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### A REVIEW OF THE FOSSIL BIRDS OF KANSAS

BY DAVID BARDACK

Thirty-seven species of birds are found as fossils in Kansas. Within this relatively modest assemblage there is real diversity. Several species are indistinguishable from living species, some others bear reasonably close relationship to living kinds, and some have no existing counterparts, even at the ordinal level. Some of the species lived only a few thousand years ago, although others lived approximately 100 million years ago. Additionally, the birds of the past occupied a wide range of habitats, some of which are no longer present in Kansas. The review below considers these matters and indicates the evidence for apparent ecologic and climatic change between the past and present in Kansas. Information concerning fossil and living birds of Kansas, from which the present summary has been made, is widely scattered through the zoological literature; extensive use here has been made of papers by Downs (1954), Johnston (1960), and Wetmore (1956).

Fossil remains of birds are nowhere common, although birds may well have been abundantly represented in living communities of the past. There are two causes for the scarcity of fossil bird-bones. First, they are small and light in weight; the action of predators, scavengers or organic decay tends to break apart, scatter and disintegrate such bones. Second, many birds do not, and presumably did not, live in areas where bones were likely to be fossilized. Yet, before bones decay, some are covered by sediments that protect the bones from weathering and consumption by scavengers, with the result that fossilization may occur. If such covering sediments are subsequently eroded away, some lucky fossil hunter may spot exposed fossil bone. Most often such fossils are proximal or distal ends of limb bones, especially those of the hind limb. Vertebrae, coracoids and sterna are found less frequently. Rarely there are impressions of scales of the feet or feathers; such impressions presumably were formed only when fine-grained sediments were undisturbed during fossilization.

The record of fossil birds in Kansas ranges from middle Late Cretaceous, about 100 million years ago, into the Wisconsin, or last, glacial stage of the Pleistocene, perhaps less than ten thousand years ago. Below, fossil bird assemblages will be discussed in chronological order from oldest to youngest. Throughout the text vernacular names have been used whenever available; current Latin and vernacular names are listed in Table 1.

*Cretaceous species.*—The species of birds from the Cretaceous of Kansas were discovered in the last half of the nineteenth century, which was a critical time in the development of evolutionary thought. At this time Thomas Huxley, the leading exponent of Darwinian principles, suggested an ancestral-descendant relationship between reptiles and birds. Nevertheless, fossil evidence to support his theory was lacking. Although *Archaeopteryx* (later recognized as the earliest fossil bird) was known, it had been assigned to the Class Reptilia on the basis of the numerous reptilian features.

O. C. Marsh, professor of paleontology at Yale University, was greatly stimulated

TABLE 1.  
GEOGRAPHIC AND GEOLOGIC DISTRIBUTION OF THE SPECIFICALLY IDENTIFIED FOSSIL BIRDS OF KANSAS. THE GEOLOGIC TIME SCALE IS NOT DIVIDED IN PROPORTION TO THE ACTUAL DURATION OF EACH UNIT. SPECIES MARKED WITH AN ASTERISK ARE EXTINCT.

Period	Epoch	Fossil Birds	Location
Quaternary	Pleistocene	<i>Podiceps caspicus</i> : Eared Grebe <i>Anas acuta</i> : Pintail Duck <i>Spatula clypeata</i> : Shoveler <i>Bartramia longicauda</i> : Upland Plover <i>Zenaidura macroura</i> : Mourning Dove <i>Calamospiza melanocorys</i> : Lark Bunting  <i>Pelecanus erythrorhynchos</i> : White Pelican <i>Chen</i> sp.: Snow Goose <i>Aix sponsa</i> : Wood Duck <i>Aythya affinis</i> : Lesser Scaup <i>Asio flammeus</i> : Short-eared Owl	Jones Fauna, Meade Co.  Shorts Creek, Meade Co.
		<i>Anas carolinensis</i> : Green-winged Teal <i>Lophodytes cucullatus</i> : Hooded Merganser <i>Bartramia longicauda</i> : Upland Plover <i>Numenius borealis</i> : Eskimow Curlew <i>Euphagus cyanocephalus</i> : Brewer's Blackbird  * <i>Anas bunkerii</i> : Duck <i>Bucephala albeola</i> : Bufflehead * <i>Pliogyps fisheri</i> : Condor * <i>Colinus hobbardi</i> : Quail <i>Meleagris gallopavo</i> : Turkey * <i>Rallus prenticei</i> : Rail <i>Fulica americana</i> : American Coot <i>Zenaidura macroura</i> : Mourning Dove	Kentuck Locality, McPherson Co.  Rexroad Fauna, Meade Co.
Tertiary	Pliocene	<i>Podiceps caspicus</i> : Eared Grebe * <i>Grus nannodes</i> : Crane  * <i>Proictinia gilmorei</i> : Kite * <i>Paleostruthus hatcheri</i> : Sparrow	Edson Quarry, Sherman Co.  Long Island Quarry, Phillips Co.
	Miocene Oligocene Eocene Paleocene		
Cretaceous		* <i>Hesperornis crassipes</i> * <i>H. regalis</i> * <i>H. gracilis</i> * <i>Baptornis advenus</i> * <i>Ichthyornis agilis</i> * <i>I. anceps</i> * <i>I. dispar</i> * <i>I. tener</i> * <i>I. victor</i>	Western Kansas (Gove and Logan cos.)

by Huxley's ideas. In the 1870s, Marsh urged his field parties, then prospecting the chalk beds of western Kansas, to search diligently for fossil birds. In 1872 he described the first fossil birds from Kansas, *Hesperornis regalis* (= regal western bird). This name was given to a headless skeleton.

Later in 1872, Marsh received a box of fossils from Professor Benjamin Mudge of

the Kansas Agricultural College in Manhattan. Marsh originally described these bones as two different kinds of animals, one avian, one saurian. Later, on further preparation of the fossils, he decided that all of Mudge's material belonged to a bird, and, most remarkably, a bird with teeth. Marsh named this bird *Ichthyornis*. Gregory (1952), upon reexamining *Ichthyornis*, demonstrated that Marsh's first assumption was correct. The toothed jaw assigned by Marsh to *Ichthyornis* actually belonged to a small marine lizard, a mosasaur, the adult-sized remains of which are fairly common in the Kansas Chalk. The remaining parts, however, still pertain to *Ichthyornis*. Thus, although we still do not know whether *Ichthyornis* possessed teeth, we are sure that *Hesperornis* did, because in 1873 a specimen of *Hesperornis* was found which included a head and teeth.

In succeeding years, collectors working in Kansas sent Marsh additional specimens. From this material he described two more species of *Hesperornis*, five species of *Ichthyornis*, and two other genera, *Baptornis* and *Apatornis*, belonging to two different families. Some features of these birds are noteworthy since the Cretaceous birds differ considerably from modern species.

*Hesperornis* and *Baptornis* were birds the size of a large loon, and their much-reduced wings indicate that they were flightless. *Hesperornis* shows several reptilian features. It had teeth, although they were in grooves, rather than in sockets as in reptiles. The lower jaw exhibits a transverse mandibular joint behind the tooth row, a characteristic of mosasaurs. The two rami of the lower jaw do not fuse at the symphysis but remain separate, connected only by ligaments, as in reptiles. *Baptornis* is distinct from *Hesperornis*. Since no skull has been found, we do not know whether *Baptornis* had teeth.

The position of the hind limbs of *Hesperornis* is noteworthy. Marsh stated that these appendages were used to produce a powerful, backward swimming stroke, as in living aquatic birds. But when a specimen was mounted at the National Museum in Washington, it became evident that such an interpretation was incorrect and that the limbs stood out from the body almost at right angles. These appendages would seem to have been used in water, much like oars, but they could have been of little use ashore; *Hesperornis* probably was unable to walk on land. This bird probably laid its eggs on shore or on a floating nest. Their movement out of water must have resembled that of a walrus. The bill might have been used as an aid for crawling out of the water, much as the bill is used for this purpose by loons today.

Marsh studied the brain cavities of *Hesperornis* and declared the brain to be smaller and more reptilian than that of any living bird. Edinger (1951), the leading student of paleoneurology, showed clearly that Marsh's reconstructions could not have been made from endocranial casts. Further, she demonstrated that the brain was of avian type and had no specific reptilian characters. The cerebrum does not extend backward over the brain stem to the same degree as in Recent birds.

Both *Hesperornis* and *Baptornis* were aquatic birds, living along coastal waters and tidal pools of the warm seas covering western Kansas in the Late Cretaceous. *Hesperornis* probably fed on fish and perhaps small marine lizards; the jaw structure indicates adaptation to such a diet.

Other fossil birds from the Kansas Cretaceous are small, tern-sized birds characterized by large wings and small feet. They are placed in two genera: *Ichthyornis*, having eight species, and the monotypic *Apatornis*. Both genera had amphicoelous vertebrae, the centra being concave on their anterior and posterior faces, rather than saddle-shaped as in living birds. Amphicoelous vertebrae can also be seen in a few living and many extinct reptiles, as well as in amphibians and fishes. The similarity of bird- and fish- vertebrae led Marsh to name the genus *Ichthyornis* (= fish-bird). Both genera show moderately well-developed sternal keels, indicating considerable capacity for flight.

These tern-like species probably skimmed along the surface of the sea or plunged headlong into the water, scooping up the small fishes on which they fed. *Ichthyornis* and *Apatornis* are found in marine deposits, along with *Hesperornis* and *Baptornis*.

After nearly a century, the knowledge of Cretaceous birds of North America is still based almost entirely on fossils from the Kansas Chalk.

*Tertiary species.*—From the beginning of the Tertiary almost until its close there is no record of bird life in Kansas; rocks of the Paleocene, Eocene, Oligocene and Miocene epochs are nowhere exposed in the state. Elsewhere in the United States in these epochs, particularly in New Jersey, Wyoming, Colorado, Oregon, Nebraska, South Dakota and California, various genera and species of birds have been described and assigned to modern families or genera.

With the start of the Pliocene, fossil birds again appear in Kansas. An Eared Grebe and three extinct species, a kite (*Proictinia gilmorei*), a crane (*Grus nannodes*), and a sparrow (*Paleostruthus hatcheri*), are recorded from Pliocene rocks. The kite and sparrow come from the Lower Pliocene Long Island Quarry in Phillips County and the grebe and crane from the Middle Pliocene Edson Quarry in Sherman County. Pliocene bird remains are abundant in Florida, California, Nebraska and Idaho.

*Quaternary species.*—The geologically more recent fossil bird assemblages of Kansas come from Meade and McPherson counties and comprise 22 species, 18 of which are specifically identical with living birds; four are recognized only as fossils. Additional fossil specimens from these counties are at present unidentified. Most of the localities containing fossil birds are of Pleistocene age. One horizon, containing the Rexroad fauna, is of somewhat uncertain stratigraphic position. On the basis of his extensive collections from Meade County, Hibbard (1950) assigned the Rexroad fauna to the Upper Pliocene. Other authorities, including Frye, Swineford and Leonard (1948) and Moore (1949), suggested that the Rexroad Formation, which includes the Rexroad fauna, is lowermost Pleistocene. It may be that the Rexroad fauna is transitional, being partly Late Pliocene and partly Early Pleistocene. In any event, the birds themselves do not allow precise dating of the Rexroad fauna.

The birds from the Rexroad include an extinct surface-feeding duck (*Anas bunkeri*); the Bufflehead; an extinct genus of condor (*Pliogyps fisheri*); an extinct species of quail (*Colinus hibbardii*); the Turkey; an extinct rail (*Rallus prenticei*); the American Coot and the Mourning Dove. Of the eight birds known from the Rexroad fauna, four are extinct.

The record of *Pliogyps fisheri* is the only one of a condor from the Great Plains. Tordoff (1959) suggested that condors soared across the plains from montane roosts in search of food. Considering that the distance from the Rocky Mountains to Meade County is about 250 miles, it is unlikely that such forays were a part of the usual foraging pattern.

Concerning the quail, Tordoff (1951) tentatively suggested the *C. hibbardii* was a larger-winged bird than the modern quail and thus perhaps a migratory species. The numerous bones of this fossil indicate either an abundance of quail or result from selective accumulation of litter left by raptors.

Hibbard (1950) described the Rexroad environment as topographically varied, with vegetation typical of grassland, meadowland and woodland. That birds from the Rexroad occupied a variety of habitats is suggested by the ecological diversity characteristic of their living representatives. Except for the quail, which comes from a stream-channel deposit, the places from which these fossils were recovered are considered to be sites of ponds or bogs. The presence of bogs may reflect the transition from moist to drier conditions that took place in southwestern Kansas at the end of the Tertiary.

From beds of the next-to-last glacial stage (Illinoian), or from the interglacial stage just prior to it (Yarmouthian), five birds of three families have been obtained (Galbreath, 1955). This material comes from the Kentuck locality of Hibbard, in McPherson County. The species recognized include a Green-winged Teal, a Hooded Merganser, an Upland Plover, an Eskimo Curlew and a Brewer Blackbird. All are identical with living birds. The Eskimo Curlew, now nearly extinct, was formerly a common transient in eastern Kansas (Johnston, 1960). This is the only fossil record of Eskimo Curlew.

A collection of fossil birds from Shorts Creek, in Meade County, has been described recently by Stettenheim (1958). The deposit probably dates from the last interglacial, the Sangamon. The birds recognized include (1) a White Pelican, the first fossil pelican recorded from Kansas; (2) a goose, probably identical with the Snow

Goose, recorded for the first time from the High Plains; (3) two surface-feeding ducks, not specifically identifiable, but probably including a Mallard and Pintail; (4) a Wood Duck, noted for the first time as a fossil; (5) a Lesser Scaup; and (6) a Short-eared Owl, recorded for the first time as a fossil from the High Plains.

This is a significant assemblage. All of the species are represented today, but not all are common on the High Plains. The Short-eared Owl is regarded as rare to uncommon and the Wood Duck as rare in western Kansas (Johnston, 1960). The owl requires a mixed-grass upland, the Wood Duck water and tall trees (as a breeding species), the pelican and goose a lake. These features are missing or of limited occurrence in western Kansas today.

The geologically most recent fossil bird assemblage of Kansas comes from Jones Fauna, of Meade County, regarded as of Wisconsin age. The birds described from this locality include an Eared Grebe, a Pintail, perhaps both Green-winged and Blue-winged teal, a Shoveler, a Lesser Scaup or Ring-necked Duck, an Upland Plover, a sandpiper (perhaps the Pectoral Sandpiper or the Dunlin), a Mourning Dove, a black-bird (perhaps *Agelaius* sp.), a cowbird (possibly the Brown-headed Cowbird), a Lark Bunting, a longspur (possibly the Lapland Longspur), and various other unidentified sparrows and buntings.

The ducks and grebe suggest that the area has been more humid than it is today. Marshes, with reedy areas and small lakes, must have been in existence. Hibbard, on the basis of mammalian studies, suggested that the climate was cooler.

Pleistocene deposits in California, Florida and Oregon have yielded more bird fossils than Kansas. Kansas has produced the best fossil record of birds from the High Plains, and additional material in various collections awaits description.

Another fossil bird described from Kansas is *Colinus eatoni* Shufeldt. Its geographic, geologic, and taxonomic positions are uncertain. Wetmore (1956) suggests that it may be an oscinine passeriform.

#### SUMMARY

Fossil birds of Kansas are represented by eleven species from the Cretaceous, all distinct from living birds. The Tertiary and Quaternary have yielded eighteen species resembling existing birds and eight additional species that are extinct. The total of well-studied species is 37; these span at least 100 million years of the Kansas past.

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*Museum of Natural History, The University of Kansas, Lawrence, Kansas, November 10, 1961.*

**Winter Distribution of Harris Sparrows in Kansas.**—Biologists no longer tend to explain things on the basis of one factor or cause. The explanatory or descriptive truth has so often been shown to have multiple bases that resort to a one-factor explanation is properly no longer trusted. Concerning distribution of birds, multiple-factor regulation of numbers and boundaries is certainly the rule. This is true to the extent that instances of relative simplicity of regulation are worth comment.

An example of such simplicity in control over winter distribution is available locally for Harris Sparrows, *Zonotrichia querula*. Table 1 shows results of twelve years of counting numbers of Harris Sparrows in winter in Kansas. Except for 1951, when few people took part in the censuses, the average number of birds per station is about 100 birds, plus or minus approximately 30 per cent; this suggests that Harris Sparrows maintain a reasonably even population number from year to year. This is important, for if it is assumed to be true, then fluctuations in numbers at any one locality from year to year are chiefly reflections of differences in local distribution. Thus considered, the figures in Table 1 reveal a remarkable pattern. There is a tendency for numbers to be relatively high in northeastern Kansas when they are relatively low in south-central Kansas, and *vice-versa*. We may say that in some years the sparrows move farther south than in others.

An examination of gross records of temperature and precipitation for northeastern Kansas provides a basis for interpreting the meaning of this reciprocal relationship in numbers of the birds in the two areas. The sparrows tended to be relatively abundant in south-central Kansas and relatively uncommon in northeastern Kansas in those years that had heavy snow and low temperatures in the month preceding the census, and *vice-versa*. The greatest exception to this generality occurred in the winter of 1957-1958, when December had warm, wet weather but numbers of sparrows were low in the north and high in the south. This exception probably indicates the operation of factors other than cold, snowy weather relative to local density of Harris Sparrows, but the overriding relationship seems to be one of persistent snow and low numbers of sparrows, or, open ground and high numbers.

From these crude analyses it is possible to suggest that Harris Sparrows tend to avoid areas with reasonably persistent snow cover. For a ground-foraging bird this suggestion seems wholly reasonable, and it is in fact what we would expect *a priori*. The suggestion can be regarded as meritorious only if numbers of birds in both southern and northern Kansas are considered simultaneously and for a period of several years. In other words, it is the relatively consistent inverse relationship in numbers at southern and northern stations that lends support to the hypothesis, which may now be formally stated: some function of persistent snow cover, most likely availability of food, is paramount in regulating winter distribution of Harris Sparrows in Kansas.

If the relationship between ground-foraging habit and snow cover as proposed is real, one would expect other ground-foraging species to show a similar distribution over the parts of Kansas here treated. A distribution resembling the one for Harris Sparrows is detectable for the White-crowned Sparrow, *Z. leucophrys*, but the evidence is not convincing. This is only to be expected, however, for the white-crown is relatively uncommon in Kansas: the mean number per station in winter censuses is less than ten birds. This is true to an even greater extent for the White-throated Sparrow, *Z. albicollis*, as well as for the Rufous-sided Towhee, *Pipilo erythrophthalmus*.

The Song Sparrow, *Passerella melodia*, might be expected, as a species showing proclivity for occurrence near water as well as for foraging on the ground surface, to show a well-marked relationship of large numbers in the north in mild winters and

TABLE 1.  
NUMBERS OF HARRIS SPARROWS AT SELECTED STATIONS IN KANSAS ON JANUARY 1,  
FROM 1951 TO 1962.

Year	Mean No., Harvey, Sedgwick, Cowley counties	Mean No., Douglas, Johnson, Shawnee counties	Mean No., All Stations in Kansas
1951	182	27	44
1952	495	25	72
1953	272	131	85
1954	316	131	115
1955	283	83	93
1956*	—	—	94
1957	234	136	93
1958	528	55	137
1959	515	66	127
1960	403	66	100
1961	322	82	71
1962	395	58	113

\* Totals per station not reported separately.

small numbers in cold, or snowy, winters, but large-scale fluctuation in overall numbers obscures detection of any such regularity. The mean number at stations in Kansas has varied from 11 birds per station (1960) to 76 birds per station (1954), and no inverse relationship in numbers at southern and northern stations can be found.

**A note on the data.**—The data used in this report are, first, the censuses made by members of the Kansas Ornithological Society (see Bull. Kansas Ornith. Soc., 1951–1962 [various authors]) each winter in association with the “Christmas Count” of the National Audubon Society, and, second, the monthly means of temperature and the monthly totals of snowfall recorded by the United States Weather Bureau at Topeka, Shawnee County, Kansas (see Local Climatological Data, 1960. U. S. Dept. Comm., Topeka).

The numbers of Harris Sparrows shown in Table 1 for northeastern Kansas are the means for five stations in Johnson, Douglas, and Shawnee counties; for south-central Kansas the numbers represent the means for two, three, and four stations in Harvey, Sedgwick, and Cowley counties. Aside from the experience of the observers involved in the counting, there is little available by which to independently check the validity of the counts. It is here considered that the censuses are reasonably accurate reflections of the actual numbers of the birds in the two areas each winter.

Mean temperatures and total monthly snowfalls are, of course, matters of objective record. The question is whether such means and totals are good enough to indicate degree of persistence of snow cover. They probably are good enough to give us order of magnitude of about the same reliability as the censuses of the birds. There is no way, short of making regular and complete investigation of places used by Harris Sparrows, of knowing precisely how much foraging area is covered by a snowfall. It is possible for a relatively light fall to cover all foraging ground and for subfreezing weather to maintain this cover for several days; such coincidence could serve as stimulus for considerable southward shifts by Harris Sparrows in winters otherwise considered to be, and statistically recorded as, “mild.” I suspect that this has happened within the census period reported on here, but there are no data to substantiate this suspicion.

In summary, it is highly likely that winter distribution of Harris Sparrows, as determined by local numbers at K.O.S. winter census stations, is governed by persistence of snow cover; more birds move farther south in rough winters, fewer in mild winters.—RICHARD F. JOHNSTON, *Museum of Natural History, The University of Kansas, Lawrence, April 24, 1962.*

**White Bird Seen Following Cattle.**—In the fall of 1961 Mrs. P. W. McPheeters reported to Katharine Kelley and Amelia Betts that she had seen a rather large bird

following their cattle. She described it as being very much like an egret. It remained in the pasture for at least two or three days. The McPheeters farm is three miles northeast of Baldwin. Could this bird possibly be a Cattle Egret? If so it would be well for the K.O.S. members to be on the alert next fall for white birds following cattle.—IVAN L. BOYD, *Baker University, Baldwin, Kansas, February 22, 1962.*

## NOTES AND NEWS

*Correction.*—In Table 1 for the *Midwinter Bird Count for 1961* (Bull., Kansas Ornith. Soc., 13:2-6), the listing of two Yellow-headed Blackbirds for Clay County should read two Red-winged Blackbirds.—TED R. ANDERSON.

On page 281 of the published hearings on appropriations requested by the U.S. Fish and Wildlife Service for 1963 (No. 79207 U.S. Govt. Printing Office, 1962) an increase of \$190,000.00 is requested in funds for bird control. The total amount requested for this purpose is \$360,000.00. According to an official of the U.S. Fish and Wildlife Service, one aspect of the proposed work "is the attempt to find lethal . . . chemicals. . . . There is one that . . . we will be field testing this winter. We are working also on the repellants. . . . We also have research underway to develop chemosterilants to cut down on the number of birds through birth control . . . in Arkansas . . . we are attempting to test out the possibility of luring the blackbirds out of the ricefields by the planting of trap crops which we will then treat with poisons and instead of birds feeding on the rice they will be drawn to these poisoned areas and be eliminated that way."

Killing animals at public expense, even birds that are disliked by some minority group, can develop into big business for expansion-minded, narrowly-trained bureaucrats unless biologists who are mindful of the public interest express themselves. Some persons will recollect the attempt 30 years ago by the same bureau to initiate a large-scale "control program" against birds. One result was an editorial containing the phrase, "It's Alive, damn it—kill it," (by the late Professor J. Grinnell, *Condor*, vol. 34, pages 54-55, January, 1932) that placed the matter in clear perspective. Thereupon the Bureau turned its attention to other matters. That editorial, if necessary, can be reprinted in the present connection because essentially the same considerations apply today.

Anyone wishing to comment on the request for \$360,000.00 to kill birds can logically address the Hon. Clarence Cannon, Chairman, Committee on Appropriations, House Office Building, Washington 25, D. C., since the request for funds was made to his Committee.

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