Northward and Upward? Detecting Climate-Induced Shifts in New York Bird Distributions

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What's known & past approaches

- Large-scale simulations and repeated biological surveys and indicate past and future climate change-induced northward and uphill shifts in bird distributions (Thomas & Lennon 1999, LaSorte and Thompson 2007, Sekercioglu et al. 2008)
- Empirical studies typically examine changes in range boundaries or centers of distribution, (sometimes) correcting for range expansion and habitat change
- Drawbacks of these approaches:
  - Ignore intra-range dynamics
  - Assume perfect detection of species

Dynamic occupancy modeling

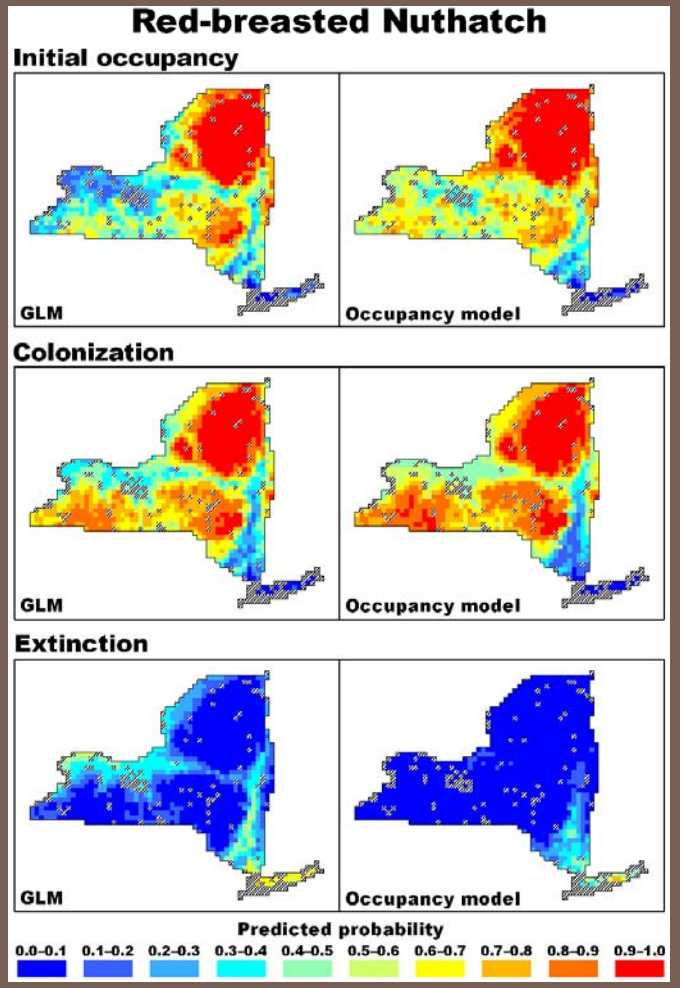
- Hierarchical maximum likelihood models accounting for imperfect detection of species (MacKenzie et al. 2006)
- *p*: observation-level detection probability
  - Modeled from detection history at temporally or spatially-repeated survey locations
  - 1 0 1 1 = detected on first, third and fourth visits
- ψ: site-level initial occupancy
- γ: site-level colonization probability
- ε: site-level extinction probability

Approach

- Employed the New York Breeding Bird Atlases (1985 and 2005)
- Eight songbirds with range boundaries within NY: four southern, four northern
- Model site-level colonization (γ) and extinction (ε) using elevation and latitude, controlling for forest cover
- Accounted for spatial autocorrelation (SAC) and spatiotemporal (ST) dependency in models
- Compared standard perfect-detection results with occupancy models

Preliminary results

- Six of eight species showed expected north or uphill trends
- Three of eight species showed opposite trends
- Models assuming perfect detection overstated trends, particularly opposite ones
- Accounting for SAC and ST generally dampened trends, sometimes reversing them



Questions?