THE AVIF[illegible]

OF

MYRICK MARSH

A Thesis

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COLLEGE OF ARTS, LETTERS, AND SCIENCES

Candidate: Paul Anthony Harris

We recommend acceptance of this thesis to the College of Arts, Letters, and Sciences in partial fulfillment of this candidate's requirements for the degree Master of Science in Biology. The candidate has completed his oral defense of the thesis.

Howard F. Young Thesis Committee Chairman	Sept 19, 1975 Date
James R. Warner Thesis Committee Member	Sept 19, 1975 Date
[illegible] Thesis Committee Member	Sept 19, 1975 Date
[illegible] Thesis Committee Member	19 Sept 1975 Date

This thesis is approved for the College of Arts, Letters, and Sciences

[illegible] Dean, College of Arts, Letters, and Sciences	9/19/75 Date

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ABSTRACT

The purpose of this study was to observe the birds of Myrick Marsh in order to determine (1) the species utilizing the marsh as breeders, (2) the transients using the marsh as a resting area, (3) the non-breeding residents, (4) which species used the marsh as a wintering area and (5) the relative abundance of species observed. Various census routes were established and followed for the duration of the study. Mist nets, funnel traps and Potter traps were used to capture birds for the purpose of banding. A total of 164 individuals belonging to sixteen species were banded. Banding was used to start a long-term project to determine the recurrence of species in the marsh during successive years. Nesting birds were determined by locating singing males, deserted nests and observations of young birds. A total of 150 species were observed with 51 species breeding in the marsh. Of the 150 species, twelve are permanent residents, eighteen winter residents, forty-six transient visitants, forty-three summer residents and thirty-one summer visitants. Three methods were used to determine the relative abundance; Kendeigh, Bond, and number per man-hour. Both the Bond and Kendeigh methods were almost identical in ranking the observed species. Relative abundance varied with the three methods but Red-winged Blackbird (Agelaius phoeniceus) and Tree Sparrow (Spizella arborea) were ranked number one according to each method during the seasons in which these species were dominant. A diversity index was used as a quantitative method in comparing the various seasons. Diversity was dependent on the number of species and individuals observed for each season. Diversity was low during the summer and winter and higher during the spring and fall migrations. A total of fifteen

orders were represented with 55.1% of the observed species belonging to the order Passeriformes. A geographical origin of the Myrick Marsh avifauna according to Mayr was also made in order to determine the composition of the avifauna when compared with a different region of the country. The data shows an increase in the number of unanalyzed species as one moves toward the northern latitudes due to increased nesting activity and the presence of more species during the summer.

ACKNOWLEDGEMENTS

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Finally, I wish to express my deepest gratitude to my wife, Rita, for her help in record keeping and assistance in the field. Her understanding and encouragement made this study possible.

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INTRODUCTION

Published studies of marshland avifauna in Wisconsin are limited. Sandburg (1968) made a study of Dunn's Marsh near Madison, Brooks (1960) made a study of the songbird communities of two marsh habitats and Thomsen (1944) made an ecological survey of the University Bay Region at Madison. These studies were primarily concerned with the marsh habitat during the breeding season. Herman (1941) made a faunal survey of the Sheboygan marsh that lasted for one year. This is the only study of a marsh that lasted for at least one year.

Marshes are areas that are constantly being drained in an effort to provide for urban growth or for agricultural use. The pressure of expanding populations on these wetland areas has not only caused a decrease in acreage but a decrease in productivity of these areas for wildlife production. Marshes are in the way of the developmental processes; they are considered eyesores, mosquito havens, and unreproductive areas by the misinformed. However, the value of marshes is well established. Dahlen and Thompson (1955), Kabat (1957), Benson and Perry (1965), and Thompson (1966) and others have attested to the importance and productivity of marshlands. They provide evidence that marshes offer a variety of habitats supporting a wide range of life forms. Cover and feeding areas are important aspects of marshes for providing growth and breeding areas (Griffith, 1948). The production of numerous species of game birds and fur-bearers depends on marsh areas, and they are valuable as a resource area. Marshes located in floodplain areas also provide a temporary impoundment for excess run off and help to maintain the water table.

The location of Myrick Marsh provides an outdoor study area that can be utilized by all age groups of citizens. The educational value of the marsh has unlimited potential if managed properly. Trails are present throughout the marsh and provide for easy access by the public. Hiking, nature study, photography and bird watching are only a few of the activities that are carried out in the marsh. The University of Wisconsin - La Crosse and several other local schools use the marsh as a study area.

The purpose of this study is to determine: (1) the species breeding in the marsh, (2) which transients utilize the marsh as a resting area, (3) which species are non-breeding summer residents, (4) which species use the marsh as a wintering area, and (5) the relative abundance of the observed species.

Hopefully information gathered here will be useful in showing the value of Myrick Marsh as a wildlife area, and will form a basis for future studies.

Description of the Area

Myrick Marsh consists of approximately 1500 acres (607.4 ha). The marsh is located within the city limits of La Crosse, Wisconsin with titleship divided among eighteen owners. The study area of 700 acres (283.4 ha) is bounded on the south by the La Crosse Cemetery and Myrick Park, on the west by the Chicago and Northwestern Railroad and on the north by the La Crosse River. The eastern portion is bounded by the Burlington and Quincy Railroad (Fig. I). Plates I, II and III show habitat for the three study areas.

FIGURE I

Map of the Study Area in Myrick Marsh

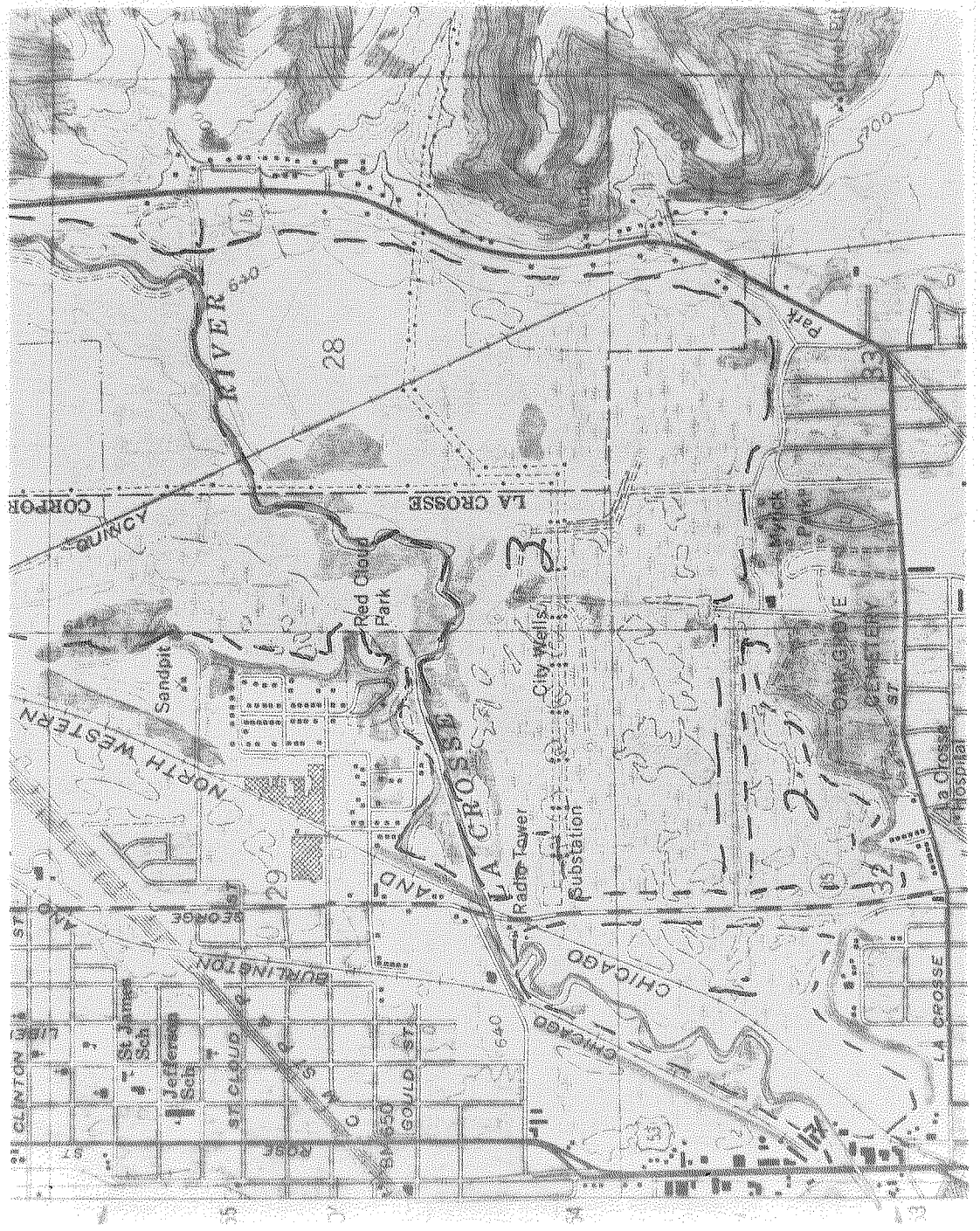

LA CROSSE
QUINCY
Red Cloud Park
Sandpit
NORTH WESTERN
Radio Tower
City Wells
Substation
Oak Grove Cemetery
La Crosse Hospital
CHICAGO
BURLINGTON
GEORGE
ST CLOUD
GOULD ST
St. James Sch.
Jefferson Sch.
CLINTON
RIVER
Park
28
29
32
33
640
700

FIGURE I

PLATE I

a. West Portion of Study Area, View from North

b. South Portion of Study Area, View from East

PLATE I a.

PLATE I b.

PLATE II

Central Portion of Study Area, View from South

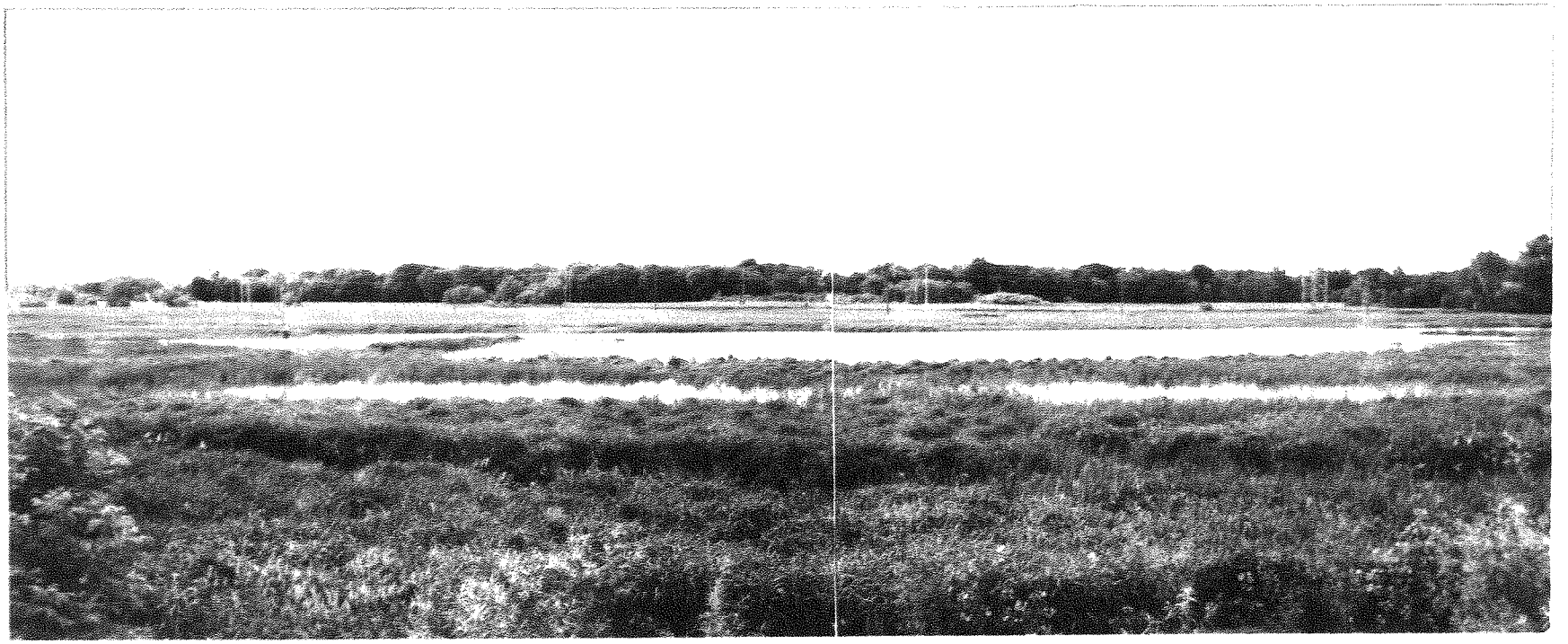


PLATE II

PLATE III

a. South-east Portion of Study Area, View from West

b. North-east Portion of Study Area, View from West

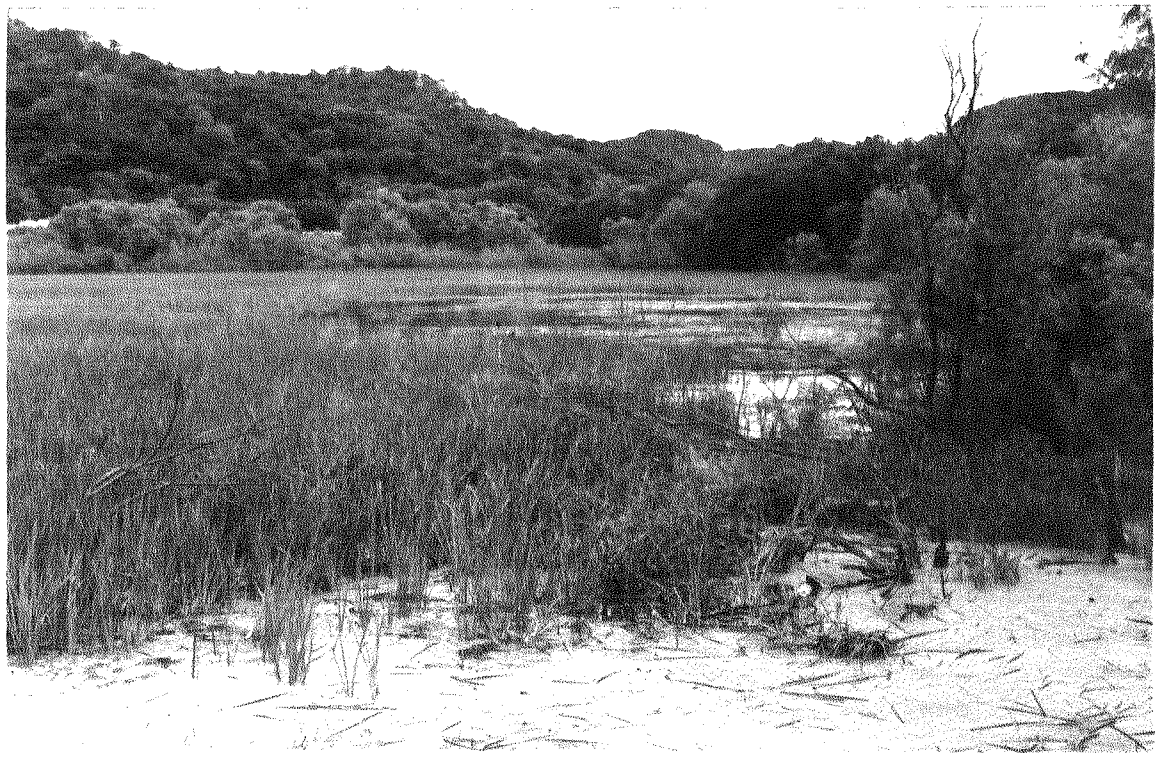


PLATE III a.

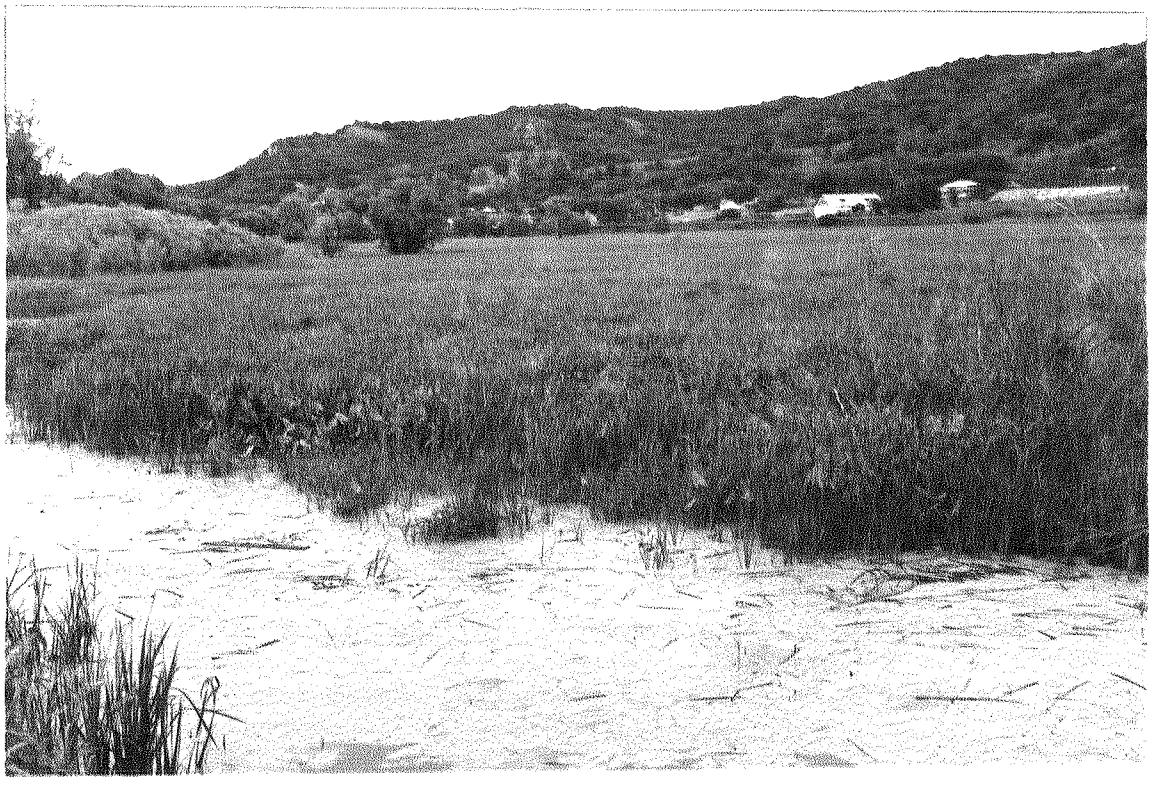


PLATE III b.

The main source of water for the marsh is the La Crosse River which provides flood waters for the marsh. The marsh also serves as a dumping site for snow during the winter, and run-off drains from the city which allows for excess water flow during the spring. Water levels are subject to periodic fluctuations of the La Crosse River and indirectly the Mississippi River.

The study area can be divided into three major plant communities (Figure II); the wet marsh, the deciduous woods and the grassy area. The dominant species of the wet marsh area are sedges (Scirpus fluviatilis), cattail (Typha latifolia), arrowhead (Sagittaria latifolia), duckweed (Lemna trisulca), marsh grass (Spartina pectinata), smartweed (Polygonum spp.), reed grass (Phragmites communis), and reed canary grass (Phalaris arundinacea). Large portions of this area are permanently flooded during wet years. The woody vegetation of the area consists primarily of box elder (Acer negundo), silver maple (Acer saccharinum), oak (Quercus spp.), black walnut (Juglans nigra), honey locust (Gleditsia triacanthos), mulberry (Morus spp.), red ash (Fraxinus pennsylvanica), elms (Ulmus spp.), cottonwood (Populus deltoides), and hackberry (Celtis occidentalis), In the grassland, the most abundant plants are brome grass (Bromus spp.), panic grass (Panicum spp.), blue grass (Poa pratensis), milkweed (Asclepias spp.), ragweeds (Ambrosia spp.), wood nettle (Laportea canadensis), and stinging nettle (Urtica dioica). Sohmer (unpublished) lists 127 plant species from Myrick Marsh. All areas of vegetation are subject to inundation.

The marsh has numerous dikes once used as service roads for city

FIGURE II

Vegetational Distribution in the Study Area

- Deciduous Woods
- Wet Marsh
- Grass Area

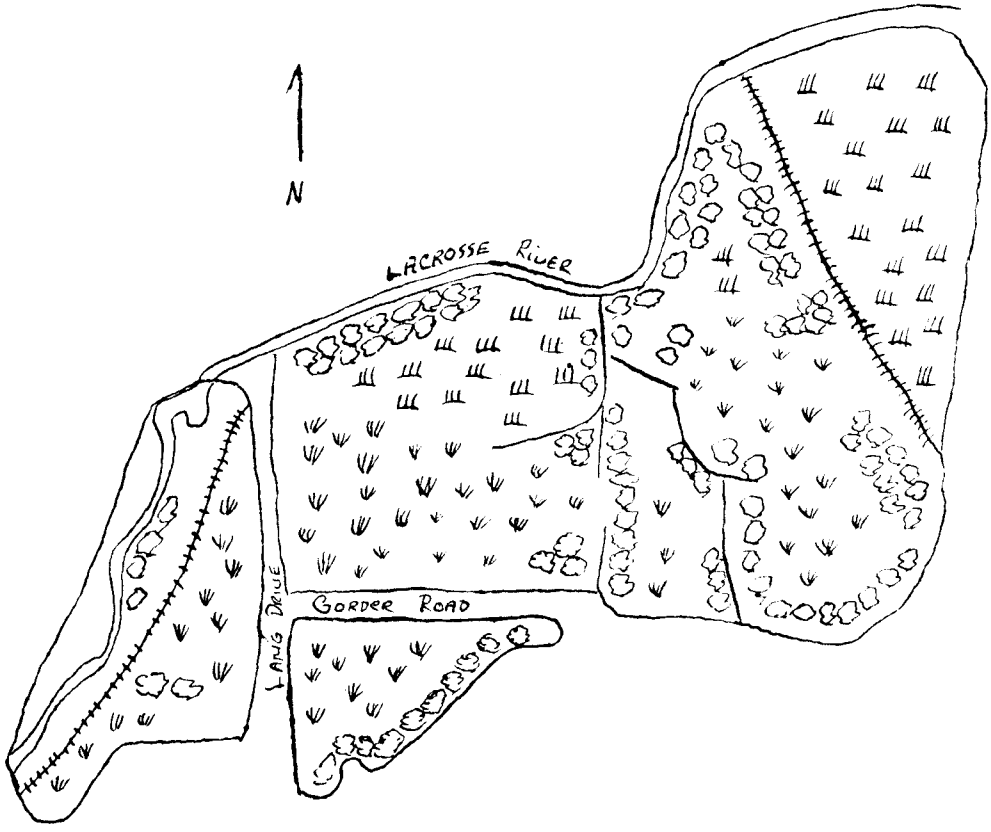


FIGURE II

water pumping stations. The pumps have since been shut down and the dikes now serve as walkways, allowing convenient approach to many parts of the marsh (Figure III).

MATERIALS AND METHODS

Various census routes were established both following existing boundaries and crossing large areas so that representative habitats were covered (Figure III). During the late fall and through early spring, two trips a week were carried out. Half of the marsh was covered on each trip. More time was required during the summer months because of increased bird numbers. Thus up to five trips a week were made. All species seen were recorded along with the numbers of individuals seen for each species. The temperature for each trip and the average temperature for each month (with the high and the low) is recorded in Appendix Table XI and XII. They also show precipitation values for each month of the study and the year prior to the study to offer some comparisons.

Along with observations on the general avifauna of the marsh, an attempt was made to determine those species utilizing the marsh as a nesting area. Nests were located by the flushing of the nesting bird and from collection of empty nests. The empty nests were identified by use of Headstrom's (1970) key. A nesting study was started in the summer of 1974 to determine hatching success of Red-winged Blackbird (Aegelaius phoeniceus), and Yellow-headed Blackbird (Xanthocephalus xanthocephalus). After one week into the study, a reflooding of the marsh eliminated 90% of the nests being observed. The high water remained for approximately two weeks before the water receded. No further attempt to start a nesting study was undertaken.

A breeding bird list was compiled by: finding of nests, observation of young, presence of singing males and records from previous observations.

FIGURE III

Census Routes Followed Through the Study Area
(Route followed: ⟶)

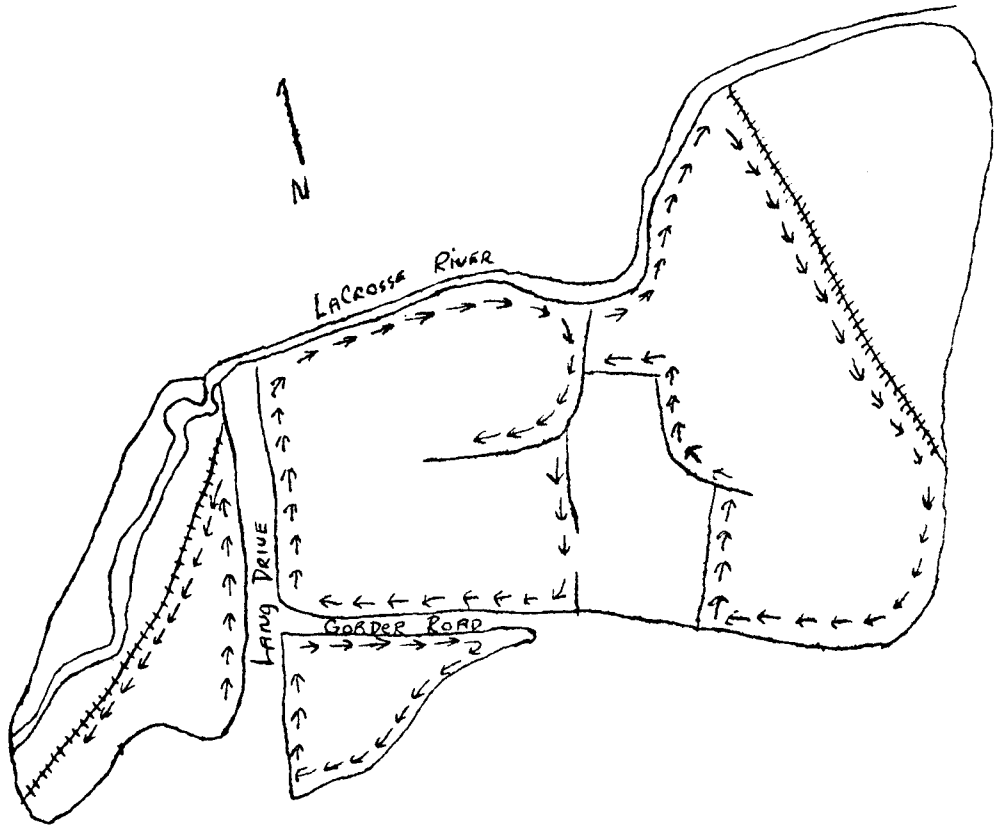


FIGURE III

A banding program was initiated to study the return of individuals to the marsh. Mist nets, funnel traps and Potter traps were used to capture birds. Feeding stations were set up and maintained during the winter and summer months to increase probability of capturing birds and to concentrate species at good observation points. A total of 16 species and 164 individuals were banded.

Observations were made with 7X50 binoculars supplemented when necessary by a 10-60 power Selsi spotting scope.

Climate

The complete climatological data for the duration of the study period and for the year previous to the study (1973) are found in Appendix Table XI and XII. The temperature for the duration of the study shows a similar trend when compared to the previous year (Figure (V). The year 1974 showed a general decrease in monthly temperatures when compared to 1973.

Precipitation was recorded in inches per month. Figure V shows the average precipitation for each month for 1973, and for 1974-75. In March of 1973, the average precipitation was 3.69 in.; in April 7.31 in.; in May 6.21 in. and June 4.47 inches. The deviation from the normal for the previous months are: 1.62 in., 4.56 in., 2.45 in., and 0.27 inches respectively. This amount of precipitation is not uncommon for the spring months of the year. The spring of 1974 was considerably drier than in 1973. Precipitation for March was 2.13 in., in April 1.83 in., in May 3.50 in., and in June 5.30 inches. The departure from the normal was 0.11 in., -0.80 in., -0.20 in., and 0.86 inches

FIGURE IV

Average Temperatures for each Month
for the Years 1973, 1974 and 1975

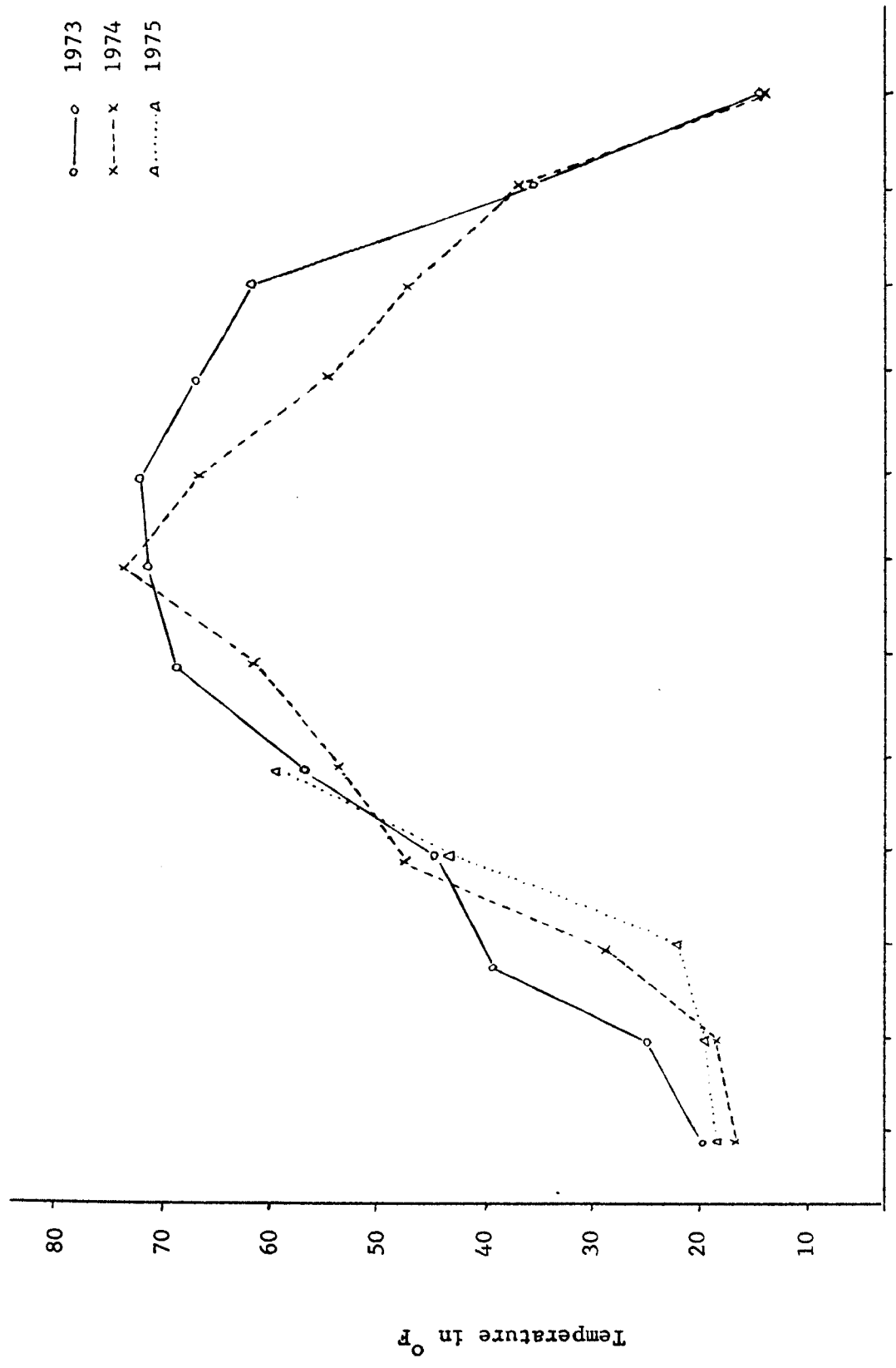

1973
1974
1975
Temperature in °F
80
70
60
50
40
30
20
10
Jan
Feb
Mar
Apr
May
June
July
Aug
Sept
Oct
Nov
Dec

FIGURE IV

FIGURE V

Total Precipitation in Inches Per Month
for the Years 1973, 1974 and 1975

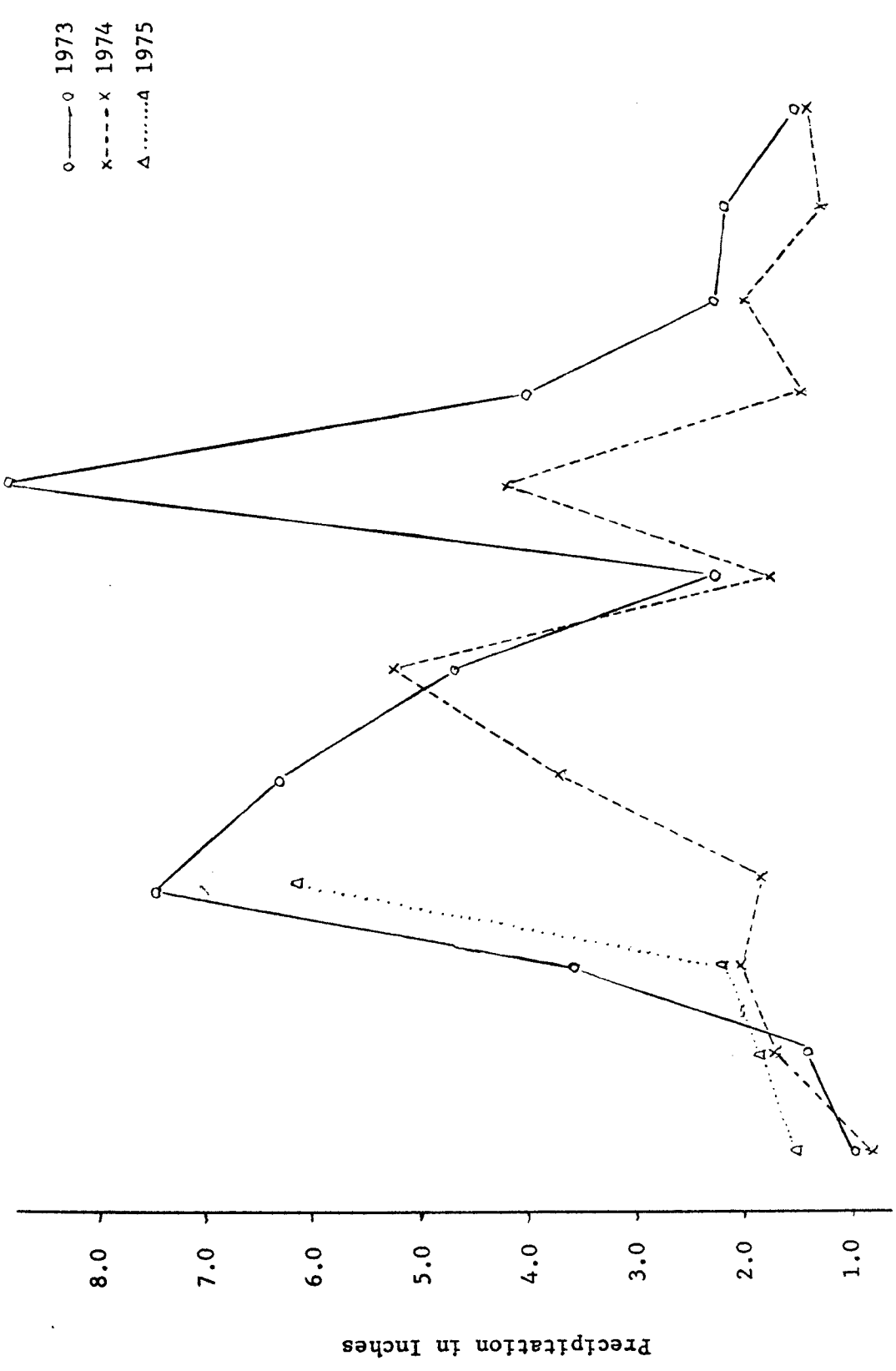

o—— o 1973
x---- x 1974
Δ.....Δ 1975
Precipitation in Inches
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
Jan
Feb
Mar
Apr
May
June
July
Aug
Sept
Oct
Nov
Dec

FIGURE V

respectively. As compared to 1973 the amount of rainfall was considerably less than expected for this time of the year.

Figure V also shows that toward the fall of 1973 precipitation increased and helped to maintain water in the marsh throughout the winter. When compared to 1973, no large amounts of precipitation occurred in 1974 and subsequently the marsh dried up except for standing water in the larger drainage ditches.

The average monthly wind speeds in miles per hour are found in Appendix Table XI and XII along with the high, low and median river stages which influence the flow of water into the marsh.

RESULTS AND DISCUSSION

Classification of Avifauna

A total of 150 species of birds was observed during the study period. Appendix Table XIII lists the species observed in taxonomic order. Nomenclature follows the 5th edition of American Ornithologists Union check-list (1957), as revised through the 32nd supplement (1973). Total trips during the study were 185, with a total of 333 man-hours spent in the field.

Table I is a list of species observed and their relationship to the marsh. Five categories were used to characterize the birds observed according to their status in the marsh. These are: (1) P.R.-permanent residents; may not breed in the marsh study area but were observed during all seasons of the year, (2) W.R.-winter residents; these birds appeared during the fall migration and remained through the winter months, decreased during the spring migration and were absent in summer, (3) T.V.-transient visitants; those that appeared during the spring and fall migration only, (4) S.R.-summer residents; breeders which arrived during the spring migration and remained through the summer, leaving during the fall migration, and (5) S.V.-summer visitants; observed in the marsh during the summer but did not breed in the marsh.

Classification of a species in any one of the five categories was based on Table II, which shows the varying seasonal abundance of the species for the period of the study. For each species the number of individuals seen during the season was divided by the total man-hours for that season, giving the number of individuals of the species per man-hours of observation. These are the values listed in Table II.

Table I

List of Birds Observed and Their Relationship to the Marsh

Species	P.R.*	W.R.	T.V.	S.R.	S.V.
Pied-billed Grebe				X	
Great Blue Heron					X
Green Heron				X	
Great Egret					X
Black-crowned Night Heron					X
Yellow-crowned Night Heron					X
American Bittern					X
Canada Goose			X		
Snow Goose			X		
Mallard				X	
Green-winged Teal					X
Blue-winged Teal				X	
American Wigeon			X		
Northern Shoveller			X		
Wood Duck				X	
Ring-necked Duck			X		
Canvasback			X		
Lesser Scaup			X		
Bufflehead			X		
Ruddy Duck			X		
Hooded Merganser				X	
Goshawk		X			

Table I - (Continued)

Species	P.R.*	W.R.	T.V.	S.R.	S.V.
Red-tailed Hawk		X			
Broad-winged Hawk		X			
Rough-legged Hawk		X			
Osprey			X		
American Kestrel		X			
Ruffed Grouse			X		
Bobwhite	X				
Ring-necked Pheasant		X			
King Rail					X
Virginia Rail				X	
Sora Rail				X	
Common Gallinule					X
American Coot				X	
Killdeer				X	
American Woodcock			X		
Common Snipe				X	
Spotted Sandpiper					X
Solitary Sandpiper					X
Greater Yellowlegs					X
Lesser Yellowlegs					X
Pectoral Sandpiper			X		
Least Sandpiper					X
Long-billed Dowitcher			X		
Stilt Sandpiper			X		

Table I - (Continued)

Species	P.R.*	W.R.	T.V.	S.R.	S.V.
Semipalmated Sandpiper			X		
Herring Gull			X		
Ring-billed Gull			X		
Bonaparte's Gull			X		
Black Tern				X	
Rock Dove	X				
Mourning Dove				X	
Yellow-billed Cuckoo				X	
Black-billed Cuckoo					X
Great Horned Owl	X				
Barred Owl		X			
Common Nighthawk				X	
Chimney Swift					X
Belted Kingfisher				X	
Common Flicker				X	
Red-bellied Woodpecker	X				
Red-headed Woodpecker					X
Yellow-bellied Sapsucker					X
Hairy Woodpecker		X			
Downy Woodpecker	X				
Great Crested Flycatcher					X
Eastern Phoebe				X	
Acadian Flycatcher					X
Traill's Flycatcher					X

Table I - (Continued)

Species	P.R.*	W.R.	T.V.	S.R.	S.V.
Least Flycatcher					X
Eastern Wood Pewee				X	
Tree Swallow				X	
Bank Swallow				X	
Rough-winged Swallow				X	
Barn Swallow				X	
Cliff Swallow				X	
Blue-Jay	X				
Common Crow		X			
Black-capped Chickadee		X			
White-breasted Nuthatch	X				
Red-breasted Nuthatch		X			
Brown Creeper	X				
House Wren				X	
Carolina Wren					X
Long-billed Marsh Wren				X	
Gray Catbird				X	
Brown Thrasher				X	
American Robin				X	
Hermit Thrush			X		
Gray-cheeked Thrush			X		
Golden-crowned Kinglet			X		
Ruby-crowned Kinglet			X		
Cedar Waxwing				X	

Table I - (Continued)

Species	P.R.*	W.R.	T.V.	S.R.	S.V.
Northern Shrike		X			
Loggerhead Shrike			X		
Starling	X				
Red-eyed Vireo			X		
Warbling Vireo				X	
Black-&-White Warbler					X
Prothonotary Warbler					X
Orange-crowned Warbler			X		
Nashville Warbler			X		
Yellow Warbler				X	
Magnolia Warbler			X		
Yellow-rumped Warbler			X		
Chestnut-sided Warbler					X
Bay-breasted Warbler			X		
Blackpoll			X		
Palm Warbler			X		
Ovenbird			X		
Northern Waterthrush					X
Louisiana Waterthrush			X		
Connecticut Warbler			X		
Mourning Warbler			X		
Common Yellowthroat				X	
Hooded Warbler			X		
Wilson's Warbler			X		

Table I - (Continued)

Species	P.R.*	W.R.	T.V.	S.R.	S.V.
American Redstart				X	
House Sparrow	X				
Eastern Meadowlark			X		
Yellow-headed Blackbird				X	
Red-winged Blackbird				X	
Northern Oriole				X	
Rusty Blackbird					X
Brewer's Blackbird					X
Common Grackle				X	
Brown-headed Cowbird				X	
Cardinal	X				
Rose-breasted Grosbeak					X
Indigo Bunting				X	
Purple Finch			X		
Hoary Redpoll		X			
Common Redpoll		X			
Pine Siskin		X			
American Goldfinch	X				
Savannah Sparrow			X		
LeConte's Sparrow			X		
Vesper Sparrow					X
Dark-eyed Junco		X			
Tree Sparrow		X			
Chipping Sparrow					X

Table I - (Continued)

Species	P.R.*	W.R.	T.V.	S.R.	S.V.
Field Sparrow				X	
White-crowned Sparrow			X		
White-throated Sparrow			X		
Fox Sparrow			X		
Lincoln's Sparrow			X		
Swamp Sparrow				X	
Song Sparrow				X	
Lapland Longspur		X			

*P.R. - Permanent Resident

W.R. - Winter Resident

T.V. - Transient Visitant

S.R. - Summer Resident

S.V. - Summer Visitant

Table II

A List of Birds Recorded Per Man-hour
for the Period of the Study

Species	Dec-Feb '73-74	Mar-May '74	Jun-Aug '74	Sep-Nov '74	Dec-Feb '74-75	Mar-May '75
Pied-billed Grebe	-	0.42	0.25	0.14	-	0.51
Great Blue Heron	-	0.25	1.08	0.42	-	0.27
Green Heron	-	0.27	1.57	1.19	-	0.30
Great Egret	-	0.03	0.25	0.20	-	0.24
Black-crowned Night Heron	-	-	0.05	-	-	-
Yellow-crowned Night Heron	-	-	0.01	-	-	-
American Bittern	-	0.10	0.03	-	-	-
Canada Goose	-	-	-	-	-	0.21
Snow Goose	-	0.05	-	-	-	-
Mallard	-	3.22	2.46	3.97	0.02	2.49
Green-winged Teal	-	-	0.02	-	-	0.06
Blue-winged Teal	-	4.35	3.25	8.36	-	1.71
American Wigeon	-	-	-	-	-	0.42
Northern Shoveller	-	0.38	-	-	-	0.48
Wood Duck	-	2.01	1.91	0.75	-	3.03
Ring-necked Duck	-	1.03	-	-	-	0.30
Canvasback	-	-	-	-	-	0.15
Lesser Scaup	-	1.56	-	-	-	0.90
Bufflehead	-	0.03	-	-	-	0.60
Ruddy Duck	-	0.03	-	-	-	-
Hooded Merganser	-	0.85	1.17	0.02	-	0.30

Table II - (Continued)

Species	Dec-Feb '73-74	Mar-May '74	Jun-Aug '74	Sep-Nov '74	Dec-Feb '74-75	Mar-May '75
Goshawk	-	-	-	-	0.02	-
Red-tailed Hawk	0.17	0.20	-	0.30	0.26	0.21
Broad-winged Hawk	-	0.03	-	-	-	-
Rough-legged Hawk	-	-	-	-	0.02	0.03
Osprey	-	0.02	-	-	-	-
American Kestrel	-	0.08	-	0.05	0.04	0.09
Ruffed Grouse	-	0.03	-	0.02	-	-
Bobwhite	0.67	0.40	0.23	0.98	0.43	1.05
Ring-necked Pheasant	0.06	-	-	-	-	0.03
King Rail	-	-	0.06	-	-	-
Virginia Rail	-	-	0.17	0.25	-	-
Sora Rail	-	0.53	0.24	0.39	-	0.03
Common Gallinule	-	-	0.02	0.06	-	-
American Coot	-	6.41	0.59	0.19	0	2.88
Killdeer	-	0.73	1.11	2.58	-	0.54
American Woodcock	-	-	-	-	-	0.06
Common Snipe	-	0.08	0.17	1.28	-	1.71
Spotted Sandpiper	-	0.02	0.03	0.02	-	-
Solitary Sandpiper	-	0.02	0.33	1.05	-	0.06
Greater Yellowlegs	-	-	0.01	0.45	-	-
Lesser Yellowlegs	-	0.95	0.28	1.05	-	-
Pectoral Sandpiper	-	-	-	0.25	-	-
Least Sandpiper	-	-	0.30	1.38	-	-

Table II - (Continued)

Species	Dec-Feb '73-74	Mar-May '74	Jun-Aug '74	Sep-Nov '74	Dec-Feb '74-75	Mar-May '75
Long-billed Dowitcher	-	-	-	0.06	-	-
Stilt Sandpiper	-	-	-	0.05	-	-
Semipalmated Sandpiper	-	0.02	-	0.75	-	-
Herring Gull	-	-	-	0.16	-	-
Ring-billed Gull	-	-	-	0.59	-	-
Bonaparte's Gull	-	-	-	0.03	-	-
Black Tern	-	0.30	1.31	-	-	0.63
Rock Dove	0.55	0.60	0.76	1.83	0.32	0.54
Mourning Dove	-	2.24	4.60	0.61	-	1.59
Yellow-billed Cuckoo	-	-	0.01	-	-	-
Black-billed Cuckoo	-	-	0.01	-	-	-
Great Horned Owl	0.20	0.03	0.01	0.09	0.13	0.03
Barred Owl	-	-	-	0.05	0.04	0.03
Common Nighthawk	-	0.05	0.68	0.56	-	0.03
Chimney Swift	-	0.51	1.45	0.83	-	-
Belted Kingfisher	-	0.18	0.29	0.17	0.04	0.09
Common Flicker	-	0.66	0.40	0.81	-	0.78
Red-bellied Woodpecker	0.43	0.10	0.01	0.02	0.26	0.12
Red-headed Woodpecker	-	-	0.18	-	-	-
Yellow-bellied Sapsucker	-	0.18	0.02	0.08	-	0.18
Hairy Woodpecker	0.61	0.12	-	0.42	0.82	0.78
Downy Woodpecker	1.74	0.40	0.22	0.61	1.31	1.05
Great Crested Flycatcher	-	0.03	0.05	0.02	-	0.03

Table II - (Continued)

Species	Dec-Feb '73-74	Mar-May '74	Jun-Aug '74	Sep-Nov '74	Dec-Feb '74-75	Mar-May '75
Eastern Phoebe	-	0.13	0.07	0.11	-	0.03
Acadian Flycatcher	-	-	0.05	-	-	-
Traill's Flycatcher	-	-	0.01	-	-	-
Least Flycatcher	-	0.08	0.08	0.03	-	-
Eastern Wood Pewee	-	0.03	0.13	0.17	-	0.03
Tree Swallow	-	3.57	0.95	0.78	-	0.63
Bank Swallow	-	0.05	0.22	-	-	-
Rough-winged Swallow	-	2.48	1.28	3.03	-	0.12
Barn Swallow	-	0.05	0.48	0.17	-	-
Cliff Swallow	-	0.05	0.14	-	-	-
Blue-Jay	2.58	0.53	0.14	1.67	0.93	0.24
Common Crow	0.55	0.48	-	1.41	2.13	0.93
Black-capped Chickadee	1.48	0.28	-	0.84	2.00	1.29
White-breasted Nuthatch	0.81	0.20	0.17	0.72	1.62	0.42
Red-breasted Nuthatch	0.03	-	-	-	-	-
Brown Creeper	0.17	0.05	0	0.19	0.71	0.21
House Wren	-	0.08	0.76	0.19	-	0.12
Carolina Wren	-	-	0.03	-	-	-
Long-billed Marsh Wren	-	-	0.45	0.09	-	-
Gray Catbird	-	0.51	1.73	0.80	-	0.21
Brown Thrasher	-	0.05	0.13	0.06	-	0.06
American Robin	-	3.44	4.96	3.89	1.14	3.93
Hermit Thrush	-	0.05	-	0.06	-	0.09

Table II - (Continued)

Species	Dec-Feb '73-74	Mar-May '74	Jun-Aug '74	Sep-Nov '74	Dec-Feb '74-75	Mar-May '75
Gray-cheeked Thrush	-	0.03	0.02	-	-	-
Golden-crowned Kinglet	-	0.15	-	0.67	-	0.18
Ruby-crowned Kinglet	-	0.27	-	0.44	-	0.18
Cedar Waxwing	-	-	0.28	0.30	-	0.18
Northern Shrike	0.03	-	-	-	0.02	-
Loggerhead Shrike	-	-	-	0.02	-	-
Starling	0.98	1.28	0.83	2.13	1.25	2.79
Red-eyed Vireo	-	-	-	0.09	-	-
Warbling Vireo	-	-	0.09	0.03	-	-
Black and White Warbler	-	0.02	0.03	0.02	-	0.03
Prothonotary Warbler	-	-	0.02	-	-	-
Orange-crowned Warbler	-	-	-	-	-	0.03
Nashville Warbler	-	0.05	-	-	-	-
Yellow Warbler	-	0.93	0.82	0.02	-	0.06
Magnolia Warbler	-	0.05	-	0.16	-	-
Yellow-rumped Warbler	-	0.80	-	1.02	-	0.60
Chestnut-sided Warbler	-	0.02	0.03	0.17	-	-
Connecticut Warbler	-	-	-	-	-	0.09
Bay-breasted Warbler	-	-	-	0.16	-	-
Blackpoll Warbler	-	-	-	0.02	-	-
Palm Warbler	-	0.07	-	0.55	-	0.66
Ovenbird	-	0.02	-	-	-	-
Northern Waterthrush	-	0.23	0.03	0.14	-	0.12

Table II - (Continued)

Species	Dec-Feb '73-74	Mar-May '74	Jun-Aug '74	Sep-Nov '74	Dec-Feb '74-75	Mar-May '75
Louisiana Waterthrush	-	0.03	-	-	-	-
Mourning Warbler	-	-	-	0.05	-	-
Common Yellowthroat	-	0.51	0.38	0.77	-	0.24
Hooded Warbler	-	-	-	-	-	0.03
Wilson's Warbler	-	-	-	0.02	-	0.03
American Redstart	-	0.10	0.06	0.05	-	0.03
House Sparrow	0.84	0.80	0.39	2.22	0.97	1.11
Eastern Meadowlark	-	0.28	-	-	-	0.24
Yellow-headed Blackbird	-	1.00	0.72	-	-	0.03
Red-winged Blackbird	3.07	48.14	70.33	42.20	3.60	14.07
Northern Oriole	-	0.35	0.28	-	-	0.24
Rusty Blackbird	-	0.96	0.05	0.45	-	0.75
Brewer's Blackbird	-	3.06	0.77	0.81	-	0.27
Common Grackle	-	15.78	5.22	3.28	-	9.21
Brown-headed Cowbird	0.43	2.34	0.45	-	-	1.47
Cardinal	1.74	2.01	0.96	1.78	1.16	2.70
Rose-breasted Grosbeak	-	0.10	0.18	0.31	-	0.03
Indigo Bunting	-	-	0.25	-	-	-
Purple Finch	-	0.25	-	0.03	0.04	0.27
Hoary Redpoll	0.03	-	-	-	-	-
Common Redpoll	1.07	-	-	-	-	-
Pine Siskin	0.03	0.10	-	-	-	-
American Goldfinch	3.10	1.03	1.42	2.75	1.27	1.38

Table II - (Continued)

Species	Dec-Feb '73-74	Mar-May '74	Jun-Aug '74	Sep-Nov '74	Dec-Feb '74-75	Mar-May '75
Savannah Sparrow	-	-	-	0.03	-	-
Le Conte's Sparrow	-	-	-	0.05	-	-
Vesper Sparrow	-	-	0.03	-	-	-
Dark-eyed Junco	1.53	0.96	-	2.42	2.46	3.90
Tree Sparrow	21.33	4.68	-	5.19	11.31	5.37
Chipping Sparrow	-	-	0.02	0.02	-	-
Field Sparrow	-	0.13	0.02	-	-	-
White-crowned Sparrow	-	-	-	0.09	-	-
White-throated Sparrow	-	0.10	-	2.98	-	0.48
Fox Sparrow	-	0.30	-	0.06	-	0.90
Lincoln's Sparrow	-	-	-	0.48	-	-
Swamp Sparrow	-	0.35	0.09	0.16	-	0.60
Song Sparrow	-	4.45	1.38	2.36	-	4.02
Lapland Longspur	0.03	-	-	-	-	-

By examining the table, one is able to determine the abundance of the species in the marsh during the various seasons. The number of species found within the five categories are twelve permanent residents, eighteen winter residents, forty-six transient visitants, forty-three summer residents and thirty-one summer visitants. Transient visitants make up almost one-third of the observed species.

Breeding birds found in the marsh are listed in the Appendix Table XIII. Fifty-one species were observed to breed in the marsh. The potential breeding area can support a variety of species not actually observed in the marsh. Table III is a list of potential breeders, whose nests were not found in the marsh during this study period. The list is based on breeding range maps in Gromme (1964), after elimination of certain species as explained below. The location of the marsh within the city limits coupled with established life-history studies (Bent, 1919, 1922, 1923, 1958) suggest Common Loon (Gavia immer), Double-crested Cormorant (Phalacrocorax auritus), Lesser Scaup (Aythya affinis), Ring-necked Duck (Aythya collaris), Ruddy Duck (Oxyura jamaicensis) and Brewer's Blackbird (Euphagus cyanocephalus) won't breed in this area. It must be kept in mind that bird populations are continually fluctuating and expanding with new breeding species becoming established, and others disappearing. This list is just a guide and as such is subject to deletions and additions.

Banding Data

A total of 164 individuals and sixteen species were banded during the study period. A list of individual distribution within the sixteen

Table III

Hypothetical Breeding List for Myrick Marsh

Common Name	Scientific Name
Great Blue Heron	*Ardea herodias*
Black-crowned Night Heron	*Nycticorax nycticorax*
Yellow-crowned Night Heron	*Nyctanassa violacea*
Great Egret	*Casmerodius albus*
Least Bittern	*Ixobrychus exilis*
American Bittern	*Botaurus lentiginosus*
Black Duck	*Anas rubripes*
Marsh Hawk	*Circus cyaneus*
Red-shouldered Hawk	*Buteo lineatus*
King Rail	*Rallus elegans*
American Woodcock	*Philohela minor*
Spotted Sandpiper	*Actitis macularia*
Herring Gull	*Larus argentatus*
Short-eared Owl	*Asio flammeus*
Great Horned Owl	*Bubo virginianus*
Barred Owl	*Strix varia*
Red-bellied Woodpecker	*Centurus carolinus*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Traill's Flycatcher	*Empidonax traillii*
Least Flycatcher	*Empidonax minimus*
Carolina Wren	*Thryothorus ludovicianus*
Short-billed Marsh Wren	*Cistothorus platensis*

Table III - (Continued)

Common Name	Scientific Name
Wood Thrush	Hylocichla mustelina
Veery	Catharus fuscescens
Blue-gray Gnatcatcher	Polioptila caerulea
Loggerhead Shrike	Lanius ludovicianus
Bell's Vireo	Vireo bellii
Prothonotary Warbler	Protonotaria citrea
Golden-winged Warbler	Vermivora chrysoptera
Blue-winged Warbler	Vermivora pinus
Rose-breasted Grosbeak	Pheucticus ludovicianus
Savannah Sparrow	Passerculus sandwichensis

species is given in Table IV. Three species, Tree Sparrow, (Spizella arborea), Red-winged Blackbird (Agelaius phoeniceus), and Song Sparrow (Melospiza melodia) made up almost 58% of the total number captured.

Relative Abundance

Methods for determining the relative abundance of birds are numerous. Two of the most important studies are those of Bond (1957) and Kendeigh (1944). Relative abundance is a value depicting the comparative abundance of a species within an area. Absolute abundance is a measure of the complete species population of an area. Although of more scientific value, it is very difficult and time consuming to determine absolute abundance. Thus, relative abundance was chosen as a measure of the species abundance for the duration of the study period.

When working with any type of census technique, certain bias occurs. The number of observers participating in the survey can cause a certain degree of bias since individual experience may vary in the identification of species. This bias was considered negligible since the author was the main observer. Certain non-human bias can be noted from differences in conspicuousness of the birds (Kendeigh, 1944; Howell, 1951; Calguhoun, 1940 and Emlen, 1971). The conspicuousness of a given species can vary at different times of the year as its behavior and environment change. Conspicuousness has only been measured by taking an absolute census. With large study areas, time does not allow a complete census. Once a value can be determined it is multiplied by the observed abundance and a more accurate estimate of the population size can be made. Seierstad (1965) has recently attacked the problem statistically although

Table IV

Number of Individuals Banded During the Study Period and Percent of Total Individuals for each Species

Species	Number Banded	Per Cent of Total
Bobwhite Quail	1	0.61
Gray Catbird	20	12.20
American Robin	2	1.21
Northern Shrike	1	0.61
Common Yellowthroat	1	0.61
House Sparrow	11	6.71
Yellow-headed Blackbird	2	1.21
Red-winged Blackbird	31	18.90
Common Grackle	12	7.32
Cardinal	11	6.71
American Goldfinch	11	6.71
Dark-eyed Junco	1	0.61
Tree Sparrow	44	26.83
Lincoln's Sparrow	1	0.61
Swamp Sparrow	1	0.61
Song Sparrow	14	8.54
TOTAL	164	100.00

the method is still being developed.

Abundance as a population estimate technique is somewhat misleading in that many species such as the Falconiformes have large areas for territories and consequently are not abundant. Thus, although the abundance may be low for a species, the species may be at the optimum level which the study area can support.

Three methods were used in determining the relative abundance of species in Myrick Marsh; Kendeigh's (1944) index of abundance, Bond's (1957) importance value, and number seen per man-hour. A comparison of the methods follows.

Kendeigh (1944) obtained an index of abundance by first grouping the trips by months and determining average number of individuals per trip for each species. Then frequency was determined by dividing the number of trips each species was observed on by the total number of trips. The two figures were then multiplied and the square root of the product was used as the index of abundance. In this study Kendeigh's method was applied to seasons rather than months in order to consolidate data. The data are given in Appendix Table XIV.

Bond (1957) used relative density and relative frequency to arrive at an importance value (Appendix Table XV). He determined relative density by taking the total number of individuals observed for a single species in each study area, and dividing by the total number of individuals observed of all species in that study area. This value was then multiplied by 100 to determine relative density per one hundred acres. Relative frequency was determined by dividing the frequency value for each species by the sum of the frequency values for all species and

multiplying this by 100. The relative frequency was added to the relative density and called the importance value. In this study, Bond's method was applied to seasons rather than stands.

The number per man-hour was determined by taking the total observed individuals of a species and dividing it by the total man-hours of observation for that season (Table II).

Table V lists the ten most abundant winter species (1973-1974) according to the three methods just described. Two of the three methods show almost identical ranking. The Bond and Kendeigh method differ only in the ranking of two species which are reversed in each method. Of the twenty-nine species observed, only twelve species were ranked for the winter of 1973-1974. Most confidence can be placed on the abundance of the Tree Sparrow, since it ranked first on all lists. Both the Bond and Kendeigh methods seem to be the most accurate since the same species are found on both lists while only eight are found using the number per man-hour method.

Determination of relative abundance by using the single parameter of number per man-hour seems least accurate, since only eight of the twenty-nine species ranked by this method were also ranked in the first ten by the Bond and Kendeigh methods.

Subsequent time periods (March-May 1974, June-August 1974, September-November 1974, December-February 1974-1975 and March-May 1975) were analyzed in the same fashion. The results are included in Table VI which is a summary of changing abundance of the species observed. Their ranking during the four seasons of the year can easily be seen - K stands for Kendeigh, B for Bond and N/mhr for number per man-hour.

Table V

A Comparison of Abundance using the Three Methods: Kendeigh, Bond, and Number Per Man-hour for the Period December-February 1973-1974

Number	Kendeigh	Bond	Number Per Man-hour
1	Tree Sparrow	Tree Sparrow	Tree Sparrow
2	Blue-Jay	Blue-Jay	American Goldfinch
3	Downy Woodpecker	Downy Woodpecker	Red-winged Blackbird
4	American Goldfinch	American Goldfinch	Blue-Jay
5	Black-capped Chickadee	Black-capped Chickadee	Downy Woodpecker
6	Dark-eyed Junco	Dark-eyed Junco	Cardinal
7	Cardinal	Red-winged Blackbird	Dark-eyed Junco
8	Red-winged Blackbird	Cardinal	Black-capped Chickadee
9	White-breasted Nuthatch	White-breasted Nuthatch	Common Redpoll
10	Hairy Woodpecker	Hairy Woodpecker	Starling

Table VI

A Summary of Changing Abundance using the Three Methods:
Kendeigh, Bond, and Number Per Man-hour
for all Seasons of the Study

Species	Dec-Feb 73-74			Mar-May 74			Jun-Aug 74			Sep-Nov 74			Dec-Feb 74-75			Mar-May 75		
	K	B	N/mhr	K	B	N/mhr	K	B	N/mhr	K	B	N/mhr	K	B	N/mhr	K	B	N/mhr
Great Blue Heron	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-	-
Green Heron	-	-	-	-	-	-	9	9	9	-	-	-	-	-	-	-	-	-
Mallard	-	-	-	8	8	9	6	7	6	8	8	4	-	-	-	-	-	-
Blue-winged Teal	-	-	-	7	7	6	5	5	5	2	2	2	-	-	-	-	-	-
Wood Duck	-	-	-	-	-	-	-	-	7	-	-	-	-	-	-	9	9	7
American Coot	-	-	-	3	3	3	-	-	-	-	-	-	-	-	-	10	10	8
Killdeer	-	-	-	-	9	-	-	-	-	7	5	10	-	-	-	-	-	-
Mourning Dove	-	-	-	10	9	-	3	3	4	-	-	-	-	-	-	-	-	-
Hairy Woodpecker	10	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Downy Woodpecker	3	3	5	-	-	-	-	-	-	-	-	-	6	7	7	-	-	-
Tree Swallow	-	-	-	-	-	7	-	-	-	-	-	-	-	-	-	-	-	-
Rough-winged Swallow	-	-	-	-	-	-	-	-	-	-	-	7	-	-	-	-	-	-
Blue-Jay	2	2	4	-	-	-	-	-	-	-	-	-	10	10	-	-	-	-

Table VI - (Continued)

Species	Dec-Feb 73-74			Mar-May 74			Jun-Aug 74			Sep-Nov 74			Dec-Feb 74-75			Mar-May 75		
	K	B	N/mhr	K	B	N/mhr	K	B	N/mhr	K	B	N/mhr	K	B	N/mhr	K	B	N/mhr
Common Crow	-	-	-	-	-	-	-	-	-	-	-	-	3	3	4	-	-	-
Black-capped Chickadee	5	5	8	-	-	-	-	-	-	-	8	-	4	5	5	-	-	-
White-breasted Nuthatch	9	9	-	-	-	-	-	-	-	-	-	-	5	6	6	-	-	-
Gray Catbird	-	-	-	-	-	-	7	8	8	-	-	-	-	-	-	-	-	-
American Robin	-	-	-	5	6	8	4	4	3	3	3	5	-	-	-	4	4	5
Starling	-	-	10	-	-	-	-	-	-	10	8	-	8	9	9	8	8	9
Red-winged Blackbird	8	7	3	1	1	1	1	1	1	1	1	1	9	4	2	1	1	1
Common Grackle	-	-	-	2	2	2	2	2	2	4	7	6	-	-	-	2	2	2
Brewer's Blackbird	-	-	-	9	-	10	-	-	-	-	-	-	-	-	-	-	-	-
Cardinal	7	8	6	-	10	-	-	-	-	-	9	-	-	-	10	7	7	10
Common Redpoll	-	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
American Goldfinch	4	4	2	-	-	-	10	-	10	6	6	9	7	8	8	-	-	-
Dark-eyed Junco	6	6	7	-	-	-	-	-	-	-	-	-	2	2	3	5	5	6
Tree Sparrow	1	1	1	6	5	4	-	-	-	5	4	3	1	1	1	3	3	3

Table VI - (Continued)

Species	Dec-Feb 73-74			Mar-May 74			Jun-Aug 74			Sep-Nov 74			Dec-Feb 74-75			Mar-May 75		
	K	B	N/mhr	K	B	N/mhr	K	B	N/mhr	K	B	N/mhr	K	B	N/mhr	K	B	N/mhr
White-throated Sparrow	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-
Song Sparrow	-	-	-	4	4	5	8	6	-	9	10	-	-	-	-	6	6	4

Twenty-nine species were ranked among the top ten. A dash indicates the species considered was not included among the ten most abundant species for that time period. From looking at Table VI, the three methods show a definite pattern. The Bond and Kendeigh methods show almost identical ranking. The Tree Sparrow ranks number one by all three methods for December-February and the Red-winged Blackbird ranks number one by all three methods for March-November. These are the only ranked species that follow that pattern. Again, the Bond and Kendeigh methods appear to be the most accurate.

The top species remained the same in all methods due to number observed being large for the period. Young (unpublished) has shown that those species observed with the greatest frequency are also observed in the greatest number. This is true for the species of Myrick Marsh. In looking at total species observed for each season, there were 12, 12, 13, 11, 10 for all three methods. Only one species remained in the ten most abundant list for the duration of the study, the Red-winged Blackbird.

Nine species were observed in both the 1973-1974 and 1974-1975 winters - only the Tree Sparrow is common in ranking for both seasons. Two species; the Hairy Woodpecker and the Common Redpoll were on the 1973-1974 list and not the 1974-1975 list; whereas, the Common Crow was observed in 1974-1975 but not in 1973-1974. The difference in ranking and the appearance of new species is believed to be a result of environmental changes in the habitat. The fall and winter of 1973-1974 were moist and water was present in the marsh during the winter season. The winter was cold in comparison to the mild winter of the 1974-1975 season. Crows were more abundant during the 1974 season due to a lack of water

in the marsh exposing dead fish, which the Crows fed on through January 1975.

Of the seven species that were common to both the 1974 and 1975 springs, only the Red-winged Blackbird and Common Grackle were common in ranking. Five species; Brewer's Blackbird, Mallard, Blue-winged Teal, Mourning Dove and Tree Swallow were ranked only during the 1974 but not the 1975 season; whereas, three species were ranked only during the 1975 and not the 1974 seasons; Wood Duck, Starling and Dark-eyed Junco. Migrational patterns and flocking tendencies influence the ranking during the spring and fall seasons. Birds move over an area one year while the next year they may stop. This influences the ranking and will vary from year to year.

Diversity

The number of individuals observed per man-hour for the seasons are found in Table VII. The two winter periods are very similar in number per man-hour. The spring migration of 1974 showed the greatest number of individuals per man-hour. This is a result of large numbers of flocks moving through. The spring of 1975 had a lesser value due to the absence of any noticeable flocks in comparison to the 1974 spring. Birds were scattered over the area making observations more difficult. Nine more species were observed in the spring of 1974 than in 1975. The summer and fall seasons surprisingly show similar numbers observed per man-hour spent in the field even though fourteen more species were observed during the fall. This was due to more species but fewer numbers of individuals in the fall while there were less species but more indi-

Table VII

Number of Species, Number of Individuals, Individuals Per Man-hour and Diversity Index for the Study Period

Season	Number of Species	Number of Ind.	Ind/mhr	hrs	Diversity Index
Winter 1973-74	27	1529	37.48	40.8	3.95
Spring 1974	97	8027	133.37	60.1	6.46
Summer 1974	86	10635	122.40	86.9	2.95
Fall 1974	100	7851	122.78	63.9	7.51
Winter 1974-75	28	1594	35.80	44.5	7.00
Spring 1975	88	2816	84.48	33	16.94

viduals in the summer.

Seasonal changes in the avian population of the marsh can also be examined by means of a diversity index (Simpson 1949), which considers not only species observed, but also the number of individuals for each species.

This index is derived mathematically by:

$$D = N(N-1)/[n_1(n_1 - 1) + n_2(n_2 - 1) + n_3(n_3 - 1) + \ldots + n_x(n_x - 1)]$$

where D = diversity, N = total individuals, n_1 = number of species #1, n_2 = number of species #2, etc., x = number of species. If only one species were observed, the diversity index would be one. If there were different species for every individual, the diversity would be infinity.

The diversity index for each season of the study is also given in Table VII. High diversity is expected during the spring and fall migration and low diversity for the winter and summer months which show less movement among avian populations. The diversity index for the spring of 1975 is 2.6 times that of the 1974 spring. The major factor causing this is the number of individuals observed, almost three times as many individuals were observed, in 1974 than in 1975, although nine fewer species were observed in 1975 than in 1974. The large diversity of the 1974-75 winter over the 1973-74 winter is due to the same reason described above.

Figures VI and VII show the species distribution for each month and season respectively. Figure VI graphically indicates the changing avifaunal population due to migrational movements. Figure VII shows seasonal changes in number of species observed. There is a large influx of species during the spring months and again in the fall. The summer

Figure VI

Number of Species Observed
for each Month of the Study

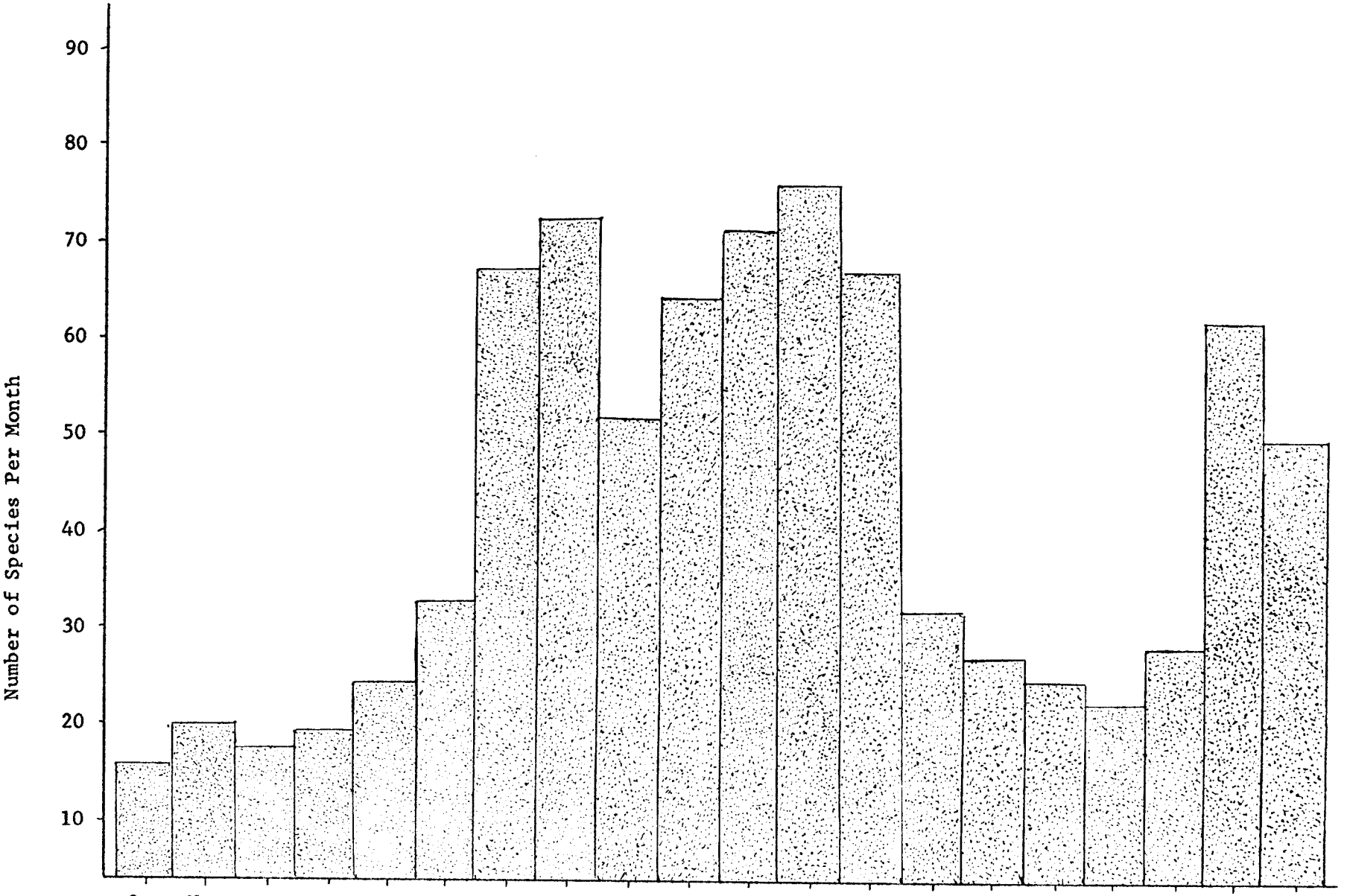

Number of Species Per Month
90
80
70
60
50
40
30
20
10
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
1973
1974
1974
1975

Figure VI

Figure VII

Number of Species Observed for each Season

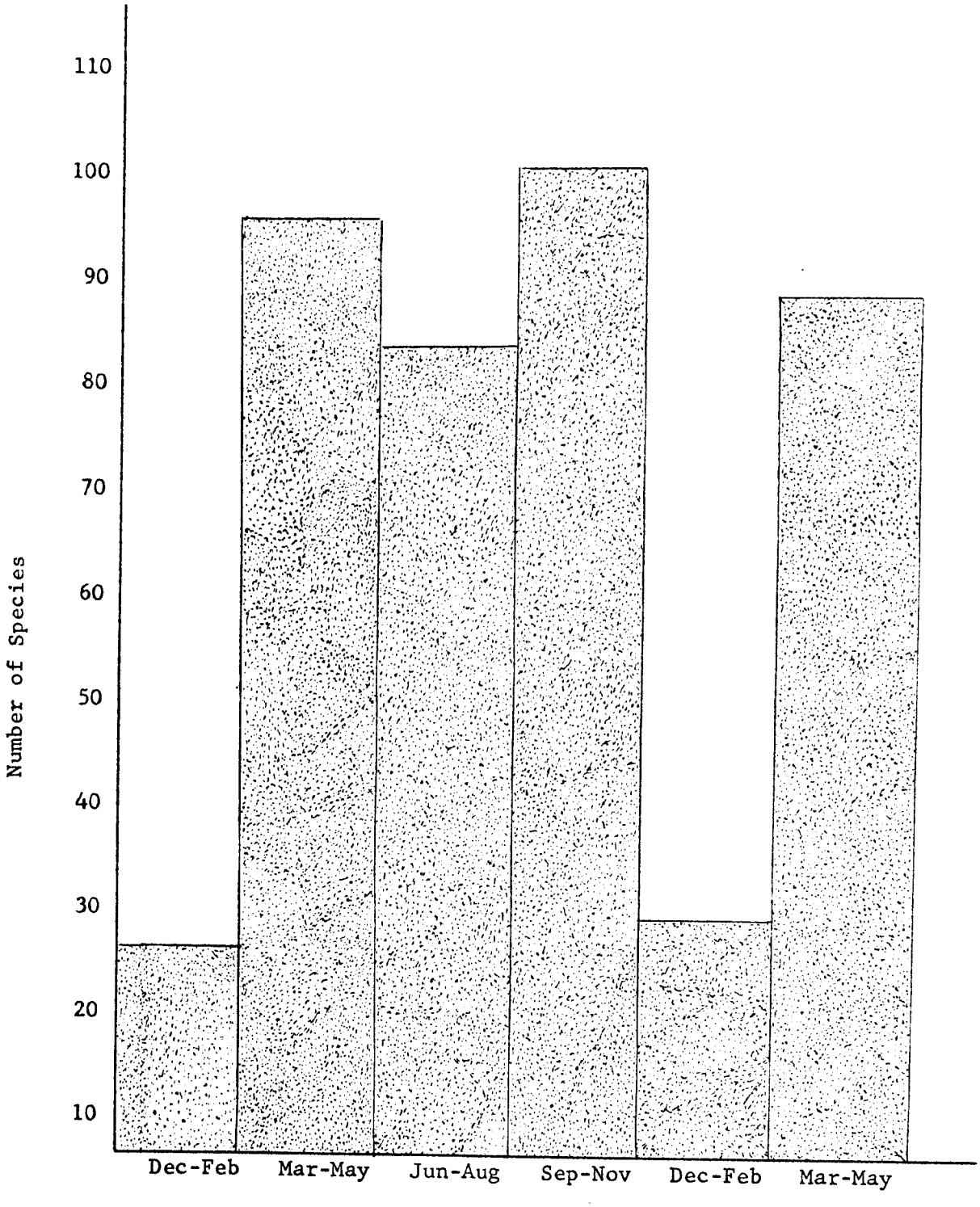

110
100
90
80
70
60
50
40
30
20
10
Number of Species
Dec-Feb
Mar-May
Jun-Aug
Sep-Nov
Dec-Feb
Mar-May
Season

Figure VII

months have a tendency to have a decrease in number of species, which is expected as some move further north during the spring and south in the fall.

Table VIII lists by orders those species seen in the marsh and the per cent of the total represented by each order (see Appendix Table XIII for the species included). The order Passeriformes was divided into families. The per cent representation was determined by adding total species observed for all orders and dividing that into total species of each order multiplied by 100. Of fifteen orders represented, 55.1% of the species belonged to the order Passeriformes. Within the Passeriformes, 40.7% of the species belonged to the families Tyrannidae, Hirundinidae, Parulidae, Icteridae and Fringillidae.

Figure VIII shows four examples of monthly changes in species abundance in Myrick Marsh. The Red-winged Blackbird, Tree Sparrow, Wood Duck, and Yellow-rumped Warbler were chosen to show the seasonal change in abundance. The Red-winged Blackbird is found during all seasons of the year, the Tree Sparrow only during fall, winter and spring, the Wood Duck during the spring, summer and fall, and the Yellow-rumped Warbler only during the spring and fall. This reinforces the fact that the avian population is continuously fluctuating.

Table VIII

Number of Species Per Order

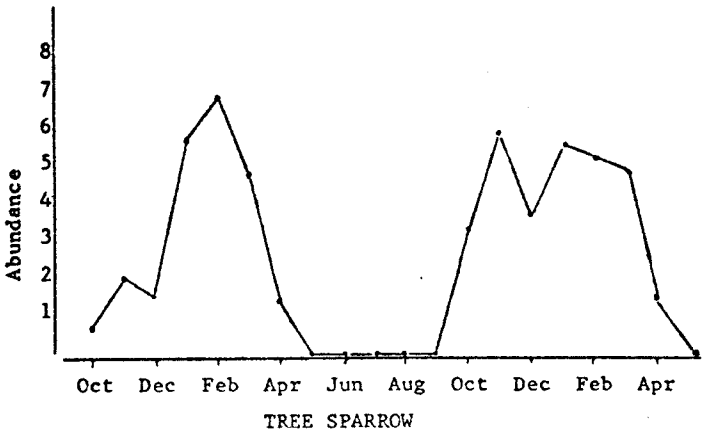
Group	Number of Species	Percent of Total
Podicipediformes	1	0.7
Ciconiiformes	6	4.0
Anseriformes	14	9.3
Falconiformes	6	4.0
Galliformes	3	2.0
Gruiformes	5	3.3
Charadriiformes	16	10.7
Columbiformes	2	1.3
Cuculiformes	2	1.3
Strigiformes	2	1.3
Caprimulgiformes	1	0.7
Apodiformes	1	0.7
Coraciiformes	1	0.7
Piciformes	6	4.0
Passeriformes		
Tyrannidae	6	4.0
Hirundinidae	5	3.3
Corvidae	2	1.3
Paridae	1	0.7
Sittidae	2	1.3
Certhiidae	1	9.7
Troglodytidae	3	2.0

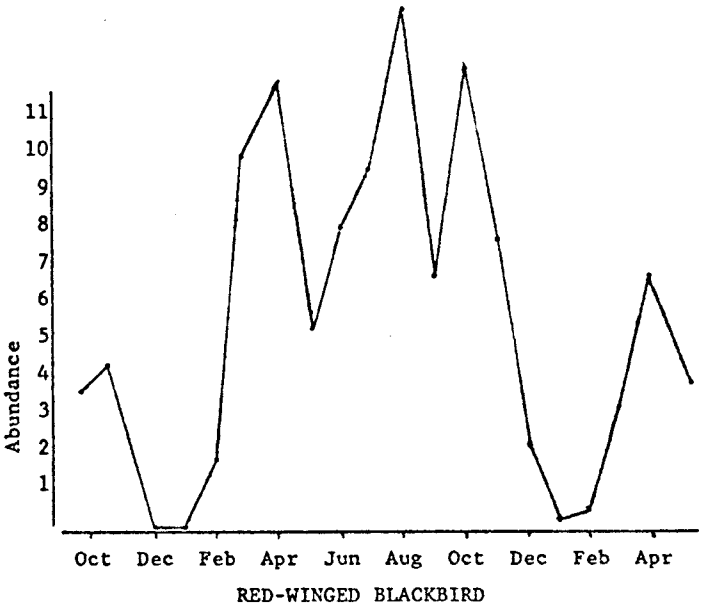
Table VIII - (Continued)

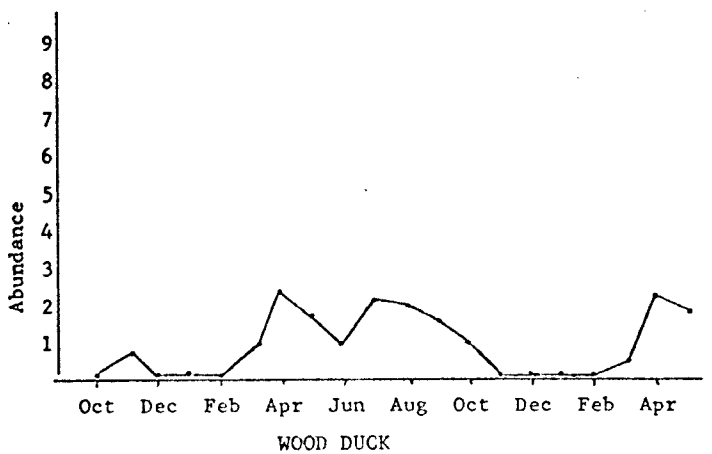
Group	Number of Species	Percent of Total
Mimidae	2	1.3
Turdidae	3	2.0
Sylviidae	2	1.3
Bombycillidae	1	0.7
Laniidae	2	1.3
Sturnidae	1	0.7
Vireonidae	2	1.3
Parulidae	20	13.4
Ploceidae	1	0.7
Icteridae	8	5.3
Fringillidae	22	14.7
Total	150	100.0

Figure VIII

Comparison of Monthly Relative Abundance
for Four Species


Abundance
1
2
3
4
5
6
7
8
Oct Dec Feb Apr Jun Aug Oct Dec Feb Apr
TREE SPARROW


Abundance
1
2
3
4
5
6
7
8
9
10
11
Oct Dec Feb Apr Jun Aug Oct Dec Feb Apr
RED-WINGED BLACKBIRD


Abundance
1
2
3
4
5
6
7
8
9
Oct Dec Feb Apr Jun Aug Oct Dec Feb Apr
WOOD DUCK

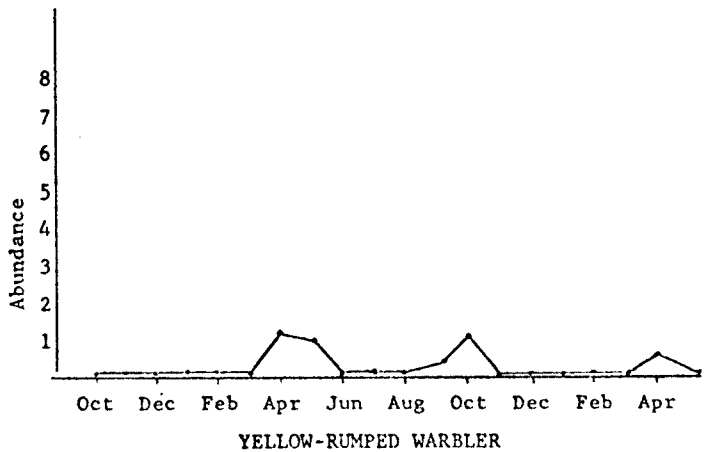

Abundance
1
2
3
4
5
6
7
8
Oct Dec Feb Apr Jun Aug Oct Dec Feb Apr
YELLOW-RUMPED WARBLER

Figure VIII

Geographical Origin of Myrick Marsh Avifauna

Ernst Mayr (1946) published a paper on the history of the North American Bird Fauna. Mayr classified birds into seven categories of which five are found in this area; unanalyzed element, old world element, North American element, Pan-American element and the South American element. The Pan-American element has been lumped with the South American element since Mayr felt that the Icteridae belong to that element. The species composition in the four elements as pertaining to the Myrick Marsh avifauna are as follows:

1) Unanalyzed Element - Shorebirds, raptors, woodpeckers, ducks geese, rails, and herons.

2) North American Element - quail, wrens, waxwings, wood warblers, and emberizine finches.

3) South American Element - Richmondenine finches, blackbirds, and flycatchers.

4) Old World Element - cuckoos, owls, thrushes, crows, kingfishers, nuthatches, and kinglets.

The paper by Mayr is old and imperfections in the groupings are suspected, although no definite re-classification has taken place. The classification of the Myrick Marsh avifauna is found in Table IX. The unanalyzed element contains over 40% of the population. The largest group in the Myrick Marsh avifauna (23.3%), the summer residents, also contains the highest percentage of unanalyzed species. When the unanalyzed group is eliminated, it can be seen that most of the species had a North American origin. Summer residents make up almost half of the total species, followed by transients with a third of the observed species.

Table IX

Classification of the Observed Species as to Origin
According to Mayr

Group	Unanalyzed		North American		South American		Old World		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Transients	19	12.7	21	14.0	1	0.7	5	3.3	46	30.7
Summer Residents	35	23.3	19	12.7	13	8.7	7	4.7	74	49.3
Permanent Residents	2	1.3	2	1.3	3	2.0	5	3.3	12	8.0
Winter Residents	5	3.3	3	2.0	0	-	10	6.7	18	12.0
Total	61	40.6	46	30.0	17	11.4	27	18.0	150	100.0

Callahan and Young (1955) made a geographical classification of the Lake Wedington area avifauna in Arkansas. This data is compared to the Myrick Marsh avifauna in Table X. The avifauna composition is quite different between the two regions. Transients are the largest representatives in the Wedington area; whereas, summer residents in Myrick Marsh. This is due to geographical variance since more summer residents are present in the northern areas as migration brings potential breeders to the area. In the Wedington area, transients are more prevalent as birds move through the area rather than staying during the summer. A similar difference occurs when the four elements are compared. The North American element made up 37% of the total species in the Wedington study whereas, in Myrick Marsh it was 30%. The most species observed belong to the unanalyzed element in Myrick Marsh. In the Wedington area it is the North American element.

The Mayr classification on origin has shown that the composition of different regions do vary causing a shifting of importance among the elements. As in the case with migrating species, the northern latitudes show more unanalyzed species since many fresh water birds breed in northern latitudes. This is evident from comparing the two regions described above.

Table X

Comparison of Origin of Avifauna
in Wedington and Myrick Marsh Studies

Group	Wedington		Myrick Marsh	
	Total	%	Total	%
Summer Resident	51	37.8	74	49.3
Winter Resident	11	8.1	18	12.0
Transients	55	40.7	46	30.7
Permanent Residents	18	13.4	12	8.0
Total	135	100.0	150	100.0
Unanalyzed	47	34.8	61	40.6
North American	50	37.1	46	30.0
South American	10	7.4	17	11.4
Old World	28	20.7	27	18.0
Total	135	100.0	150	100.0

SUMMARY

Five categories were used to classify the observed species; permanent residents, winter residents, transient visitants, summer residents and summer visitants. Of the 150 species observed, the permanent residents numbered twelve species, winter residents eighteen species, transient visitants forty-six species, summer residents forty-three species and summer visitants thirty-one species. Transient visitants accounted for the most species because the breeding ranges of many of the birds observed are farther north.

The relative abundance of the observed species were compared using the three methods; Kendeigh, Bond and number per man-hour. Bond used relative frequency and relative density to determine an importance value, Kendeigh used frequency and abundance to arrive at an index of abundance and number per man-hour dealt with numbers observed per unit of time. Number per man-hour does not use relative abundance which proved to be a major fault of that method. In comparing the three methods, the Bond and the Kendeigh methods were almost identical in ranking the observed species. Since the methods compare closely, the author does not feel that an endorsement of one or the other methods is necessary. Both methods used were found to be very good indicators of abundance. A more accurate value could be obtained if a method for incorporating a factor that would allow for the conspicuousness of the bird could be determined.

A diversity index was used to compare species diversity between seasons. Species diversity was expected to be high during the spring and fall seasons and low during the summer and winter seasons. This appeared to be the case except for the winter of 1974-75 which showed

a large diversity index. This was highly unusual since approximately the same number of individuals and species was observed for each season. The cause of this irregular pattern was due to a few species having large numbers of individuals while several species had lower numbers of individuals.

A total of fifteen orders was represented among the Myrick Marsh avifauna. The order Passeriformes accounted for over 55% of the total species observed. This was found to be typical for other studies.

The composition of the marsh avifauna showed a definite trend with more summer residents found at Myrick Marsh than in the more southernly Wedington area. This trend would continue as one moved farther north, culminating in the Canadian breeding grounds for most waterfowl and shore birds.

The species observed during this study reflect the observations of the author and in no way suggest that the species observed are the only ones present. The presence of other species utilizing the marsh as transients or breeding birds is quite probable. The study provides a start for further documentation and study of avian species found in Myrick Marsh.

CONCLUSIONS

1. A total of 150 species was observed in Myrick Marsh.
2. Fifty-one species were found to breed in the marsh.
3. Twelve permanent residents, eighteen winter residents, forty-six transient visitants, forty-three summer residents and thirty-one summer visitants were observed.
4. Sixteen species of birds were banded with a total of 164 individuals.
5. Of the three methods used; Kendeigh, Bond and number per man-hour, the Kendeigh and the Bond method proved to be almost identical for the determination of relative abundance.
6. A diversity index showed that avian populations show greater diversity during the spring and fall seasons than in the other seasons.
7. Fifteen orders were observed in the marsh with the order Passeriformes accounting for over fifty-five percent of the total species observed.
8. The geographical origin of the species of Myrick Marsh showed a larger number of unanalyzed species and more summer residents than the Wedington area.

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APPENDIX

Table XI

Climatological Data for Year Previous to the Study

Date	Temperature (F°)			Dep.	Wind	Precipitation		River Stage (Ft)		
	High	Low	Avg.	From Nor.	(mph)	in/mo	Dep./Nor.	High	Low	Med
1972										
November	57[5*]	18[15]	34.4	0.2	6.1	1.45	-0.49	ND**	ND	ND
December	44[30]	-19[7]	15.7	-6.1	6.2	2.46	1.31	ND	ND	ND
1973										
January	52[26]	-22[6]	20.1	3.6	6.6	0.85	-0.34	6.8	5.8	6.3
February	48[4]	-7[17]	24.8	5.4	7.5	1.38	0.33	6.2	5.0	5.6
March	67[14]	21[18]	41.3	10.8	6.4	3.69	1.62	13.0	5.0	9.0
April	73[21]	22[11]	44.5	-2.5	8.8	7.31	4.56	10.4	7.1	8.75
May	82[31]	29[4]	55.2	-4.0	7.5	6.21	2.45	11.1	7.1	9.1
June	95[10]	51[29]	70.3	1.5	6.6	4.47	0.27	9.9	5.3	7.6
July	99[12]	52[16]	73.9	0.1	6.6	2.53	-1.22	5.3	4.5	4.9
August	95[27]	50[2]	72.2	0.6	5.4	8.63	5.00	6.2	4.5	5.35
September	90[1]	36[30]	62.6	0.4	4.7	3.68	0.20	5.7	4.4	5.05
October	80[24]	33[30]	57.1	6.0	7.1	2.06	-0.13	7.6	5.0	6.3

* - Day of month which temperature occurred **ND - No Data

Table XII

Climatological Data for Study Period

Date	(F°) Temperature			Dep.	Wind	Precipitation		River Stage (Ft)		
	High	Low	Avg.	From Nor.	(mph)	in/mo	Dep./Nor.	High	Low	Med*
1973										
November	64[13**]	14[9]	36.7	2.5	6.1	1.93	-0.01	6.5	4.7	5.60
December	51[2]	-18[31]	18.9	-2.9	6.3	1.37	0.22	6.5	5.0	5.75
1974										
January	51[16]	-24[12]	18.0	1.9	5.3	0.40	-0.56	5.7	5.2	5.45
February	44[20]	-16[7]	19.1	-0.9	4.7	1.65	0.78	5.7	5.0	5.35
March	65[6]	-1[24]	32.1	1.0	6.8	2.13	0.11	7.0	5.1	6.05
April	83[28]	23[8]	48.7	1.1	7.7	1.83	-0.80	9.6	5.8	7.70
May	84[21]	30[6]	55.0	-4.0	6.9	3.50	-0.20	8.6	7.8	7.80
June	88[29]	45[25]	65.0	-3.5	6.3	5.30	0.86	10.1	6.5	7.30
July	101[13]	50[31]	75.9	3.1	8.3	1.76	-1.76	6.6	4.3	5.45
August	89[19]	47[31]	68.4	-3.0	6.7	4.20	1.18	5.6	4.6	5.10
September	82[9]	31[23]	56.9	-4.9	6.7	1.40	-1.98	5.2	4.6	4.90

Table XII - (Continued)

Date	(F°) Temperature			Dep.	Wind	Precipitation		River Stage (Ft)		
	High	Low	Avg.	From Nor.	(mph)	in/mo	Dep./Nor.	High	Low	Med
October	75^{24}	20^{2}	50.4	-1.4	6.1	1.91	-0.14	5.2	4.6	4.9
November	67^{1}	18^{25}	37.6	2.2	6.8	1.11	-0.34	5.2	4.6	4.9
December	42^{11}	7^{9}	26.6	4.8	5.7	1.39	0.35	5.3	4.3	4.8
1975										
January	41^{10}	-10^{31}	18.1	2.0	6.4	1.50	0.54	5.0	4.5	4.8
February	40^{21}	-22^{9}	18.7	-1.3	6.5	1.71	0.84	5.3	4.8	5.1
March	49^{20}	-10^{14}	24.5	-6.6	6.1	2.14	0.12	6.6	5.1	5.9
April	68^{23}	15^{4}	41.4	-6.2	6.4	6.07	3.44	14.2	5.2	9.7
May	92^{23}	38^{16}	62.3	3.3	5.5	2.52	-1.18	14.6	7.9	11.3

* - A median of the two values.

** - Day of month which temperature occurred.

Table XIII

Taxonomic List of Species Observed in Myrick Marsh

Common Name	Scientific Name
Podicipediformes	
Pied-billed Grebe*	Podilymbus podiceps
Ciconiiformes	
Great Blue Heron	Ardea herodias
Green Heron	Butorides virescens
Great Egret	Casmerodius albus
Black-crowned Night Heron	Nycticorax nycticorax
Yellow-crowned Night Heron	Nyctanassa violacea
American Bittern	Botaurus lentiginosus
Anseriformes	
Canada Goose	Branta canadensis
Snow Goose	Chen caerulescens
Mallard*	Anas platyrhynchos
Green-winged Teal	Anas carolinensis
Blue-winged Teal*	Anas discors
American Wigeon	Anas americana
Northern Shoveller	Anas clypeata
Wood Duck*	Aix sponsa
Ring-necked Duck	Aythya collaris
Canvasback	Aythya valisineria
Lesser Scaup	Aythya affinis

Table XIII - (Continued)

Common Name	Scientific Name
Buffle-head	Bucephala albeola
Ruddy Duck	Oxyura jamaicensis
Hooded Merganser*	Lophodytes cucullatus
Falconiformes	
Goshawk	Accipiter atricapillus
Red-tailed Hawk	Buteo jamaicensis
Broad-winged Hawk	Buteo platypterus
Rough-legged Hawk	Buteo lagopus
Osprey	Pandion haliaetus
American Kestrel	Falco sparverius
Galliformes	
Ruffed Grouse	Bonasa umbellus
Bobwhite*	Colinus virginianus
Ring-necked Pheasant	Phasianus colchicus
Gruiformes	
King Rail	Rallus elegans
Virginia Rail*	Rallus limicola
Sora Rail*	Porzana carolina
Common Gallinule	Gallinula chloropus
American Coot*	Fulica americana
Charadriiformes	
Killdeer*	Charadrius vociferus

Table XIII - (Continued)

Common Name	Scientific Name
American Woodcock	Philohela minor
Common Snipe*	Capella gallinago
Spotted Sandpiper	Actitis macularia
Solitary Sandpiper	Tringa solitaria
Greater Yellowlegs	Totanus melanoleucus
Lesser Yellowlegs	Totanus flavipes
Pectoral Sandpiper	Calidris melanotos
Least Sandpiper	Calidris minutilla
Long-billed Dowitcher	Limnodromus scolopaceus
Stilt Sandpiper	Micropalama himantopus
Semipalmated Sandpiper	Calidris pusillus
Herring Gull	Larus argentatus
Ring-billed Gull	Larus delawarensis
Bonaparte's Gull	Larus philadelphia
Black Tern*	Chlidonias niger
Columbiformes	
Rock Dove	Columba livia
Mourning Dove*	Zenaidura macroura
Cuculiformes	
Yellow-billed Cuckoo*	Coccyzus americanus
Black-billed Cuckoo	Coccyzus erythropthalmus
Strigiformes	
Great Horned Owl	Bubo virginianus

Table XIII - (Continued)

Common Name	Scientific Name
Barred Owl	Strix varia
Caprimulgiformes	
Common Nighthawk*	Chordeiles minor
Apodiformes	
Chimney Swift	Chaetura pelagica
Coraciiformes	
Belted Kingfisher*	Megaceryle alcyon
Piciformes	
Common Flicker*	Colaptes auratus
Red-bellied Woodpecker	Centurus carolinus
Red-headed Woodpecker	Melanerpes erythrocephalus
Yellow-bellied Sapsucker	Sphyrapicus varius
Hairy Woodpecker*	Dendrocopus villosus
Downy Woodpecker*	Dendrocopus pubescens
Passeriformes	
Tyrannidae	
Great Crested Flycatcher	Myiarchus crinitus
Eastern Phoebe*	Sayornis phoebe
Acadian Flycatcher	Empidonax virescens
Traill's Flycatcher	Empidonax traillii
Least Flycatcher	Empidonax minimus
Eastern Wood Pewee*	Contopus virens

Table XIII - (Continued)

Common Name	Scientific Name
Hirundinidae	
Tree Swallow*	Iridoprocne bicolor
Bank Swallow*	Riparia riparia
Rough-winged Swallow*	Stelgidopteryx ruficollis
Barn Swallow*	Hirundo rustica
Cliff Swallow*	Petrochelidon pyrrhonota
Corvidae	
Blue-Jay*	Cyanocitta cristata
Common Crow	Corvus brachyrhynchos
Paridae	
Black-capped Chickadee	Parus atricapillus
Sittidae	
White-breasted Nuthatch*	Sitta carolinensis
Red-breasted Nuthatch	Sitta canadensis
Certhiidae	
Brown Creeper	Certhia familiaris
Troglodytidae	
House Wren*	Troglodytes aedon
Carolina Wren	Thryothorus ludovicianus
Long-billed Marsh Wren*	Telmatodytes palustris
Mimidae	
Gray Catbird*	Dumetella carolinensis
Brown Thrasher*	Toxostoma rufum

Table XIII - (Continued)

Common Name	Scientific Name
Turdidae	
American Robin*	Turdus migratorius
Hermit Thrush	Hylocichla guttata
Gray-cheeked Thrush	Catharus minima
Sylviidae	
Golden-crowned Kinglet	Regulus satrapa
Ruby-crowned Kinglet	Regulus calendula
Bombycillidae	
Cedar Waxwing*	Bombycilla cedrorum
Laniidae	
Northern Shrike	Lanius excubitor
Loggerhead Shrike	Lanius ludovicianus
Sturnidae	
Starling*	Sturnis vulgaris
Vireonidae	
Red-eyed Vireo	Vireo olivaceus
Warbling Vireo	Vireo gilvus
Parulidae	
Black-&-White Warbler	Mniotilta varia
Prothonotary Warbler	Protonotaria citrea
Orange-crowned Warbler	Vermivora celata
Nashville Warbler	Vermivora ruficapilla
Yellow Warbler*	Dendroica petechia

Table XIII - (Continued)

Common Name	Scientific Name
Magnolia Warbler	Dendroica magnolia
Yellow-rumped Warbler	Dendroica coronata
Chestnut-sided Warbler	Dendroica pensylvanica
Bay-breasted Warbler	Dendroica castanea
Blackpoll	Dendroica striata
Palm Warbler	Dendroica palmarum
Ovenbird	Seiurus aurocapillus
Northern Waterthrush	Seiurus noveboracensis
Louisiana Waterthrush	Seiurus motacilla
Connecticut Warbler	Oporornis agilis
Mourning Warbler	Oporornis philadelphia
Common Yellowthroat*	Geothlypis trichas
Hooded Warbler	Wilsonia citrina
Wilson's Warbler	Wilsonia pusilla
American Redstart*	Setophaga ruticilla
Ploceidae	
English Sparrow*	Passer domesticus
Icteridae	
Eastern Meadowlark	Sturnella magna
Yellow-headed Blackbird*	Xanthocephalus xanthocephalus
Red-winged Blackbird*	Agelaius phoeniceus
Northern Oriole*	Icterus galbula

Table XIII - (Continued)

Common Name	Scientific Name
Rusty Blackbird	Euphagus carolinus
Brewer's Blackbird	Euphagus cyanocephalus
Common Grackle*	Quiscalus quiscula
Brown-headed Cowbird*	Molothrus ater
Fringillidae	
Cardinal*	Cardinalis cardinalis
Rose-breasted Grosbeak	Pheucticus ludovicianus
Indigo Bunting*	Passerina cyanea
Purple Finch	Carpodacus purpureus
Hoary Redpoll	Acanthis hornemanni
Common Redpoll	Acanthis flammea
Pine Siskin	Spinus pinus
American Goldfinch*	Spinus tristis
Savannah Sparrow	Passerculus sandwichensis
LeConte's Sparrow	Ammospiza leconteii
Vesper Sparrow	Pooecetes gramineus
Dark-eyed Junco	Junco hyemalis
Tree Sparrow	Spizella arborea
Chipping Sparrow	Spizella passerina
Field Sparrow*	Spizella pusilla
White-crowned Sparrow	Zonotrichia leucophrys
White-throated Sparrow	Zonotrichia albicollis

Table XIII - (Continued)

Common Name	Scientific Name
Fox Sparrow	Passerella iliaca
Lincoln's Sparrow	Melospiza lincolnii
Swamp Sparrow*	Melospiza georgiana
Song Sparrow*	Melospiza melodia
Lapland Longspur	Calcarius lapponicus

*Birds that breed in the marsh

Table XIV

List of Species in Decreasing Order of Abundance for each Season using the Kendeigh Method *

Species	Abundance	Species	Abundance
December-February 1973-74			
Tree Sparrow	5.21	Bobwhite	0.39
Blue-Jay	1.60	Common Crow	0.35
Downy Woodpecker	1.39	Rock Dove	0.30
American Goldfinch	1.37	Red-tailed Hawk	0.24
Black-capped Chickadee	1.14	Great Horned Owl	0.24
Dark-eyed Junco	1.05	Brown Creeper	0.23
Cardinal	0.98	Brown-headed Cowbird	0.23
Red-winged Blackbird	0.82	Ring-necked Pheasant	0.08
White-breasted Nuthatch	0.79	Red-breasted Nuthatch	0.05
Hairy Woodpecker	0.63	Northern Shrike	0.05
Starling	0.62	Hoary Redpoll	0.05
Common Redpoll	0.55	Pine Siskin	0.05
House Sparrow	0.53	Lapland Longspur	0.05
Red-bellied Woodpecker	0.49		
March-May 1974			
Red-winged Blackbird	9.64	Yellow-bellied Sapsucker	0.28
Common Grackle	5.43	Eastern Meadowlark	0.28
American Coot	2.80	Northern Oriole	0.27
Song Sparrow	2.52	Eastern Phoebe	0.22
American Robin	2.27	Purple Finch	0.22

Table XIV - (Continued)

Species	Abundance	Species	Abundance
Tree Sparrow	2.25	Black Tern	0.20
Blue-winged Teal	2.22	Hairy Woodpecker	0.20
Mallard	2.20	Golden-crowned Kinglet	0.20
Brewer's Blackbird	1.93	Fox Sparrow	0.20
Mourning Dove	1.92	Field Sparrow	0.20
Cardinal	1.86	American Bittern	0.17
Tree Swallow	1.73	American Kestrel	0.17
Brown-headed Cowbird	1.59	Red-bellied Woodpecker	0.17
Wood Duck	1.42	Pine Siskin	0.17
Starling	1.28	White-throated Sparrow	0.17
American Goldfinch	1.09	American Redstart	0.15
Rough-winged Swallow	0.93	Rose-breasted Grosbeak	0.15
Hooded Merganser	0.92	Common Snipe	0.14
Killdeer	0.92	Palm Warbler	0.14
Lesser Scaup	0.82	Least Flycatcher	0.10
Blue-Jay	0.82	Brown Creeper	0.10
Common Flicker	0.81	House Wren	0.10
Rusty Blackbird	0.79	Brown Thrasher	0.08
Yellow-headed Blackbird	0.76	Hermit Thrush	0.08
House Sparrow	0.75	Barn Swallow	0.08
Common Crow	0.72	Magnolia Warbler	0.08
Yellow-rumped Warbler	0.71	Nashville Warbler	0.08
Yellow Warbler	0.64	Great Egret	0.07

Table XIV - (Continued)

Species	Abundance	Species	Abundance
Downy Woodpecker	0.63	Great Horned Owl	0.07
Rock Dove	0.62	Eastern Wood Pewee	0.07
Ring-necked Duck	0.60	Gray-cheeked Thrush	0.07
Sora Rail	0.58	Louisiana Waterthrush	0.07
Dark-eyed Junco	0.58	Snow Goose	0.05
Pied-billed Grebe	0.57	Common Nighthawk	0.05
Lesser Yellowlegs	0.57	Bank Swallow	0.05
Black-capped Chickadee	0.52	Cliff Swallow	0.05
Gray Catbird	0.47	Broad-winged Hawk	0.05
Northern Shoveler	0.44	Ruffed Grouse	0.05
Chimney Swift	0.42	Ruddy Duck	0.05
Common Yellowthroat	0.42	Bufflehead	0.05
Swamp Sparrow	0.41	Great Crested Flycatcher	0.05
Bobwhite	0.41	Osprey	0.03
Red-tailed Hawk	0.36	Solitary Sandpiper	0.03
White-breasted Nuthatch	0.36	Spotted Sandpiper	0.03
Great Blue Heron	0.35	Semipalmated Sandpiper	0.03
Green Heron	0.35	Black-&-White Warbler	0.03
Belted Kingfisher	0.33	Chestnut-sided Warbler	0.03
Northern Waterthrush	0.32	Ovenbird	0.03
Ruby-crowned Kinglet	0.30		

Table XIV - (Continued)

Species	Abundance	Species	Abundance
	June-August 1974		
Red-winged Blackbird	11.45	Rose-breasted Grosbeak	0.25
Common Grackle	3.08	Least Sandpiper	0.22
Mourning Dove	2.86	White-breasted Nuthatch	0.22
American Robin	2.83	Brown Thrasher	0.20
Blue-winged Teal	1.96	Eastern Wood Pewee	0.20
Mallard	1.73	Common Snipe	0.17
Gray Catbird	1.60	Blue-Jay	0.17
Song Sparrow	1.51	Virginia Rail	0.17
Green Heron	1.45	Bank Swallow	0.16
American Goldfinch	1.30	Savannah Sparrow	0.14
Wood Duck	1.26	Eastern Phoebe	0.10
Great Blue Heron	1.22	American Redstart	0.10
Cardinal	1.10	Least Flycatcher	0.10
Black Tern	1.09	Cliff Swallow	0.10
Chimney Swift	1.07	Warbling Vireo	0.10
Rough-winged Swallow	1.03	Long-billed Marsh Wren	0.10
Killdeer	1.02	Rusty Blackbird	0.07
Tree Swallow	0.98	Great Crested Flycatcher	0.07
House Wren	0.86	King Rail	0.07
Hooded Merganser	0.75	Black-capped Chickadee	0.06
Brewer's Blackbird	0.73	Spotted Sandpiper	0.06
Yellow Warbler	0.73	Carolina Wren	0.06

Table XIV - (Continued)

Species	Abundance	Species	Abundance
Starling	0.72	American Bittern	0.05
Yellow-headed Blackbird	0.71	Vesper Sparrow	0.05
Common Nighthawk	0.62	Yellow-bellied Sapsucker	0.04
Common Flicker	0.55	Prothonotary Warbler	0.04
Common Yellowthroat	0.54	Acadian Flycatcher	0.04
Brown-headed Cowbird	0.53	Black-crowned Night Heron	0.04
American Coot	0.50	Northern Waterthrush	0.03
Rock Dove	0.49	Black-&-White Warbler	0.03
Northern Oriole	0.47	Chestnut-sided Warbler	0.03
Barn Swallow	0.45	Field Sparrow	0.03
House Sparrow	0.45	Gray-cheeked Thrush	0.03
Belted Kingfisher	0.40	Green-winged Teal	0.03
Indigo Bunting	0.36	Chipping Sparrow	0.03
Solitary Sandpiper	0.35	Common Gallinule	0.03
Bobwhite	0.35	Red-bellied Woodpecker	0.02
Downy Woodpecker	0.33	Great Horned Owl	0.02
Great Egret	0.33	Black-billed Cuckoo	0.02
Cedar Waxwing	0.32	Yellow-billed Cuckoo	0.02
Lesser Yellowlegs	0.32	Traill's Flycatcher	0.02
Sora Rail	0.30	Greater Yellowlegs	0.02
Pied-billed Grebe	0.28	Yellow-crowned Night Heron	0.02
Red-headed Woodpecker	0.25		

Table XIV - (Continued)

Species	Abundance	Species	Abundance
September-November 1974			
Red-winged Blackbird	8.80	Ruby-crowned Kinglet	0.37
Blue-winged Teal	2.88	Rose-breasted Grosbeak	0.35
American Robin	2.83	Brown Creeper	0.33
Common Grackle	2.65	House Wren	0.30
Tree Sparrow	2.45	Belted Kingfisher	0.28
American Goldfinch	2.15	Eastern Wood Pewee	0.26
Killdeer	2.12	Pectoral Sandpiper	0.25
Mallard	1.99	Virginia Rail	0.25
Song Sparrow	1.75	American Coot	0.25
Starling	1.71	Swamp Sparrow	0.25
Cardinal	1.65	Great Egret	0.25
Blue-Jay	1.52	Pied-billed Grebe	0.22
House Sparrow	1.49	Cedar Waxwing	0.22
Common Snipe	1.29	Northern Waterthrush	0.22
Rough-winged Swallow	1.27	Herring Gull	0.22
Dark-eyed Junco	1.18	Eastern Phoebe	0.20
Common Crow	1.18	Magnolia Warbler	0.18
Rock Dove	1.12	Great Horned Owl	0.17
White-throated Sparrow	1.08	Brown Thrasher	0.14
Black-capped Chickadee	1.07	Chestnut-sided Warbler	0.14
Common Flicker	0.96	Bay-breasted Warbler	0.14
White-breasted Nuthatch	0.95	Common Gallinule	0.12

Table XIV - (Continued)

Species	Abundance	Species	Abundance
Green Heron	0.93	White-crowned Sparrow	0.12
Lesser Yellowlegs	0.87	Red-eyed Vireo	0.12
Least Sandpiper	0.85	Yellow-bellied Sapsucker	0.10
Gray Catbird	0.85	Barred Owl	0.10
Downy Woodpecker	0.84	Barn Swallow	0.10
Bobwhite	0.82	Long-billed Dowitcher	0.10
Solitary Sandpiper	0.81	Hermit Thrush	0.10
Mourning Dove	0.78	Stilt Sandpiper	0.08
Wood Duck	0.71	American Kestrel	0.08
Yellow-rumped Warbler	0.69	American Redstart	0.08
Common Yellowthroat	0.69	Bonaparte's Gull	0.07
Ring-billed Gull	0.64	Purple Finch	0.05
Lincoln's Sparrow	0.64	Least Flycatcher	0.05
Golden-crowned Kinglet	0.60	Warbling Vireo	0.05
Fox Sparrow	0.59	Savannah Sparrow	0.05
Semipalmated Sandpiper	0.59	LeConte's Sparrow	0.05
Great Blue Heron	0.57	Mourning Warbler	0.05
Hairy Woodpecker	0.57	Red-bellied Woodpecker	0.03
Long-billed Marsh Wren	0.56	Hooded Merganser	0.03
Red-tailed Hawk	0.55	Ruffed Grouse	0.03
Brewer's Blackbird	0.55	Spotted Sandpiper	0.03
Palm Warbler	0.50	Black-&-White Warbler	0.03
Tree Swallow	0.49	Great Crested Flycatcher	0.03

Table XIV - (Continued)

Species	Abundance	Species	Abundance
Greater Yellowlegs	0.46	Chipping Sparrow	0.03
Common Nighthawk	0.46	Blackpoll	0.03
Sora Rail	0.42	Loggerhead Shrike	0.03
Chimney Swift	0.42	Yellow Warbler	0.03
Rusty Blackbird	0.41	Wilson's Warbler	0.03
	December-February 1974-75		
Tree Sparrow	4.41	American Robin	0.81
Dark-eyed Junco	1.89	Red-bellied Woodpecker	0.40
Common Crow	1.72	Red-tailed Hawk	0.39
Black-capped Chickadee	1.60	Rock Dove	0.28
White-breasted Nuthatch	1.50	Bobwhite	0.22
Downy Woodpecker	1.33	Great Horned Owl	0.20
American Goldfinch	1.24	American Kestrel	0.07
Starling	1.23	Barred Owl	0.07
Red-winged Blackbird	1.17	Belted Kingfisher	0.07
Blue-Jay	1.11	Purple Finch	0.07
Cardinal	1.05	Mallard	0.04
House Sparrow	0.93	Goshawk	0.04
Hairy Woodpecker	0.91	Rough-legged Hawk	0.04
Brown Creeper	0.91	Northern Shrike	0.04
	March-May 1975		
Red-winged Blackbird	4.40	Northern Waterthrush	0.24
Common Grackle	2.99	Yellow-bellied Sapsucker	0.22

Table XIV - (Continued)

Species	Abundance	Species	Abundance
Tree Sparrow	2.35	Common Yellowthroat	0.22
American Robin	2.01	Eastern Meadowlark	0.22
Dark-eyed Junco	1.94	Northern Shoveller	0.20
Song Sparrow	1.89	Golden-crowned Kinglet	0.20
Cardinal	1.83	Ruby-crowned Kinglet	0.20
Starling	1.81	Gray Catbird	0.20
Wood Duck	1.37	Purple Finch	0.20
American Coot	1.34	American Wigeon	0.17
Mallard	1.30	Red-bellied Woodpecker	0.17
Mourning Dove	0.99	Canada Goose	0.14
Black-capped Chickadee	0.99	Canvasback	0.14
Downy Woodpecker	0.97	Great Egret	0.14
American Goldfinch	0.97	American Kestrel	0.14
Green Heron	0.86	Belted Kingfisher	0.14
Common Crow	0.84	Rough-winged Swallow	0.14
House Sparrow	0.83	House Wren	0.14
Blue-winged Teal	0.77	Northern Waterthrush	0.14
Brown-headed Cowbird	0.77	Hermit Thrush	0.11
Common Snipe	0.69	Cedar Waxwing	0.10
Hairy Woodpecker	0.69	Connecticut Warbler	0.10
Common Flicker	0.65	American Woodcock	0.09
Bobwhite	0.61	Brown Thrasher	0.09

Table XIV - (Continued)

Species	Abundance	Species	Abundance
Killdeer	0.58	Green-winged Teal	0.07
Pied-billed Grebe	0.50	Solitary Sandpiper	0.07
Lesser Scaup	0.49	Yellow Warbler	0.07
Tree Swallow	0.47	Palm Warbler	0.07
Fox Sparrow	0.44	Rough-legged Hawk	0.05
White-breasted Nuthatch	0.41	Ring-necked Pheasant	0.05
Bufflehead	0.40	Sora Rail	0.05
Rusty Blackbird	0.40	Great Horned Owl	0.05
Swamp Sparrow	0.40	Barred Owl	0.05
Yellow-rumped Warbler	0.40	Common Nighthawk	0.05
Rock Dove	0.33	Eastern Phoebe	0.05
Hooded Merganser	0.32	Eastern Wood Pewee	0.05
Red-tailed Hawk	0.32	Great Crested Flycatcher	0.05
Blue-Jay	0.32	Hooded Warbler	0.05
Great Blue Heron	0.30	Orange-crowned Warbler	0.05
Black Tern	0.30	Black-&-White Warbler	0.05
Brown Creeper	0.30	Wilson's Warbler	0.05
Brewer's Blackbird	0.26	American Redstart	0.05
White-throated Sparrow	0.26	Yellow-headed Blackbird	0.05
Ring-necked Duck	0.24	Rose-breasted Grosbeak	0.05

*Raw data are available upon request

Table XV

List of Birds in Order of Importance
using the Bond Method for each Season*

Species	Importance	Species	Importance
	December-February 1973-74		
Tree Sparrow	59.42	Bobwhite	3.45
Blue-Jay	14.60	Red-tailed Hawk	3.32
Downy Woodpecker	13.68	Common Crow	3.19
American Goldfinch	12.37	Great Horned Owl	2.90
Black-capped Chickadee	11.14	Brown Creeper	2.83
Dark-eyed Junco	9.18	Rock Dove	2.70
Red-winged Blackbird	8.88	Brown-headed Cowbird	1.95
Cardinal	8.80	Ring-necked Pheasant	1.10
White-breasted Nuthatch	8.66	Northern Shrike	0.55
Hairy Woodpecker	7.22	Red-breasted Nuthatch	0.55
Red-bellied Woodpecker	5.86	Lapland Longspur	0.55
Starling	5.63	Hoary Redpoll	0.55
Common Redpoll	4.81	Pine Siskin	0.55
House Sparrow	4.83		
	March-May 1974		
Red-winged Blackbird	39.94	Ruby-crowned Kinglet	0.91
Common Grackle	15.49	Eastern Phoebe	0.80
American Coot	7.21	Hairy Woodpecker	0.79
Song Sparrow	6.14	American Kestrel	0.77
Tree Sparrow	5.63	Eastern Meadowlark	0.77

Table XV - (Continued)

Species	Importance	Species	Importance
American Robin	5.58	Northern Oriole	0.73
Blue-winged Teal	5.47	Golden-crowned Kinglet	0.68
Mallard	5.38	Field Sparrow	0.66
Mourning Dove	4.97	Red-bellied Woodpecker	0.64
Cardinal	4.91	Pine Siskin	0.64
Brewer's Blackbird	4.71	American Bittern	0.64
Tree Swallow	4.40	White-throated Sparrow	0.64
Brown-headed Cowbird	3.93	Palm Warbler	0.62
Starling	3.56	Purple Finch	0.62
Wood Duck	3.49	American Redstart	0.50
American Goldfinch	3.07	Rose-breasted Grosbeak	0.50
Blue-Jay	2.95	Common Snipe	0.49
Killdeer	2.87	Fox Sparrow	0.48
Rough-winged Swallow	2.61	Black Tern	0.48
Hooded Merganser	2.59	Brown Creeper	0.47
Common Flicker	2.49	House Wren	0.34
Common Crow	2.49	Least Flycatcher	0.34
Downy Woodpecker	2.29	Brown Thrasher	0.32
Black-capped Chickadee	2.05	Magnolia Warbler	0.32
Lesser Scaup	2.05	Hermit Thrush	0.32
House Sparrow	2.02	Barn Swallow	0.32
Rusty Blackbird	1.98	Nashville Warbler	0.32

Table XV - (Continued)

Species	Importance	Species	Importance
Yellow-headed Blackbird	1.89	Great Horned Owl	0.30
Yellow-rumped Warbler	1.88	Louisiana Waterthrush	0.30
Pied-billed Grebe	1.86	Great Egret	0.30
Rock Dove	1.78	Gray-cheeked Thrush	0.30
Sora Rail	1.68	Eastern Wood Pewee	0.30
Yellow Warbler	1.55	Snow Goose	0.18
Ring-necked Duck	1.51	Cliff Swallow	0.18
Dark-eyed Junco	1.41	Common Nighthawk	0.18
Lesser Yellowlegs	1.41	Bank Swallow	0.18
Red-tailed Hawk	1.38	Ruffed Grouse	0.16
White-breasted Nuthatch	1.38	Broad-winged Hawk	0.16
Northern Shoveller	1.29	Ruddy Duck	0.16
Belted Kingfisher	1.28	Bufflehead	0.16
Swamp Sparrow	1.25	Great Crested Flycatcher	0.16
Gray Catbird	1.24	Osprey	0.15
Great Blue Heron	1.18	Solitary Sandpiper	0.15
Bobwhite	1.15	Spotted Sandpiper	0.15
Common Yellowthroat	1.11	Semipalmated Sandpiper	0.15
Chimney Swift	1.18	Black-&-White Warbler	0.15
Green Heron	1.05	Chestnut-sided Warbler	0.15
Northern Waterthrush	1.02	Ovenbird	0.15
Yellow-bellied Sapsucker	0.99		

Table XV - (Continued)

Species	Importance	Species	Importance
	June-August 1974		
Red-winged Blackbird	61.93	Pied-billed Grebe	0.96
Common Grackle	8.64	Eastern Wood Pewee	0.95
Mourning Dove	8.04	Brown Thrasher	0.95
American Robin	7.97	Red-headed Woodpecker	0.90
Blue-winged Teal	5.53	White-breasted Nuthatch	0.85
Song Sparrow	5.06	Blue-Jay	0.67
Mallard	4.92	Least Sandpiper	0.58
Gray Catbird	4.89	Savannah Sparrow	0.55
Green Heron	4.51	Common Snipe	0.48
Great Blue Heron	4.20	Bank Swallow	0.48
American Goldfinch	4.03	Virginia Rail	0.48
Cardinal	3.82	Least Flycatcher	0.45
Wood Duck	3.58	Eastern Phoebe	0.44
Black Tern	3.27	American Redstart	0.43
Tree Swallow	3.25	Warbling Vireo	0.36
Killdeer	3.16	Long-billed Marsh Wren	0.36
Chimney Swift	3.09	Rusty Blackbird	0.32
Rough-winged Swallow	2.98	Great Crested Flycatcher	0.32
House Wren	2.96	Spotted Sandpiper	0.31
Brewer's Blackbird	2.30	Carolina Wren	0.31
Yellow Warbler	2.30	King Rail	0.24

Table XV - (Continued)

Species	Importance	Species	Importance
Starling	2.21	Black-capped Chickadee	0.23
Hooded Merganser	2.13	American Bittern	0.22
Northern Oriole	2.11	Vesper Sparrow	0.22
Common Flicker	2.09	Yellow-bellied Sapsucker	0.21
Common Yellowthroat	2.09	Prothonotary Warbler	0.21
Common Nighthawk	1.92	Black-crowned Night Heron	0.13
Brown-headed Cowbird	1.91	Acadian Flycatcher	0.13
American Coot	1.54	Northern Waterthrush	0.12
House Sparrow	1.53	Black-&-White Warbler	0.12
Belted Kingfisher	1.52	Chestnut-sided Warbler	0.12
Barn Swallow	1.44	Field Sparrow	0.11
Indigo Bunting	1.44	Gray-cheeked Thrush	0.11
Bobwhite	1.43	Green-winged Teal	0.11
Downy Woodpecker	1.43	Chipping Sparrow	0.11
Rock Dove	1.35	Common Gallinule	0.11
Great Egret	1.25	Red-bellied Woodpecker	0.10
Solitary Sandpiper	1.15	Great Horned Owl	0.10
Sora Rail	1.14	Black-billed Cuckoo	0.10
Lesser Yellowlegs	1.07	Yellow-billed Cuckoo	0.10
Cedar Waxwing	1.07	Traill's Flycatcher	0.10
Rose-breasted Grosbeak	1.00	Greater Yellowlegs	0.10

Table XV - (Continued)

Species	Importance	Species	Importance
	September-November 1974		
Red-winged Blackbird	37.74	Chimney Swift	1.08
Blue-winged Teal	8.61	House Wren	1.06
American Robin	6.94	Sora Rail	1.06
Tree Sparrow	6.29	Eastern Wood Pewee	0.99
Killdeer	5.28	Rose-breasted Grosbeak	0.98
American Goldfinch	5.26	Ruby-crowned Kinglet	0.92
Common Grackle	5.07	Swamp Sparrow	0.81
Mallard	5.01	Northern Waterthrush	0.80
Cardinal	4.28	Pied-billed Grebe	0.80
Song Sparrow	4.27	Eastern Phoebe	0.77
Starling	4.19	Great Egret	0.76
White-throated Sparrow	3.93	American Coot	0.71
Blue-Jay	3.89	Herring Gull	0.69
Dark-eyed Junco	3.81	Great Horned Owl	0.64
House Sparrow	3.61	Brown Thrasher	0.61
Rough-winged Swallow	3.49	Pectoral Sandpiper	0.60
Common Snipe	3.47	Virginia Rail	0.60
Black-capped Chickadee	3.18	Magnolia Warbler	0.53
Common Crow	3.01	Cedar Waxwing	0.52
White-breasted Nuthatch	2.96	Common Gallinule	0.45
Common Flicker	2.75	Barred Owl	0.44

Table XV - (Continued)

Species	Importance	Species	Importance
Rock Dove	2.75	Chestnut-sided Warbler	0.42
Downy Woodpecker	2.59	Bay-breasted Warbler	0.41
Green Heron	2.53	White-crowned Sparrow	0.36
Lesser Yellowlegs	2.38	Red-eyed Vireo	0.36
Mourning Dove	2.31	Yellow-bellied Sapsucker	0.34
Gray Catbird	2.30	Long-billed Dowitcher	0.33
Least Sandpiper	2.09	Hermit Thrush	0.33
Bobwhite	2.05	American Redstart	0.32
Solitary Sandpiper	2.03	American Kestrel	0.32
Red-tailed Hawk	2.01	Stilt Sandpiper	0.32
Wood Duck	1.85	Bonaparte's Gull	0.31
Ring-billed Gull	1.75	Barn Swallow	0.26
Common Yellowthroat	1.73	Mourning Warbler	0.16
Great Blue Heron	1.71	Savannah Sparrow	0.15
Hairy Woodpecker	1.71	Warbling Vireo	0.15
Yellow-rumped Warbler	1.68	Least Flycatcher	0.15
Lincoln's Sparrow	1.65	Purple Finch	0.15
Long-billed Marsh Wren	1.62	Wilson's Warbler	0.13
Golden-crowned Kinglet	1.52	Yellow Warbler	0.13
Fox Sparrow	1.47	Loggerhead Shrike	0.13
Semipalmated Sandpiper	1.45	Blackpoll Warbler	0.13
Brewer's Blackbird	1.34	LeConte's Sparrow	0.13

Table XV - (Continued)

Species	Importance	Species	Importance
Palm Warbler	1.30	Chipping Sparrow	0.13
Brown Creeper	1.28	Great Crested Flycatcher	0.13
Greater Yellowlegs	1.22	Black-&-White Warbler	0.13
Tree Swallow	1.20	Hooded Merganser	0.13
Common Nighthawk	1.18	Red-bellied Woodpecker	0.13
Belted Kingfisher	1.11	Spotted Sandpiper	0.13
Rusty Blackbird	1.08	Ruffed Grouse	0.13
	December-February 1974-75		
Tree Sparrow	41.51	American Robin	6.14
Dark-eyed Junco	14.52	Red-bellied Woodpecker	3.99
Common Crow	13.18	Red-tailed Hawk	3.64
Red-winged Blackbird	12.39	Rock Dove	2.19
Black-capped Chickadee	12.17	Great Horned Owl	2.04
White-breasted Nuthatch	11.68	Bobwhite	1.90
Downy Woodpecker	10.52	Belted Kingfisher	0.73
American Goldfinch	9.73	Purple Finch	0.73
Starling	9.63	Barred Owl	0.73
Blue-Jay	9.42	American Kestrel	0.73
Cardinal	8.22	Northern Shrike	0.40
Brown Creeper	7.87	Rough-legged Hawk	0.40
Hairy Woodpecker	7.48	Goshawk	0.40
House Sparrow	7.28	Mallard	0.40

Table XV - (Continued)

Species	Importance	Species	Importance
	March-May 1975		
Red-winged Blackbird	21.29	Yellow-bellied Sapsucker	1.11
Common Grackle	14.24	Ring-necked Duck	1.11
Tree Sparrow	9.83	White-throated Sparrow	1.05
American Robin	8.13	Eastern Meadowlark	1.01
Dark-eyed Junco	7.83	Common Yellowthroat	1.01
Song Sparrow	7.78	Golden-crowned Kinglet	0.91
Cardinal	7.34	Ruby-crowned Kinglet	0.91
Starling	7.19	Gray Catbird	0.91
Wood Duck	5.67	Northern Shoveller	0.85
American Coot	5.47	Red-bellied Woodpecker	0.81
Mallard	5.17	American Kestrel	0.81
Downy Woodpecker	4.18	Belted Kingfisher	0.81
Black-capped Chickadee	4.02	American Wigeon	0.75
Mourning Dove	3.97	Purple Finch	0.75
American Goldfinch	3.87	Canvasback	0.65
Common Crow	3.62	American Woodcock	0.55
House Sparrow	3.37	Brown Thrasher	0.55
Blue-winged Teal	3.16	Hermit Thrush	0.55
Brown-headed Cowbird	3.06	Rough-winged Swallow	0.55
Hairy Woodpecker	2.97	House Wren	0.55
Common Snipe	2.91	Northern Waterthrush	0.55

Table XV - (Continued)

Species	Importance	Species	Importance
Common Flicker	2.72	Connecticut Warbler	0.55
Killdeer	2.67	Great Egret	0.55
Green Heron	2.47	Canada Goose	0.45
Bobwhite	2.36	Cedar Waxwing	0.45
Lesser Scaup	2.01	Solitary Sandpiper	0.35
White-breasted Nuthatch	1.86	Green-winged Teal	0.35
Tree Sparrow	1.86	Yellow Warbler	0.35
Fox Sparrow	1.81	Palm Warbler	0.35
Pied-billed Grebe	1.76	Great Horned Owl	0.29
Blue-Jay	1.66	Ring-necked Pheasant	0.29
Rusty Blackbird	1.61	Rough-legged Hawk	0.29
Yellow-rumped Warbler	1.61	Eastern Phoebe	0.29
Swamp Sparrow	1.61	Hooded Warbler	0.29
Bufflehead	1.61	Eastern Wood Pewee	0.29
Brown Creeper	1.56	Great Crested Flycatcher	0.29
Hooded Merganser	1.56	Orange-crowned Warbler	0.29
Great Blue Heron	1.46	Black-&-White Warbler	0.29
Red-tailed Hawk	1.36	Barred Owl	0.29
Green Heron	1.36	Common Nighthawk	0.29
Rock Dove	1.31	Wilson's Warbler	0.29
Brewer's Blackbird	1.21	American Redstart	0.29
Northern Oriole	1.21	Yellow-headed Blackbird	0.29

Table XV - (Continued)

Species	Importance	Species	Importance
Black Tern	1.15	Rose-breasted Grosbeak	0.29

*Raw data are available upon request