Avian use of two experimental wetland basins in central Ohio in 1999 and 2001

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Abstract

Two experimental wetland basins, created under essentially identical conditions except for vegetative structure, are examined to compare the differences in their use by three populations of birds. The two wetlands are located in the Olentangy River Wetland Research Park on the campus of The Ohio State University, Columbus, Ohio USA. A census of birds was taken for each of the two wetlands in October 2001. Populations of mallard (*Anas platyrhynchos*), song sparrow (*Melospiza melodia*) and of the red-winged blackbird (*Agelaius phoeniceus*) were analyzed as to differences in use of the two wetlands. Mallards showed a significant difference in use of the two experimental basins ($t = 2.356$; $P = 0.015$; $df = 16$) as did the song sparrows ($t = 2.962$; $P = 0.004$; $df = 16$). Both mallards and song sparrows were more abundant in the less productive but more complex vegetative structure of the planted basin. Red-winged blackbirds were not observed during the census effort. The difference in wetland use by each species was also compared to an earlier study conducted in the spring of 1999. Animal activity may contribute to the difference in vegetative structure and the subsequent difference in use between the two wetlands by the species under investigation.

Introduction

Wetlands provide an important habitat for many species of birds including waterfowl and obligate and facultative wetland birds. Such species rely on wetlands for foraging habitat, nesting and residential uses (Weller, 1999). With the disappearance of wetland habitats over the years and the resulting loss in biodiversity, legislative steps have been taken to replace lost wetlands by constructing or restoring wetlands. These mitigated wetlands are to restore habitat that was lost or degraded for fish and wildlife including birds.

The Olentangy River Wetland Research Park was created in part to develop proper design criteria for wetland construction and to evaluate their effectiveness. The specific objectives of this study are to analyze the difference in use between two wetlands in the park among populations of several bird species and relate the differences or non-differences in use to the vegetative structure of the two wetlands. Vegetative structure has been recognized as an important determinate among several species of birds in selecting nesting and foraging sites (Orians and Wittenberger, 1991). Understanding such factors as the vegetative structure of a wetland and its relationship to increased association with waterfowl and other wetland birds would provide insight into refining wetland managing techniques to increase productivity and biodiversity. The area to be studied has two experimental basins that were excavated in the fall of 1993 and flooded in 1994. The basins are separated by an upland characterized as oldfield succession. One wetland (designated planted basin) was planted with 12 species of wetland macrophytes, the other wetland (the unplanted basin) was colonized naturally. The hydrology of the two experimental wetlands is artificially controlled by means of a pump bringing water from the Olentangy River. Each receives the same inflow and experiences approximately the same outflow.

Methods

Bird surveys were conducted at the Olentangy River Wetland Research Park (ORWRP) on The Ohio State University campus, in Columbus, Ohio. A census was conducted three times a week from October 9, 2001 to November 4, 2001 to quantify avian species richness and abundance in two experimental wetland basins, one that was planted and the other colonized naturally (Figure 1). Nine sampling efforts were conducted over each Tuesday, Thursday and Sunday during the census period. Data was not collected for two days of the set census dates due to weather conditions, including high-speed winds and rains, which increased bias and prohibited accurate counts. Only a partial census was taken on another set census date, as access to the oldfield habitat separating the two basins was restricted. Census data was not included from this day. Counts were taken by observer(s) moving along a fixed transect (Figure 1) counting birds by sight and by sound with each sampling effort lasting approximately 75 minutes. Observers assumed singing birds were reliably detected. The time of the census alternated each sampling effort between 10:00 am and 5:00 pm. Observations and counts were delineated between the planted and unplanted basins. Any birds found in the oldfield separating the two basins that were not within 10 meters of either shoreline were omitted from the count. Location of birds in this oldfield area was deemed indeterminate to a specific wetland site for bird use and/or association. Species observed within the

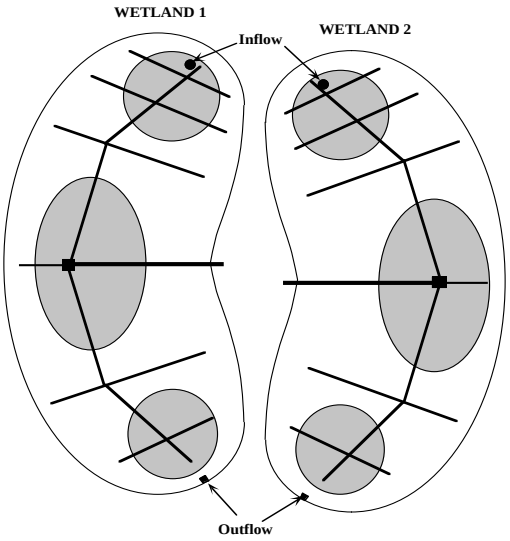

Figure 1. Study area of the experimental wetlands at ORWRP.

two wetlands are found in Table 1.

Mallards (*Anas platyrhynchos*) and song sparrows (*Melospiza melodia*) were the only two species counted in sufficient numbers in the wetland basins for analysis. Mean numbers of mallards and song sparrows per sampling effort were calculated (Table 2). T-tests were used to compare differences in use of the planted and unplanted wetland basins for both species. Results were compared to the t-test results in mallard, song sparrow and red-winged blackbird use of the two basins in 1999 (Zuwerink and Gates, 2000).

Results

The total number of observed bird species in the planted basin was 10 and in the unplanted basin 14 (Table 1). The most abundant species in both wetland basins were the mallard and song sparrow. This data corresponds to some degree with the findings of Zuwerink and Gates (2000) where 10 species were counted in the planted basin and 12 in the unplanted basin. Six of the species identified in the basins are classified as obligate waterfowl (Weller, 1999). Mallards, song sparrows and red-winged blackbirds were the most abundant species in the census taken in 1999 (Zuwerink and Gates, 2000). Red-winged blackbirds were not observed during any of the sampling efforts undertaken in this study. Mallards were observed both foraging in the open water and sheltered in the tall grasses of the wetland. No nests or broods were observed. Song sparrows were observed in the woody edge vegetation of the wetlands and as the seasonal defoliation of this deciduous vegetative covering progressed, the song sparrows were increasingly observed in the emergent macrophyte patches.

Mallard association with the planted wetland significantly differs from association with the unplanted wetland (Table 2) ($t = 2.356$; $P = 0.015$; $df = 16$). This is a

Table 1. Locations of bird sightings in the planted and unplanted wetland basins at the Olentangy River Wetland Research Park during October-November 2001.

Species	Wetland 1 (planted)	Wetland 2 (naturallly colonizing)
Cardinal	X	X
Mallard	X	X
Song sparrow	X	X
White-throated sparrow	—	X
White-crowned sparrow	—	X
Chipping sparrow	—	X
Field sparrow	X	X
Great Blue Heron	X	X
Belted kingfisher	X	—
Canada goose	—	X
Eastern phoebe	—	X
Cooper's Hawk	X	—
American kestrel	X	—
Marsh Wren	X	X
Pie-billed grebe	—	X
Robin	—	X
Red-winged blackbird	—	—
Goldfinch	X	X
Total number of species	10	14

Table 2. Mean ± standard error of birds observed per sampling session using the Olentangy River Wetland Research Park during October-November 2001 and March-June 1999 (Zuwerink and Gates, 2000).

Species	Wetland 1		Wetland 2	
	SP 1999	AU 2001	SP 1999	AU 2001
Mallards	3.5 ± 0.8	4.7 ± 1.0	2.4 ± 0.8	1.7 ± 0.6
Song Sparrows	3.0 ± 0.5	4.7 ± 0.9	1.8 ± 0.4	1.1 ± 0.7
Red-winged blackbird	4.6 ± 0.7	*	7.1 ± 0.6	*

* species not encountered during sampling period in 2001.

change from Zuwerink and Gate's (2000) findings of no differences in mallard use between wetland basins ($t = 0.921$; $P = 0.37$; $df = 13$). Song sparrows were observed more frequently in the planted basin for 1999 and 2001 (Table 2). Use or association by the song sparrow with the planted wetland basin differs significantly from use of the unplanted basin ($t = 2.962$; $P = 0.004$; $df = 16$), reflecting a greater use than Zuwerink and Gate's (2000) analysis ($t = 1.960$; $P = 0.063$; $df = 22$).

Discussion

Mallard use of the planted and unplanted basins had a detectable difference in 2001 (Table 2), indicating a change from 1999 (Zuwerink and Gates, 2000). Mallards increase their intake of invertebrates (protein) in preparation for wintering and as a dabbling duck forage in the open water (Palmer, 1976). While the planted basin does have a greater area of open water than the unplanted basin, this difference has been present since 1995 (Mitsch & Zhang, 2001) and would not explain the lack of difference in use of both wetlands by the mallards in 1999. Likewise both wetlands did not have a difference in relative abundance of macroinvertebrates in 1999 or between the years 1998 and 1999 (Custer, Johnson and Mitsch, 2000). This is expected since the two wetland basins are in close proximity to one other and share the same water source. The assumption is made that the two wetlands continue to be similar in macroinvertebrate abundance at the time of this investigation. The vegetative structure for the planted basin continues to be more complex than the unplanted basin, though its net productivity and above ground productivity are less (Mitsch et al., 2001). There has been an increase in *Typha* cover in the planted basin though it is not the dominant vegetation (Mitsch & Zhang, 2001). This increased *Typha* cover and the more complex vegetative structure in the planted basin, coupled with an increase in muskrat activity in the unplanted wetland, may account for the greater association of mallards with the planted wetland basin. The unplanted basin has developed into a wetland dominated by *Typha* sp. and has had greater productivity than the planted basin (Mitsch and Zhang, 2001; Mitsch et al., 2001). The higher productivity leads to an increased availability in building material for muskrat huts and a higher nutritional value for muskrat consumption. The result is the presence of twice as many muskrat huts in the unplanted, more productive wetland (Higgins and Mitsch, 2001). The observations of this investigation were made in October, when muskrat hut building activity is taking place. It was observed that a substantial amount of *Typha* cover was removed by what appeared to be animal activity, assumed to be muskrat by the appearance of more and larger muskrat huts (Figures 3 & 4). Roosting sites for over-wintering ducks are often selected to minimize loss of body heat by use of sheltered areas and that bird numbers are related to the amount of roosting habitat in wetlands (Weller, 1999; Leitch, Linz & Baltezore, 1997). The more extensive the roost sites, the greater potential for more birds including mallards in the case of this study (Figure 2). Thus, removal of *Typha* cover in the unplanted basin may have influenced the mallards to favor the planted basin where the grass and sedge communities offered, along with the *Typha* cover not exploited by the muskrats, greater cover and shelter for roosting. The large population of muskrats in the unplanted basin may also create such a disturbance to the mallard population as to favor their association with the less disturbed planted basin. Attempts to quantify the loss of *Typha* sp. cover and the increase in muskrat activity in the unplanted basin on resident mallard behavior during the fall season may provide understanding in why there was a change in use between the two basins by the mallards from 1999 to 2001.

Song sparrow use of the planted basin versus the unplanted basin did continue to be different for both 1999 and 2001. However the difference in use was more than marginal as stated by Zuwerink and Gates (2000) for 1999. Song Sparrows remain on or near their nesting sites to roost during the winter (Weller, 1999) and typically prefer dense vegetation along marshes, waterways etc. for nesting and roosting (Bent, 1968). Like the mallard, the greater use of

the planted wetland basin by the song sparrow may result from the loss of *Typha* sp. cover in the unplanted basin due to seasonal muskrat activity. The song sparrows thus find the needed roosting materials and cover in the more vegetative complex and less muskrat-exploited planted wetland.

Zuwerink and Gates (2000) observed the red-winged blackbird population showing a difference in association between the two wetland basins, favoring the unplanted basin in the spring of 1999. Linz et al. (1996) found that densities of red-winged blackbirds were higher in wetlands that were not treated with *Typha* inhibiting herbicides than those where the cattails were reduced by aerial sprays of the herbicide. Ozesmi and Mitsch (1997) also found red-winged blackbirds preferred *Typha sp.* for nest construction and cover since it has a higher durability (i.e. more resistant to wind and wave action) compared to other macrophytes found in the wetlands. The red-winged blackbirds also prefer their nests to be closer to open water (Ozesmi & Mitsch, 1997). With both wetland basins having substantial areas of open water adjacent to *Typha* sp. stands, it appears that the number of red-wing blackbirds in the wetland basins was limited by *Typha* density. The unplanted basin in Zuwerink and Gates (2000) study had the greatest *Typha* sp. density and this more than likely would explain its greater use by red-wing blackbirds compared to the planted basin in the spring of 1999. Red-winged blackbirds were not observed during the current sampling effort (Table 1). Foraging and wintering strategies of the *Agelaius phoeniceus* would explain the change in observed populations between the census taken in the spring of 1999 and in the fall of 2001. Blackbirds, after nesting season and in preparation for fall migration, tend to wander in flocks and forage in farmlands, forest edges and in marshes (Kaufman, 2000). They thus forage agricultural fields by day and congregate in marshes by night. It is assumed that the blackbird population of the surveyed wetland basins was engaged in this activity during the sampling effort, which took place near the migrating and wintering season. Further research into the use of the planted versus unplanted basin by red-winged blackbirds would involve taking a census of red-wing blackbirds from March to June. These results could be compared to the Zuwerink and Gates (2000) study to determine changes in use of the wetland basins. Such a study may also provide an examination of the impact that nearby human activity has on the ORWRP's experimental wetlands. The northeast bank of the Olentangy River that borders the experimental wetland study site is currently under further development for housing. Such activity may influence red-wing populations as suggested by Vierling (2000). Anthropogenic activity that influences habitats may cause that habitat to be a sink for a population of a species. Vierling (2000) sought to distinguish demographic source and sink habitats for red-winged blackbirds. Her findings identified habitats strongly influenced by human activities (such as a suburban area) as a sink for red-wings. This may be in part due to loss of foraging areas resulting from increased building activity and subsequent habitat loss. It may also result from the increase in densities of human-commensal predators such as raccoons that predate nests of the red-winged blackbird. Further study of the red-wing blackbird population in the study site, as well as the mallard and song sparrow, may provide insight on how human activity on the habitat influences these bird populations.

The data generated by this study is very limited and lacks the rigor of a more elaborately designed census. The investigation was designed to be conducted over a very brief time period and was by necessity very simple. Yet the data and subsequent t-test results may be useful in ascertaining simple shifts in the use of the two wetlands by the bird populations present. It appears that vegetative structure plays an important role in determining the association/use of different species with a wetland. Acquiring a better understanding of the interactions of the vegetative structure of various wetlands with specific wetland species of birds will provide better tools and methods of managing the wetlands for greater biodiversity.

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References.

Bent, A.C. 1968. Life Histories of North American Cardinals, Grosbeaks, Buntings, Towhees,Finches, Sparrows, and Allies; Order Passeriformes: Family Fringillidae. Dover Publications, New York. 1889 pp.

Custer, K.W., D.L. Johnson and W.J. Mitsch. 2000. Fish, amphibians and aquatic macroinvertebrate diversity in two Olentangy Wetlands – Spring 1999. In: W.J. Mitsch and L. Zhang (eds.), The Olentangy River Wetland Research Park at the Ohio State University,Annual Report 1999. The Ohio State University, Columbus, OH, pp.121-128.

Higgins, C. and W.J. Mitsch, 2001. Muskrat (Ondatra zibethicus) huts and population estimates in two experimental basins in winters 1999-2000 and 2000-2001. In: Mitsch, W.J., Zhang, L., (Eds.), The Olentangy River Wetland Research Park at the Ohio State University, Annual Report 2000. The Ohio State University, Columbus, OH, pp. 113-114.

Kaufman, K. 2000. Birds of North America. Houghton Mifflin, New York. 383 pp.

Leitch, J.A., G.M. Linz and J.F. Baltezore. 1997. Economics of cattail (*Typha* spp.) control to reduce blackbird damage to sunflower. Agri. Ecosys. & Envir. 65. 141-149.

Linz, G.M., D.C. Blixt, D.L. Bergman and W.J. Bleier, 1996. Responses of red-winged blackbirds, yellow-headed blackbirds and marsh wrens to glyphosate-

induced alterations in cattail density. Journ. Field Ornith. 67(1). 167-176.

Mitsch, W.J. and L. Zhang. 2001. Plant community development after seven growing seasons in the two experimental wetland basins. In: Mitsch , W.J., Zhang L., (Eds.), The Olentangy River Wetland Research Park at the Ohio State University, Annual Report 2000. The Ohio State University, Columbus, OH, pp.43-46.

Mitsch, W.J., C. Ahn and V. Perry. 2001. Net primary productivity of macrophyte communities after seven growing seasons in experimental planted and unplanted marshes. In: Mitsch , W.J., Zhang L., (Eds.), The Olentangy River Wetland Research Park at the Ohio State University, Annual Report 2000. The Ohio State University, Columbus, OH, pp. 49-53.

Orians, G.H. and J.F. Wittenberger. 1991. Spatial and temporal scales in habitat selection. Amer. Nat. 137. S29-S49.

Ozesmi, U. and W.J. Mitsch. 1997. A spatial habitat model for the marsh-breeding red-winged blackbird (*Agelaius phoeniceus* L.) in coastal Lake Erie wetlands. Ecol. Model. 101.139-152.

Palmer, R.S. (Ed.). 1976. Handbook of North American Birds. Vol. 2. Waterfowl. Yale University Press, New Haven. 521 pp.

Vierling, K.T., 2000. Source and sink habitats of red-winged blackbirds in a rural/suburban landscape. Ecol. Appl. 10(4). 1211-1218.

Weller, M.W., 1999. Wetland Birds. Habitat Resources and Conservation Implications. University Press, Cambridge. 271 pp.

Zuwerink, D.A., R.J. Gates, 2000. Avian use of planted versus unplanted wetland basins a Olentangy River Wetland Research Park. In: Mitsch , W.J., Zhang L., (Eds.), The Olentangy River Wetland Research Park at the Ohio State University, Annual Report 1999. The Ohio State University, Columbus, OH, pp. 143-145.

Pictures of avian activities during the study in the experiments wetlands.

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