Linking Declines in Marsh Birds to Urbanization: an Evaluation of Potential Mechanisms

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Background

Habitat loss and fragmentation are the leading causes of species decline and extinction in the U.S. (Wilcove et al. 1998). Wetland habitat has suffered severe losses as some states have lost >80% of their historic wetlands (Dahl 1990, Mitsch and Gosselink 2000). Wetland loss decreases population sizes of wetland obligate bird species and fragmentation isolates populations, increasing the likelihood of local extinction (Hanski 1999). Wetlands fragmented by urbanization may be further compromised by a decrease in habitat quality resulting from alteration of hydrological cycles and increased input of nutrients and pollutants.

As wetland loss and fragmentation continue, knowledge of bird species habitat requirements will be crucial to conservation efforts (cf. Reed 2004). Correlation between species distribution and urbanization allows researchers to predict species distributions and to identify areas where conservation actions are needed (Fielding and Haworth 1995). However, in order for management to be effective, resources managers need to know why such relationships exist, i.e. the mechanism linking bird species to habitat features. With respect to the influence of urbanization on wetlands, a possible mechanism could be reduced water quality due to increased nutrient and pollutant input. Decreased water quality (via increasing salinity) can negatively impact bird communities by changing the plant and aquatic invertebrate communities, altering the availability of important nesting and food resources during the breeding season.

During the summer of 2007, I documented a negative influence of urbanization in the surrounding landscape on the species richness of wetland bird communities in eastern Massachusetts. Consequently, I sought funding from Tufts Institute of the Environment (TIE) 1) to determine whether this pattern was temporally consistent (i.e. the same from year-to-year) and 2) to determine whether a change in water quality was responsible for the observed relationship. Specifically, I tested the following predictions:

1. Richness models relating wetland bird communities to urbanization from 2007 will accurately predict richness patterns in 2008
2. In urban settings, wetland plant communities will show an increased prevalence of invasive species (e.g. P. australis)
3. Aquatic invertebrate abundance will decreases in urban landscapes
4. Salinity levels will increase in urban landscapes
Summer 2008 Accomplishments

Wetland Bird Surveys

During 2008, I surveyed wetland breeding bird communities in 29 eastern Massachusetts sites. These sites were located in landscapes with varying degrees of urbanization as quantified by road density (ArcMap 9.0). I used road density as my index of urbanization because roads might affect wetlands by altering hydrological regimes and decreasing water quality. Within each site, I conducted 50m fixed-radius point counts at randomly placed points along the wetland-upland and water-wetland interfaces. The total number of points depended on wetland size. Counts included a call broadcast period to elicit calls from visually cryptic species. Surveys occurred from 0500-1000, and points were visited twice between May 15 and July 10.

Regression procedures were used to relate species richness of wetland specialists to the degree of surrounding urbanization.

Invasive Plant Surveys

Following bird surveys, I quantified local habitat information at each survey point using a line-intercept method. Two 25 m transects were laid out at 60° angles on opposite sides of a line bisecting the semi-circular point count stations. I walked each transect and determined the length that ran through the invasives purple loosestrife (*Lythrum salicaria*) and phragmites (*Phragmites australis*). The representation of each habitat type at a site was quantified as a proportion of the total transect length covered.

Regression procedures were used to relate the proportional coverage of purple loosestrife and phragmites to the degree of surrounding urbanization.

Aquatic Invertebrate Surveys

I sampled aquatic invertebrate from 10 wetlands using activity traps. Five activity traps were placed within each site at the interface of vegetation and water as a relatively large amount of aquatic invertebrates occur here. Traps were left in place for 24 hours before aquatic invertebrates were removed and frozen for later identification. Trapping occurred during two periods, the final weeks of May and June. These two periods correspond to the time when wetland birds are making habitat selection decisions and attempting to meet the energetic demands of their broods, respectively. All invertebrate samples were sorted and counted within six months of collection.

Regression procedures were used to relate aquatic invertebrate abundance to the degree of surrounding urbanization.

Water Quality Sampling

I collected water samples from each aquatic invertebrate sampling station and used a refractometer to determine salinity levels. Regression procedures were used to relate salinity levels to the degree of surrounding urbanization.

2008 Results

Results of my analysis are currently being prepared for publication. Copies of resulting papers will be available from TIE.
Acknowledgements

_Funding:_ Tufts Institute of the Environment, The Garden Club of America, Norcross Wildlife Foundation, Sigma Xi, Nuttall Ornithological Club, USGS through Massachusetts Water Resources Research Center; _Fieldwork:_ Tracey Dafonte, Emily Rockwell, Nick Skaff; _Statistical Support:_ Durwood Marshall; _GIS support:_ Barbara Parmenter, Patrick Florance; _Public and private Landowners_ for access to properties.

_Literature Cited_


Budget

The table below represents the approximate costs associated with research conducted in 2008. TIE funds were used to pay a field assistant salary ($4,332) and to partially cover travel costs ($1768).

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<th>Personnel</th>
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<tr>
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| Travel for field research | $6,000 |

<table>
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<th>Supplies</th>
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<td>Refractometer</td>
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| Total Costs            | $11,582 |