

# **Report for 2005MA45B: Cryptic Marsh Birds as Bioindicators of Wetland Health**

## Publications

- Other Publications:
  - Tavernia B., S. Melvin. and J.M. Reed, 2006 Local and Landscape-level Effects on Marsh Bird Distributions in a Developing Landscape. Conserving Birds in Human-Dominated Landscapes, symposium sponsored by American Museum of Natural History's Center for Biodiversity and Conservation, New York, NY. (Poster).

## Report Follows

## **Project Summary:**

### **Local and Landscape-level Effects on Marsh Bird Distributions in a Developing Landscape**

**Brian G. Tavernia, Scott Melvin, & J. Michael Reed**

#### **Abstract**

Extensive wetland loss associated with agriculture and urban sprawl has placed many marsh-dependent birds at risk, including several species of conservation concern at state and federal levels. Assessing effects of habitat loss requires effective monitoring. Many marsh species, however, are poorly covered by common survey methods, and rails in particular are behaviorally cryptic. During 2005, we used visual surveys and call playback to do repeated surveys for breeding marsh birds in 44 wetlands in central and eastern Massachusetts. Wetlands were in habitat matrices ranging from urban to rural settings. We analyzed the relationships between measured local and landscape features and species richness, as well as occupancy by the most common rail species, the Virginia Rail (*Rallus limicola*). Local habitat variables included areas of wetland, open water, and cover of different types of emergent vegetation. At the landscape level we quantified features thought to affect wetland occupancy by these species, including land use, road cover, and human census size at 8 spatial scales (50 m through 4 km). We found both local and landscape variables associated with species richness ( $r^2 = 0.84$ ) and occupancy by Virginia Rails ( $r^2 = 0.46$ ). Important landscape-level variables associated with species richness included a variety of urban associations, including census size and road cover. These factors had effects at larger spatial scales (1-4 km); urban measures negatively associated with human census size (e.g., industrial land) were positively associated with species richness. Virginia Rail occupancy was driven by area of water smartweed (*Polygonum punctatum*), and wetland cover measures (at 50 m and 1 km levels). One insight from this analysis is that some urban measures (people, roads) are negatively associated with others (industrial, commercial), and should be distinguished when assessing effects of “urbanization”.

#### **Introduction**

Wetlands are biologically diverse habitats that are under immediate threat from agriculture expansion and suburban sprawl. In some states of the U.S., >80% of historic wetlands have vanished. An important factor in the loss, degradation, and fragmentation wetland habitat is urban and suburban sprawl. These changes in landscapes are thought to be the most important threat to cryptic marsh birds (e.g. rails, bitterns, and grebes), several of which are of conservation concern at state and federal levels. Unfortunately, cryptic marsh birds are a poorly known group, so it is difficult to quantify the full impact of wetland loss and alteration.

Our goal was to determine the local and landscape variables associated with the richness and distribution of cryptic marsh bird species. Research has shown that landscape features as much as 4 km from a wetland can influence wetland chemistry. Therefore, it is reasonable to predict that large-scale landscape level characteristics might influence the suitability of wetland habitat for cryptic marsh birds.

Our specific objectives were to: (1) use playback surveys to determine the presence or absence of cryptic marsh birds in 44 MA wetland sites; (2) relate cryptic marsh species richness to local and landscape level information gathered for each site; and (3) determine the influence of local and landscape characteristics on wetland occupancy by the most common rail species in our study area, the Virginia Rail (*Rallus limicola*).

## Methods

From May to July of 2005, we used playback surveys to gather occupancy data for cryptic marsh birds in 44 freshwater emergent wetlands in central and eastern Massachusetts. Target species were the American Bittern (*Botaurus lentiginosus*), Least Bittern (*Ixobrychus exilis*), Pied-billed Grebe (*Podilymbus podiceps*), King Rail (*Rallus elegans*), Virginia Rail (*Rallus limicola*), Common Moorhen (*Gallinula chloropus*), Sora (*Porzana carolina*), Great Blue Heron (*Ardea herodias*), and Green Heron (*Butorides virescens*). As these species are difficult to detect, playback surveys used recorded vocalizations to elicit responses from birds. Sites were surveyed on three occasions to ensure a  $\geq 90\%$  chance of detecting species if they were present. The number of species detected was summed to obtain a measure of species richness for each site. Some of the sites were surveyed by the USFWS, who used the same survey protocol.

During July, the areas of different vegetation types and open water in each site were visually estimated. ArcMap 9.0 was then used to determine the average local habitat conditions within 50 m and 100 m of established survey points in each of the wetland sites. Local factors considered included wetland area, aquatic bed vegetation, open water, cattail, purple loosestrife, shrub, swamp loosestrife, water smartweed, and fine-leaved emergents.

Landscape level information was gathered for each of the sites using ArcMap 9.0 at 8 spatial scales (50 m - 4 km). Specifically, we measured the area of several different land use types: agriculture, forest, wetland, water bodies, and developed land (e.g. commercial and industrial). The number of people and road length at each spatial scale were also measured. Landscape information was obtained from MassGIS ([www.mass.gov/mgis](http://www.mass.gov/mgis)).

Species richness was related to local and landscape factors using multiple regression. Logistic regression was used to relate the occupancy of Virginia Rails to local and landscape characteristics of each site. Statistical analyses were carried out in SAS 9.1.

## Results

We found significant relationships between local and landscape measures and waterbird species richness and occupancy by Virginia rails.

<b>Results of species richness (multiple regression)</b>	
<u>Source</u>	<u>df</u>
Model	10
Error	33
Corrected Total	43
p-value = <0.01 $r^2 = 0.84$	

<b>Independent variables in Model (Type III values)</b>		
<u>Variable</u>	<u>Effect</u>	<u>p-value</u>
Fine-leaved emergents (50 m)	(-)	0.02
Cattail (100 m)	(+)	<0.01
Agricultural land (50 m)	(+)	<0.01
Wetland (50 m)	(+)	<0.01
Wetland (1 km)	(+)	<0.01
Water bodies (1 km)	(+)	<0.01
Developed (1 km)	(+)	<0.01
Developed (2 km)	(+)	0.03
Major Roads (3 km)	(-)	0.05
Major Roads (4 km)	(-)	<0.01

<b>Virginia Rail occupancy (logistic regression)</b>	
<u>Variable</u>	<u>Effect</u>
Water smartweed (50 m)	(+)
Wetland (50 m)	(+)
Water bodies (1 km)	(+)
p-value = <0.05 $r^2 = 0.46$	

## **Discussion**

We found local wetland characteristics and features of the surrounding landscape to be significantly related to cryptic marsh bird species richness and wetland occupancy by Virginia Rails. Many of the factors associated with species richness were measures of urbanization. Increasing road length at larger spatial scales was negatively correlated with species richness. Roads are thought to negatively affect wetlands and wetland wildlife in several ways. For example, roads can increase the amount of and alter the chemical composition of runoff into wetlands as well as allow humans greater access. Interestingly, increasing amounts of developed land (e.g. industrial land) were positively associated with species richness. This could be because developed land is negatively

correlated with other measures of urbanization, e.g. road density or human population size.

While not directly related to measures of urbanization, Virginia Rail occupancy was, in part, driven by measures of wetland cover at the landscape scale. This influence could be due to rails cueing in on water body rich areas because they possess a fairly broad and diverse resource base. Continued development of the surrounding landscapes would result in increasing loss of wetland habitat decreasing the suitability of many areas for Virginia Rails.

The effects of urbanization are generally thought to be correlated, and associated with negative effects on native biodiversity. For example, the number of people and road cover tend to co-occur. The presence of people also increases other problems, such as feral cat numbers. However, some urban measures, such as industrial land and commercial property cover, are associated with lower human numbers and road density. So, it would be valuable to think of urbanization in terms of specific mechanisms that might impact – or favor (compared to other human development) – native biodiversity.

Our results lend support to the idea that continuing development and urbanization of landscapes will be detrimental to cryptic marsh bird species. Future efforts to conserve these species will need to account for the potential impact of continuing landscape development.

### **Acknowledgements**

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WRRRC funds were used to pay the travel expenses of an undergraduate research assistant.

### **Presentations:**

- Tavernia B., S. Melvin. and J.M. Reed. 2006. Local and Landscape-level Effects on Marsh Bird Distributions in a Developing Landscape. Conserving Birds in Human-Dominated Landscapes, symposium sponsored by American Museum of Natural History's Center for Biodiversity and Conservation, New York, NY. (Poster)

### **Additional Funding:**

No additional funding has been obtained to date.