survived 30 days per nesting attempt	1.27 (0.35–3.67)	1.01 (0.12–3.77)
Summer survival (6 months)	0.267 (95% CI = 0.172–0.417)	0.39 (0.01–0.92)
Winter survival (6 months)	0.308 (95% CI = 0.210–0.453)	0.26 (0.01–0.73)
λ (Median and 95% CI)	0.548 (0.263–1.124)	0.543 (0.034–2.175)

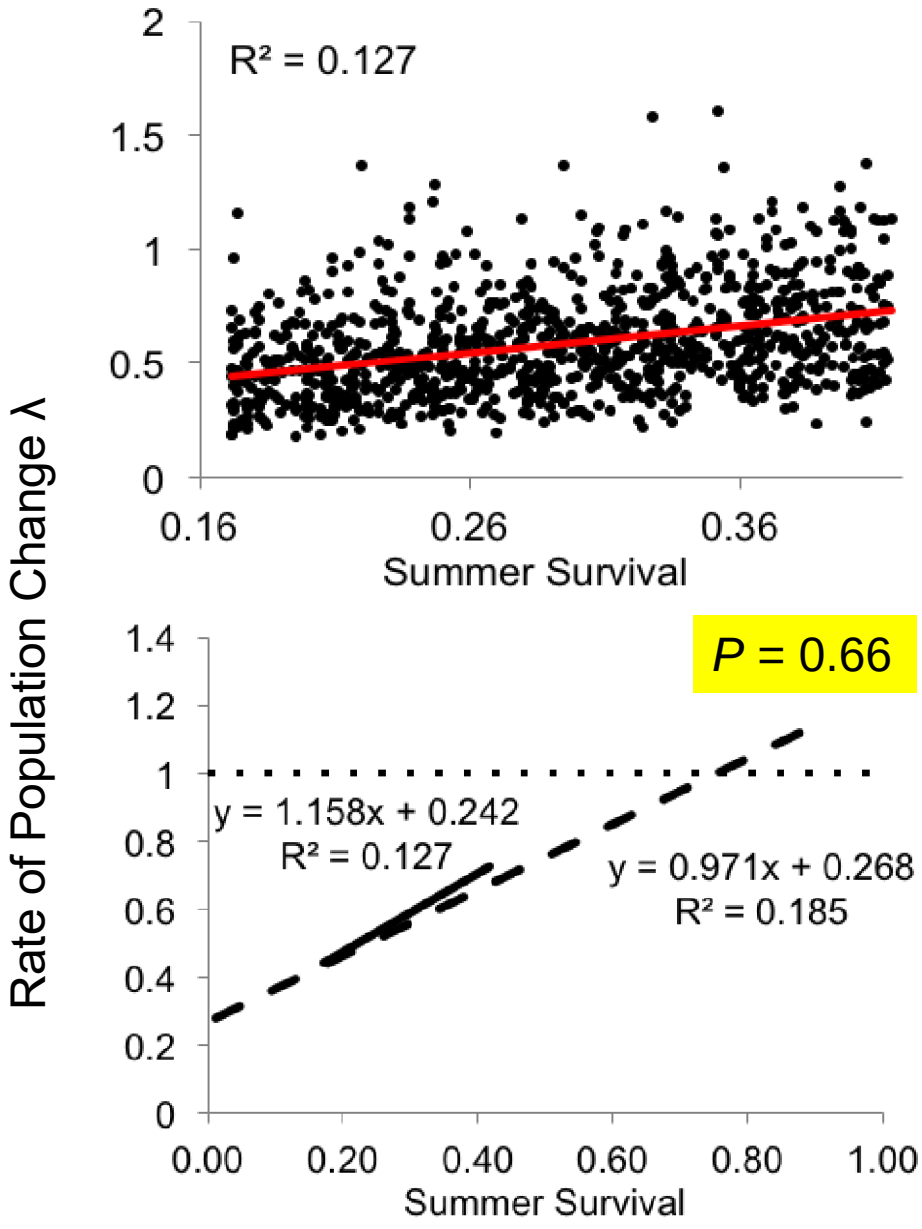
Results of Life-stage Simulation Analyses: NJ





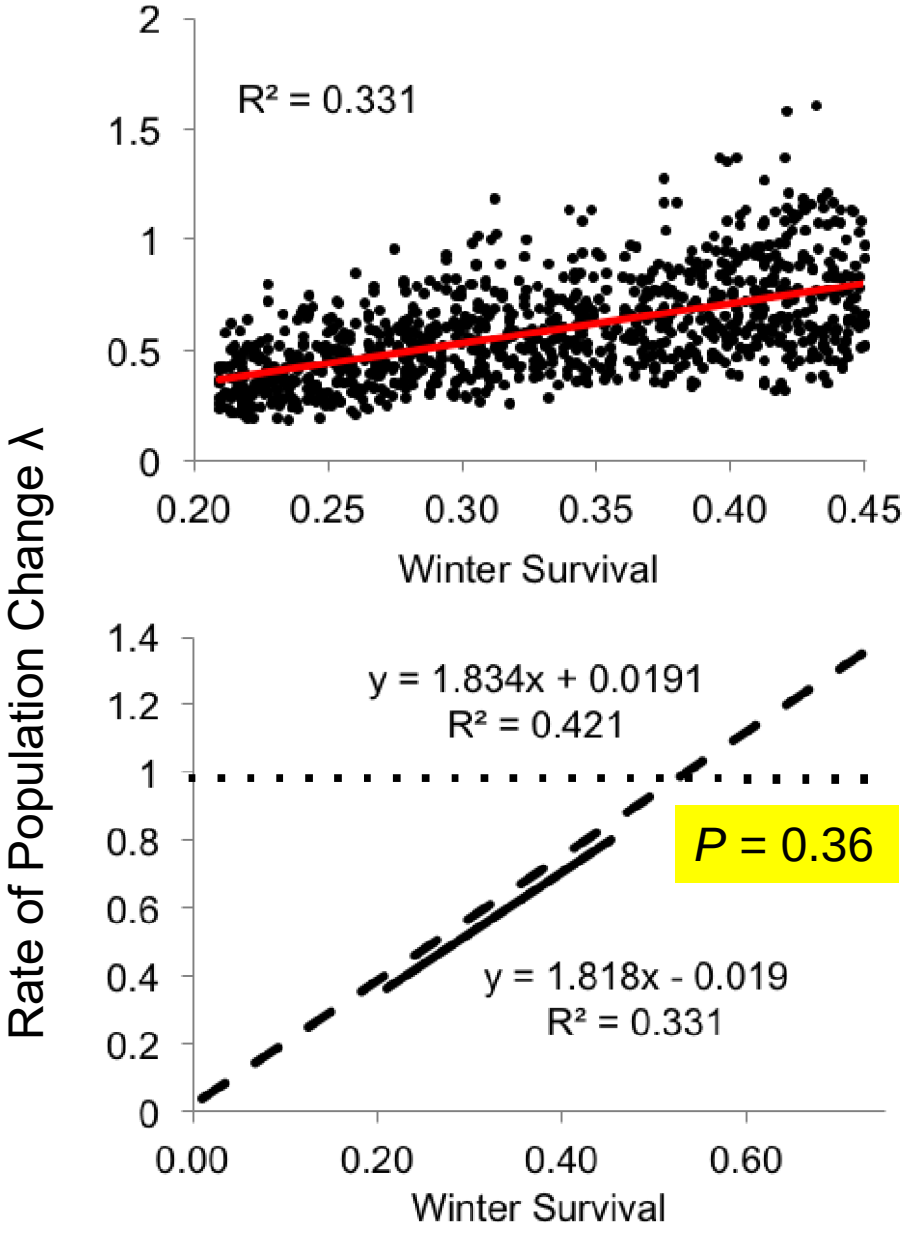
Nest Success

- A 1% change in nest success would produce a λ change of 0.8% in the NJ model and 0.9% in the national model.
- The NJ model predicted 103.4% nest success would be required to produce λ = 1 whereas the national model predicted 76.0% nest success would be required.
- Management Target? OK



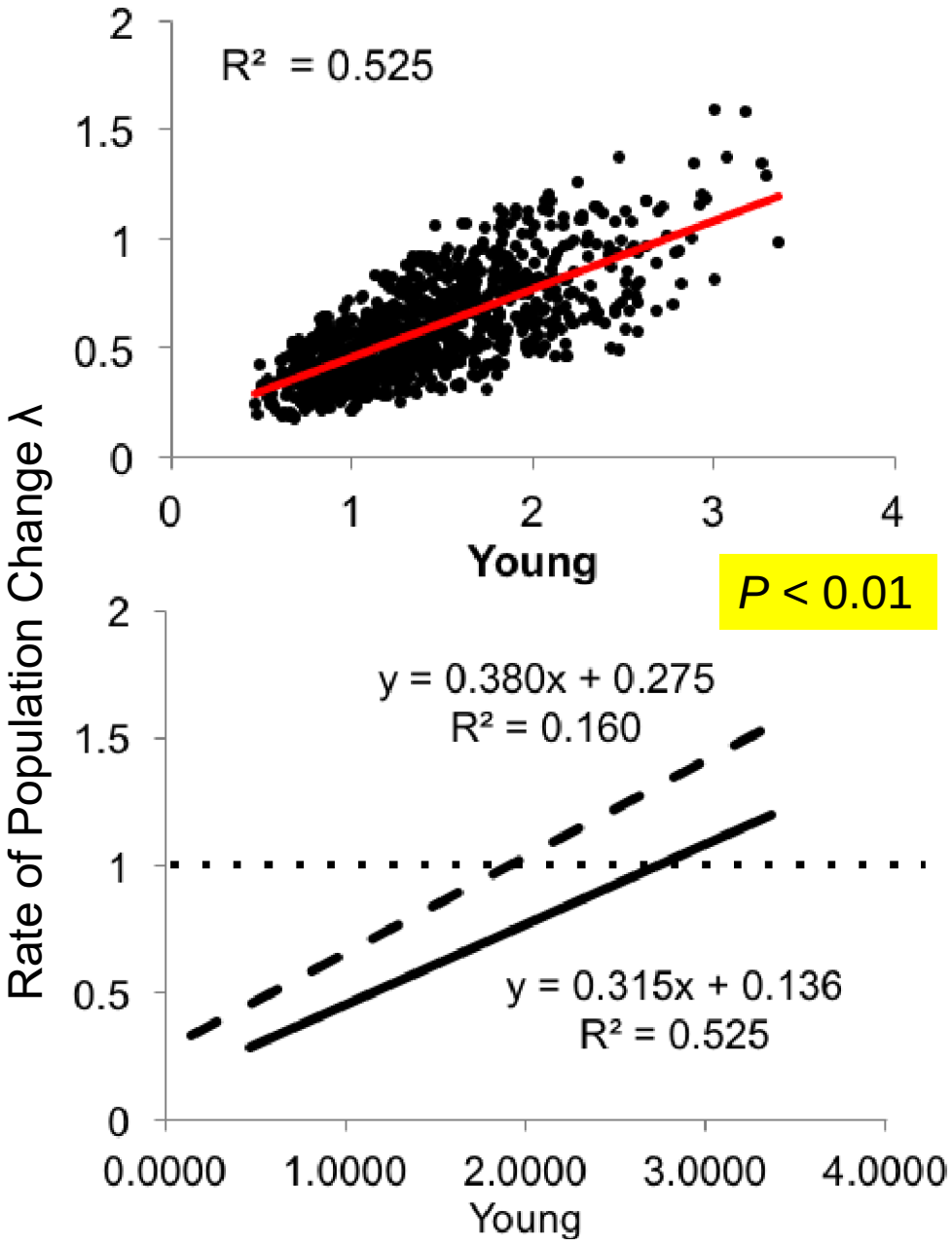
Summer Survival

- A 1% change in summer survival would produce a λ change of 1.4% in the NJ model and 1.2% in the national model.
- The NJ model predicted 65.5% summer survival would be required to produce λ = 1 while the national model predicted 75.4% survival would be required.
- Management Target? Good



Winter Survival

- A 1% change in winter survival would produce a change in λ of 1.8% for NJ and national models.
- The NJ model predicted 56.1% overwinter survival would be required to produce λ = 1 while the national model predicted 53.5%.
- Management Target? Increasing Priority



Management Target? High Priority

Female young per nesting attempt

$$Young = TCL \times Nest \times Hatch \times 0.5 \times S_c$$

- Addition of 1 female young produced per nesting attempt that survived to independence at 30 days would produce a λ change of 31.5% in the NJ model and 38.0% in the national model.
- The New Jersey model predicted 2.74 young would be required to produce λ = 1 while the national model predicted 1.90 female young.

Conclusions for local modeling

- NBCI recommends increased efforts to increase scientific rigor and develop an information framework for regional planning.
- This method allows comparisons to identify local regional weaknesses while not requiring *a priori* knowledge of a probability distribution and large datasets.
  - Note similarity of regression beta coefficients though very different data sources.

Acknowledgements

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