

Birds in the Ohio River Valley: Possible Indicators of Environmental Quality¹

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ABSTRACT. The 1987 Boatload of Knowledge provided a unique opportunity to census the birds along the Ohio River from Pittsburgh to Louisville. A daily species count and determinations of species diversity on three sections of the River were done. While some difficulties were experienced during the censusing along the River, the overall results, field work plus a literature and information search, point to differences in bird species diversity along the Ohio River. The diversity of birds species corresponds to differences observed in the habitat along the sampled sections of the Ohio River.

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INTRODUCTION

During the winter of 1825-26, a keelboat of learned individuals made their way on the Ohio River from Pittsburgh, PA to Mount Vernon, IN (Pitzer 1989). The trip, which has become known as the Boatload of Knowledge, provided a record of the natural environment and particularly the birds of the Ohio River Basin at that time period. Charles-Alexandre Lesueur, an artist and naturalist, reported geese, bald eagles, and turkey vultures. Robert Dale Owen hunted frequently while the boat was ice-bound for a month. He reported shooting at partridge, doves, and pheasants (possibly bob-white quail, passenger pigeons, and roughed grouse, respectively). His initial hunting was largely unsuccessful until he received some instruction on the use of his newly purchased rifle. After lessons, it is reported that "a favorite sport of the young humanitarian was shooting the heads off woodpeckers" (Wilson 1975). The unfortunate birds may have been pileated woodpeckers.

The second Boatload of Knowledge on the Ohio River during the summer of 1987 provided an opportunity to study the birds in the Ohio River valley. Specifically, a boatload of observant and environmentally conscious graduate students spending two weeks on the Ohio River provided the opportunity to gather data on bird populations. This project documented the presence of different species of birds along the River, categorized their status, and used diversity estimates as an indicator of environmental quality. The primary objective was to provide a baseline of data that might be expanded in future years as the Boatload of Knowledge continues.

Using the flora and fauna of a region as an indicator of environmental quality is an accepted practice (Weber 1973). Most of this work has been done in aquatic environments using invertebrates or fish populations. Some studies have examined the use of bird populations as a measure of environmental quality (Custer and Osborne 1977). However, problems of studying bird populations over a large area are many (Mengel 1958).

MATERIALS AND METHODS

Bird census data were collected from River Mile (RM) 0 to 800 on the Ohio River from 21 July to 2 August as part of the 1987 Boatload of Knowledge (Mitsch et al. 1989). Four techniques were used to collect data for this study:

1. A record of species seen or heard each day was kept. The spotting of species was done primarily by the author, but significant

help was received from the other 10 passengers on the Boatload of Knowledge. Birdwatching improves with additional eyes and ears. Gaps in the data occur because the author was not on the boat on 7-25 and 7-30 and travel on the River did not occur on 7-27 and 7-31. The average number of hours of observation for the nine days on the River was 7.1 hrs. Of particular interest were birds like bald eagles, ospreys, and the heron family that are at the top of the aquatic food chain and were at one time more abundant in the Ohio River Valley. According to Peterson (1980), the study area is beyond the breeding range of eagles, ospreys, and yellow-crowned night herons. Peterjohn et al. (1987) listed eagles as casual-rare summer visitors in southern Ohio, ospreys as casual-rare nonbreeding summer visitors, and yellow-crowned night herons as rare to uncommon migrant and summer residents in Ohio.

2. Three diversity counts were done during the trip—one on the upper Ohio (RM 220), one on the middle Ohio (RM 400), and one on the lower Ohio (RM 575). Species and number of individuals were recorded until 100 individuals had been counted. The diversity counts were done while observers were on the boat, which presented problems because of the noise and constant motion. The third diversity count was interrupted by an off the River field trip before 100 individuals were observed. Species diversity (H) was calculated using the Shannon Weaver Index (Weber 1973):

$$H = - \sum_{i=1}^S p_i \ln p_i$$

where $p_i = n_i/N$; n_i = number of individual species; N = total number observed; and S = number of species.

3. Records of the Audubon Christmas Bird Counts (1957-1985) were obtained for the counts done in the Ohio River Valley. The following Christmas counts were reviewed:
 - Wheeling, West Virginia (RM 90)
 - Washington Co. (Marietta), Ohio (RM 172)
 - Parkersburg, West Virginia (RM 185)
 - Mason Co. (Pt. Pleasant), West Virginia (RM 250).
 - Portsmouth, Ohio (RM 355)
 - Cincinnati, Ohio (RM 462)
 - Louisville, Kentucky (RM 602)Total number of species and individuals for each count and year were recorded.
4. Results of the Ohio Breeding Bird Atlas (Rice 1988) were obtained for all of the blocks counted in the Ohio River Valley. Total number of species reported for each block were recorded.

RESULTS

SPECIES FREQUENCY AND DIVERSITY. A total of 73 species of birds were observed during the Boatload of Knowledge voyage from Pittsburgh to Louisville. The species were recorded by day and by the number of days each species was observed (Table 1). While no bald eagles (*Haliaeetus leucocephalus*) were observed, ospreys (*Pandion haliaetus*) were seen on two occasions. Two immature yellow-crowned night herons (*Nycticorax violaceus*) were observed just north of Neal Island (RM 181).

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TABLE I

Daily list of bird species recorded along the Ohio River Corridor during the Boatload of Knowledge 7/20-8/2, 1987

	7/20*	7/21	7/22	7/23	7/24	7/25	7/26	7/28	7/29	8/1	8/2	Number of Days Observed
Great Blue Heron		0	0	0	0		0	0	0	0	0	9
Green-backed Heron				0			0		0			3
Yellow-crowned Night Heron				0								1
Snow Goose		0										1
Canada Goose		0	0	0	0		0	0				6
Mallard		0	0				0	0	0			5
Wood Duck			0	0	0				0			4
Red-breasted Merganser						0						1
Turkey Vulture		0	0	0			0	0	0		0	7
Black Vulture											0	1
Red-tailed Hawk			0	0	0							3
American Kestrel		0			0		0	0	0			5
Osprey						0			0			2
Bobwhite							0					1
Killdeer		0	0	0	0		0			0	0	7
Greater Yellowlegs											0	1
Lesser Yellowlegs											0	1
Spotted Sandpiper					0		0		0			3
Ring-billed Gull		0										1
Common Tern									0			1
Rock Dove	0	0	0	0	0		0	0	0		0	9
Mourning Dove			0	0	0		0	0	0	0	0	8
Yellow-billed Cuckoo									0		0	2
Common Nighthawk											0	1
Chimney Swift		0	0	0	0		0	0	0			7
Ruby-throated Hummingbird			0	0	0				0	0		5
Belted Kingfisher		0	0	0	0		0	0	0	0	0	9
Common Flicker					0		0		0	0	0	5
Red-headed Woodpecker									0		0	2
Eastern Kingbird			0	0					0	0		4
Eastern Phoebe					0				0			2
Least Flycatcher			0	0								2
Eastern Wood Pewee											0	1
Tree Swallow				0								1
Bank Swallow					0		0	0				3
Rough-winged Swallow		0	0	0	0							4
Barn Swallow			0	0	0		0	0	0			6
Purple Martin								0				1
Blue Jay					0			0			0	3
Common Crow		0	0	0	0		0	0	0	0		8
Carolina Chickadee								0				1
Tufted Titmouse								0			0	2
White-breasted Nuthatch		0	0	0						0		4
House Wren					0			0	0	0	0	4
Carolina Wren			0	0	0		0	0	0	0	0	8
Mockingbird									0	0		2
Gray Catbird		0	0	0								3
Brown Thrasher				0								1
American Robin		0	0	0			0	0	0	0	0	8
Wood Thrush									0		0	2
Eastern Bluebird										0		1
Blue-gray Gnatcatcher		0										1
Starling	0				0		0	0	0		0	6
White-eyed Vireo							0					1
Red-eyed Vireo		0							0		0	3
Warbling Vireo							0		0			2
Yellow-throated Warbler							0					1
Yellow Warbler			0	0								2
Common Yellow-throat			0	0			0		0	0		5
House Sparrow	0				0			0	0	0		5
Eastern Meadowlark										0		1
Redwinged Blackbird		0							0			2
Northern Oriole											0	1
Common Grackle	0		0	0	0			0	0	0	0	8
Brown-headed Cowbird										0		1
Cardinal	0	0	0	0	0		0	0	0	0	0	10
Indigo Bunting			0	0			0	0	0	0	0	7
House Finch					0							1
American Goldfinch	0		0	0	0			0	0	0	0	8
Rufous-sided Towhee		0					0	0			0	4
Chipping Sparrow											0	1
Field Sparrow										0		1
Song Sparrow		0	0	0	0		0	0	0	0	0	9
NUMBER OF SPECIES	6	22	28	31	28	2	28	27	37	22	31	

*The only time spent at the River on the 20th was at Clemente Park in Pittsburgh

The number of days a species was observed was calculated as a function of the number of species seen for that number of days (Fig. 1). One species, the cardinal, was seen on ten days. A total of twenty-four species were only seen on one day. This inverse relationship is what would be expected.

Three counts of species and individuals were done so that species diversity could be calculated (Table 2). The species diversity demonstrated variance among the three areas that were sampled. These differences are consistent with observations of the regions in which the counts were done. The upper Ohio River count area was just above Ravenswood. It was a relatively rural and agricultural section with roads and railroads on both sides of the River. The section where the middle Ohio River count was done had a wide diversity of habitats. Forested hills and floodplains were mixed with agricultural uses. One island was passed as this count was being done. A small community was also passed on the Ohio side. The lower Ohio River count area was highly developed agriculturally.

Data from twenty-two blocks of the Ohio Breeding Bird Atlas project were obtained for the upper Ohio River (Steubenville) to lower Ohio River (Cincinnati area). No apparent differences were noted from upper to lower sections of the river. There was a correlation between the species counts for three blocks where the Boatload of Knowledge diversity counts were done (Table 2).

COMPARISON WITH CHRISTMAS COUNTS. The data collected from the Audubon Christmas Bird counts showed significant differences from the upper to lower sections of the Ohio River, while counts from this study did not show a pronounced difference from upstream to downstream (Fig. 2). The upriver areas have lower counts

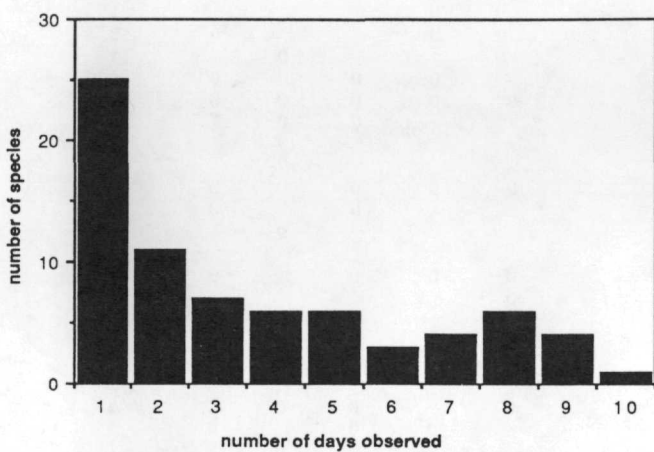


FIGURE 1. Frequency diagram illustrating the number of days species were observed during the 1987 Boatload of Knowledge.

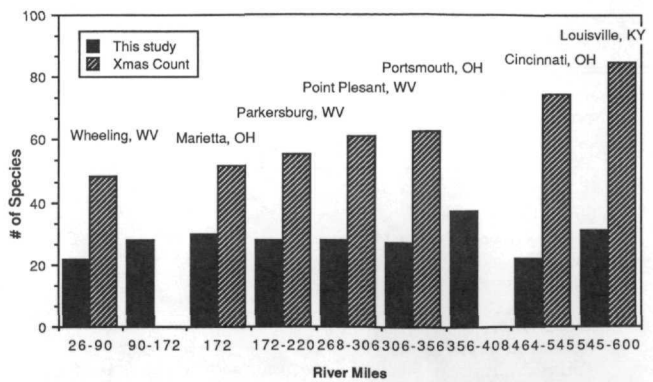


FIGURE 2. Comparison of the number of species observed in this study and the Audubon Christmas Count in the Ohio River Valley.

than the downstream areas in the summary of the available data on Christmas Counts. The number of species for all areas in the Ohio River Valley participating in the Audubon Christmas Bird Count varies considerably from year to year (Fig. 3). As would be expected, the number of species counted increases to the south. There has been a statistically significant ($\alpha = 0.01$) decline in the average number of species throughout the Ohio River Valley from 1957 to 1984 (Fig. 4).

DISCUSSION

There was a relationship between the observed habitat quality and bird species diversity for the three locations of the diversity counts. Diversity counts should be incorporated on a daily basis in a future study. These counts should be done in conjunction with the collection of other environmental data (e.g., water quality parameters, vegetation analyses, and land-use patterns).

The correlation between number of breeding bird species and diversity counts noted in this study may be a chance occurrence. A closer attempt to do diversity

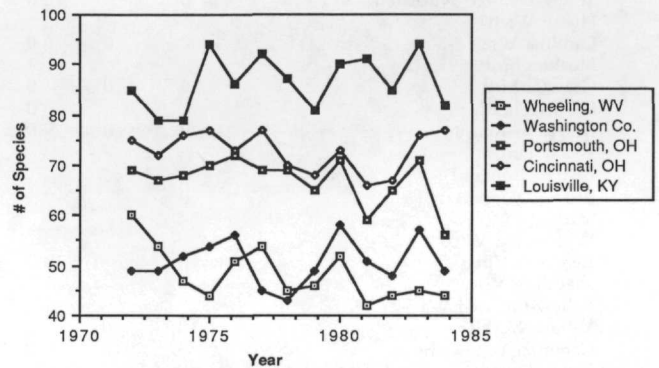


FIGURE 3. The number of species observed in the Audubon Christmas Counts in the Ohio River Valley. Note that for the last 13 years the number of species is higher downriver.

TABLE 2
Diversity counts of birds in three reaches of the Ohio River Valley

	Number of Individuals Observed	Number of Species Seen	Diversity Index	Ohio Breeding Bird Atlas Number of Species
Upper Ohio River (RM 220)	100	15	2.10	82
Middle Ohio River (RM 400)	100	21	2.65	87
Lower Ohio River (RM 575)	73	13	1.62	75

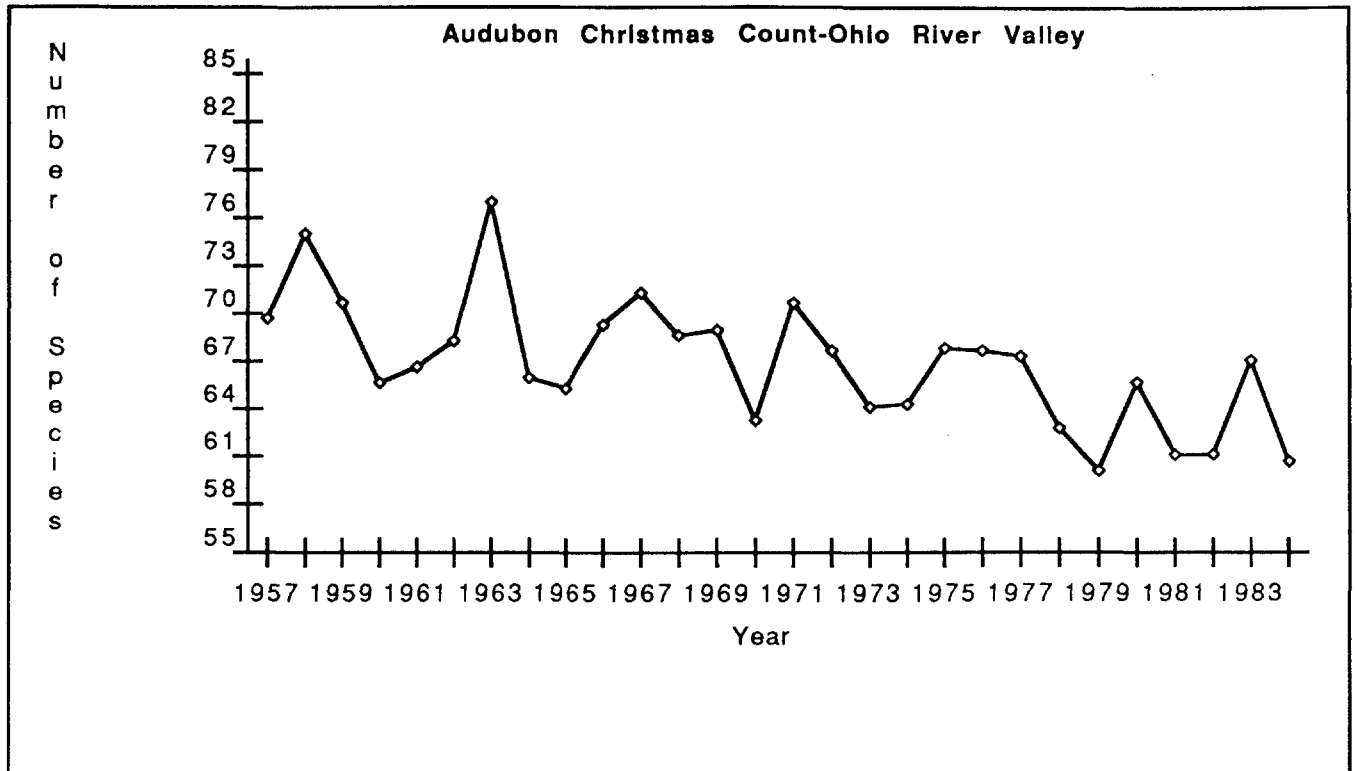


FIGURE 4. A downward trend exists for the average number of species for all locations in the Audubon Christmas Counts in the Ohio River Valley, $r = -.64$.

counts at all the locations of breeding bird census blocks would yield more data for a correlational study.

The downward trend of the average number of species counted along the Ohio River Valley in the Audubon Christmas Bird Count is worthy of further investigation. The difference in average number of species observed at each location during the Audubon Christmas Bird Count has a number of plausible explanations. For example, the Cincinnati and Louisville counts have significantly more birdwatchers involved, the lower Ohio River counts are more directly in Mississippi flyway migration routes, and the weather in the more southern regions is less harsh. Since so many explanations are possible, it would be erroneous to say that the lower Ohio environmental quality is better because of consistently more species being present.

The overall trend in species observed over the entire Ohio River Basin deserves further study. Is environmental quality in the basin deteriorating or improving as evidenced by the number of species of birds? The Ohio River Valley Water Sanitation Commission (1983) is finding that fish diversity is improving in the Ohio River Basin. Could water quality be improving in the Basin while overall environmental quality is deteriorating?

The question of utilizing birds as indicators of environmental quality in the Ohio River Basin has not been answered. Differences in bird population characteristics along the Ohio River Valley were found in the species diversity counts and the Audubon Christmas Bird Count, but additional study with more detailed coverage and refined techniques is needed.

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