Proceedings of the Iowa Academy of Science

Volume 86 | Number Article 3

1979

Birds of Some Iowa Wetlands in Relation to Concepts of Faunal Preservation

Mitlon W. Weller
Iowa State University

Proc. Iowa Acad. Sci. 86(3):81-88. 1979

Birds of Some Iowa Wetlands in Relation to Concepts of Faunal Preservation[1]

MILTON W. WELLER

Department of Animal Ecology[2], Iowa State University, Ames, IA 50011

Forty-one species of birds nested in the prairie-wetlands complex of Dewey's Pasture during the period 1962 to 1974. Numbers of pairs and nests were recorded annually for the ducks and other waterbirds that dominated the avifauna, but observations on terrestrial species were less detailed and only frequency of occurrence data are presented. These data on bird use of a relict pothole area demonstrate the dynamics of bird populations in relation to habitat conditions. Abundance and diversity of waterbirds were positively correlated with increasing water depth. Problems of conserving typical avifaunas in small wetlands units surrounded by intensive agriculture are discussed in reference to extirpated species and to the role of habitat size and diversity in maintaining species richness.
INDEX DESCRIPTORS: Waterbirds, Wetlands, Conservation.

Although drainage of Iowa wetlands probably exceeds 95% of those originally present (Bennett, 1938; Mann, 1955), a few remaining marshes still attract and produce a significant number and variety of waterbirds. Such relicts are mostly in the rolling morainal country bordering the Wisconsin glacial lobe, as near Ruthven in northwestern Iowa. Perhaps because of the rolling topography, these wetlands remained undrained into the 1940s, and many eventually were acquired by the Iowa Conservation Commission. One of the most attractive and productive areas in this region is Dewey's Pasture, a near-natural prairie pothole unit (Figure 1) that is now a Registered National Landmark.

This study started in 1958 with general observations after the severe drought of 1955-57. Low water levels, dense marsh conditions, and low bird populations provided a base for measuring responses to any future changes in habitat quality. Intensive field studies from 1962 to 1974 were funded by Pittman-Robertson Research Projects W-105-R and W-113-R of the Iowa Conservation Commission. I am deeply indebted to many students who were involved in this and related projects and who contributed data on populations and nest success.

THE STUDY AREA

Dewey's Pasture is a rolling morainal area of 136 ha (336 acres) with about equal areas of uplands and wetlands (Table 1). There are three drainage systems, termed A, B, and C, each influenced by low earthen dams lacking water control structures. Wetlands in drainages B and C are so similar that data are often pooled for analyses.

An exhaustive study of vegetation of the region was published by Hayden (1943). Wetlands are dominated by hybrid cattail (*Typha angustifolia* x *T. latifolia*) that occurs in more permanent waters. Broad-leaved cattail (*T. latifolia*) is restricted to seasonally flooded or very shallow areas. Other major emergent plants are hardstem bulrush (*Scirpus acutus*), river bulrush (*S. fluviatilis*), and lake sedge (*S. lacustris*).

Upland vegetation is dominantly bluegrass (*Poa pratensis*) and smooth brome (*Bromus inermis*), but prairie remnants include western wheatgrass (*Agropyron smithii*) and numerous forbs. The area was severely overgrazed in 1934 (Bennett, 1938) but was not grazed during the period of study or probably since the area was acquired by the state in the 1940s. Some patches of wolfberry (*Symphoricarpos occidentalis*) occur on knolls. Bands of willows (*Salix* spp.) occur along shorelines of several wetlands, a few large cottonwoods (*Populus deltoides*) or willows are present by dams, and clumps of wild plum (*Prunus americana*) are scattered mostly on slopes where badgers (*Taxidea taxus*) and other fossorial mammals have disturbed the soil. Soils are mainly Lamoure silty clay loam with some O'Neil fine sandy loam and O'Neil loam (Stevenson and Brown, 1919).

METHODS

Waterfowl Pair Counts

Duck populations were assessed by pair counts each year because of the uncertainty that nests alone would reflect actual populations or changes in populations. Pairs, and especially drakes, are conspicuous during the prenesting occupancy of preferred loafing and feeding areas (Hochbaum, 1944). This index was especially useful for species with nests that are difficult to find.

Pair counts were conducted by four to six persons in early morning. All water areas could be viewed from knolls or trees, and team operation resulted in minimal overlap in counts. Lone males were counted as pairs; flocks were not included regardless of sex ratio. Three to five counts were made each season, and these observations were supplemented during other activities to establish pair locations. A male or pair using a site two or more times was tallied as a breeding pair. The total number of sites used represented the pair index for that species in that year.

Waterbird Nest Search

Nests of upland-nesting ducks, Ring-necked Pheasants (*Phasianus colchicus*), and occasionally songbirds, were found by dragging a rope with attached cans to flush hens from their nests. Searching was interrupted periodically to rest; birds that normally sat tight when a drag passed over them often flushed at this time. The entire area was covered at least twice during searches from late May until July when the rate of nest-finding made searching impractical. Many nests were found during other activities on the area. No estimate of the percentage of nests found is available, but, with the exception of 1962, the intensity of nest search was fairly constant from year to year, and the methodology was identical. All nests were marked with a stake placed 4 m away and in a constant direction from the nest.

Female Blue-winged Teal (*Anas discors*) were trapped regularly during 1964-67 when studies of renesting (Strohmeyer, 1967) and physiology (Harris, 1970) were underway. In spite of the fact that trapping was restricted to midincubation when brooding drives were strongest, trapping may have had an unmeasured, detrimental influence on nest success during this period. From 1968 to 1974, special care was made to avoid visits to nests except to determine success — usually after the hatch. It was obvious, however, that some desertion resulted from the presence of field investigators in the area because some

[1]Journal Paper No. J-9221 of the Iowa Agriculture and Home Economics Experiment Station, Ames, IA. Project No. 1504 and 1969.
[2]Present address: Department of Entomology, Fisheries & Wildlife, University of Minnesota, St. Paul, MN 55108.

Fig. 1. *Aerial view of Dewey's Pasture, looking Northwest. Mud Lake at bottom; Trumbull Lake at upper left. 1975 photo by Thomas Rothe.*

Table 1. *Area (in hectares) of wetlands and uplands in Dewey's Pasture (modified from Heiser, 1971).*

Drainage	Wetlands	Uplands	Ratios	Totals
A	37.3	40.9	0.9/1.0	78.2
BC	25.9	32.0	0.8/1.0	57.9
Total	63.2	72.9	0.87/1.0	136.1

females with one or few eggs did not return to their nests after disturbance.

Nests over water were found by two to four persons wading through emergent cover surrounding water openings. Each area was searched at least twice during the peak of the nesting season. Repeated checks to determine success of old nests resulted in a low rate of finding of new nests, suggesting that most nests were found.

Because of the relatively conspicuous nature of some nests and the degree of cover for others, I suspect that most nests of American Coots (*Fulica americana*), Common Gallinules (*Gallinula chloropus*), and terns were found. Discovery of nests of Ruddy Ducks (*Oxyura jamiacensis*), Redheads (*Aythya americana*), Least Bitterns (*Ixobrynchos exilis*), and Pied-billed Grebes (*Podilymbus podiceps*) was probably less successful. Undoubtedly, a still lower percentage of Sora (*Porzana carolina*) and Virginia Rail (*Rallus limicola*) nests was discovered, but population changes were so great that peak and low years probably were reflected because the search effort was reasonably constant.

Songbird Populations

Because search methods for larger birds were inadequate for songbirds, in 1969, eight quadrats of 220 ft. × 440 ft. (0.89 hectare or 2.22 acres) were randomly selected from 200 such plots entirely or partly in the study area. However, only plots fully inside Dewey's Pasture were selected to avoid including diverse roadside habitats. The number of quadrats chosen was based on the number feasible for one person to study intensively during a single season rather than upon adequacy of the sample to reflect the area. The sample, however, was fairly repre-

Table 2. *Waterfowl pair counts, Dewey's Pasture 1962-1974*

Species	62	63	64	65	66	67	68	69	70	71	72	73	74	Mean Pairs
Blue-winged Teal	62	67	110	111	72	45	20	56	31	80	50	98	82	68.0
Redhead	13	13	6	8	8	7	1	5	4	8	3	10	9	11.2
Mallard	5	9	7	7	7	10	6	4	12	7	6	7	11	7.5
Ruddy Duck	2	3	3	8	6	4	0	11	6	9	9	6	11	6.0
Shoveller	3	4	5	1	1	0	1	2	0	2	1	5	2	2.0
Green-winged Teal	0	2	2	2	1	0	1	2	1	1	0	1	1	1.0
Gadwall	0	0	0	1	0	1	2	0	3	0	0	3	3	1.0
Ring-necked Duck	0	1	1	3	2	0	0	1	1	0	0	1	1	0.8
Wood Duck	0	0	0	0	2	0	1	0	1	1	0	0	2	0.5
Lesser Scaup	0	0	1	0	0	0	0	0	0	0	1	0	3	0.4
Canada Goose	0	0	0	0	0	0	0	0	0	1	0	0	3	0.3
Pintail	0	1	1	0	0	0	0	0	0	0	0	1	0	0.2
Canvasback	0	0	0	0	0	0	0	0	0	0	1	0	0	0.1
Total Pairs	85	100	136	141	99	67	32	81	59	109	71	132	125	95.2

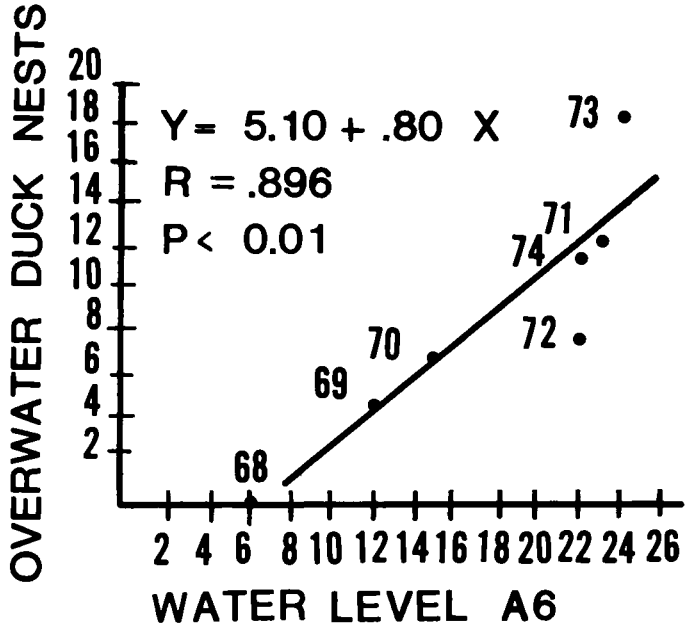

Fig. 2. *Correlation of all overwater duck nests with water levels in pothole A6.*

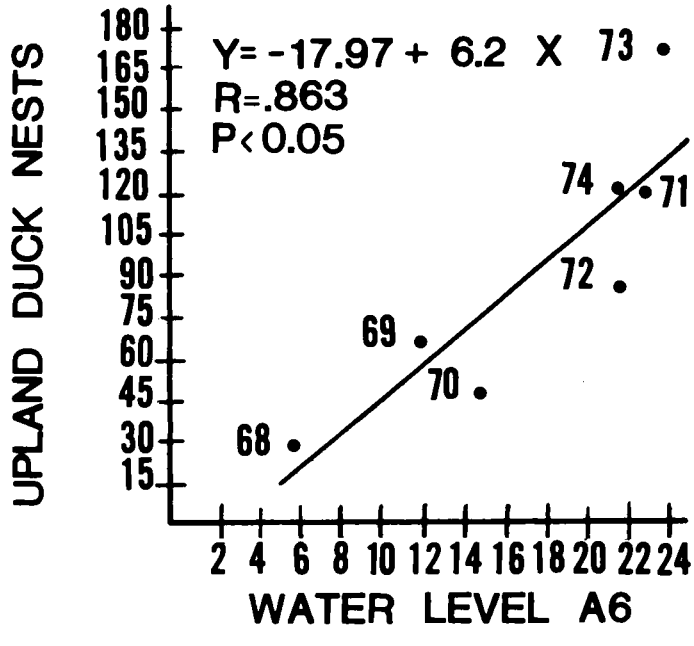

Fig. 3. *Relationship between all terrestrial duck nests and water levels in pothole A6.*

sentative of available habitat with a 51:49 marsh:upland ratio compared with a 46:54 ratio for all of Dewey's Pasture. Because precise population data were not available for all years, these quadrats were used only to appraise species composition and regularity of songbirds (i.e., presence or absence by year and quadrat) during 1969 to 1974 excluding 1973 when data were not collected.

Water Levels

Water levels were recorded to determine the influence of seasonal variation on nesting populations. Various systems were used from 1962 to 1968, but, because frost-heaving of temporary gauges prevented accurate year-to-year comparison, steel fence posts were driven into the centers of nearly-dry potholes during 1968. Waterbirds seem to be

Table 3. *Number of nests found and species richness on Dewey's Pasture, 1962 through 1974. Introduced species and passerines are not included.*

Waterfowl	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**Mean**
Blue-winged Teal	52	91	300	276	186	99	28	59	39	115	81	157	105	121.9
Mallard	0	4	10	14	28	14	2	6	7	6	7	11	15	9.5
Redhead	11	2	7	10	8	1	0	4	4	8	3	8	10	5.8
Ruddy Duck	0	0	3	9	4	2	0	1	2	5	5	7	2	3.1
Shoveller	0	1	2	1	1	0	0	0	0	0	0	2	0	0.5
Gadwall	0	0	0	3	0	0	0	0	1	0	0	3	2	0.5
Ring-necked Duck	0	0	0	0	1	0	0	0	1	0	0	4	0	0.5
Green-winged Teal	0	0	0	1	0	0	0	3	1	0	0	0	0	0.4
Canada Goose	0	0	0	0	0	0	0	0	0	0	0	0	3	0.2
Pintail	0	0	0	0	0	0	0	0	0	0	0	1	0	0.1
Subtotal	63	98	322	314	228	120	30	73	55	134	96	193	137	143.1
Other Water Birds														
Coot	93	26	37	74	20	9	0	61	27	31	43	130	44	45.0
Black Tern	*	*	*	*	*	*	4	14	19	28	19	7	27	16.8
Pied-billed Grebe	17	7	15	56	21	17	0	16	18	15	9	10	13	16.5
Virginia Rail	2	0	3	9	15	5	0	3	3	4	1	13	5	4.5
Sora	1	0	0	7	5	0	0	15	3	6	1	3	0	3.2
Least Bittern	1	0	1	3	4	6	0	0	2	5	3	1	0	1.6
Common Gallinule	0	0	7	3	1	1	0	0	1	0	0	1	0	1.1
American Bittern	2	1	0	1	0	0	0	1	1	0	1	0	0	0.5
King Rail	1	1	0	0	0	0	0	0	0	0	0	0	0	0.2
Subtotal	117	35	63	153	66	38	4	110	74	89	77	165	89	83.1
Species Richness	10	9	11	15	13	10	3	11	15	10	11	15	9	10.9

*Species nesting but numbers not recorded.

Table 5. *Broods of waterfowl observed on Dewey's Pasture, 1968-1974 and on Dewey's Pasture, Mud Lake and Oppedahl Tract, 1962-1967. Records are mainly from casual observations rather than organized brood surveys.*

Species	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**
Blue-winged Teal	10	9	13	15	42	3	9	5	16	13	9	19	19
Mallard	0	0	3	3	14	0	3	2	11	1	4	3	3
Redhead	9	0	1	1	5	2	1	1	7	1	5	2	4
Ruddy Duck	9	1	0	2	0	0	0	0	5	4	3	1	3
Wood Duck	0	0	0	0	0	0	5	1	5	0	3	0	4
Canvasback	0	0	0	0	0	0	0	0	0	0	1	0	0
Canada Goose	0	0	0	0	0	0	0	0	0	1	1	0	4
Ring-necked Duck	0	0	0	0	0	0	0	0	1	0	0	0	0
Green-winged Teal	0	0	0	0	0	0	0	0	1	0	0	1	0
Gadwall	0	0	0	0	0	0	0	0	1	0	0	0	0
Total Broods	28	10	17	21	61	5	18	9	47	20	26	26	37

Table 4. *Nests of known fate and per cent nest success in Dewey's Pasture, 1963-1974. Species that nest over water are indicated by an asterisk.*

Species	Nests of Known Fate	% Nest Success*
Waterfowl		
Blue-winged Teal	1174	25
Mallard	106	33
Redhead	66	55*
Ruddy Duck	32	50*
Gadwall	7	29
Ring-necked Duck	6	33*
Canada Goose	4	75*
Green-winged Teal	3	66
Shoveller	3	0
Pintail	2	0
Other Water Birds		
American Coot	429	84*
Pied-billed Grebe	121	88*
Black Tern	60	44*
Virginia Rail	41	68*
Sora	33	82*
Least Bittern	12	100*
Common Gallinule	9	56*
American Bittern	5	100

attracted by spring water conditions, and readings taken in pothole A6 during the end of May or the first days of June were used as index values. As an index to water levels for the entire study period, 1962 to 1974, water-level data were used for Lake Okoboji, 29 km northwest, and Spirit Lake, 35 km northwest of Dewey's Pasture (U.S. Geological Survey). The general pattern of water-level fluctuation was one of severe drought in 1955 and 1956, with levels rising in the late 1950s and early 1960s; another severe but shorter-term drought occurred in 1968, and levels then rose through the early 1970s.

ABUNDANCE AND COMPOSITION OF THE BREEDING BIRD POPULATION

Data on numbers of pairs observed, nests recorded, nest success, and broods observed are shown in Tables 2 through 5. In addition to species mentioned elsewhere in text or tables, Common Flickers (*Colaptes auratus*) and Tree Swallows (*Iridoprocne bicolor*) also occurred regularly. Additional species favoring woodlands nested in large willow and cottonwood groves adjacent to Dewey's Pasture, but these habitats were not surveyed.

Ducks and other waterbirds constituted 22 of the 41 species recorded from 1962 to 1974. Blue-winged Teal, Redhead, Mallard (*Anas platyrhynchos*), and Ruddy Duck were the most common of 12 species of nesting waterfowl. Two human influences on the species composition of waterfowl were the addition in the 1960s of a large number of Wood Duck (*Aix sponsa*) nest boxes on Mud Lake, adjacent to Dewey's Pasture, and the reintroduction of Canada Geese (*Branta canadensis*) in the late 1970s. Of the nine other nesting waterbirds, American Coot, Black Tern (*Chlidonias niger*), Pied-billed Grebe, Virginia Rail, and Sora were the most numerous.

Numbers of breeding pairs or nests varied from those species recorded breeding only once to those that nested annually in large numbers. Blue-winged Teal and American Coots dominated the waterbird populations as reflected in mean numbers observed for the 13-year period. But, dramatic annual fluctuations were evident in most species. Mean numbers of nests shown in Table 3 reflect the usual species composition and provide a ranking for most waterbirds, but success at nest-finding varies among species. Thus, pooling of all data to establish relative rank in the average annual species composition was attempted (Table 6). Year-to-year constancy or regularity is influenced by: 1) adaptability of species whose needs are met in spite of year-to-year variations in habitat, and 2) abundance of species likely to be recorded annually. Occasionally, however, there are species present in large numbers that are rare or absent in other years, such as Short-billed Marsh Wrens (*Cistothorus platensis*).

Table 6. Ranking of species (excluding the introduced Canada Goose) based on per cent year-to-year regularity of breeding water birds from 13 years of observations, Dewey's Pasture 1962-1974 (i.e., 10/13 years = 77). Spearman's Rank Correlation Coefficient indicated below for waterfowl; all are significant at the 0.01 level.

Waterfowl	Pairs	Rank	Broods	Rank	Nests	Rank	Combined Rank
Blue-winged Teal	100	1	100	1	100	1	1
Redhead	100	2	92	2	92	2	2
Mallard	100	3	77	3	92	3	3
Ruddy Duck	92	4	62	4	77	4	4
Shoveller	85	5	0	10	38	5	5
Green-winged Teal	77	6	15	6	23	7	6
Ring-necked Duck	62	7	8	7	23	8	7
Gadwall	46	8	8	8	31	6	8
Wood Duck	38	9	38	5	0	10	9
Pintail	23	10	0	11	8	9	10
Canvasback	8	12	8	9	0	11	11
Lesser Scaup	23	11	0	12	0	12	12
		$r_s = 0.82$		$r_s = 0.78$			
		$r_s = 0.97$					
Other Water Birds							
Black Tern*	--		--		100		1
American Coot	--		--		92		2
Pied-billed Grebe	--		--		92		3
Virginia Rail	--		--		85		4
Least Bittern	--		--		77		5
Sora	--		--		62		6
Common Gallinule	--		--		46		7
American Bittern	--		--		46		8
King Rail	--		--		15		9

*Based on only 7 years of records.

Table 7. *Per cent a) year-to-year regularity of passerines and pheasants, and b) maximal observed occurrence on Dewey's Pasture, based on occurrence in 8 quadrats during 1969-1972 and 1974.*

Species	Year to Year Regularity[1]	Maximal Occurrence[2]
Redwinged Blackbird *(Agelaius phoeniceus)*	100	95
Yellow-headed Blackbird *(Xanthocephalus xanthocephalus)*	100	80
Yellowthroat *(Geothlypis trichas)*	100	80
Swamp Sparrow *(Melospiza georgiana)*	100	80
Long-billed Marsh Wren *(Telmatodytes palustris)*	100	63
Yellow Warbler *(Dendroica petechia)*	100	25
Willow Flycatcher *(Empidonax traillii)*	100	23
American Goldfinch *(Spinus tristis)*	100	15
Short-billed Marsh Wren *(Cistothorus platensis)*	80	13
Bobolink *(Dolichonyx oryzivorus)*	60	13
Song Sparrow *(Melospiza melodia)*	60	10
Common Grackle *(Quiscalus quiscula)*	60	10
Western Meadowlark *(Sturnella neglecta)*	40	5
Ring-necked Pheasant *(Phasianus colchicus)*	20	3
Brown-headed Cowbird *(Molothrus ater)*	20	3
Savannah Sparrow *(Passerculus sandwichensis)*	20	3
Brown Thrasher *(Toxostoma rufum)*	20	3

[1]Observed in any quadrats during the 5 years, e.g. 4 of 5 years = 80%.
[2]Occurrence in 40 possible quadrats (8 quadrats × 5 years), e.g. 38 of 40 = 95%.

To assess the year-to-year regularity of terrestrial birds (Table 7) and provide another estimate for waterbirds, presence or absence in quadrats was analyzed. These figures are strongly influenced by abundance because of both the small size and number of quadrats, but they reflect birds that might be expected every year. Only 30 of the 41 species (73%) were observed in these quadrats. Data on waterbirds generally support rankings shown in Table 6 and are not presented, but information on passerines seem to support general observations (Table 7). Four marsh or marsh-edge and four upland passerines occurred in all five years of study. Although nest searches were not made every year, all eight species also nest regularly.

Also summarized are data on the maximal occurrence in all quadrats (8) in all years (5), making 40 possible occurrences. These rankings agree precisely with data on year-to-year regularity but at lower occurrence levels, suggesting that both systems indicate relative abundance.

Information on nest success of waterbirds (Table 4) reflects the general pattern that species nesting in terrestrial sites have a lower nest success than do species nesting over water. This was due mainly to predation by Striped Skunks (*Mephitis mephitis*).

WATERBIRD POPULATION CHANGES IN RELATION TO WATER LEVELS

In spite of variation in observers, the survey techniques used were sufficiently standard and the year-to-year population fluctuations sufficiently great that data on variation seem to reflect changes apparent even to the casual observer. These fluctuations are best shown in data on pairs (Table 2) and nests (Table 3). Abundant and regularly occurring species like Blue-winged Teal and those restricted to nesting in emergent vegetation overwater like Redheads had the most dramatic population changes. Hence, a discussion of population changes is impossible without reference to habitat conditions.

Waterbird populations were lowest in 1962 when water levels were low and emergent vegetation was dense, and again in 1968 when most areas were nearly dry but unvegetated. Gradual population buildups were characteristic of both postdrought periods, with peaks of all species occurring in 1965 and 1971. By using pothole A6 as an indication of marsh conditions, a positive relationship between water availability and duck populations is demonstrated by regression lines for both overwater- (Figure 2) and upland-nesting ducks (Figure 3). Although species that nest over water (e.g., Redhead, Ruddy Duck) were nearly eliminated by drought, both overwater- and upland-nesting birds responded positively and significantly to increased water availability. These data support general observations that, when larger potholes like A6 were low, small wetlands were dry and unattractive to waterfowl pairs. In wet years, all wetlands were full to overflowing, and all species of waterfowl were attracted, regardless of their nesting site. Surprisingly, correlation coefficients were not significant for the relationship between Pied-billed Grebe and American Coot nests and the indices to water level.

Species richness, the number of species nesting in a particular year (see bottom of Table 3), was greatest during high water levels on Dewey's Pasture, but the correlation coefficient ($r = 0.562$) based on pothole A6 water levels was not significant at the .05 level. Species richness did correlate significantly with data on water levels from Lake Okoboji ($r = 0.837$; $P < .01$) and Spirit Lake ($r = 0.810$; $P < .01$) for 1962 to 1974. These periods also generally coincided with low water levels in more optimal pothole areas to the north. Obviously both local and distant conditions are important, and one must recognize the mobility of prairie marsh species over broad geographic regions, in addition to their adaptability to local conditions. Although it might be expected that species richness would correlate with numbers of nests, the level ($r = 0.05$) was not significant.

DISCUSSION

Changes in Avifauna

Fluctuations in species composition and relative abundance of birds in Dewey's Pasture during this study demonstrate the importance of habitat quality in maintaining species richness and numbers. Although Dewey's Pasture retains many of the typical prairie wetland birds, extirpations probably have resulted from loss of wetlands surrounding this complex. No quantitative data are available on the extent of drainage in the Ruthven area, but Bennett (1938) estimated a 95% loss

of wetlands state-wide. Mohlis (1974) reported a 55% loss of wetlands of one area in north-central Iowa between 1939 and 1972.

The impact of this drainage and other agricultural development on bird populations has not been quantitated, but, fortunately, some observations have been made on the species composition of birds in the Ruthven area since the late 1800s. Bennett and Hendrickson (1939) compared bird populations of the 1930s with those observed by Ruthven in 1907 (Tinker, 1914) and concluded that most species had adapted to environmental changes and survived. They did not, however, refer to earlier observations such as those reported by Cooke (1906), Anderson (1907) or DuMont (1933), who with Stephens (1943) and later authors indicated that a number of large and now more northerly waterbirds once nested regularly in northwestern Iowa, including Whooping Crane (*Grus americana*), Sandhill Crane (*Grus canadensis*), Trumpeter Swan (*Cygnus buccinator*), Canada Goose, Marbled Godwit (*Limosa fedoa*), Long-billed Curlew (*Numenius americana*), and Common Loon (*Gavia immer*). Greater Prairie Chickens (*Tympanuchus cupido*) also were very abundant in the uplands. Of these, only the Canada Goose now nests because of reintroduction. Although some of the waterbirds may have been at the edges of their ranges, it is likely that the reduction in size of the habitat and disturbance were major influences on their extirpation.

Additional species have been lost since the observations by Bennett and Hendrickson (1939), Provost (1947), and Tanner and Hendrickson (1956). Species using marsh edges, such as Marsh Hawks (*Circus cyanus*), Short-eared Owls (*Asio flammeus*), and Upland Sandpipers (*Bartramia longicauda*), no longer nest, and probably King Rails (*Rallus elegans*) have been lost since inception of this study. Eared Grebes (*Podiceps nigricollis*) nest overwater and have been erratic in Iowa since 1934 (Friley and Hendrickson, 1937; Brown, 1971). American Bitterns (*Botaurus lentiginosus*), Shovellers (*Anas clypeata*), and probably Mallards are reduced in numbers. Burrowing Owls (*Athene cunicularia*) are known to be irregular and probably were most common in dry years of the 1930s when overgrazed pastures were common. None seems to have been recorded in the county since 1934. Grasshopper Sparrows (*Ammodramus savannarum*) are no longer found in the bluegrass areas of Dewey's Pasture but occur in heavily-grazed areas (as Dewey's Pasture was in the 1930s) or in alfalfa fields with tall weeds suitable for song perches nearby.

Species composition of ducks has varied considerably. Several species now associated with either northerly marshes or forested areas were recorded by Cooke (1906) as nesting in northern Iowa: Black Duck (*Anas rubripes*), Ring-necked Duck (*Aythya collaris*), Canvasback (*Aythya valisineria*), Lesser Scaup (*Aythya affinis*), Bufflehead (*Bucephela albeola*), Hooded Merganser (*Mergus cucullatus*), and Common Merganser (*Mergus merganser*). Anderson (1907) reported two Gadwall (*Anas strepera*) nests but noted this as unusual. Anderson had no nesting records of either Green-winged Teal (*Anas crecca carolinensis*) or American Wigeon (*Anas americana*), but Musgrove and Musgrove (1943) suggested that Green-winged Teal and American Wigeon originally nested in Iowa.

Most of these species have been recorded as occasional nesters in Iowa from the mid 1930s to 1974, seemingly breeding when conditions are good in Iowa — or when conditions elsewhere are poor. A Canvasback nest, the first recorded in this century, was discovered in 1934 by Bennett (1937), and one nested again in 1972. Five additional records were noted in 1977 (Iowa Ornithologists' Union, 1977). Two obvious range expansions are Green-winged Teal and Ring-necked Ducks, and the latter species seems to have expanded its range considerably in North America (Mendall, 1958). During this study, a few American Wigeon were seen in the area, but no nests were found. The first nest recorded for the state was found in north-central Iowa at the Union Slough Refuge (Trauger, 1962). Gadwall nested in 1938 (Low, 1941) and again in 1964 (Strohmeyer and Fredrickson, 1964) and were recorded as breeding pairs in six of the 13 years of this study. Young Hooded Mergansers were seen on Trumbull Lake near Dewey's Pasture in 1958 (Weller, 1961). Buffleheads were not reported on our study area, probably because of the scarcity of suitable trees, but young were seen in Sac County (Sieh, 1962). Lesser Scaup have not nested since 1937 (Bennett and Hendrickson, 1939). A Black Duck nested in 1933 (Errington and Bennett, 1934), but none was recorded during this study. Pintail (*Anas acuta*) use of this area has been most erratic, possibly because of variation in quality of habitat elsewhere. Anderson (1907) listed it as a former breeder. Errington and Bennett (1934) found one nest in 1933. It was reasonably common in drought years in the prairies and ranked fourth among broods observed by Travis in Iowa in 1935 (1939). Bennett and Hendrickson (1939) suggested that 20-30 nested yearly in Clay and Pal Alto counties, ranking about sixth among eight species of waterfowl. Low (1945) noted their presence during 1938-40. Glover (1956) reported none during his study in 1947-49, and no records of the species were noted until this study. Pintails also breed in the Arctic when the prairie potholes are dry (Henny, 1973).

Several terrestrial species either not recorded earlier or not recorded for many years were encountered during this study. Wilson's Phalaropes (*Steganopus tricolor*) nested in the drought year of 1968 (Bergman, Bates, and Voigts, 1968) for the first time since those reported by Bennett and Hendrickson (1939). Savannah Sparrows (*Passerculus sandwichensis*), not recorded by either Tinker (1914) or Bennett and Hendrickson (1939), now occur occasionally in sparsely vegetated hillside fence rows or experimentally burned areas. The most dramatic change in populations was obvious for the introduced Ring-necked Pheasant. They had not yet become established in 1907 (Tinker, 1914), but Bennett and Hendrickson (1939) estimated 200 to 300 nests per year in Clay and Palo Alto counties. Hammerstrom (1936) found very dense populations nesting in dry sloughs (one nest per two acres in one case). Frederick Hammerstrom (personal communication) indicated that nests were common on Dewey's Pasture where, in recent years, numbers ranged from only three to six on the uplands. The reason for this recent decline is unknown, but it seems typical of their population behavior over a wide area.

In summary, avifaunal changes in northwestern Iowa have been great, and many losses seem to have been habitat-related. Numerous large waterbirds no longer nest, and it is unlikely that sufficient large ranges are now available to permit reestablishment. But many species still occur and fluctuate in presence or numbers with variation in habitat on these areas, and probably with conditions elsewhere. Wetland species especially seem to have adapted to the natural instability of their substrate by population shifts on either a year-to-year or long-term basis. It is unfortunate that better long-term data aren't available from banded birds to document such shifts. Changes in presence or abundance of terrestrial species frequenting short grasses or bare areas may have been reduced by the elimination of grazing on Dewey's Pasture, but their absence or reduction in surrounding areas suggests that casual influences are not fully understood.

Implications for Faunal Preservation

Because of agricultural activity in the uplands, waterbirds have survived more successfully in the southern Prairie Pothole Region than have terrestrial species like Prairie Chickens and Upland Sandpipers. Nevertheless, waterbird habitat has decreased drastically because of drainage and cultivation, and species richness has been reduced. Concurrently, certain species like Blue-winged Teal and American Coots seem to have become dominants in the sense of both abundance and regularity. Both have small home ranges and adaptability in nest sites, foods, and brood-rearing cover. A reduction in interspecific competition also may be involved, but too little is know about original species interaction to identify causes.

Understanding the causes of species extirpation is vital to devising

strategies for faunal preservation. It is obvious that certain species (i.e., Trumpeter Swan and Whooping Crane) have larger home ranges than can be met by small relict areas. Others require a greater diversity of wetland types than now exist, such as extensive meadows adjacent to marshes that Marsh Hawks and Short-eared Owls use. Undoubtedly, some species were vulnerable to shooting during the breeding season (especially Canada Goose and Whooping Crane). Terborgh (1974) discussed similar problems in relation to South American species.

It has been shown experimentally that an isolated 162-hectare (400 acre), semipermanent marsh, called Rush Lake, attracted and maintained a normal diversity of species when other areas were dry (Weller and Fredrickson, 1974). The diversity of birds found in Dewey's Pasture, however, is still larger than at Rush Lake. I suspect that Dewey's Pasture, a 136-hectare habitat "island", has been productive in the midst of extensive corn fields because the protected area includes significant uplands for nesting, several large shallow lakes that attract flocks of migrants, and an adjacent cluster of diverse marshes. Currently, there is considerable discussion of the desirable size of refuges (often "islands" of habitat) based on theories of island biogeography and sociological problems (e.g., Simberloff and Abele, 1976; Diamond, 1975; Diamond, 1976). Although purchase or protection of the largest possible unit generally is ideal and results in acquisition of habitat diversity as well, the present nature of remnant marshes may make purchase of small clusters ("archipelagos") of wetlands both more feasible and equally effective. As pressures on land reduce the size and diversity of such areas, precise data that will allow predictive modeling are vital to the conservation of wetlands biota.

REFERENCES

ANDERSON, R.M. 1907. The birds of Iowa. Proc. Davenport Acad. Sci. 11: 125-417.

BENNETT, L.J. 1937. Nesting of the canvasback in Iowa. Auk 54: 534.

_____. 1938. The blue-winged teal, its ecology and management. Iowa State University Press, Ames, IA 144 pp.

BENNETT, L.J. and G.O. HENDRICKSON. 1939. Adaptability of birds to changed environment. Auk 56: 32-37.

BERGMAN, R.D., L.C. BATES, and D.K. VOIGTS. 1968. Wilson's Phalaropes nesting in northwest Iowa. Iowa Bird Life 38: 132-133.

BROWN, W.H. 1971. An annotated list of the birds of Iowa. Iowa State J. Sci. 45: 387-469.

COOKE, W.W. 1906. Distribution and migration of North American ducks, geese, and swans. U.S. Dept. Agric. Biol. Surv. Bull. 26. 90 pp.

DIAMOND, J.M. 1975. The island dilemma: lessons of modern biographical studies for the design of natural reserves. Biol. Conserv. 7: 129-146.

_____. 1976. Island biogeography and conservation: strategy and limitations. Science 193: 1027-1029.

DUMONT, P.A. 1933. A revised list of the birds of Iowa. Univ. Iowa Studies in Nat. Hist. 15(5): 1-171.

ERRINGTON, P.L., and L.J. BENNETT. 1934. Iowa duck studies. Trans. Am. Game Conf. 20: 249-257.

FRILEY, C.E., JR., and G.O. HENDRICKSON. 1937. Eared Grebes nesting in northwest Iowa. Iowa Bird Life 7: 2-3.

GLOVER, F.A. 1956. Nesting and production of the blue-winged teal (*Anas discors* (Linnaeus) in northern Iowa. J. Wildl. Manage. 20: 28-46.

HAMMERSTROM, F.N., JR. 1936. A study of the nesting habits of the Ring-necked Pheasant in northwest Iowa. Iowa State J. Sci. 10: 173-203.

HARRIS, H.J. 1970. Evidence of stress response in breeding blue-winged teal. J. Wildl. Manage. 34: 747-755.

HAYDEN, A. 1943. A botanical survey in the Iowa Lake region of Clay and Palo Alto counties. Iowa State J. Sci. 17: 277-416.

HEISER, N.G. 1971. Nest site selection by blue-winged teal (*Anas discors*) in northwest Iowa. M.S. thesis. Iowa State Univ. Ames. 29 pp.

HENNY, C.J. 1973. Drought displaced movement of North America pintails into Siberia. J. Wildl. Manage. 37: 23-29.

HOCHBAUM, H.A. 1944. The canvasback on a prairie marsh. American Wildlife Institute, Washingtion D.C. 201 pp.

IOWA ORNITHOLOGISTS' UNION. 1977. Field reports, Summer 1977. Iowa Bird Life 47: 99-100.

LOW, J.B. 1941. Gadwall and Franklin's Gull nesting in Iowa. Iowa Bird Life 11: 31-32.

_____. 1945. Ecology and management of the redhead, *Nyroca americana*, in Iowa. Ecol. Mongr. 15: 35-69.

MANN, G.E. 1955. Wetlands inventory of Iowa. Office of River Basin Studies, Fish & Wildlife Service. Minneapolis, MN 41 pp. + append. 27 pp.

MENDALL, H.L. 1958. The ring-necked duck in the northeast. Univ. Maine Bull. 40: 1-137.

MOHLIS, C.K. 1974. Land use and pheasant habitat in north-central Iowa, 1938-1973. M.S. thesis, Iowa State Univ., Ames. 84 pp.

MUSGROVE, J.W., and M.R. MUSGROVE. 1943. Waterfowl in Iowa. Iowa Conserv. Comm., Des Moines, IA. 124 pp.

PROVOST, M.W. 1947. Nesting of birds in the marshes of northwest Iowa. Am. Midl. Nat. 38: 485-503.

SIEH, J. 1962. Buffleheads breeding in Iowa. Iowa Bird Life 32: 85.

SIMBERLOFF, D.S., and L.G. ABELE. 1976. Island biogeography theory and conservation practice. Science 191: 285-286.

STEPHENS, T.C. 1943. Early bird life in Clay County, Iowa. Iowa Bird Life 13: 65.

STEVENSON, W.H., and P.E. BROWN. 1919. Soil survey of Iowa. Iowa Agric. Exp. Stn. Soil Rep. 12. 54 pp.

STROHMEYER, D. 1967. The biology of renesting by the blue-winged teal (*Anas discors*) in northwest Iowa. Ph.D. thesis. Univ. Minn., St. Paul. 135 pp.

STROHMEYER, D., and L.H. FREDRICKSON. 1964. Gadwall nesting in Iowa. Iowa Bird Life 34: 72-73.

TANNER, W.D., JR., and G.O. HENDRICKSON. 1956. Ecology of the King Rail in Clay County, Iowa. Iowa Bird Life 26: 54-56.

TERBORGH, J. 1974. Preservation of natural diversity: the problem of extinction prone species. Bioscience 24: 715-722.

TINKER, A.D. 1914. Notes on the ornithology of Clay and Palo Alto counties, Iowa. Auk 31: 70-81.

TRAUGER, D.L. 1962. American Wigeon nests at Union Slough National Wildlife Refuge. Iowa Bird Life 32: 26-27.

TRAVIS, B.V. 1939. Duck brood counts in Iowa during the summer of 1935. Iowa Bird Life 9: 46-50.

WELLER, M.W. 1961. Cattle Egret and other uncommon Iowa water-birds. Iowa Bird Life 31: 44-45.

WELLER, M.W., and L.H. FREDRICKSON. 1974. Avian ecology of a managed glacial marsh. Living Bird 12: 269-291.