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A COMPARISON OF MID-WINTER BIRD CENSUS METHODS IN SOUTHEASTERN KANSAS

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The objective methods developed recently by the U.S. Bureau of Sport Fisheries and Wildlife (BSFW) for its annual Breeding Bird Survey have stimulated speculation as to their applicability for a mid-winter bird census to supplement the uncertain qualitative and quantitative aspects of the annual National Audubon Society (NAS) mid-winter census.

In December 1969 I conducted a "standard" Audubon census (NAS) near Pittsburg, an area censused in this fashion annually for many years. In addition, during the same time period, I conducted two surveys using BSFW routes and survey methods. Although the two census methods cannot be compared directly an analysis of the results is both interesting and instructive. Table 1 presents the numerical data from the three December censuses (2 BSFW, 1 NAS) and the June 1969 Breeding Bird Survey data from the same two BSFW routes. All five censuses are the observations of a single observer thereby eliminating potential variability induced by several observers.

CENSUS AREAS AND ROUTES

Pittsburg (NAS): 24 December 1969. Observation time 8 hours, between 0800 and 1700 hours. For NAS counts the Pittsburg area is defined by a circle with a radius of 7½ miles, centered at Pittsburg State College (37° 23' N and 094° 41' W). Only that part of the Pittsburg count made by the writer, working alone, is included—about four miles on foot along West and Center Cow Creeks to the southwest of Pittsburg, and 12 miles by car and four miles on foot along East Cow Creek to the southeast of Pittsburg. About 45% of this area is streamside woods (originally Oak-Hickory forest); about 50% fields and pastures, and 5% urban. The BSFW stratum category (Type 33) for the area is tall grass prairie, now nearly completely converted to agriculture.

Other data were: soil nearly dry; streams low and open; ponds nearly full and covered by thin ice; ground bare of snow; temperature 28 to 36° F; wind NE at 1 to 6 mph; sky overcast; light sleet during morning and a light rain in late afternoon totalled .07 inch precipitation.

Melrose (Kansas Route 001) (BSFW, winter): 30 December 1969. Observation time 0712 to 1126 hours. This route starts at 37° 03' N, 094° 59' W, two miles west of the community of Melrose, near the southwestern corner of Cherokee County and runs northward and slightly eastward a distance of 24½ miles to a point in southwestern Crawford County about seven miles west of the village of Cherokee. It is classified as stratum Type 33 and is mostly upland fields and pastures, with limited areas of strip-mined lands, and crossed by several small forest-bordered streams. The small village of Hallowell is located along the route.

Other data were: soil frozen; some areas covered by thin snow layer; streams low and open; ponds nearly full and mostly covered by thin ice; temperature 24 to 25° F; wind NE at 6 to 12 mph; sky overcast, developing light snow during the morning.

TABLE I. DATA FROM FIVE BIRD CENSUSES CONDUCTED IN SOUTHEASTERN KANSAS DURING 1969.

Species	Number of Individuals				
	NAS† Pittsburg 24 Dec.	BSFW Melrose 30 Dec.	BSFW Galesburg 1 Jan. (70)	BSFW Melrose 3 June	BSFW Galesburg 5 June
Green Heron	—	—	—	4	2
Pintail	29	—	—	—	—
Mississippi Kite	1*	—	—	—	—
Red-tailed Hawk	4	8	4	—	—
Marsh Hawk	—	7	6	—	1
Sparrow Hawk	1	—	3	—	—
Bobwhite	15	—	12	36	61
Killdeer	—	—	—	5	10
Upland Plover	—	—	—	—	1
Rock Dove	4	1	—	4	1
Mourning Dove	7	—	6	25	46
Yellow-billed Cuckoo	—	—	—	11	12
Black-billed Cuckoo	—	—	—	1	—
Horned Owl	—	—	1	1	—
Barred Owl	4	—	—	1	—
Common Nighthawk	—	—	—	1	4
Chimney Swift	—	—	—	2	5
Belted Kingfisher	1	1	—	—	—
Yellow-shafted Flicker	14	6	10	2	3
Red-bellied Woodpecker	12	11	4	7	8
Red-headed Woodpecker	34	2	—	1	4
Downy Woodpecker	11	—	2	—	2
Eastern Kingbird	—	—	—	8	11
Western Kingbird	—	—	—	—	2
Scissor-tailed Flycatcher	—	—	—	1	8
Great Crested Flycatcher	—	—	—	7	8
Eastern Phoebe	—	—	—	2	1
Eastern Wood Pewee	—	—	—	5	1
Horned Lark	7	117	9	1	2
Barn Swallow	—	—	—	4	17
Purple Martin	—	—	—	1	1
Blue Jay	45	11	1	2	11
Common Crow	38	43	49	35	37
Carolina Chickadee	24	—	—	—	—
Tufted Titmouse	23	—	—	13	9
Brown Creeper	2	—	—	—	—
Carolina Wren	7	1	1	4	1
Mockingbird	4	2	2	37	60
Brown Thrasher	—	—	—	1	4
Robin	3	8	59	12	9
Eastern Bluebird	3	—	—	—	1
Golden-crowned Kinglet	1	—	—	—	—
Ruby-crowned Kinglet	2	—	—	—	—
Loggerhead Shrike	—	1	1	5	7
Starling	994	6	388	5	18
Bell's Vireo	—	—	—	1	1
Red-eyed Vireo	—	—	—	1	—
Warbling Vireo	—	—	—	1	—
Yellowthroat	—	—	—	8	4
Yellow-breasted Chat	—	—	—	2	—
House Sparrow	9	37	146	51	66
Eastern Meadowlark	34	157	126	57	112
Redwing	4,132	16,592	459	71	53
Orchard Oriole	—	—	—	9	8
Baltimore Oriole	—	—	—	1	5
Common Grackle	207	2	—	10	57
Brown-headed Cowbird	—	—	—	15	13
Cardinal	93	8	15	67	61
Indigo Bunting	—	—	—	16	4
Dickcissel	—	—	—	119	99
American Goldfinch	12	83	97	3	1
Lark Sparrow	—	—	—	3	1
Slate-colored Junco	104	16	20	—	—
Tree Sparrow	31	—	6	—	—
Field Sparrow	—	—	—	12	2
Harris' Sparrow	43	—	12	—	—
White-crowned Sparrow	2	1	—	—	—
White-throated Sparrow	34	—	—	—	—
Fox Sparrow	2	—	—	—	—
Song Sparrow	5	2	—	—	—
Total Species**	39	24	25	49	48
Total Individuals	5,998	17,123	1,439	691	855

* Not verified.

** Total of 70 species recorded from all five routes.

† Only that part of Pittsburg count made by author.

Galesburg (Kansas Route 002) (*BSFW, winter*): 1 January 1970. Observation time 0715 to 1120 hours. This route starts at 37° 36' N, 095° 17' W, two miles west and three miles north of the village of Galesburg, in central Neosho County and runs southward and slightly westward a distance of 24½ miles to a point in central Labette County about three miles southwest of the town of Altamont. This route is classified as stratum Type 33 and entirely traverses upland fields and pastures, interrupted near its center where it bypasses the two mile long Lake Parsons reservoir.

Other data were: soil frozen; no snow cover at the north end of route to about one inch of snow at south end; lake and ponds moderately full and frozen; temperature 22 to 28° F; wind SW at 2 to 5 mph; sky overcast; light fog at the start, forming a heavy rime along the entire route.

Melrose (*BSFW, summer*): 3 June 1969. Observation time 0526 to 0925 hours. Weather data: temperature 49 to 58° F; wind SW at 0 to 4 mph; sky clear, becoming broken with scattered showers at end of route.

Galesburg (*BSFW, summer*): 5 June 1969. Observation time 0528 to 0928 hours. Weather data: temperature 60 to 65° F; wind SW at 0 to 12 mph; sky with scattered clouds, becoming clear.

CENSUS METHODS

Condensed versions of census "rules" are presented here. For details see Robbins and Van Velzen (1967) and Anonymous (1966). The philosophies of the Audubon census and the BSFW Breeding Bird Survey contrast. For the Audubon census, the observer "beats the birds out of the bushes," counting everything he can find within his area, and seeking the rarest species and the largest possible numbers of individuals. There is a distinct premium on the amount of energy used, the ability to locate birds and speed of recognition of the species flushed. For the BSFW Breeding Bird Survey, the observer occupies a passive role counting those birds which "come to see the observer," i.e., those seen or heard by him at his observation station.

In the Audubon census, the coverage of the area circle should be as complete as the number of observers allows and preferably uses a large number of observers divided into several small groups, scattered to prevent duplicate observations. A minimum of five observers and eight hours of elapsed observation time are requested on one date within a 13 or 14-day time period set each winter by the Audubon Society (20 December 1969 to 1 January 1970 in 1969). The only qualifications set for the observers are those determined by the groups themselves, but most group leaders and many participating members are competent and reliable. Locations of census areas are left to the convenience of the groups concerned, except that areas may not overlap and older groups (in terms of previous censuses) have priority. Successive annual repetition of censuses for a given area is encouraged, but is not required.

Locations of BSFW Breeding Bird Surveys (the Audubon Society also conducts Breeding Bird Censuses) are determined by a "randomized grid" consisting of lines of latitude and longitude, with the actual locations within each grid determined by random numbers. Each census route consists of 50 roadside stations located one-half mile apart with road forks arbitrarily selected by alternately turning right (first) then left to continue in so far as possible the original direction of the census route. The direction of the census (north, east, south, or west) is also determined randomly. Only observers of known competence are selected and only one observer may census a route (although he may be accompanied by a technical assistant and recorder).

Each route is started exactly one-half hour before sunrise, and each station is censused exactly three minutes, noting only those birds actually seen or heard at the station during that period. Neither birds seen or heard at the station before or following the three minute interval nor any birds seen between stations are counted. Stations or routes may not be changed to include choice observation areas, nor to avoid known barren or sterile localities. Each census consists *solely* of those birds noted by a single observer at 50 predetermined stations over a total of exactly 150 minutes of observation time.

DISCUSSION

The two summer and two winter censuses for the Melrose and Galesburg routes (BSFW) were identical as to observer, location and time relative to sunrise. The Pittsburg Audubon census had the same observer, but otherwise is comparable only as to season and section of the state involved. The following numbered items refer to Table 1.

1. The NAS census locates many more species of birds than does a BSFW route census for a comparable date (here 39 versus 24 (Melrose) and 25 (Galesburg) species respectively). This is due to both the greater length of observation time involved (8 hours on NAS versus 2½ hours on each BSFW route) and to the methods employed.

2. The number of species present is much less (on identical routes) during winter than during summer—here 24 (Melrose) and 25 (Galesburg) for the winter as compared to 49 and 48 respectively for summer.

3. The flocking habit of many species during the winter season produces census totals which are much more erratic than those for the breeding season, depending upon whether or not a winter flock was encountered during a particular census. This is particularly evident for such species as the Redwing, Starling, Eastern Meadowlark, Horned Lark and American Goldfinch and to a lesser extent for the House Sparrow, Robin, Cardinal and Common Crow.

4. The BSFW census may also be used to indicate, in a general way, the degree of flocking of certain species during the winter months. Table 2 presents, for selected species, the total numbers recorded on BSFW routes (the two for each season are combined) and the number of stations on which each was recorded.

In this analysis, it is the approximate frequency per station which should be compared, not the total numbers recorded. Actual frequencies are not presented here because the presence of single birds at some stations greatly influence "flock size." For example, only single Redwings were recorded at four of the 23 winter stations and four other stations had less than ten birds.

Other winter species not included in this table, such as the woodpeckers and Blue Jay, show little tendency to flock and most winter sparrows and parids commonly occur in small (often mixed) flocks.

5. The Audubon census favors streamside species while the route census favors open field and pasture species. The Audubon census provides much higher totals for woodpeckers, Blue Jay, chickadee, titmouse, Carolina Wren, Cardinal and winter sparrows. BSFW censuses show much higher totals for the hawks, Horned Lark, House Sparrow (around farm buildings), meadowlark, goldfinch, and perhaps crow and Redwing. Species forming the largest flocks, such as the Redwing and Starling, are so conspicuous and erratic in their distribution that their totals on the censuses are probably more a matter of chance observation than the census technique used. The same statement probably applies also to the Pintail, Bobwhite, Mourning Dove, Robin and grackle.

6. Fields and pastures cover about 98% of southeastern Kansas and wooded areas not over 1%. Since the Audubon census included nearly equal time for forest (45%) and open areas (50%), a statistical treatment would be required to make the totals for the entire open area comparable to the totals recorded from the forest areas. While other censusing factors might modify such statistical treatment substantially, it is still obvious that Audubon census totals are very strongly skewed in favor of the forest (streamside) species.

7. While the winter and/or summer status of various species are clearly indicated in Table 1, the censuses (especially the BSFW route censuses) are not sufficiently complete to make these seasonal differences fully reliable. For example, two regular summer species—the Brown Thrasher and Field Sparrow—are occasionally recorded in this area during winter but were not observed on the 1969 winter censuses. Similarly, the Red-tailed Hawk, Sparrow Hawk, and Carolina Chickadee regularly occur during

TABLE 2. NUMBERS AND FREQUENCY OF OBSERVATION OF SELECTED SPECIES OBSERVED ON BSWF CENSUS ROUTES, SOUTHEASTERN KANSAS, 1969.

Species	Combined Summer Censuses (Two routes — 100 stations)		Combined Winter Censuses (Two routes — 100 stations)	
	Total Individuals	Number of Stations at which observed	Total Individuals	Number of Stations at which observed
Bobwhite	97	57	12	1
Horned Lark	3	2	126	8
Robin	21	12	67	10
Starling	23	10	394	6
House Sparrow	117	17	183	12
Eastern Meadowlark	169	76	283	22
Redwing	124	55	17,051	23
American Goldfinch	4	3	180	9

the summer but were not recorded on the 1969 summer censuses. The Bobwhite, which appears in Table 1 to be much more common in the June breeding season, is actually more abundant during winter but the mating calls in June make it highly conspicuous (auditorily) in contrast to the relative silence of winter coveys. To some extent, any census is a measure of avian conspicuousness rather than a measure of actual avian presence.

8. For a number of species present during both winter and summer seasons, the numbers recorded are higher for the winter census than for the summer. While this would be expected (but does not show) for a resident species such as the Bobwhite, in most cases it probably represents winter concentrations of migrant individuals from farther north. Probable examples are hawks, woodpeckers, Horned Lark, Blue Jay, Crow, Eastern Meadowlark, Redwing, grackle and goldfinch and possibly also the chickadee, titmouse, Robin, Starling and Cardinal.

9. Other species show a reverse pattern in that southward movement out of the area exceeds movement into the area from farther north. Probable examples are the Mourning Dove and Mockingbird.

10. The bird populations (numbers of individuals) in southeastern Kansas are apparently several times as great in late December as in early June, with the Redwing clearly the most common winter species. This reflects the extensive amounts of grain sorghums (milo, etc.) grown as stock feed and allowed to stand in the fields during the winter. However, even without Redwings, the wintering bird population still exceeds the breeding bird totals for June. This might not be true in August after fledging of young is complete.

SUMMARY

Five bird censuses conducted by a single observer in southeastern Kansas are compared. These included a standard Audubon Society mid-winter count and four censuses conducted along two BSWF Breeding Bird Survey routes—two during June and two during mid-winter.

The contrasting census methods used for the Audubon Society counts and the BSWF surveys reflect the differing objectives of the two censuses. Each method reveals data not shown by the other method and hence each contributes to our knowledge of avian populations.

For winter censuses, the Audubon count reveals many more species than does the BSWF route census because of the more intensive coverage of the forested (stream-side) areas where the majority of species of wintering small birds concentrate. In contrast, although the number of open country species is smaller during the winter, the number of individuals is high. Since the Audubon count emphasizes numbers of

species, it tends to neglect the individual numbers of open area birds, and the population abundance totals are strongly skewed in favor of the forest species, or presumably any species occupying a more or less local specialized habitat. Since an estimated 98% of the land area of southeastern Kansas is occupied by fields and pastures, the route census which randomly samples the total land area reflects much more accurately the relative total winter bird population of this area.

Total numbers of flocking species on winter censuses tend to be highly erratic, since the presence or absence of a single large flock on the census will cause these totals to fluctuate widely. Such data must be carefully interpreted to reflect the limited scope of the censuses and repetitive counts are needed for more uniform results. The degree of flocking of various winter species can, to a limited extent, be measured quantitatively by the BSWF route census.

Both census methods show the Redwing to be much the most abundant species in southeastern Kansas during the winter, with the Starling far behind in second place. Other abundant species are Eastern Meadowlark, Common Grackle, House Sparrow, Horned Lark, American Goldfinch and Slate-colored Junco. All except perhaps the House Sparrow and junco are field species.

The BSWF route censuses make possible a direct comparison of winter and breeding bird species over exactly the same routes. In this study the number of breeding bird species was just twice that of the wintering species. The number of individuals, however, was several times greater during the winter than in the breeding season.

Seasonal censuses indicate the status of summer residents and winter residents. Some, such as the Bobwhite, are clearly permanent residents. Others occur as both wintering and breeding species but different individuals occur at different seasons. Seasonal differences in populations indicate migratory patterns. During the winter such species as the Redwing, Eastern Meadowlark and Horned Lark increase in numbers while others such as the Mourning Dove and Mockingbird decrease in numbers.

Although Bobwhite are more abundant in late December than in early June the census results would indicate that the reverse was true, demonstrating that to a great extent censuses measure avian conspicuousness rather than avian abundance.

A comparison of summer and winter routes makes it clearly evident that the total numbers of individuals are several times greater during the winter than early in the breeding season, in early June.

LITERATURE CITED

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NOTES

A Summer Record of the Red Crossbill in Meade County, Kansas, with Comments on Variation in Red Crossbills.—On 1 August 1969 I shot a Red Crossbill, *Loxia curvirostra*, from a flock of three olive-green crossbills that had flown together from the open prairie and alighted in a small cottonwood tree near the abandoned Civilian Conservation Corps barracks northwest of Lake Larrabee, in Meade State Park, Meade County, Kansas. The gonads of the specimen (K.U. 63871) were destroyed by shot, but the completely ossified skull and lack of red in the plumage identify it as an adult female. The specimen was fat, weighed 31.4 grams, and had wing chord, culmen, and bill depth measurements of 82.7 mm, 16.0 mm and 8.4 mm. This is the first summer record of the Red Crossbill for Kansas. The only breeding record of the Red Crossbill for Kansas (Johnston, "The Breeding Birds of Kansas," *Univ. Kansas Publ., Mus. Nat. Hist.*, 12, No. 14, 1964: 648) is provided by a clutch completed in March.

TABLE 1. MENSURABLE CHARACTERISTICS OF THREE SUBSPECIES OF *Loxia curvirostra* (ADAPTED FROM GRISCOM, 1937).

Subspecies	Wing chord	Bill depth	Culmen length
<i>sitkensis</i>	81.0–88.5 mm	8.0–9.0 mm	13.0–15.0 mm
<i>minor</i>	86.5–91.0 mm	9.0–10.0 mm	15.5–17.5 mm
<i>bendirei</i>	86.5–94.0 mm	9.0–10.5 mm	15.0–18.5 mm

According to Griscom's "A Monographic Study of the Red Crossbill," (*Proc. Boston Soc. Nat. Hist.*, 41, 1937; see accounts of *L. c. minor* (= *sitkensis*), *neogaea* (= *minor*), and *bendirei*) the wing chord and bill depth measurements of my specimen correspond to those of *L. c. sitkensis*, the subspecies of the Pacific Northwest. The culmen measurement, however, is too large for that subspecies and falls within the ranges of *minor*, the common breeding Red Crossbill of eastern Canada and the northeastern United States, and *bendirei*, the subspecies of south-central British Columbia and parts of the northwestern United States (see Table 1). Griscom's measurement classes (*op. cit.*: 138–139) were constructed from male birds, but he apparently considered them applicable to females.

Of 87 female Crossbill specimens in the collection of the Museum of Natural History, University of Kansas, 6 had been assigned to *sitkensis*, 11 to *minor*, and 13 had been relabeled as "nearest *minor*" (after having previously been labeled *pusilla* or *bendirei*, or both in that order). Only one specimen (K.U. 10, labeled *minor*, collected in Maine) was taken in the breeding range of any of the subspecies concerned; and all but two were taken in the months November through March.

Measurements of wing chord, bill depth, and culmen were made on 29 specimens labeled *minor* or *sitkensis* (one specimen was excluded because the tip of its rhinotrochlea was missing), and an attempt was made to identify each to subspecies using Griscom's (*op. cit.*) measurement classes (see Table 2). None of the 29 specimens showed striped juvenile feathers or wing coverts with buff tips, as would be expected of immature birds (Witherby, *et al.*, *The Handbook of British Birds*, I, 1938: 97). Of all specimens measured, one (K.U. 10) could be assigned to *minor* on the basis of all three characters, none of which was unequivocal. One specimen could be assigned to *bendirei*, but again no measurement was unequivocal. A third specimen could be

TABLE 2. POSSIBLE SUBSPECIES ASSIGNMENTS OF 29 FEMALE *L. curvirostra* USING MENSURAL LIMITS PROPOSED BY GRISCOM. POSSIBLE SUBSPECIFIC AFFINITIES SUGGESTED BY THE INDIVIDUAL MENSURAL CHARACTERS ARE INDICATED AS FOLLOWS: B—*L. c. bendirei*; M—*minor*; P—*pusilla*; S—*sitkensis*.

	Wing chord	Bill depth	Culmen	Specimens	Possible assignment
	S	S	S	4	<i>sitkensis</i> unequiv.
	S-M	M-B	M-B	1	<i>minor</i> equiv.
	S-M-B	S-M-B	B-P	1	<i>bendirei</i> equiv.
	S-M-B	M-B	M-B	1	<i>bendirei-minor</i>
CORRESPOND TO	S	S	B	1	none
	S	S	M-B	10	none
	S	M-B	S	1	none
	S	M-B	B-P	1	none
	S	M-B	M-B	2	none
	S	S	M-B-P	2	none
	S	M-B	M-B-P	3	none
	S-M-B	S	M-B-P	1	none
	S	S-M-B	M-B	1	none

T = 29

assigned to either *minor* or *bendirei*. Four specimens could be assigned unequivocally to *sitkensis*. The remaining 22 specimens (76% of the sample) could not be assigned to any one of the three subspecies on the basis of the three mensurable characteristics used by Griscom (*op. cit.*). Such variation seems to have been encountered frequently, among both vagrant and breeding birds, when large series of specimens have been examined (see Tordoff, *Condor*, 54, 1952: 200-203; Selander, *Condor*, 55, 1953: 158-160; and Dickerman, *Wilson Bull.*, 69, 1957: 367-368); and clearly demonstrates the complications of trying to assign Red Crossbill specimens to subspecies. It appears to be the rule, rather than the exception, to find one or two characters indicating subspecific identity contradicted or unsubstantiated by the rest. It is obvious, as implied by Jollie (*Condor*, 55, 1953: 193-197), that Griscom (*op. cit.*) did not adequately analyze size and plumage variation. There is need for a much-expanded study of variation of many more characters than were used by Griscom (*op. cit.*). A profitable approach might include investigation of variation within and among both breeding and non-breeding populations. The methods of numerical taxonomy could be very useful here in describing the phenetics of skin and skeletal characters. A great deal of additional collecting would be necessary, and a premium would properly be placed on attempts to investigate the amount and patterns of gene flow.—JAMES W. PARKER, *Museum of Natural History, University of Kansas, Lawrence, Kansas 66044.*

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