A demographic matrix-model analysis of Spotted Turtles (*Clemmys guttata*) in Illinois

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**Introduction**

- Matrix models and perturbation analyses are used to evaluate demographic vital rates crucial to maintaining population growth.
- Necessary for effective management of long-lived organisms facing population declines
- In Illinois, the state-endangered Spotted Turtle (*Clemmys guttata*) occurs in two isolated populations (1-R and 2-L).
- Better understanding of the species’ local demographic behavior will help craft effective management actions.
- We used mark-recapture and reproductive data to analyze demography.

**Objectives:**
1. Determine vital rates for each population
2. Construct Leslie matrices for each population
3. Identify which vital rates most influence population growth

**Methods**

**Age-specific survival rates:**
- Limited to adult females and juveniles (assumed female sex)
- Analyzed data using Program R Package ‘RMark’, CJSRandom model

**Class-specific fecundity rates:**
- Three classes
  - Young adult (7-9 years)
  - Mature adult (10-19 years)
  - Old adult (20+ years)
- Product of average clutch size, proportion of gravid females, hatching sex ratio (assumed 1:1), and age-specific survival (post-breeding census)

**Leslie matrices and perturbation analysis:**
- Constructed Leslie matrices from estimated vital rates and 95% confidence levels
- Ran sensitivity and elasticity analyses using R Package ‘popbio’

**Results**

**Age-specific survival rates:**
- Sample size: n₁ = 105, n₂ = 153
- Results were inconclusive for Site 1-R due to insufficient data or stochasticity
- Survival increased with age and approached asymptote near 100% at Site 2-L (Fig. 1).

**Class-specific fecundity rates:**
- Clutch size increased with age while the proportion of gravid females decreased.
- Average clutch size was much larger at Site 1-R, suggesting site-specific adaptation through demographic divergence.

**Leslie matrices:**
- We derived vital rates for ages up to the oldest female found at each site (Tables 2 & 3).
- Estimated vital rates for Site 2-L had high precision.
- Site 2-L rates can be used to determine other population parameters such as generation time, net reproductive rate, the geometric growth rate, the damping ratio, and the stable age distribution.

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