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WINTER BIRD DIVERSITY IN KANSAS

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Since 1900, Christmas Bird Counts have promoted bird protection and conservation and have provided participants with a recreational activity. The published results of these counts yield information on the distribution and abundances of winter bird populations. Recently, several studies have used the data to investigate geographic trends in avian abundance and diversity (Bock and Lepthien 1974, 1976b, Tramer 1974). Other studies (e.g. Bock and Lepthien 1972, 1976a, Schreiber and Schreiber 1973, De Haven 1973) have used the data to study the change and distribution of individual species' populations. Most of these papers have cited the shortcomings of Christmas Bird Counts—most notable is the extreme variation in interlocality effort—but all have agreed that the data are useful when properly analyzed.

In this paper, we use the Shannon-Wiener index of diversity to examine avian diversities throughout Kansas. Bock and Lepthien (1974) performed a similar type of study for the entire North American continent. They measured avian diversity within 5° latitude-longitude blocks by using total number of species seen only and did not account for relative abundances. A later paper (Bock and Lepthien 1976b) used the Shannon-Wiener index to investigate diversity of wintering fringillids. Use of Kansas counts allows the investigation of avian diversity across a rather abrupt east-west environmental gradient. Here, we expect a longitudinal gradient of diversity which is caused by the transition from wet, more woody environments in the eastern part of the state to the dry grasslands in western Kansas.

There are two components encompassed by the term diversity. Intuitively, a locality with 20 species is considered more diverse than a locality with only 10 species. Also, a locality reporting 10 species with near equal numbers is more diverse than a locality with 10 species with one being very abundant and the remaining 9 rare. These two components—species number or richness, and relative abundances of each species or equitability—are both taken into account in the Shannon-Wiener diversity index, H'.

Materials and Methods

The published results of Kansas Christmas Bird Counts for the years 1972-1975 as published in the Kansas Ornithological Society Bulletin provided the data for this study. Only localities that had counts for at least 3 of the 4 years were used. In our calculations we omitted waterbirds since these species are greatly restricted to special habitats. We also omitted blackbird species, Starlings, House Sparrows and Rock Doves since these species frequently flock and are not consistently counted. We counted only the first 2000 individuals when any species exceeded that number at a given locality. This tended to increase the actual diversity at several localities, but we felt that since flocking behavior observed in winter populations of several species is highly localized, the inclusion of these numbers would not indicate the actual diversity which the locality is capable of sustaining. Not using these limitations would result in lower diversity values for western localities, exaggerating the trends that were observed. We did not standardize the data for variation in party hours or other measures of intensity of coverage.

For each locality, the Shannon-Wiener diversity index was calculated for each year. This index is calculated as $H' = -\sum p_i \log_2 p_i$, where p_i is the proportion of the ith species. The maximum diversity for a locality, given the restriction of a set total number of species, S, is $H'_{max} = \log_2 S$. Evenness is measured as $J' = H'/H'_{max}$ (Pielou 1969), the ratio of the actual observed diversity to the maximum possible diversity if every species was equally represented. This index allows for comparison of relative abundance between localities.

Results

Table 1 lists the 23 localities used in this study, and mean diversity indices at each. H' ranged from 1.98 at Goodland to 4.18 at Lawrence. A few relatively high standard deviations demonstrate that some localities were quite variable for H' over the 4 years. To test the change in rank of localities from year to year, we performed Friedman's Rank Correlation Test (Sokal and Rohlf 1969:397) and found that the rank of localities from most to least diverse did not change significantly between years ($P < 0.01$).

Table 1. Mean diversity (H'), number of species (S), and evenness values (J') for 23 Kansas localities.

Location	$\overline{H'}$	(SD)	$\overline{S}$	$\overline{J'}$
Lawrence	4.18	(0.13)	54.5	0.72
Linn Co.	4.18	(0.17)	44.3	0.76
Pittsburg	4.17	(0.17)	33.5	0.82
Topeka	4.03	(0.19)	54.5	0.70
Baldwin	4.01	(0.24)	43.5	0.74
Kansas City	4.00	(0.16)	50.0	0.71
Manhattan	3.99	(0.06)	64.0	0.66
Emporia	3.87	(0.22)	58.2	0.66
Udall-Winfield	3.70	(0.32)	52.5	0.65
Elk City Reservoir	3.68	(0.48)	40.2	0.69
Olathe	3.63	(0.20)	35.5	0.70
Wichita	3.46	(0.20)	49.5	0.61
Halstead-Newton	3.40	(0.13)	47.2	0.61
Coffey-Lyon Co.	3.39	(0.52)	34.5	0.66
McPherson	3.08	(0.20)	37.3	0.59
Junction City	3.07	(0.74)	47.8	0.55
Dodge City	2.97	(0.17)	36.8	0.57
Great Bend	2.86	(0.20)	46.2	0.52
Ellis Co.	2.82	(0.18)	46.2	0.51
Kingman	2.70	(0.52)	39.2	0.51
Morton Co.	2.69	(0.65)	35.3	0.52
Quivira	2.43	(0.68)	34.3	0.48
Goodland	1.98	(1.32)	25.0	0.43

Figure 1 shows the localities used and isopleths showing regions of similar diversity. The longitudinal gradient in diversity is evident. Figure 2 is a plot of longitude against H'. The correlation coefficient was highly significant for this relationship ($r=-0.88$, $P < 0.01$). The mean number of species for each locality was not significantly correlated with longitude ($r=-0.40$); however, species evenness, J', was significantly correlated with longitude ($r=-0.89$, $P < 0.01$).

Discussion

Since H' incorporates species number and relative abundances, it will not be severely affected by moderate fluctuations in party hours and quality of coverage between localities. Both party hours and number of species change for each locality annually, yet our results show that these do not significantly affect a locality's rank order in diversity. Additionally, these results indicate that studies

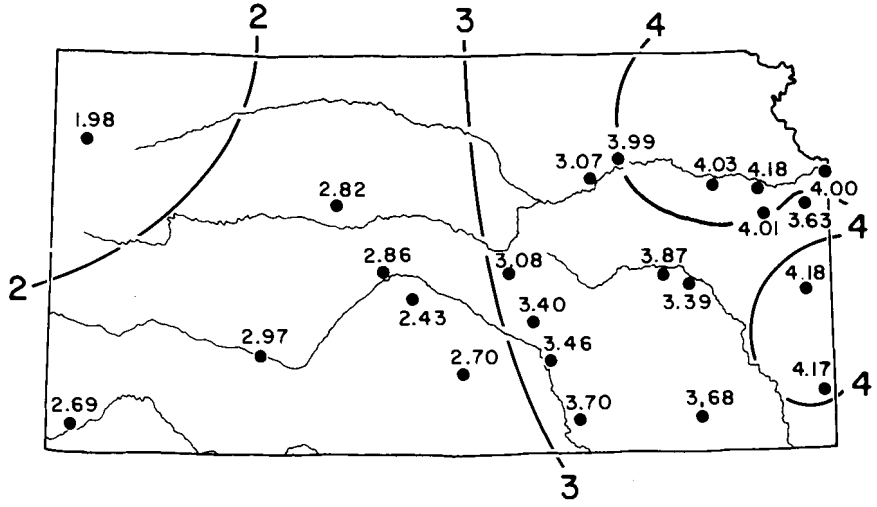

Figure 1. Mean diversities of Christmas Bird Counts at 23 Kansas localities. The isopleths join regions of similar diversity.

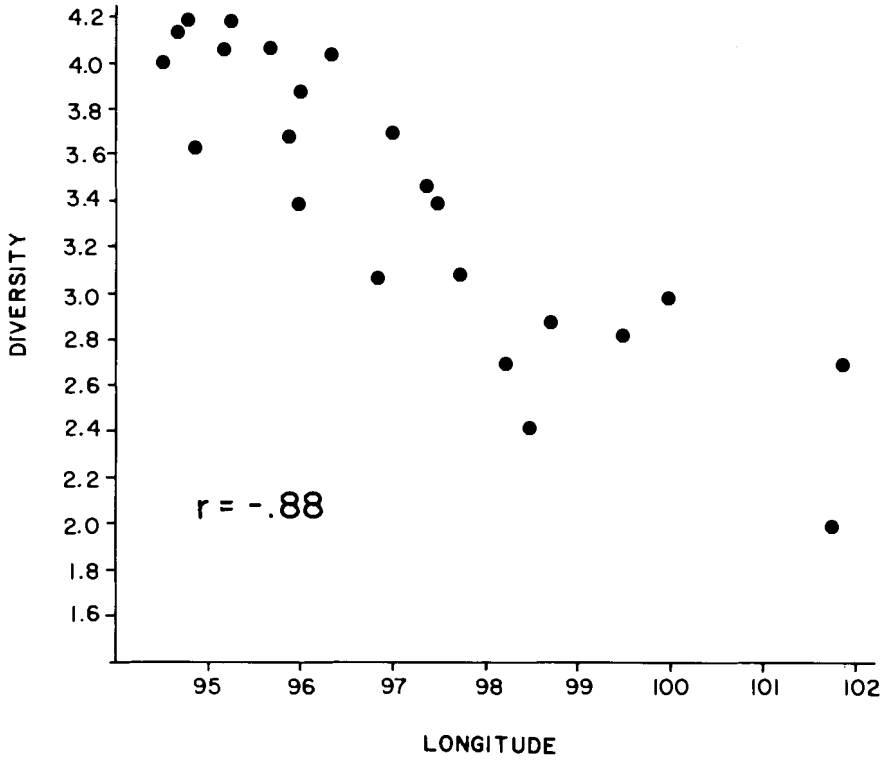

Figure 2. Relationship between longitude and Christmas Bird Count Diversity at 23 Kansas localities.

of this type need not average many years of data. Sites such as Goodland, however, demonstrate that some localities can be quite variable, and the averaging of several years' diversity indices would help define the normal diversity of a locality.

Initial studies by Bock and Lepthien (1974) and Tramer (1974) showed the Great Plains to be in an area of transitional (i.e. intermediate) diversities. This was noted on both latitudinal and longitudinal gradients. Although Kansas does not span much latitude for profitable study, the span of more than 7° of longitude does show a dynamic transition in vegetational complexity from deciduous forest in the east to short grass prairie in the west. We feel that the longitudinal decrease in avian diversity is a reflection of this transition. As demonstrated by Zimmerman (1977) and others, woodlands are capable of sustaining a richer avifauna than grasslands. The transition in vegetational complexity across the state should influence the avifauna and our results corroborate this. Although most of Kansas' Christmas Bird Counts occur in more highly populated and eastern sites, enough western localities exist to show low diversity for the more simply structured vegetation of western Kansas.

Although the total species number, S, also tends to be inversely correlated with longitude, this relationship is not statistically significant. Species evenness, J', however, drops sharply in western localities. This suggests that the decrease in diversity is due to a decrease in species evenness. Winter avifaunas in western Kansas tend to be dominated by a few species, whereas eastern counts have high equitability among species. These results can be contrasted with those of Tramer (1969) which showed a positive correlation between diversity and species richness in breeding populations; species evenness remained relatively constant between localities.

Apparently, the structural complexity of winter avifaunas is influenced by vegetational complexity. Resource diversity may be expected to decrease at western localities and produce faunas which are dominated by only a few species. The more complex vegetation of eastern Kansas, however, helps to broaden the available resource diversity and permits a more "even" fauna. Tramer (1969) and Kircher (1972) have hypothesized that more open (less complex) environments may be more rigorous and less predictable in winter, thus placing additional pressures on these avifaunas. Kircher (1972) further reasoned that lowered J' values characterize ecosystems containing opportunistic species. Our results tend to agree with these hypotheses.

Although Christmas Bird Counts usually include at least a small percentage of woodland (along or near watercourses), localities dominated by short- or mid-grass prairie demonstrate this decrease in evenness. This is encouraging, because one of the disadvantages of using Christmas Bird Counts is that they include "unnatural" habitats, including man-made reservoirs, parks, fields, etc. We think that the use of Christmas Bird Counts in this way is the most practical and efficient for studies of patterns of diversity in a small area. In examining larger areas the idiosyncrancies of Christmas Bird Counts have little effect—species richness and density can show patterns of variation in winter bird populations.

Acknowledgements.—We would like to thank our colleagues in the Division of Ornithology for their comments and discussion about this study. Richard F. Johnston read the manuscript and made several helpful suggestions.

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Black Rail summers in Pawnee County.—On 26 July 1978 while swathing a small grass waterway near our home in the northwestern corner of Pawnee county I flushed a small, unusual bird which alighted in the dirt a few meters away. It was very dark and small and my first thought was of a melanistic Spotted Sandpiper. I stopped the machine for a better look noting that it resembled a juvenile pigeon with its rather small wings and non-existent tail.

The grass from which the bird had flown was very dense and about one meter tall but the ground on both sides of the waterway was completely bare summer fallow. As the bird crouched behind a small clod I noticed the unusual darkness of the bill and a rusty colored area from the back of its head to its shoulders. I also noted that the bird was less than 20 cm tall. Remembering Ben Franklin's advice about hands and bushes I left the swather with the intention of capturing the bird. I crept to within two meters of the bird before it flew back into the grass. Meanwhile I had noticed the tiny white spots on the wings and back, its dark legs and feet, a reddish gleam to its eye and (as it flew) the finely barred rump so typical of rails.

I ran to where it dropped but could not find it among the dense undergrowth so resumed swathing certain that I would see it again. I saw it briefly in the grass but as I made the final pass it had disappeared. A few minutes later my wife and I searched the grass stubble and sifted through the windrows for the rail's body but without success. The rail had apparently flown to safety unnoticed.

After consulting field guides I had no doubt that the bird was a Black Rail (*Laterallus jamaicensis*). My only question was why a Black Rail had chosen to live in a strip of grass barely eight meters in width and a mile from the nearest water. I also wondered how many Black Rails and Yellow Rails are seen by other farmers who don't know or don't care about birds.

The rail was not seen again until 31 August when I was swathing a road ditch some 300 meters from the original place of sighting. The bird flushed, fluttered awkwardly and after a chase was finally captured. It appeared in good health except for a broken left wing. The bird was flushed from a roadside ditch with sparse grass and firebush—again atypical rail habitat. I believe that the bird may have already been injured when first flushed in July and suspect that its presence here might be due to an injury sustained during the spring migration. I contacted Charles Ely who suggested that the bird be preserved since it was obviously incapable of migration and represents a species rarely documented in the state. It is presently at Fort Hays State University and will eventually become part of that collection. *Scott Seltman, Nekoma 67559.*

Piracy by Ring-billed Gull on Common Goldeneye.—Piracy by the Ring-billed Gull (*Larus delawarensis*) has been reported on Pied-billed Grebe (*Podilymbus podiceps*), Greater and Lesser Scaup (*Aythya marila* and *A. affinis*), Common and Red-breasted Merganser (*Mergus merganser* and *M. serrator*) and American Coot (*Fulica americana*) (*e.g.*, Palmer, Ed., 1976, Handbook of North American Birds, Vols. 2 and 3, New Haven, 1081 pp) but there are few explicit accounts of this relationship.

On 27 March 1978, at Cheyenne Bottoms Waterfowl Management Area, Barton County, Kansas, we saw a sub-adult Ring-billed Gull attack two Common Goldeneyes. The gull began its attack by dropping onto a female, forcing her to dive and then repeated this behavior on a male forcing him to dive also. When the ducks surfaced the gull flew at them again but this time the ducks flew away. The gull then alighted near where the ducks had been and began feeding. Although there were nearly 50 Ring-billed Gulls and individuals of five other species of ducks in the area, this was the only act of piracy observed. Moreover, most of the gulls were actively feeding on crayfish (*Procambarus sp.*) in shallow water near shore.

Although the significance of this behavior as a feeding strategy in the Ring-billed Gull is unclear, we feel that it is sufficiently important to warrant further study and hope this note will stimulate other observers to join us in investigating this phenomenon. *Mike Moulton and Mark Ports, Department of Biology, Fort Hays State University, Hays 67601.*

BOOK REVIEWS

The World of Roger Tory Peterson. An authorized biography. John C. Devlin and Grace Naismith. Quadrangle-The New York Times Book Co., Inc. (Three Park Ave., New York, N.Y. 10016). 266 pp with 15 color plates and 20 line drawings by Peterson and 1 pp of photographs. Hard Cover. $14.95.

This thorough biography describes the life and work of one of the world's best known artist-naturalists and could easily be subtitled "all you ever wanted to know about Roger Tory Peterson." The authors had the complete cooperation of Peterson and his associates and their writing, largely anecdotal in nature, makes very interesting reading. The book is generally sympathetic but mentions his "other side" and at times is too personal for my taste. There are numerous references to his family life, especially the invaluable aid provided by his second wife, Barbara.

The book is divided into three parts. Part 1 begins with his early childhood in Jamestown, N. Y. and ends with the publication of his field guide at age 25. Incidentally the first guide was rejected by four publishers and the fifth printed only 2,000 copies. All were sold the first week and over two million copies have now been sold! Peterson was interested in nature as a small child but it was a Junior Audubon Club in the seventh grade (age 11) that brought forth his real interest in birds and his first painting—the two subjects which were to dominate his life. The authors describe his early bird-watching days with the Bronx County Bird Club; his early art training; his early meetings with Fuertes, Jaques, Chapman and Griscom, and his experiences as camp counselor and teacher which revealed his talent for effective, informal teaching. From this varied background developed the present Roger Tory Peterson—a man of many talents, but basically artist-naturalist.

In Part 2 we learn of his work with the National Audubon Society for which he wrote, painted and lectured. The authors estimate that over nine million school children were exposed to the Audubon bird study leaflets during his tenure. During World War II he was briefly assigned to an early evaluation of the effects of DDT on wildlife. In later years he became one of the most outspoken opponents of pesticides. The section concludes with his free-lancing days which began with the writing of "Birds over America" in 1948.

In Part 3 we learn Peterson's thoughts on a number of subjects and get some exposure to his working methods. One chapter discusses bird-watching (call him a

bird-watcher never a bird-lover). Another describes his worldwide travels as a photographer and film maker (the authors call him the "world's most travelled ornithologist"). His efforts for conservation throughout the world are included in another chapter. To many, the name Peterson is synonymous with painting and Chapter 18 describes his methods and includes his assessment of bird art and bird artists. He never copies photos or pictures but does use his collection of over 100,000 transparencies as reference for background and detail. Although best known for his field guides his ambition remains to be a gallery artist.

The accomplishments of this talented man are listed at the end of the book under three categories: works of art and books (6 pages), activities and professional affiliations (3 pages) and honors and awards (5 pages). I consider the book well worth the asking price and recommend it to birders. *Charles A. Ely.*

A Guide to North American Bird Clubs. First Edition. Compiled and edited by Jon E. Rickert, Sr. Avian Publications, Inc. (P. O. Box 310, Elizabethtown, Kentucky 42701). 565 pp plus numerous outline maps. Hard Cover. $15.00.

The stated main purpose of this book is to provide a source of up-to-date bird finding information. The author hopes to encourage communication between bird clubs and to provide a source of information for traveling birders. After a quick examination of the book, I believe these objectives will be met.

Over 835 organizations are included, ranging geographically from Hawaii and Alaska to Panama. Each state is represented by at least one organization and California and New York each have 45 listed. The book includes 17 national organizations ranging from the American Ornithologists' Union to the 600 Club. One Kansas-based organization is listed—the Bird Populations Institute. Individual clubs are included by state (arranged alphabetically), province or foreign country (*e.g.*, Bermuda).

Each state account begins with an alphabetical list of local clubs and an outline map locating them. The name of the organization and either its permanent address or the addresses of one or more "permanent" birders follows. Detailed information follows under these headings: "Birding Report"—names and phone numbers of two (usually) persons who can provide up-to-date reports of local birding. "Publications"—description and subscription rate of any journal or newsletter. "Field Trips"—listing of any scheduled trips and-or favorite birding areas. "Meetings"—listing of regular meeting time and place.

The Kansas section describes KOS and 11 local organizations at Baldwin City, Dodge City, Emporia, Hays, Hutchinson, Manhattan, Mound City, Parsons, Salina, Topeka and Wichita. The information for those clubs with which I am familiar seems generally accurate. I did find a number of misspellings and typos but do not know whether these are the fault of author, contributor or printer.

The publishers stress the book's value to traveling birders. The author encourages travelers to write in advance for newsletters and whenever possible to join local clubs or to subscribe to newsletters as a token of appreciation for information provided by local contacts. If this is done both the traveler and the local organization will be benefited.

I recommend the book for organizations and public libraries and for any birder who plans to use the information in his travels. Properly used the book could be a valuable companion to the Pettingill "guides to bird-finding." *Charles A. Ely.*

Animal Communication. Hubert and Mabel Frings. Second Edition, Revised and Enlarged. The University of Oklahoma Press (Norman, Okla. 73019). 207 pp, 6 photographs and numerous line drawings. Hard Cover. $9.95.

Many readers will remember the authors (both KOS members) from the 1972 KOS meeting. They were pioneers in the field of animal communication and among the first to suggest practical application of observed phenomena (*e.g.*, use of distress calls to disperse starling flocks).

The book is an expanded version of the 1964 Edition with a new chapter (11) discussing recent advancements and future prospects in the field. The annotated bibliography is also updated and about one-third of the references are post 1964. The book is intended for the nonspecialist and is written with a minimum of scientific jargon. It is also a serious book written in a clear, concise, no-nonsense style with NO attempt to be cute or to personalize the animals being discussed. It is a storehouse of information.

The first three chapters are introductory in nature. The authors define their terms and explain the importance of animal communication both to the organisms themselves and to man. Also described are the various means of communication used by animals (tactile, chemical, etc.). Of special interest are descriptions of their study methods—a combination of careful observation (of sender, signal and receiver) and experimentation. A blend of field and laboratory studies usually give the most satisfactory results.

The remaining chapters are entitled: Species Identification; Social Cooperation; Sexual Attraction and Recognition; Courtship and Mating; Parental Care for Developing Eggs and Young; Efficiency and Evolutionary Importance; Practical Aspects; Recent Advances and Future Prospects. These chapters are filled with examples from throughout the Animal Kingdom. Among the avian examples are the "submissive display" used by a cowbird near the nest of a potential host and the development of song. I especially enjoyed the examples from invertebrates (*e.g.*, departing signals by grasshoppers; sex odors of female moths, effective five miles away). The section describing courtship and mating in spiders is especially effective. The small male has a problem in approaching the larger female which by instinct attacks and kills any small animal moving near her. The mechanisms by which males of different species have solved this problem are fascinating.

The book will provide answers to persons who have watched animals and wondered about their activities. Anyone who reads this book and then deliberately takes the time to observe on his or her next trip afield will be well rewarded. I recommend the book to all who wish to better understand the animals around them. *Charles A. Ely.*