

BIRD USAGE BY HABITAT TYPES IN A LARGE FRESHWATER LAKE

by

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ABSTRACT

Winter and summer bird numbers were determined for four aquatic habitats in Miller's Lake, Evangeline Parish, Louisiana. As the succession of the vegetation progressed from open water to water tupelos (Nyssa aquatica), the number of bird species occurring in each habitat increased during both seasons, and the number of individuals and avian species diversity increased during summer. Bird numbers in each habitat were higher in winter than summer. In the more structurally complex aquatic habitats avian densities and species richness were higher than in upland areas of similar vegetative complexity.

More than 29,900 km² of Louisiana is wetlands. They are comprised of coastal marshes (15,900 km²), lakes and rivers (8,000 km²), bald cypress (*Taxodium distichum*)—water tupelo swamps (4,400 km²), and ricelands (1,600 km²) (St. Amant 1959:273). In addition, there are many streams, canals, bayous, and rivers with various sizes of swamplands bordering the major ones, and thousands of natural and artificial freshwater ponds and lakes scattered throughout the state; large sections of bottomlands are inundated for months at a time during flood periods.

These wetlands consist of many different aquatic habitats. Some of them are open water, submerged vegetation, mats of floating and emergent vegetation, shrub thickets, and forested swamps. In each of these habitats, a variety of species of aquatic or amphibious plants may exist. The exact species present vary with the season, climatic conditions, water depth, flow, turbidity, permanence and stability, and soil type.

Even though the functioning of aquatic ecosystems is not understood, wetlands have been used and abused by people for many years without regards to effects on ecosystem quality. Aquatic systems need to be studied in detail in order to ascertain their importance and to determine details of their functioning. The species of birds and their abundance are two attributes of aquatic ecosystems that are not well understood. In Louisiana, Lynch (1967), Bateman and Summerall (1971), Palmisano (1972), and Chabreck (1975) studied waterfowl usage of broad physical regions. Chabreck et al. (1974), and Duke and Chabreck (1975) studied waterfowl usage of select bodies of water. In addition, McCartney (1963), Bateman (1965), and Meanley (1971) have studied the ecology of a single species in aquatic ecosystems, but no known studies have been conducted on all avian species using aquatic habitats.

This study was initiated to determine the bird species and density of each species using the habitat types within a large freshwater lake, Miller's Lake, Evangeline Parish, in Louisiana.

Scientific nomenclature used in this study is from American Ornithologists' Union (1957) and its supplement (1973) for birds, and Correll and Johnston (1970) for plants.

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MATERIALS AND METHODS

Miller's Lake is a 14 km² impounded lake in south-central Louisiana. It is located 11.9 km NW of Ville Platte, Evangeline Parish. The southern portion of Miller's Lake is deeper than the northern part. The variety of depths, the stability of the water level, and long existence of the lake have encouraged the development of many diverse aquatic plant

communities. These plant communities vary from submergent weed-beds in the southwest corner of the lake to bottomland hardwoods in the northwest.

We established a study plot within each of 11 different aquatic habitats to study their seasonal use by birds and have included the results from 4 of these plots here. Each plot's boundary was conspicuously marked. Its size was calculated by either measuring the boundary extent in boat lengths, or by use of a calibrated dot grid placed on an aerial photograph with a scale of 1:7920.

Vegetation Sampling

Circular sample plots of 100 m², 10 m², and 1 m² were randomly located in each study plot to sample the overstory, midstory, and understory vegetation respectively.

Within each 100 m² circular plot, all of the woody vegetation was identified. Diameter at breast height (dbh) was measured as recommended by Avery (1967:71-77) and placed into appropriate 5.1-cm dbh classes by species with a minimum dbh of 7.6 cm (7.6-12.7 cm; 12.8-17.9 cm; etc.).

Percent cover of all species of understory vegetation from 1.5 m above the surface to ground level was visually estimated for each species within the randomly located circular 1 m² plots each season. The median for each 10 percent (5,15, etc.) estimate of cover was recorded. Therefore, the maximum cover estimate for a species in a plot is 95 percent; it is possible for the total percent cover for all species within a plot to be greater than 100 because several species normally occur in layers in each plot.

The water was too deep in the Open Water area plots to observe all submergent vegetation. The 3.8 cm wide tip of a range pole was used to make a 1 m stroke through the water column from the surface to the bottom at each randomly located sample point. The raked vegetation was identified and given an abundance rating: 1, rare (1-10 estimated filaments); 2, uncommon (11-50); 3, common (51-200); 4, abundant (200-500); 5 very abundant (500+).

Bird Counts

Seasonal bird numbers were estimated by conducting transect counts within each habitat. Most transect counts were conducted by paddling or pushing a 3.1 m flat bottomed boat through a habitat on a path that allowed a potential view of all birds on the study plots. Birds in the Open Water and Water-shield (*Brasenia schreberi*) areas were counted from a boat propelled by a 6, 9.5, or 9.9 hp Johnson outboard motor.

Territorial mapping (Kendeigh 1944; Svensson 1970) was used to census breeding birds in the Water Tupelo area during June 1975. Because only males sing and establish territories, and a defended territory was assumed to be an indication of successful mating, the number of territories of a species was doubled to estimate the total breeding population. Any pairs known to have completed nesting before the mapping started and all nonterritorial birds observed during the census period, were added to the total.

Within each habitat, the seasonal species diversity of birds and understory vegetation was calculated with the Shannon-Wiener formula (Shannon and Weaver 1949):

$$H' = - \sum_{i=1}^n \frac{N_i}{N} \ln \frac{N_i}{N}$$

Where: H' = species diversity index
N = total numbers of individuals of n species
N_i = number of individuals of the *i*th species

This index is affected by both the number of species present and the distribution of individuals among the species present. It equals 0 when only one species is present and increases as the number of species and the evenness of their distribution increases.

RESULTS AND DISCUSSION

Population estimates were affected by the conspicuousness of birds in the surrounding vegetation in a variety of weather conditions, and our ability to locate them.

Plot sizes were different for the habitats because Miller's Lake is extremely heterogenous and large blocks of contiguous habitats are very rare. The Open Water habitat (82.9 ha) was the largest such block present and the entire area was used as a study plot because bird densities were low and the area could be effectively censused. The 10 ha Water-shield and Water Tupelo sample areas were chosen because their size was roughly comparable to sizes used in most studies similar to ours. Ten ha was the largest area that could be censused effectively. The 2.3 ha buttonbush area was the largest buttonbush area available that contained suitable sized boat roads.

Open Water

The 82.9 ha Open Water study plot had an average depth of 1.5 m. Submergents were the only herbaceous vegetation observed.¹ Their densest growth occurred in August, and most of it was killed and dislodged during the first cold front in September. The 12 scattered water tupelos (*Nyssa aquatica*) that occurred in the plot had an average dbh of 16 cm and height of 6 m.

Lesser Scaups (*Aythya affinis*) and American Coots (*Fulica americana*) were the primary users of open water during winter (Table 1). Lesser Scaups restricted their resting and diving to two locations where no vegetation was present. Fresh water clams (Pelecypoda) were present on the sandy soils in these locations. These two non-vegetated locations were probably mainly used by Lesser Scaups for resting and obtaining grit during daytime, and were usually vacated at sunset.

Coots fed in locations where highest densities of herbaceous vegetation occurred.

American Anhingas (*Anhinga anhinga*) were the primary users of the Open Water area during summer. They apparently used this as a feeding area and used the water tupelos and a few stakes in the plot for perching, and drying their feathers.

On numerous occasions the birds were harassed by boat traffic in the study plot. We believe that this harassment of birds by boat traffic has an adverse effect on the abundance of most species that occur in the open water habitat. Harassment was severe in the Open Water plot because of the lack of cover and because this plot was located between the boat-launching area and the other parts of the lake; it was traversed, therefore, by almost all boats using the lake.

Water-shield

Water-shield (*Brasenia schreberi*) was the most abundant plant species in the Water-shield area (35 percent cover in winter; 85 percent in summer). The total cover of vegetation within this 10 ha area varied from 75 percent in winter to 146 percent in summer. Water depth averaged 1.3 m, and woody vegetation was not present above the water's surface.

There was much American Coot and Green-winged Teal (*Anas crecca*) usage of the Water-shield area during winter and less usage from Ring-necked Ducks (*Aythya collaris*), Mallards (*Anas platyrhynchos*), Lesser Scaups, and Northern Shovelers (*Anas clypeata*). The ducks were probably attracted by the availability of water-shield seeds. Martin et al. (1961) report that water-shield is a valuable food source for waterfowl, and McCartney (1963) found it an important food for Fulvous Tree Ducks (*Dendrocygna bicolor*) in the spring. The water-shield area was used less often by birds in the summer when small numbers of gallinules, American Coots, Green Herons (*Butorides virescens*) and American Anhingas were present.

Buttonbush

The 2.3 ha Buttonbush study plot was part of a common buttonbush (*Cephalanthus occidentalis*) swamp with a water depth never greater than 1 m under shrubs and 2 m in small openings. The woody vegetation averaged 2.7 m high with a basal area (BA) of 3.9 m² and 16,800 stems per ha. The understory vegetation cover varied from 16 percent in winter to 81 percent in summer. Emergents and submergent vegetation were more prevalent in openings with free-floating vegetation dominating under shrubs.

The common buttonbush swamp and several islands of common buttonbush in Miller's Lake were used as roosting sites by approximately 15 million blackbirds (primarily Brown-

¹ Specific vegetation data for each habitat are in Ortego (1976).

Table 1. Winter and summer bird abundance and avian species diversity (H') by habitat type in Miller's Lake, Evangeline Parish, Louisiana, 1975. (Populations expressed as birds per km².)

Species	Winter				Summer			
	January - March 1975				May - June 1976			
	OW (17) ^a	W-s (6)	But (6)	WT (6)	OW (11)	W-s (6)	But (6)	WT (6)
Pied-billed Grebe— <i>Podilymbus podiceps</i>	3	0	0	0	++	0	0	0
Double-crested Cormorant— <i>Phalacrocorax auritus</i>	+	0	0	0	0	0	0	0
American Anhinga— <i>Anhinga anhinga</i>	0	0	0	0	10	7	0	3
Great Blue Heron— <i>Ardea herodias</i>	0	0	15	11	0	0	0	3
Green Heron— <i>Butorides virescens</i>	0	0	0	0	0	26	160	23
Cattle Egret— <i>Bubulcus ibis</i>	0	0	0	0	0	0	0	10
Yellow-crowned Night Heron— <i>Nyctanassa violacea</i>	0	0	0	0	0	0	0	40
American Bittern— <i>Botaurus lentiginosus</i>	0	0	0	0	0	0	15	0
Mallard— <i>Anas platyrhynchos</i>	+	47	44	19	0	0	0	0
Northern Pintail— <i>Anas acuta</i>	1	0	0	41	0	0	0	0
Green-winged Teal— <i>Anas crecca</i>	+	133	0	0	0	0	0	0
American Wigeon— <i>Anas americana</i>	0	7	0	0	0	0	0	0
Northern Shoveler— <i>Anas clypeata</i>	0	25	0	0	0	0	0	0
Wood Duck— <i>Aix sponsa</i>	0	0	0	8	0	0	0	40
Redhead— <i>Aythya americana</i>	+	0	0	0	0	0	0	0
Ring-necked Duck— <i>Aythya collaris</i>	0	75	0	0	0	0	0	0
Canvasback— <i>Aythya valisineria</i>	+	0	0	0	0	0	0	0
Greater Scaup— <i>Aythya marila</i>	8	0	0	0	0	0	0	0
Lesser Scaup— <i>Aythya affinis</i>	73	28	0	0	0	0	0	0
Ruddy Duck— <i>Oxyura jamaicensis</i>	+	0	0	0	0	0	0	0
Red-shouldered Hawk— <i>Buteo lineatus</i>	0	0	0	8	0	0	0	7
Purple Gallinule— <i>Porphyrio martinica</i>	0	0	0	0	0	30	22	20
Common Gallinule— <i>Gallinula chloropus</i>	+	0	0	0	0	30	29	10
American Coot— <i>Fulica americana</i>	125	2198	261	801	+	13	0	0
Franklin's Gull— <i>Larus pipixcan</i>	+	0	0	0	0	0	0	0
Yellow-billed Cuckoo— <i>Coccyzus americanus</i>	0	0	0	0	0	0	0	40
Barred Owl— <i>Strix varia</i>	0	0	0	3	0	0	0	0
Chimney Swift— <i>Chaetura pelagica</i>	0	0	0	0	0	0	0	80
Belted Kingfisher— <i>Megascyle alcyon</i>	0	0	0	3	0	0	0	3
Common Flicker— <i>Colaptes auratus</i>	0	0	36	80	0	0	0	0
Pileated Woodpecker— <i>Dryocopus pileatus</i>	0	0	0	11	0	0	0	0
Red-bellied Woodpecker— <i>Centurus carolinus</i>	0	0	7	264	0	0	0	160
Yellow-bellied Sapsucker— <i>Sphyrapicus varius</i>	0	0	0	19	0	0	0	0
Hairy Woodpecker— <i>Dendrocopus villosus</i>	0	0	7	107	0	0	0	10
Downy Woodpecker— <i>Dendrocopus pubescens</i>	0	0	36	187	0	0	0	160
Eastern Kingbird— <i>Tyrannus tyrannus</i>	0	0	0	0	+	0	0	20
Great-crested Flycatcher— <i>Myiarchus cineritus</i>	0	0	0	0	0	0	15	380
Eastern Phoebe— <i>Sayornis phoebe</i>	0	0	51	44	0	0	0	0
Acadian Flycatcher— <i>Empidonax virescens</i>	0	0	0	0	0	0	0	380
Blue Jay— <i>Cyanocitta cristata</i>	0	0	15	27	0	0	0	60
Common Crow— <i>Brachyrhynchus corvus</i>	0	0	0	3	0	0	0	0
Carolina Chickadee— <i>Parus carolinensis</i>	0	0	87	124	0	0	51	160
Tufted Titmouse— <i>Parus bicolor</i>	0	0	7	33	0	0	0	40
Brown Creeper— <i>Certhia familiaris</i>	0	0	0	99	0	0	0	0
Winter Wren— <i>Troglodytes troglodytes</i>	0	0	0	19	0	0	0	0
Carolina Wren— <i>Thryothorus ludovicianus</i>	0	0	87	60	0	0	0	160
Brown Thrasher— <i>Toxostoma rufum</i>	0	0	7	0	0	0	0	0
American Robin— <i>Turdus migratorius</i>	0	0	0	60	0	0	0	0
Blue-gray Gnatcatcher— <i>Poliophtia caerulea</i>	0	0	0	0	0	0	15	0
Golden-crowned Kinglet— <i>Regulus satrapa</i>	0	0	15	17	0	0	0	0
Ruby-crowned Kinglet— <i>Regulus calendula</i>	0	0	22	387	0	0	0	0
European Starling— <i>Sturnus vulgaris</i>	0	0	0	214	0	0	0	80
Yellow-throated Vireo— <i>Vireo flavifrons</i>	0	0	0	0	0	0	0	3
Red-eyed Vireo— <i>Vireo olivaceus</i>	0	0	0	0	0	0	0	20
Prothonotary Warbler— <i>Protonotaria citrea</i>	0	0	0	0	0	0	58	400
Orange-crowned Warbler— <i>Vermivora celata</i>	0	0	109	0	0	0	0	0
Northern Parula Warbler— <i>Parula americana</i>	0	0	0	0	0	0	0	220
Yellow-rumped Warbler— <i>Dendroica coronata</i>	0	0	290	2399	0	0	0	0
Pine Warbler— <i>Dendroica pinus</i>	0	0	0	239	0	0	0	0
Red-winged Blackbird— <i>Agelaius phoeniceus</i>	0	0	247	401	0	0	471	180
Orchard Oriole— <i>Icterus spurius</i>	0	0	0	0	0	0	29	0
Northern Oriole— <i>Icterus galbula</i>	0	0	0	0	0	0	0	80
Rusty Blackbird— <i>Euphagus carolinus</i>	0	0	0	14	0	0	0	0
Common Grackle— <i>Quiscalus quiscula</i>	0	0	7	0	0	0	0	140
Brown-headed Cowbird— <i>Molothrus ater</i>	0	0	29	0	0	0	0	80
Summer Tanager— <i>Piranga rubra</i>	0	0	0	0	0	0	0	40
Northern Cardinal— <i>Cardinalis cardinalis</i>	0	0	0	11	0	0	51	160
American Goldfinch— <i>Spinus tristis</i>	0	0	0	8	0	0	0	0
White-throated Sparrow— <i>Zonotrichia albicollis</i>	0	0	0	11	0	0	0	0
Swamp sparrow— <i>Melospiza georgiana</i>	0	0	94	19	0	0	0	0
Total Individuals	210	2513	1473	5751	10	106	916	3212
Total Species	13	7	21	34	4	5	11	33
H'	1.00	0.56	2.44	2.22	0.53	1.50	1.65	2.93

*Number of counts
 ++< 0.5
 + used as 0.5 in H' calculations

OW = Open Water Area
 W-s = Water-shield area

But = Button bush area
 WT = Water Tupelo area

headed Cowbirds, *Molothrus ater*; Red-winged Blackbirds, *Agelaius phoeniceus*; and Common Grackles, *Quisacalus quiscula*) and 2,000 ardeids during winter, 1974-75. In addition, the islands were used by 14,000 Cattle Egrets (*Bubulcus ibis*) for nesting each year, 1974-75 (Ortego 1976). Most roosting birds left the area before any transect counts were conducted, and went to nearby agricultural and forested communities for feeding.

American Coots, Red-winged Blackbirds, Yellow-rumped Warblers (*Dendroica coronata*), and Orange-crowned Warblers (*Vermivora celata*) made up 58.0 percent of the total numbers of the 20 species present in winter (Table 1). American Coots (most concentrating near small openings) were scattered throughout the study plot and fed on the herbaceous vegetation present. Red-winged Blackbirds occurring during count periods were predominantly males that had established breeding territories near openings. Female redwings were very seldom observed during this season. Yellow-rumped Warblers were normally observed on vines growing amongst shrubs.

In summer, Red-winged Blackbirds and Green Herons made up 68.4 percent of the numbers of birds present (Table 1). The Red-winged Blackbirds' abundance increased in the Buttonbush area when more territories were established by males and when females began staying in the area during the breeding season. Green herons used the area mainly for nesting and seldom fed in this study plot.

Water Tupelo

This 10 ha study plot is part of a 20 ha water tupelo swamp that had an average depth of 1.1 m. Water tupelo comprises 99.8 percent of the stands 47.1 m² BA per ha, and 98.9 percent of the 1046 trees per ha. Average canopy height was 19.8 m and the average dbh was 22 cm. The understory was very open with only 0.4 m² BA per ha of shrubs, and 1000 stems per ha. The herbaceous vegetation was comprised primarily of free-floating and submergent vegetation; the mean percent cover varied from 21 in winter to 80 in summer.

The highest number of individuals and species in the Water Tupelo area occurred in winter (Table 1). The most numerous species in winter were Yellow-rumped Warblers, American Coots, Red-winged Blackbirds, and Ruby-crowned Kinglets (*Regulus calendula*). The Yellow-rumped Warblers searched most above-water, woody vegetation for food.

All passerines present fed lower in the vegetation when freezing temperatures occurred. American Coots ate whatever herbaceous vegetation that was available.

During summer 10 species made up 72.9 percent of the total number. The most common of these species were Prothonotary Warblers (*Prothonotaria citrea*), Acadian Flycatchers (*Empidonax virescens*) and Great-crested Flycatchers (*Myiarchus crinitus*).

General Trends

The abundance of breeding birds, number of breeding species and breeding bird diversity (H') increased with the complexity of the habitat in the four study areas. Similar relationships exist in upland habitats (Balda 1975; Hamilton and Noble 1975). The abundance pattern between habitats was somewhat different in the winter. Number of individuals increased with increasing complexity except there was a surplus of individuals, primarily coots, in the Water-shield area. The number of species followed a somewhat different pattern; the number increased from the Water-shield area to the Water Tupelo area, but there were more species present in Open Water than the Water-shield area. The Open Water area was used primarily for resting; many of the individuals found there fed elsewhere. The species diversity pattern was more complex but the two diverse, layered areas had much higher diversities than the two more structurally simple areas.

In all cases, the number of individuals and the number of species were larger in the winter than in the summer; this gives an indication of the importance of these wetlands to wintering birds. The same pattern is found in some upland Louisiana sites (Noble and Hamilton 1975).

Wintering birds in the Water Tupelo area were more numerous than the birds in any of Noble and Hamilton's (1975) upland sites. The Water Tupelo stand consisted primarily of two strata even though the most complex upland area had more vegetative strata. An

upland site with two strata, superficially similar to the tupelo stand was a 20 year old pine plantation that held a maximum number of birds of 380/Km². Densities were about 10 times as high in the tupelo stand. Bird numbers and species were less in the Open Water and Water-shield areas, but the environment was much more simple in these aquatic habitats. The number of species corresponds with what Balda (1975) reports for simple habitats. The summer density in Open Water is probably especially low because of the lack of potential nest sites. These comparisons indicate that the later developmental stages of these aquatic habitats have especially high bird densities and high avian species richness. Disregarding the uniqueness of the avifauna, these areas are still especially desirable for birds.

Although Miller's Lake was the site of a blackbird roost of approximately 15 million birds, the blackbirds could probably have roosted in upland wooded sites in the same area.

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