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JORNADA BIRD CENSUSES, 1972

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ABSTRACT

Jornada grassland birds have been censused since 1971 by two methods: (1) intensive counts on two replicate plots (1600' × 2400'), at monthly intervals in 1971, at weekly intervals in 1972, and (2) roadside counts repeated twice each month, usually on consecutive days. In both 1971 and 1972 low numbers of breeding insectivores, Mourning Doves, and raptors have been replaced in the fall by large numbers of migrant and wintering Mourning Doves, raptors, Lark Buntings, Horned Larks, and various sparrows. The result has been a reversal of the usual situation in temperate grasslands of much higher numbers in the breeding season than in fall and winter. More precipitation occurred in 1972 than in 1971, but bird densities increased less than was expected. Parallels between temporal changes in insect abundance and bird densities indicate a probable dependence of the latter on the former.

INTRODUCTION AND METHODS

Birds of the Jornada IBP Grassland site were first censused in May 1970 by Wiens and his assistant, who used a standard territorial-flush technique on two small plots and an extensive roadside count method on a 15-mile route (Wiens 1971*a*). In the winter of 1970-1971 it was decided to continue the roadside counts (using the same protocol and route), but to conduct them in the nonbreeding as well as breeding seasons and to establish two larger (1600' × 2400') replicate plots on which intensive censuses employing a variety of techniques would be attempted (French 1971). This modified program was begun in spring 1971 and continued through 1972. Some additional modifications or procedures were made. Roadside counts were made on a monthly schedule (with one omission) since May 1971. Intensive censusing of the two replicate plots was done at approximately monthly intervals in 1971, but in 1972 we attempted to adhere to a weekly schedule. The backlog of results of these plot censuses is presently sufficient to apply the method of Emlen (1971) to their analysis, a goal agreed upon early in 1971 but not reached in that year. A computer program to calculate Emlen Coefficients of Detection and to modify the plot counts accordingly is in final stages of perfection. The resulting modified plot results will presumably be more reliable as density estimates, but we must rely for the present upon uncorrected figures and upon roadside counts.

Results and methods of the efforts of 1971 have been described and discussed previously (Raitt 1972). In the present one we will treat the combined results of 1971 and 1972, adding interpretations for 1971 data in the light of the longer series of censuses. Details of methods given in previous reports (Wiens 1971*a*, Raitt 1972) will not be repeated.

RESULTS

The plan of this section is to present results briefly, first those of the roadside counts, then those of the plot censuses. All discussion of these results will be given in combined form in the following section.

Roadside Counts

Combined results for 1971 to 1972 are given in Table 1. Figures for each month are the sum of counts for each of the 2 days of each monthly census. Table 2 presents these data in a more concise form and also includes monthly figures on biomass and species diversity. Fig. 1, 2, and 3 show some of these same data in graphical form.

Plot Censuses

Tables 3 and 4 and Fig. 4 and 5 include the results of plot census on a monthly basis. Results for the two plots were similar and the data are combined. For months in which more than one census was conducted the figures given are means.

DISCUSSION

Seasonal Changes

One of the most striking patterns exhibited by the data, from both types of census, is the markedly higher overall density in nonbreeding months than in the breeding season. The rows of total numbers and biomass in Tables 2 and 3 and the graph for total numbers of birds of Fig. 3 clearly illustrate this pattern. In both 1971 and 1972 the low densities of the breeding months of May, June, and July were succeeded by increasingly greater densities during autumn. Data for the winter of 1972 to 1973 are not yet available, but in 1971 to 1972 the upward trend continued into

Table 1. Numbers of birds recorded on monthly roadside counts (totals for each 2-day count).

	1971							
Species	M	J	J	A	S	O	N	D
AMBI	12	1	2	0	2	5	15	1
LALU	22	10	7	25	8	16	17	12
MYCI	0	5	0	0	0	0	0	0
CASQ	2	3	16	3	0	21	0	0
TYVE	13	14	1	5	2	0	0	0
CABR	3	5	3	14	4	4	0	0
BUSW	1	5	3	4	2	2	4	2
SPBR	0	0	1	0	25	66	54	7
CAME	0	0	3	87	32	429	177	1150
FASP	0	0	0	0	5	4	9	0
PIFU	0	0	0	0	0	0	0	0
ERAL	0	0	0	0	0	0	0	373
AMBE	0	0	0	0	0	66	169	161
STNE	0	0	1	0	0	32	0	0
CICY	0	0	0	0	0	5	0	2
ORMO	0	0	0	0	2	0	1	0
NUAM	0	0	0	0	0	0	0	0
PEPY	0	0	2	0	0	0	0	0
MIPO	0	3	1	0	0	0	0	0
ZEMA	2	0	7	2	0	0	0	0
HIRU	0	0	0	0	0	0	0	0
BURE	0	0	0	0	0	1	0	0
TRSP	0	0	0	0	0	0	0	0
CHAC	0	2	0	0	0	0	0	0
XAXA	0	0	0	1	0	0	0	0
POGR	0	0	0	0	0	0	0	0
CHCH	0	0	0	0	0	0	4	0
SPPA	0	0	0	0	0	0	0	0
SPCU	0	0	0	0	0	0	0	0
ZOLE	0	0	0	0	0	0	0	0
CAMX	0	0	0	0	0	3	0	150
AQCH	1	1	0	1	1	0	4	1
COCR	1	0	0	0	0	0	0	0
ICPA	2	6	0	0	0	0	0	0
BALO	0	0	0	1	0	0	0	0
MOAT	0	0	0	20	0	0	0	0
SPAM	0	0	0	1	0	0	0	0
CHGR	0	0	0	0	2	5	0	0
STMA	0	0	0	0	0	1	7	0
BUJA	0	0	0	0	0	0	0	5
FAME	0	0	0	0	0	0	0	0
ANSP	0	0	0	0	0	0	0	0
SASA	0	0	0	0	0	0	0	0
SICU	0	0	0	0	0	0	0	0
DEAU	0	0	0	0	0	0	0	0
PILU	0	0	0	0	0	0	0	0
GECA	0	0	0	0	0	0	0	0
AICU	0	0	0	0	0	0	0	0
CAAU	0	0	0	0	0	0	0	0
EUFU	0	0	0	0	0	0	0	0
SAOB	0	0	0	0	0	0	0	0
APCO	0	0	0	0	0	0	0	0
MELI	0	0	0	0	0	0	0	0
RHMC	0	0	0	0	0	0	0	0
Total	59	55	47	164	85	660	461	1864

Table 1 (cont.).

Species	1972 J	F	M	A	M	J	J	S	O
AMBI	0	0	0	0	0	0	0	0	0
LALU	9	10	6	7	10	24	20	19	18
MYCI	0	0	0	0	1	3	0	0	0
CASQ	4	0	0	0	1	1	1	0	5
TYVE	0	0	0	0	14	10	25	4	0
CABR	0	2	0	0	3	8	5	9	3
BUSW	0	0	0	0	1	2	8	17	5
SPBR	50	8	24	32	0	0	0	121	193
CAME	49	300	2	14	1	0	11	882	900
FASP	1	0	0	3	0	0	1	6	1
PIFU	0	0	0	0	0	0	0	0	0
ERAL	359	187	0	0	0	0	0	7	0
AMBE	57	48	0	0	0	0	0	0	7
STNE	0	0	0	0	0	0	0	0	1
CICY	1	0	1	0	0	0	0	3	2
ORMO	0	0	2	14	1	0	0	0	0
NUAM	0	0	0	3	0	0	0	0	0
PEPY	0	0	0	5	0	0	0	0	0
MIPO	0	0	0	0	11	20	7	1	0
ZEMA	0	0	0	2	16	19	44	84	22
HIRU	0	0	0	0	0	0	0	0	0
BURE	0	0	0	0	0	0	0	0	0
TRSP	0	0	0	0	0	0	0	0	0
CHAC	0	0	0	0	0	0	0	0	0
XAXA	0	0	0	0	0	0	0	1	0
POGR	0	0	0	0	0	0	0	15	221
CHCH	0	0	0	0	0	0	0	1	0
SPPA	0	0	0	0	0	0	0	0	0
SPCU	0	0	0	0	0	0	0	0	0
ZOLE	0	0	0	0	0	0	0	0	5
CAMX	72	0	0	0	0	0	2	0	0
AQCH	1	1	3	0	0	0	0	1	0
COCR	0	0	0	0	0	0	0	0	0
ICPA	0	0	0	0	2	1	2	1	2
BALO	0	0	0	0	0	0	0	0	0
MOAT	0	0	0	0	2	0	0	0	0
SPAM	0	0	0	0	0	0	0	0	0
CHGR	0	0	0	0	0	0	9	3	0
STMA	0	0	0	0	0	0	0	0	0
BUJA	1	0	0	0	0	0	0	0	2
FAME	1	0	1	0	0	0	0	0	1
ANSP	1	0	0	0	0	0	0	0	0
SASA	1	1	0	0	0	0	0	3	0
SICU	0	17	0	0	0	0	0	0	0
DEAU	0	0	0	0	7	0	0	0	0
PILU	0	0	0	0	1	0	0	0	0
GECA	0	0	0	0	0	0	1	1	0
AICU	0	0	0	0	0	0	3	0	0
CAAU	0	0	0	0	0	0	0	2	0
EUFU	0	0	0	0	0	0	0	2	0
SAOB	0	0	0	0	0	0	0	1	0
APCO	0	0	0	0	0	0	0	8	1
MELI	0	0	0	0	0	0	0	0	1
RHMC	0	0	0	0	0	0	0	0	1
Total	617	574	39	80	71	88	139	1192	1391

Table 2. Monthly summaries of roadside counts (totals for each 2-day count).

	1971								1972										
	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N
Raptors	2	6	3	5	8	12	17	10	5	18	5	3	1	2	9	--	29	11	6
Quail and doves	4	3	23	5	0	21	0	0	14	0	0	2	17	20	45	--	84	27	64
Insecti-vores	40	45	15	44	16	53	25	12	10	13	8	26	50	66	59	--	38	24	43
Horned Lark	0	0	0	0	0	0	0	373	359	187	0	0	0	0	0	--	0	7	897
Lark Bunting	0	0	3	87	32	429	177	1150	49	300	2	14	1	0	11	--	882	900	294
Others	13	1	3	23	29	145	242	319	180	56	24	35	2	0	13	--	159	422	314
TOTAL	59	55	47	164	85	660	461	1864	617	574	39	80	71	88	139	--	1192	1391	1618
Biomass (kg)	8.5	11.8	7.9	15.3	9.1	32.3	34.5	55.7	25.4	22.5	15.1	3.6	5.1	7.4	17.1	--	73.1	53.9	
Species diversity	1.61	2.14	2.06	1.54	1.75	1.32	1.50	1.12	1.40	1.19	1.09	1.38	2.41	1.79	2.07	--	1.06	1.13	

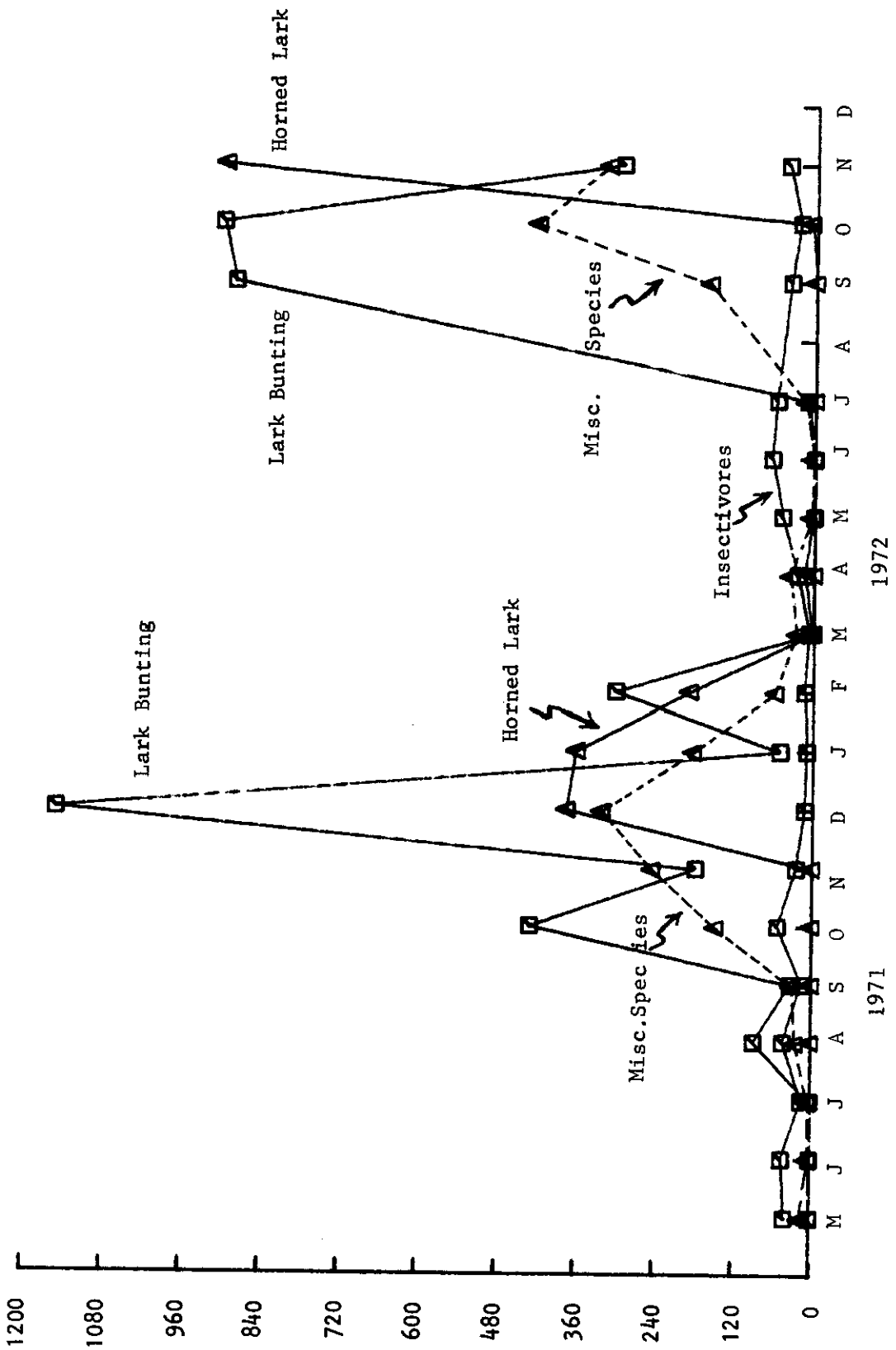

Fig. 1. Number of birds seen on roadside counts against date.

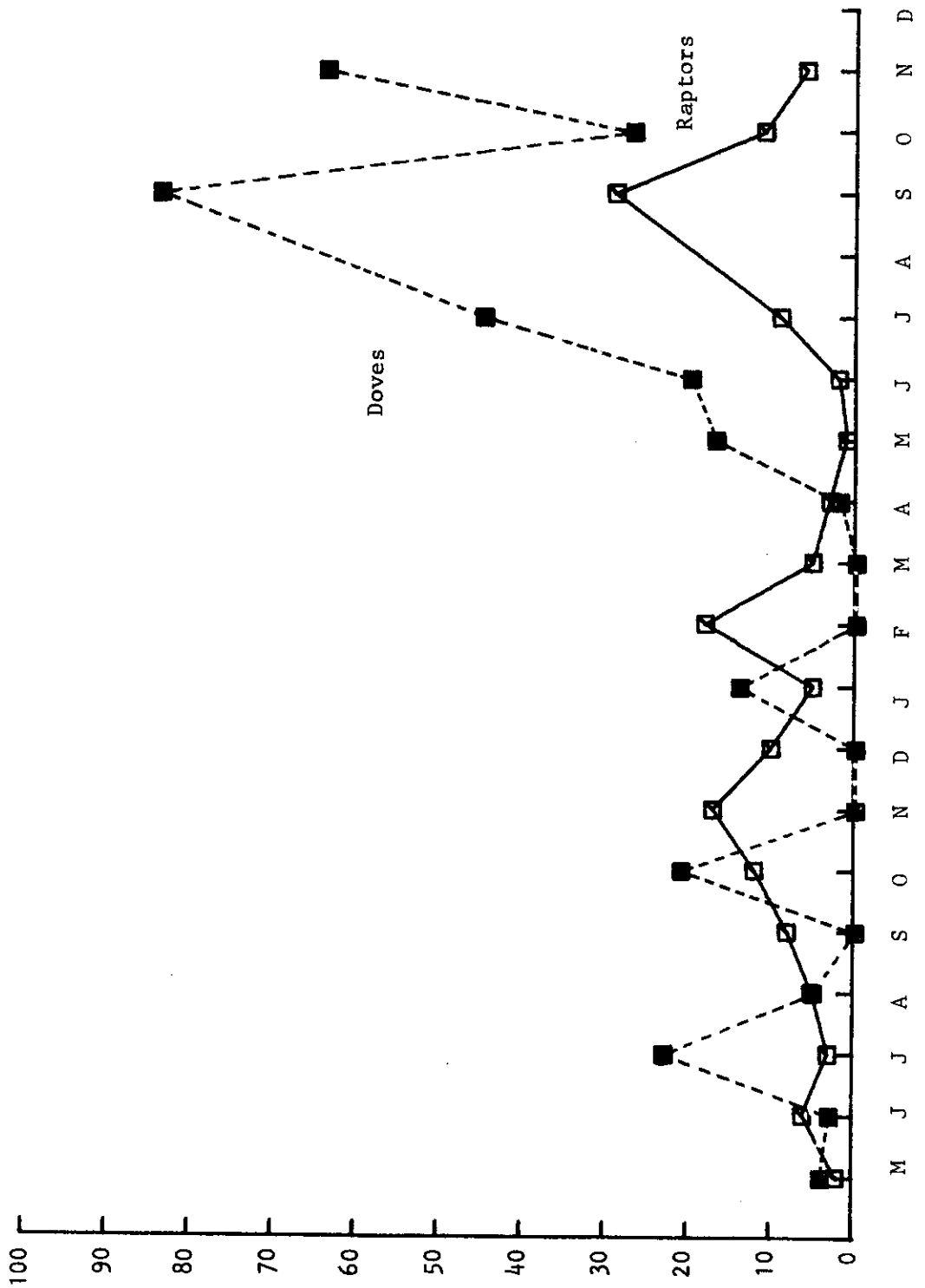

Fig. 2. Numbers of birds seen on roadside counts against date.

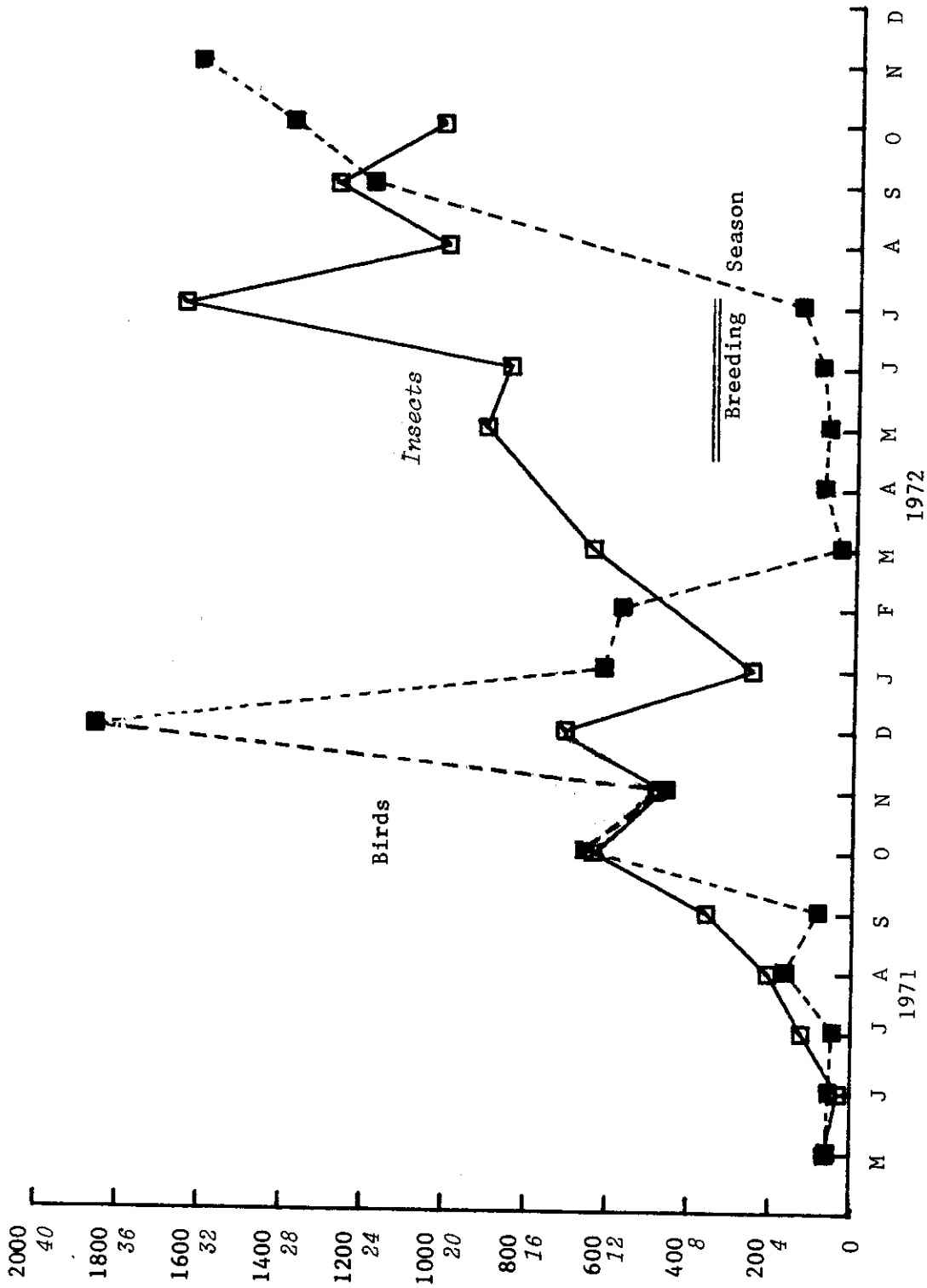

Fig. 3. Total numbers of birds seen on roadside counts and *numbers of insects/m^2 against data.*

Table 3. Monthly summaries of plot census (mean numbers per 100 ha).

	1971								1972								
	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
Raptors	0.0	0.0	0.7	--	1.4	2.2	1.3	--	--	0.7	2.8	1.4	0.3	1.4	0.0	0.0	2.8
Quail and doves	0.5	0.0	0.0	--	0.0	0.0	0.0	--	--	0.0	0.0	1.4	13.2	11.2	7.0	0.0	0.0
Insecti-vores	6.5	2.8	5.4	--	7.0	2.2	6.3	--	--	3.0	1.4	4.2	7.9	12.1	11.2	1.4	2.8
Horned Lark	0.0	0.0	0.0	--	0.0	0.3	5.2	--	--	132.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lark Bunting	0.0	0.0	0.0	--	117.9	6.4	19.8	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.6
Others	2.3	0.0	0.0	--	19.6	3.9	13.4	--	--	10.8	2.8	0.5	0.0	0.5	0.0	9.3	151.3
TOTAL	9.3	2.8	6.1	--	205.9	15.1	46.0	--	--	146.7	7.0	7.5	21.3	25.2	18.2	10.7	190.52
Biomass (g/ha)	4.08	1.23	9.29	--	72.3	14.2	14.69	--	--	44.5	28.97	6.93	21.51	32.74	13.18	1.73	33.37
Species diversity	1.47	0.69	1.50	--	0.55	1.62	1.50	--	--	0.42	1.05	1.60	1.35	1.62	1.48	0.84	1.64

Table 4. Monthly means of plot census results for 1971, 1972.

	1971							
Species	M	J	J	A	S	O	N	D
AMBI	2.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LALU	3.27	1.40	2.33	0.00	7.00	2.24	1.84	0.00
MYCI	1.87	0.00	0.70	0.00	0.00	0.00	0.00	0.00
CASQ	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TYVE	0.00	0.00	1.17	0.00	0.00	0.00	0.00	0.00
CABR	0.00	1.40	1.17	0.00	0.00	0.00	0.90	0.00
BUSW	0.00	0.00	0.70	0.00	0.00	0.84	0.00	0.00
SPBR	0.00	0.00	0.00	0.00	16.81	3.08	14.21	0.00
CAME	0.00	0.00	0.00	0.00	177.92	6.44	19.79	0.00
FASP	0.00	0.00	0.00	0.00	0.00	1.40	1.34	0.00
PIFU	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00
ERAL	0.00	0.00	0.00	0.00	0.00	0.28	5.25	0.00
AMBE	0.00	0.00	0.00	0.00	0.00	0.00	0.88	0.00
STNE	0.00	0.00	0.00	0.00	0.00	0.00	1.31	0.00
CICY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ORMO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NUAM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PEPY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MIPO	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZEMA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HIRU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BURE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRSP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHAC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
XAXA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
POGR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHGH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SPPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SPCU	0.00	0.00	0.00	0.00	1.40	0.00	0.00	0.00
ZOLE	0.00	0.00	0.00	0.00	1.40	0.00	0.00	0.00
CAMX	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHGR	0.00	0.00	0.00	0.00	1.40	0.56	0.47	0.00
Totals	9.34	2.80	6.07	0.00	205.94	15.13	46.00	0.00

Table 4 (cont.).

	1972								
Species	J	F	M	A	M	J	J	A	S
AMBI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LALU	0.00	2.33	0.00	2.80	1.82	3.74	2.80	0.93	1.40
MYCI	0.00	0.00	0.00	0.00	0.56	0.00	0.00	0.00	0.00
CASQ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TYVE	0.00	0.00	0.00	0.00	1.59	4.20	4.20	0.00	0.00
CABR	0.00	0.00	0.00	0.00	1.40	0.93	1.40	0.47	0.00
BUSW	0.00	0.00	2.80	0.00	0.00	1.40	0.00	0.00	0.00
SPBR	0.00	0.00	2.80	0.00	0.00	0.00	0.00	7.94	16.81
CAME	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.41
FASP	0.00	0.00	0.00	1.40	0.00	0.00	0.00	0.00	1.40
PIFU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ERAL	0.00	132.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AMBE	0.00	10.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STNE	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CICY	0.00	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ORMO	0.00	0.35	1.40	0.00	0.00	0.00	0.00	0.00	0.00
NUAM	0.00	0.00	0.00	0.47	0.00	0.00	0.00	0.00	0.00
PEPY	0.00	0.00	0.00	0.93	0.00	0.00	0.00	0.00	0.00
MIPO	0.00	0.00	0.00	0.47	2.52	2.80	2.80	0.00	0.00
ZEMA	0.00	0.00	0.00	1.40	12.89	11.21	7.00	0.00	0.00
HIRU	0.00	0.00	0.00	0.00	0.28	0.00	0.00	1.40	1.40
BURE	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.00
TRSP	0.00	0.00	0.00	0.00	0.00	0.47	0.00	0.00	0.00
CHAC	0.00	0.00	0.00	0.00	0.00	0.47	0.00	0.00	0.00
XAXA	0.00	0.0C	0.00	0.00	0.00	0.00	0.00	0.00	21.01
POGR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.83
CHGH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.40
SPPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.60
SPCU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZOLE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAMX	0.00	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHGR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Totals	0.00	146.75	7.00	7.47	21.34	25.22	18.21	10.74	95.26

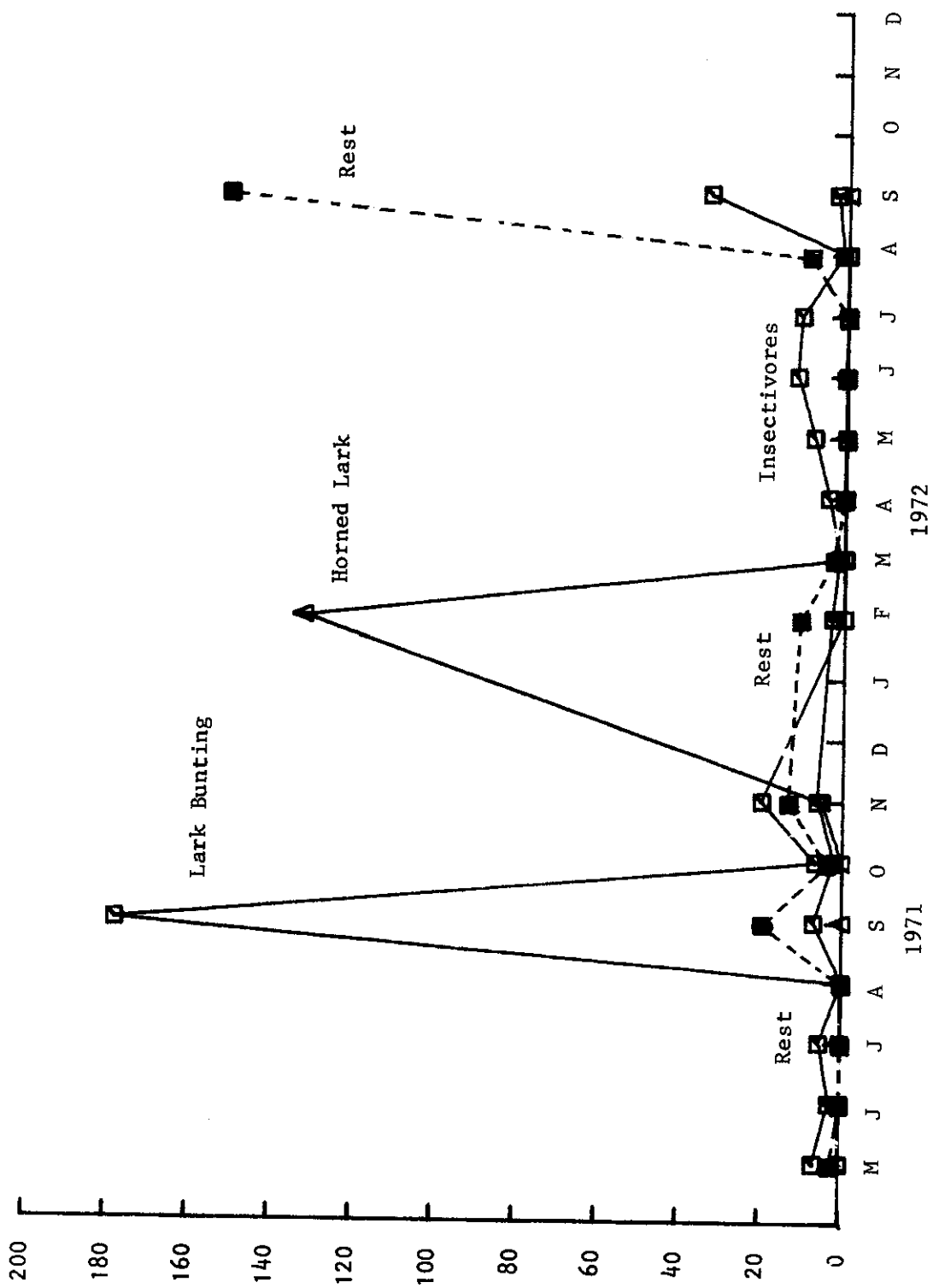

Fig. 4. Numbers of birds seen on plot censuses/100 ha against date.

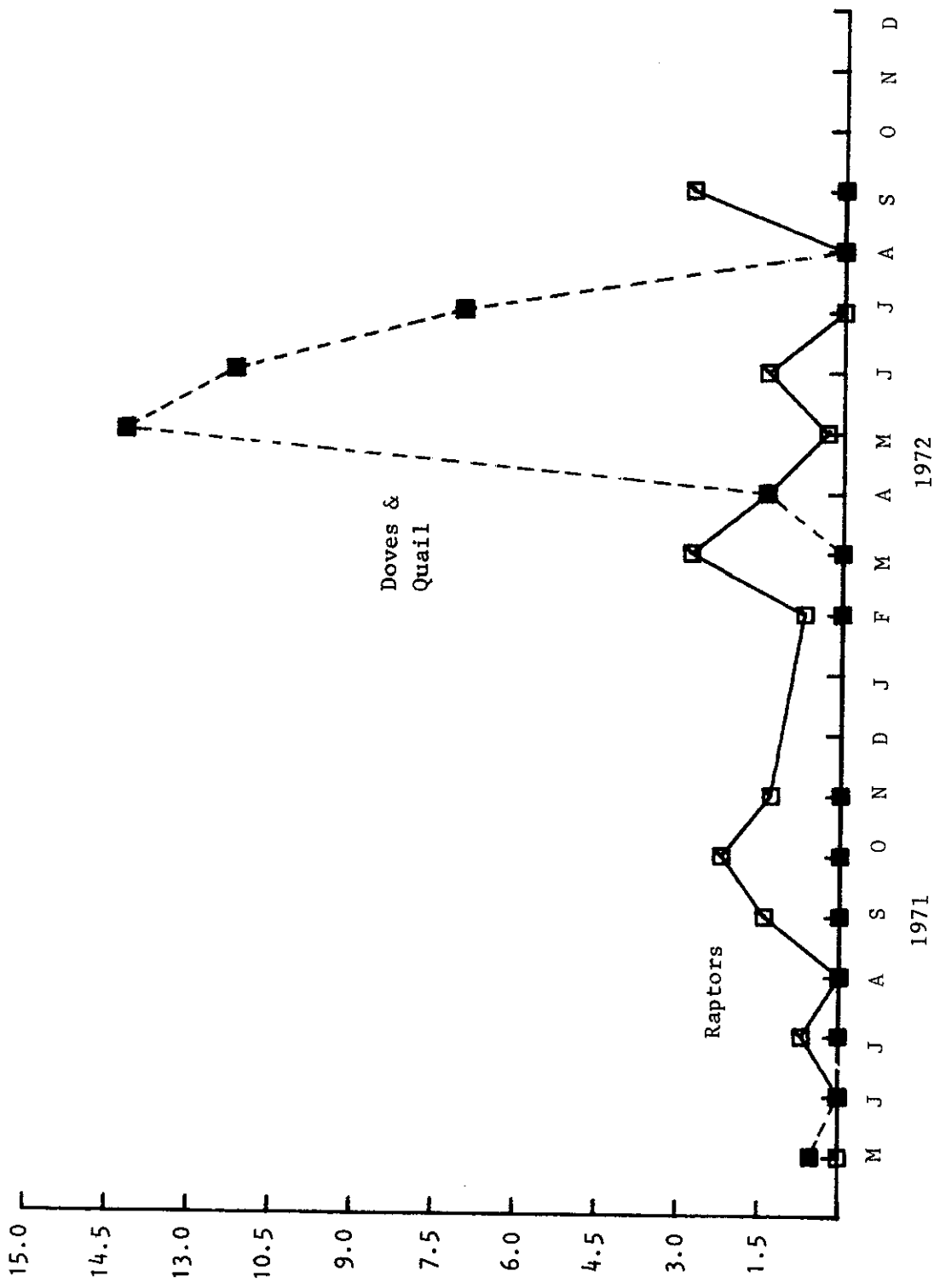

Fig. 5. Numbers of birds seen on plot censuses/100 ha against date.

December after which numbers and biomass declined gradually to the low breeding levels in May.

This pattern is almost exactly the converse of that given by Wiens (1971*b*:150) as the generalized pattern for migrant grassland bird species and is likewise markedly different from the pattern found on the Pawnee Site in Colorado (Ryder 1972, Fig. 5). The implications of this difference in seasonal relationships are probably quite important, but have not yet been fully explored. The usual basis for comparison of avian communities of different areas has been the breeding bird avifauna and its characteristics. The bird community of the Jornada desert grassland has been compared with those of the other grassland network sites on this basis (Wiens 1971*a*,*b*; Raitt 1972), and to have done so was both logical and justifiable. On the other hand, it is now apparent that the avian ecology on the Jornada must be judged, also, on a year-round basis and compared with that of other areas on this basis if the nature and magnitude of the role of birds in the desert grassland are to be fully understood on both local and biome-wide scales. We are not prepared to undertake such analyses at this time, but expect to make merely a beginning here which will be followed by a fuller analysis later in 1973.

We can, however, examine the seasonal pattern in some more detail by subdividing the birds into groups of similar trophic relationships and determining the seasonal changes in presence and abundance of each. Fig. 1 and 2 provide the most reliable and most graphical basis for this analysis. The breeding avifauna consists largely of three elements: (1) a group of insectivorous passerine species, most of which migrate to and from the area in the pattern common to that of birds in general in other North American grasslands, (2) Mourning Doves, which are largely spermophilous,

and (3) raptors, predominantly hawks. The breeding population of Mourning Doves is augmented by their progeny and, later in the season, by large numbers of migrants, which may (1972 to 1973) or may not (1971 to 1972) remain in large numbers throughout the winter (Fig. 2). Some breeding species of raptors depart in autumn; others remain to be joined by sizable numbers of winter visitors (Fig. 2). Wintering birds include the doves and raptors just mentioned and large numbers of two migrant passerines, Horned Larks and Lark Buntings (Fig. 1). These latter species are analyzed separately because each has unique ecological attributes and each is a dominant in its own right; however, both are flocking winter residents (Horned Larks breed in small numbers in the Jornada basin in localized tabosa playas), both are important breeding species in other grasslands (Wiens 1971*a*,*b*; Ryder 1972), and both are omnivorous, at least on a year-round basis (Baldwin et al. 1969, Wiens 1971*b*). A remaining group of miscellaneous species includes predominantly migrant and winter residents, spermophilous finches and sparrows, some of which are breeding species on other grasslands (e.g., Brewer's Sparrow, Vesper Sparrow).

In summary, rather low numbers of breeding insectivorous passerines, Mourning Doves, and raptors are partially replaced and partially augmented by greater numbers of migrant and wintering Mourning Doves, raptors, Lark Buntings, Horned Larks, and several species of sparrows. The net effect of these changes is higher overall bird numbers and biomass in winter than in the breeding season. This pattern is the converse of that characteristic of other North American grasslands; it is similar to that occurring on one of the nearby IBP desert sites (Playa), but not the other (Bajada).

Species diversity (Table 2) seems also to follow a seasonal cycle, with highest values in the breeding season and lowest ones in winter.

The disproportionately high numbers of a few species in winter are almost certainly at least partially responsible for the low diversity values in those months because such disproportions reduce the equitability component of the diversity index.

Annual Differences

Both 1970 and 1971 were very dry years on the Jornada as well as elsewhere in the region while in 1972 the area received an exceptionally large amount of rainfall. This fortuitous succession of years with opposite extremes of rainfall provided an opportunity for interesting year-to-year comparison of parameters of the bird community.

In the report on results of Jornada bird work in 1971 (Raitt 1972) three principal conclusions were drawn: (1) The theory that Jornada desert grassland breeding birds are much less dense than are breeding birds at other network sites (Wiens 1971*a*) was confirmed and extended. (2) Breeding densities in 1971 were even lower than those found in 1970, a decrease attributed to the effects (indirect and/or direct) of continued drought. (3) Almost universal failure of breeding efforts occurred in 1971, also presumably linked to very dry conditions. The findings of 1972 in regard to these points are summarized in Table 5. Overall breeding densities (i.e., those for spring to early summer) were higher than in 1971, but the increase was lower than might have been expected in light of the increase in precipitation. In fact, the 1970 levels were reached or surpassed by only two species, Mourning Dove and Cactus Wren. And for only two species (Mourning Dove and Mockingbird) the density was significantly higher than in 1971. We may conclude from these comparisons that actual numbers of adults resident during the breeding season for

Table 5. Annual comparisons of breeding and post-breeding populations.[a/]

Species	Spring-early summer[b/]			Late summer-autumn[c/]	
	1970	1971	1972	1971	1972
LALU	34	16.0	17.0	13.3	19.5[d/]
MYCI	24	2.5	2.0	0.0	0.0
TYVE	24	13.5	17.0	2.7	14.5[d/]
CABR	2	4.0	5.5	7.0	7.0
MIPO	51	1.5	15.5[e/]	0.3	4.0[d/]
ICPA	4	4.0	1.5	0.0	1.5
Total	139	41.5	58.5	23.3	46.5
ZEMA	4	1.0	17.5[e/]	3.0	64.0[d/]
BUSW	4	3.0	1.5	3.0	12.5[d/]

[a/] All figures are mean numbers recorded per roadside census.

[b/] Spring-early summer includes counts from May and June.

[c/] Late summer-autumn includes counts from July, August, and September.

[d/] Indicates significant differences between 1971 and 1972.

[e/] Indicates significant differences ($P < 0.05$) between 1971 and 1972.

several species of insectivorous passerines species and for Swainson Hawks are either unaffected by annual variations in favorability of rainfall and plant productivity or that their recovery from low levels after severe drought is delayed. Mourning Doves and Mockingbirds are obviously more responsive.

Preliminary analysis of possible factors affecting bird numbers indicates that in general insects probably play an important role, not only in annual variations but also in seasonal changes and perhaps also in differences between areas. Fig. 3 shows strikingly parallel changes in monthly figures for densities of birds and insects. The single marked departure of the two curves in the summer of 1972 is partly an artifact caused by the failure of bird counts of June and July to include numbers of nestlings and fledglings. This probable dependence of bird numbers upon insect densities is being investigated further.

We were very interested to learn whether the breeding failure of 1971 would be repeated in 1972. In the absence of direct data on nesting success per unit area, we are obliged to rely upon autumn densities as indices of reproductive success. It is assumed that young birds produced on the area will augment census results in late summer to early autumn (July to September) to a greater degree and produce relatively higher census totals for years in which reproductive success is higher. Comparison of these results for 1971 and 1972 is given in Table 5. As expected, autumn totals were absolutely higher in 1972 and were also higher relative to the respective breeding season totals. This clear cut indication of higher breeding success confirms our impression based on the ease of finding nests and the success of those whose outcome we ascertained. Thus the more favorable growing-reproductive conditions

of 1972 resulted in a marked increase in avian productivity even though breeding densities were higher in but a few species.

Finally, it is apparent that data for additional successive years would clarify and strengthen a number of the points discussed in this report.

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