Technical Report No. 205

AVIAN POPULATIONS AT IBP GRASSLAND BIOME SITES: 1971

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ABSTRACT

This report summarizes studies of breeding bird populations conducted at the ALE, Pantex, Osage, Pawnee, and Cottonwood Sites of the U.S. IBP Grassland Biome during 1971. Data obtained from plot censuses and roadside counts were analyzed to determine local, regional, seasonal, and yearly patterns of variation in species presence and abundance, density, standing crop biomass, and avifaunal diversity and ecological differentiation.

Replicated sample plots frequently differed in their population characteristics, and these differences are considered to be more indicative of local heterogeneity in population dispersion than of sampling error. Changes in density and standing crop from 1970 to 1971 were considerable at some plots and minor at others. The breeding species composition at the sites was relatively unchanged between years, but the abundance of individual species fluctuated markedly at some sites. These yearly changes showed no direct relationship to variations in major environmental variables. It is suggested that these annual variations may be due in part to changes in dispersion patterns within populations, which may be largely unrelated to local plot conditions.

Roadside counts were conducted on standardized routes at Pantex, Osage, and Cottonwood by both an IBP team and local observers. Annual variations were assessed using the results of the IBP team censuses. Total densities of individuals were greater in 1971 than in 1970 at all sites, but in most cases fewer species were seen in 1971. Individual species showed variable changes in abundance between years, and the changes which did occur did not always parallel the changes recorded in plot censuses. Roadside counts conducted by local observers provided indications of seasonal shifts in species presence and abundance. Interseasonal species turnover ranged from 33 to 77%, but generally involved primarily uncommon species. Analysis of count results by ecological categories rather than species revealed that the ecological composition of the breeding avifaunas recorded at these sites remained relatively constant from year to year, but changed seasonally, especially at Osage.

Roadside count data also provide information on dispersion characteristics of species or ecological categories, and a graphical model is developed to analyze results in this framework. This model may have general applicability to censuses where information is gathered on frequency of occurrence and abundance.

INTRODUCTION

Birds are a conspicuous element of grassland ecosystems to the casual observer, but the magnitude of their functional importance in ecosystem dynamics is far less obvious. Their importance may lie in their role in processing and transferring energy and nutrients or in their effect as controllers or "governors" of other elements of the system, or they may in fact be "unnecessary frills" in the ecosystem, adapted to exploit grassland habitats, but not evolved into the cybernetic or energy-nutrient flow patterns of the ecosystem (Wiens, 1971*b*). The research efforts summarized in this report were not directly designed to reveal the functional role of birds in grasslands, however, but rather the immediate objective was to document the abundance and species composition of plots within the Comprehensive Network Sites of the U.S. IBP Grassland Biome Program and the determination from these population estimates of regional and yearly patterns of variation in species presence, density, standing crop, and avifaunal diversity and ecological differentiation. In addition, collection of specimens provided data on variations in weight, external and internal morphological features, and dietary composition. This information is essential to any consideration of bird populations as consumer state variables in grassland ecosystem models, but may also contribute to the development of a comprehensive theory of avian ecology in grasslands (e.g., Wiens, 1971*b*).

The research activities conducted during 1971 largely paralleled and continued studies initiated in 1970 (Wiens, 1971*a*), and are summarized in Table 1. This report includes results, preliminary analyses, and comparisons with 1970 results from plot and roadside population censuses and from specimen collections. Dietary samples, relationships to vegetation structure

Table 1. Summarization of avian ecology research conducted on IBP Grassland Biome Comprehensive Network Sites, 1971.

Site	Dates Visited 1971	Plot Census				Roadside Count[b/]		Specimens Collected
		Treatments Censused[a/]	Plots per Treatment	Plot Size (ha)	Vegetation Structure Measured	IBP Team	Local Observers	
ALE	23 to 25 April	U	1	10.6	No	0	0	13
	7 to 10 May	U	2	10.6,10.6	Yes (2)	0	0	26
Pantex	9 to 12 June	G	2	10.6,10.6	Yes (1)	B	S,B,F	31
		U	1	10.3	No			
Osage	14 to 18 June	G	2	8.4,10.6	Yes (1)	B	S,B,F	35
Pawnee	19 to 22 June	HW	1	10.6	Yes	0	0	0
		HS	1	10.6	Yes	0	0	0
Cottonwood	24 to 29 June	G	1	9.6	Yes	B	S,B,F	57
		U	2	10.6,10.6	Yes (1)			

a/ U = ungrazed or lightly grazed; G = grazed; HW = heavy winter grazing; HS = heavy summer grazing.

b/ B = breeding season; S = spring migration; F = fall migration.

measurements (see Wiens, 1969, 1970), and spatial patterns between species will be considered in later technical reports.

STUDY AREAS AND METHODS

Study Areas

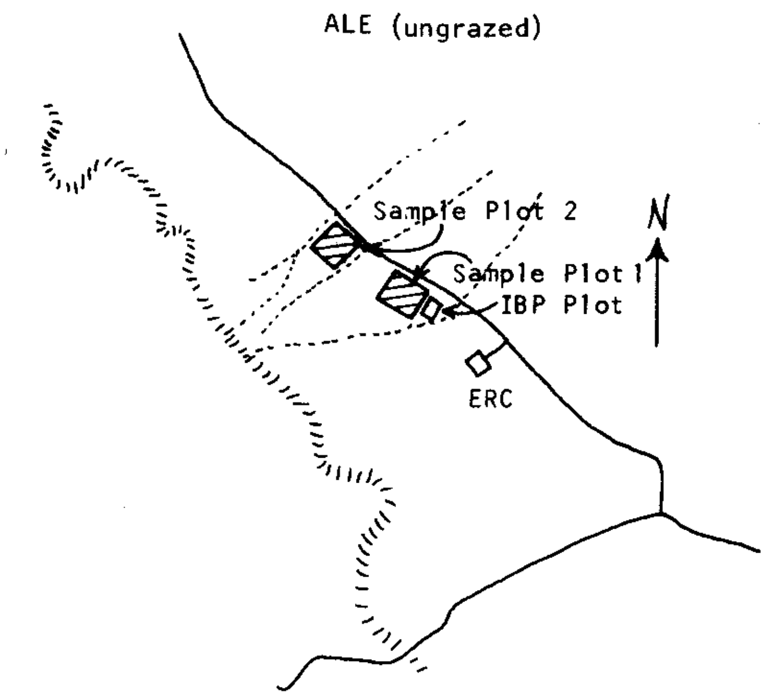
Among the Comprehensive Network Sites, studies were conducted during the 1971 breeding season at ALE, Pantex, Osage, Cottonwood, and on two treatment pastures at Pawnee which have been studied annually since 1968 (Wiens, 1970). Population census plot locations at each site are diagrammed in Fig. 1. In cases where two plots were sampled in a treatment type, plot 1 coincided in position with the plot used in 1970.

Plot Census

The densities of breeding bird populations were estimated on census plots (8.4 to 10.6 ha) located on grazed and/or ungrazed (or lightly grazed) treatments, using the "territory-flush" procedure. Details of plot census procedures used in 1970 are given elsewhere (Wiens, 1971*a*; French, 1971) and were followed without change in 1971. In 1971, however, a second "replicate" sample plot was included at ALE (ungrazed), Pantex (grazed treatment), Osage (grazed), and Cottonwood (lightly grazed). These plots were initially established in an attempt to define the extent of sampling error in population estimation, but ended up serving a different purpose (see below) largely due to the difficulties of locating two 10.6-ha sample plots within sufficiently homogeneous habitat units.

Roadside Count

Routes for roadside counts of birds in the general area of the sites were the same as those followed in 1970. Single counts were conducted during



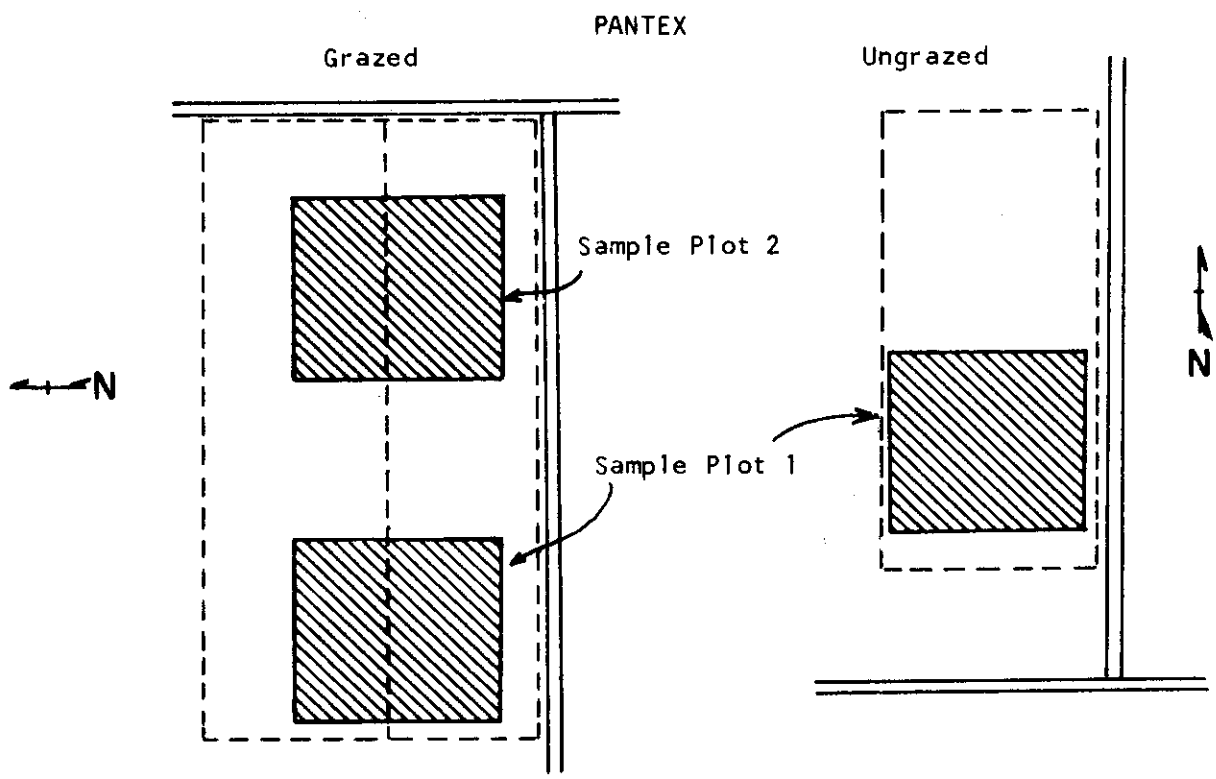


Fig. 1. Location of plot census sample plots at IBP Grassland Biome sites (1971). "IBP plot" refers to the fenced plot in which the sampling of most other IBP teams was conducted. Plot sizes are given in Table 1.

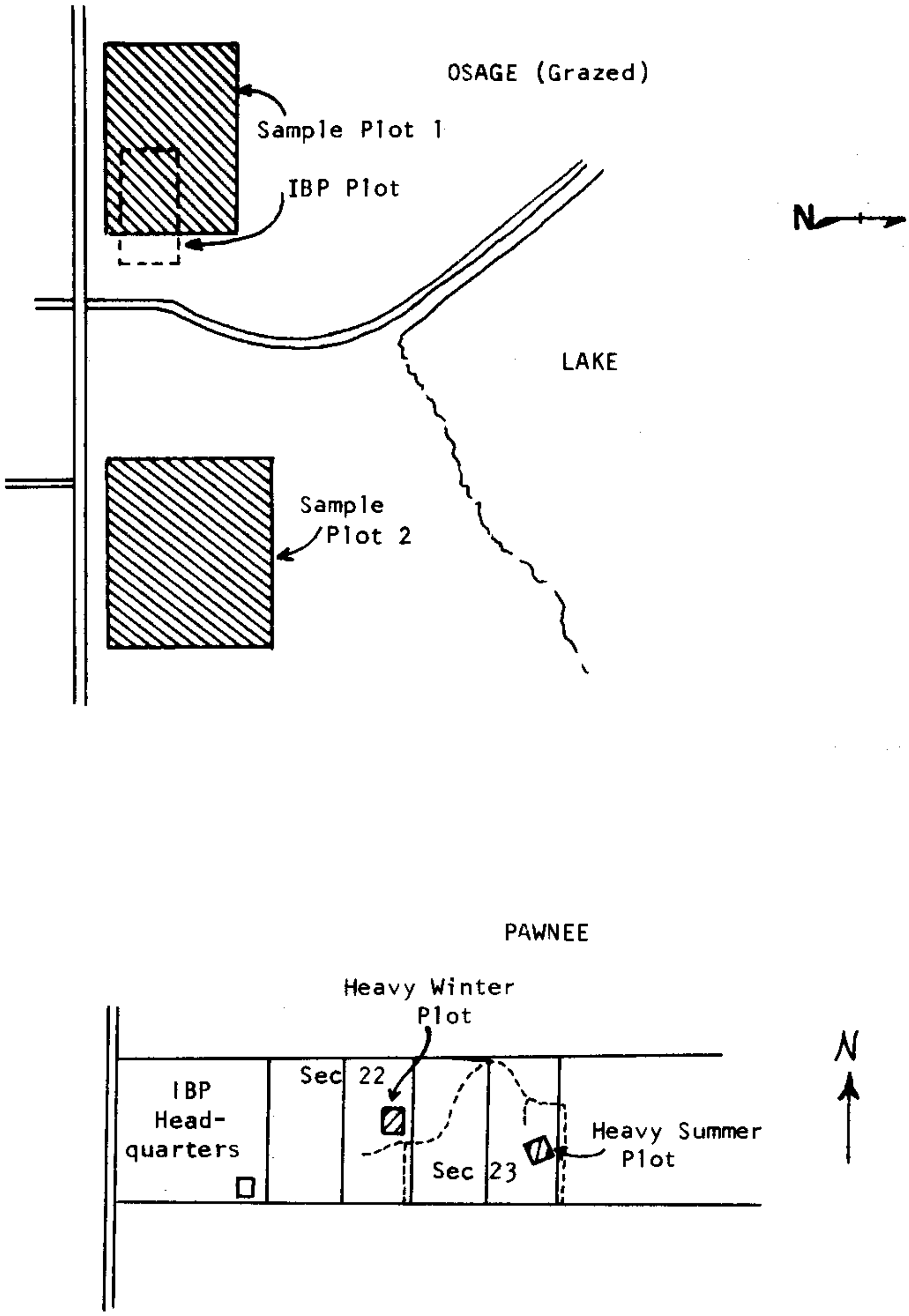


Fig. 1 (continued).

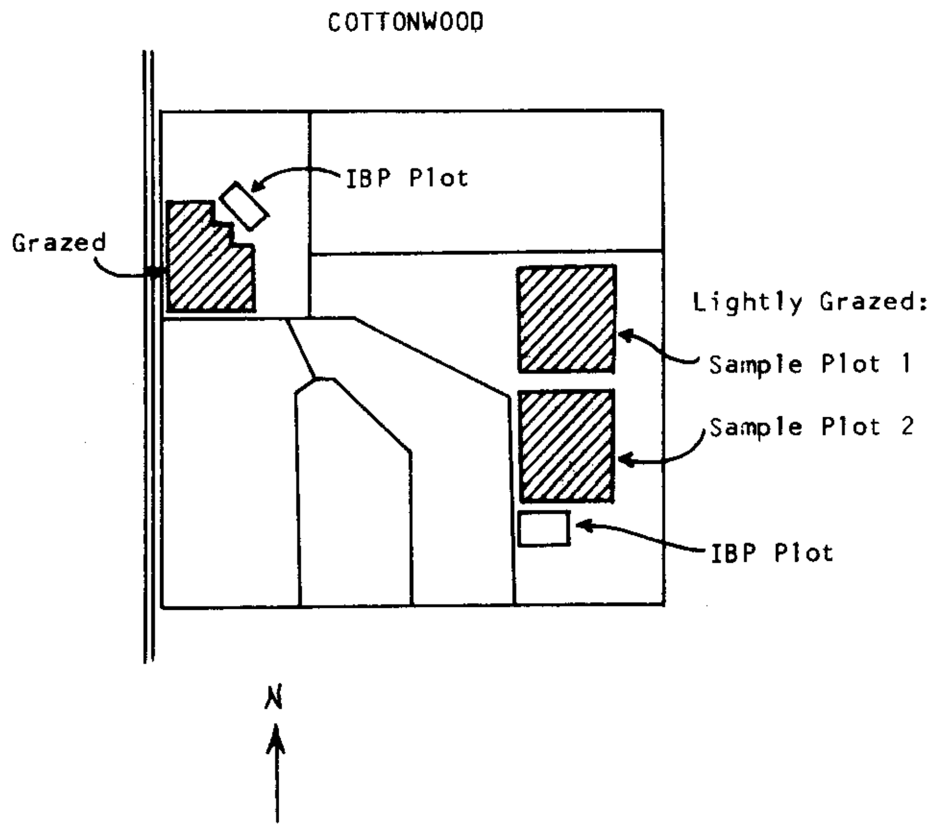


Fig. 1 (continued).

midbreeding season at Pantex, Osage, and Cottonwood, following the procedures outlined by Wiens (1971*a*). In addition, the assistance of several well-qualified amateurs living in the vicinity of these sites was solicited in conducting roadside counts over the same census route during spring migration, in midsummer (roughly coinciding with our census of the route), during fall migration, and in midwinter. In this way, some estimation of patterns of flux in species abundance and distribution at the sites might be obtained. These observers conducted their censuses following the IBP methodology (an example of the instruction sheet followed by these observers is provided in Appendix I). The Pantex censuses were conducted by Mr. Kenneth Seyffert, Amarillo; Osage counts were made by Mrs. Emma Messerly, Bartlesville; and Cottonwood was censused by Dr. N. R. Whitney, Rapid City. In addition, Dr. Whitney has, since 1967, conducted roadside counts as part of the North American Breeding Bird Census (see Robbins and Van Velzen, 1967); 17 stops of his 50-stop Cedar Pass route coincide with the IBP Cottonwood route, and Dr. Whitney has generously made available to us his records for these 17 stops. We wish to take this opportunity to express our appreciation to these three individuals for their continuing efforts on behalf of the IBP studies.

Specimen Collections and Measurements

Specimen collection procedures followed those established in 1970 (Wiens, 1971*a*; French, 1971). Examination of 1970 dietary data indicated that a sample size of 20 was generally sufficient to reveal basic dietary habits, and this was used as the target sample size in 1971 collections. Attempts were made to distribute collections evenly between early morning and late afternoon feeding periods, and between sexes. Weights were recorded, to tenths of a gram, with a portable Ohaus dial-o-gram balance shortly after collection. Measurements were made, to the nearest tenth of a millimeter, with Helios dial calipers.

RESULTS

As in 1970, our results in 1971 were subject to the temporal constraints discussed earlier (Wiens, 1971*a*). The relation of 1971 sampling times to breeding activity are briefly discussed with reference to specimen data below; additional evidence of the coincidence of our work with local breeding phenology at the sites is provided by the summarization of nesting activity presented in Appendix II.

Plot Censuses

The territory mappings of breeding individuals of each species occupying a sample plot were the basis of density and standing crop estimations. These mappings are presented in Appendix III; the estimations are tabulated for each species and plot in Table 2, and are summarized in Table 3. Two aspects of these plot censuses deserve comment, the status of the "replicate" plots sampled in 1971 and relations between 1970 and 1971 results.

Plot "replication." In an attempt to assess sampling variation, a second 10.6-ha sample plot was censused at several sites. A basic requirement for such replication, of course, is that both samples be taken from the same "population" or from a large area of homogenous habitat. In fact, it was difficult, if not impossible, to locate two plots of sufficient size in a single homogenous habitat, and the results of "replicate" plot samplings (Tables 2,3; Fig. 2,3) show varying agreement. At Pantex the duplicate plots were located at opposite ends of the same grazed field, and if major differences in habitat existed between these plots, they were not apparent. Yet plot 1 had a greater density of Horned Larks, fewer Western Meadowlarks,

Table 2. Bird species densities and standing crops on IBP Grassland Biome plots, 1971. 1970 census values (Wiens, 1971*a*) are included for comparison. Biomass values were obtained using the weights given in Table 16 and by Wiens (1971*a*).

Site	Treatment	Species[a/]	Density (birds/km²)			Standing Crop Biomass (g/ha)		
			1970	1971		1970	1971	
				Sample 1	Sample 2		Sample 1	Sample 2
ALE	Ungrazed (April)	Horned Lark	-	33.6	-	-	10.6	-
		Sage Sparrow	-	38.9	-	-	7.4	-
		Western Meadowlark	-	30.2	-	-	31.5	-
	Ungrazed (May)	Horned Lark	-	106.0	93.2	-	33.7	29.6
		Mourning Dove	-	-	9.4	-	-	11.6
		Sage Sparrow	-	67.5	141.7	-	13.8	28.9
		Western Meadowlark	-	39.9	47.0	-	41.6	49.0
Pantex	Grazed	Grasshopper Sparrow	17.0	-	-	2.9	-	-
		Horned Lark	196.7	350.4	237.9	63.3	110.7	75.2
		Lark Bunting	2.8	-	-	1.0	-	-
		Western Meadowlark	49.8	26.9	48.4	49.1	27.0	48.6
	Ungrazed	Grasshopper Sparrow	19.4	-	-	3.3	-	-
		Horned Lark	120.2	91.9	-	38.7	29.0	-
		Lark Bunting	1.9	-	-	0.7	-	-
		Western Meadowlark	70.6	57.3	-	69.6	57.6	-
Osage	Grazed	Dickcissel	80.9	94.0	282.3	22.2	24.9	74.8
		Eastern Meadowlark	88.3	80.3	124.0	86.6	78.8	121.6
		Grasshopper Sparrow	71.4	58.3	83.2	12.0	10.0	14.2
		Upland Plover	9.5	6.9	29.1	12.2	9.0	37.9
Pawnee	Heavy Winter	Brewer's Sparrow	25.8	68.6	-	3.1	8.2	-
		Horned Lark	114.9	73.9	-	37.1	23.9	-
		Lark Bunting	136.4	144.0	-	48.6	51.3	-
		Nighthawk	-	15.1	-	-	11.3	-
		Western Meadowlark	-	38.0	-	-	41.8	-
	Heavy Summer	Horned Lark	136.0	71.3	-	43.9	23.0	-
		Lark Bunting	37.3	-	-	13.3	-	-
		McCown's Longspur	75.6	133.8	-	19.0	33.6	-
		Mountain Plover	4.7	21.2	-	5.3	24.0	-
		Nighthawk	6.6	-	-	5.0	-	-
		Western Meadowlark	9.4	-	-	10.3	-	-
Cottonwood	Grazed	Grasshopper Sparrow	3.8	-	-	0.7	-	-
		Horned Lark	130.7	99.1	-	41.6	30.4	-
		Western Meadowlark	17.6	70.0	-	17.7	67.1	-
	Lightly Grazed	Chestnut-collared Longspur	4.7	5.9	7.6	0.9	1.2	1.5
		Grasshopper Sparrow	153.9	96.4	93.9	26.9	15.4	15.3
		Horned Lark	48.7	19.8	13.6	15.5	6.1	4.2
		Long-billed Curlew	15.8	18.4	9.5	93.5	108.8	56.2
		Upland Plover	14.1	-	-	18.1	-	-
		Western Meadowlark	73.1	68.0	48.0	73.7	65.2	46.0

[a/] Scientific names of species given in Appendix IV.

Table 3. Summary of avifaunal features of IBP Grassland Biome plots, 1971, from plot census data. 1970 values (Wiens, 1971*a*) are included for comparison.

Site	Treatment	Sample Plot	Number of Species		Density (birds/km^2)		Standing Crop Biomass (g/ha)		Species Diversity (H')		Species Equitability (H'/H'MAX)		Biomass Diversity (H')		Biomass Equitability (H'/H'MAX)	
			1970	1971	1970	1971	1970	1971	1970	1971	1970	1971	1970	1971	1970	1971
ALE	Ungrazed	April	-	3	-	102.7	-	49.5	-	1.09	-	1.00	-	0.90	-	0.83
		May--1	-	3	-	213.4	-	89.1	-	1.00	-	0.92	-	0.96	-	0.88
		May--2	-	4	-	291.3	-	119.1	-	1.11	-	0.80	-	1.24	-	0.89
Pantex	Grazed	1	4	2	266.3	377.3	116.3	137.7	0.74	0.26	0.54	0.38	0.83	0.49	0.60	0.71
		2	-	2	-	286.3	-	123.8	-	0.41	-	0.59	-	0.67	-	0.97
	Ungrazed	1	4	2	212.1	149.2	112.3	86.6	0.95	0.67	0.68	0.97	0.76	0.64	0.55	0.93
Osage	Grazed	1	4	4	250.1	239.5	133.0	122.7	1.22	1.18	0.88	0.85	1.01	1.00	0.73	0.72
		2	-	4	-	518.6	-	248.5	-	1.13	-	0.82	-	1.14	-	0.82
Pawnee	Heavy Winter	1	3	5	277.1	339.6	88.8	136.5	0.94	1.41	0.85	0.88	0.81	1.44	0.74	0.89
	Heavy Summer	1	6	3	269.6	226.3	96.8	80.6	1.26	0.90	0.70	0.82	1.53	1.08	0.86	0.98
Cottonwood	Grazed	1	3	2	152.1	169.1	60.0	97.5	0.44	0.68	0.40	0.99	0.61	0.62	0.56	0.90
	Lightly Grazed	1	6	5	310.3	208.5	228.6	196.7	1.32	1.32	0.74	0.82	1.39	1.05	0.76	0.65
		2	-	5	-	172.6	-	123.2	-	1.28	-	0.79	-	1.17	-	0.73

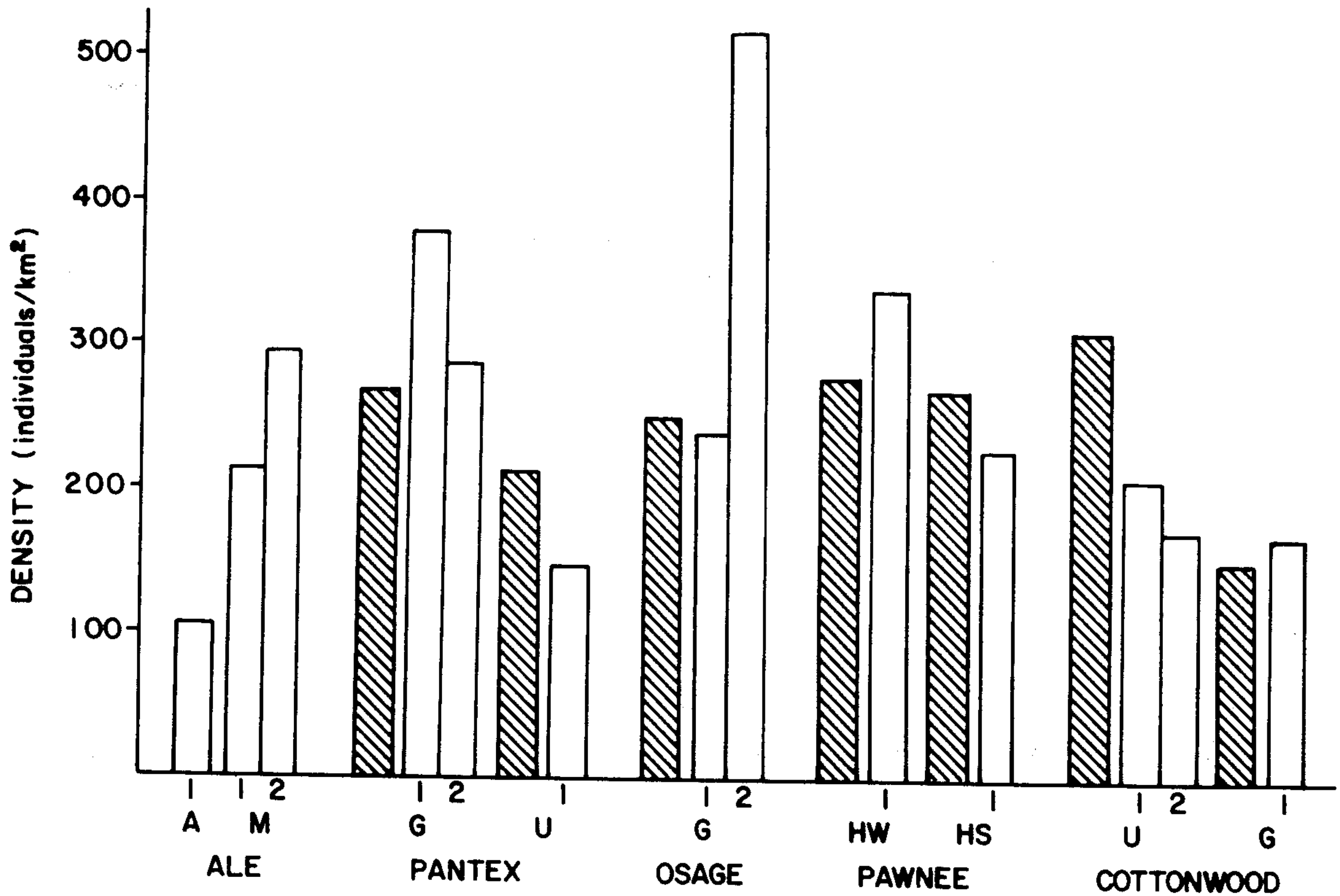


Fig. 2. Density of breeding bird populations in sample plots at IBP sites. Solid bar = 1970 values, open bar = 1971 values for sample plots 1 and 2. G = grazed, U = ungrazed or lightly grazed, HW = heavy winter grazing, HS = heavy summer grazing, A = April sample, M = May sample.

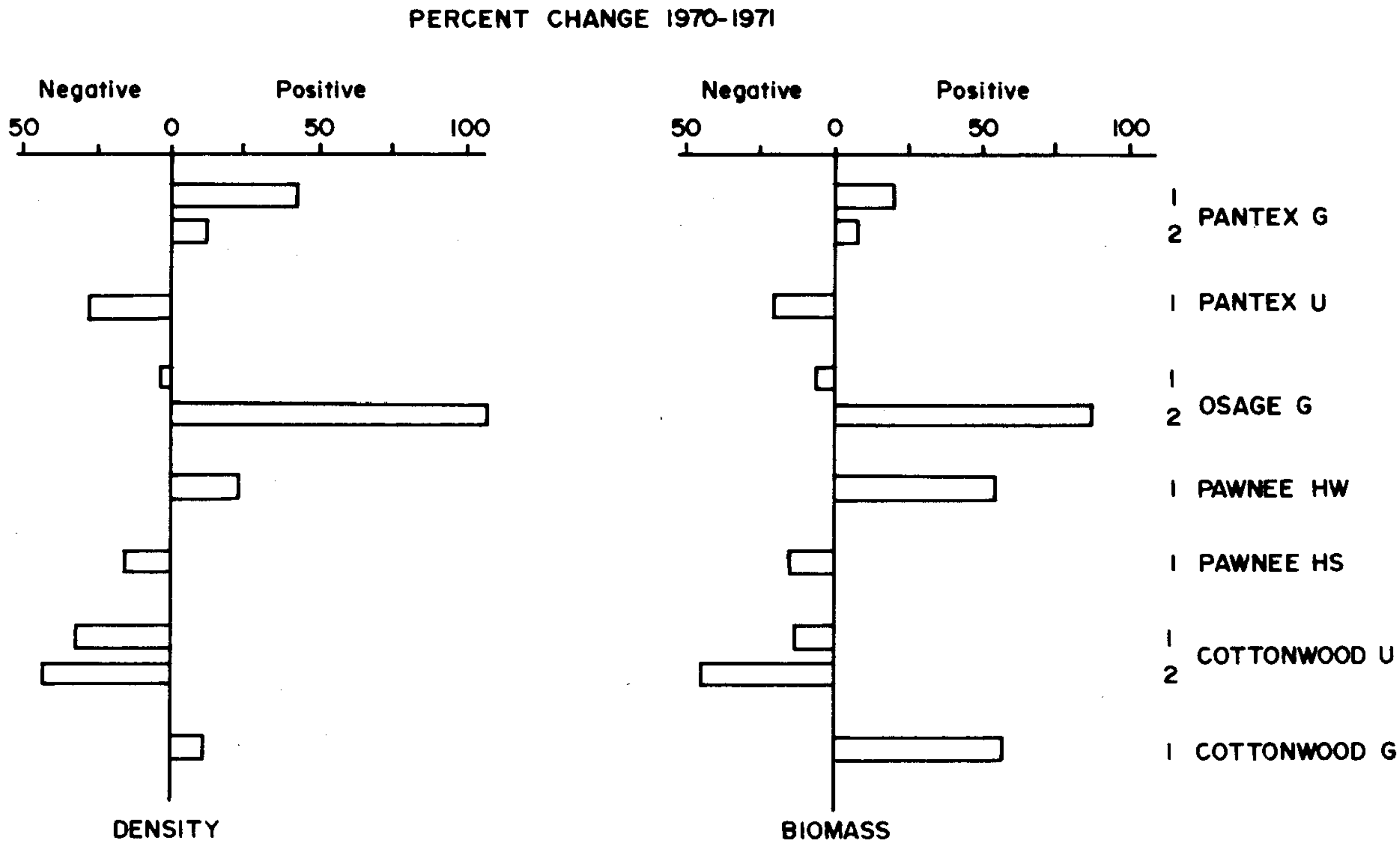


Fig. 3. Percent change in avian density and standing crop biomass at IBP grassland sites between 1970 and 1971. Data are from plot censuses. Symbols are as in Fig. 2.

and higher overall density than plot 2. Diversity and equitability were higher in the second sample plot. At Cottonwood the sample plots in the lightly grazed pasture were in generally similar habitat (plot 2 was somewhat higher up a small rise), and here plot counts were generally similar, although plot 1 supported somewhat more biomass than plot 2. At ALE slight differences in coverage of sagebrush (*Artemisia tridentata*) existed between plots, and these were reflected in the higher Sage Sparrow density in plot 2. Between-sample differences were most startling at Osage, where the second sample plot was located over deeper soil than the first, producing a considerably greater coverage of large emergent forbs. Dickcissels, especially, responded to these habitat differences, but densities of all species were higher in plot 2. In all, density and biomass were more than twice as high in plot 2 than in plot 1. Examination of the territory mappings for these two plots (Appendix III) vividly indicates the nature of between-plot differences.

It is difficult to provide an unambiguous interpretation of these differences. Certainly, sampling error does contribute to the differences, but this is superimposed on differences stemming from the birds' reactions to the habitat mosaic or to each other. Vegetation structure was sampled at some of these "replicate" sample plots; and when analysis of these data is completed, it may be possible to document more precisely the magnitude of habitat differences between plots. But it also seems reasonable to expect differences in the dispersion or packing of individual territories of a species, even in absolutely uniform habitat, especially if the populations have not attained carrying capacity or if there is any tendency toward clustering or social aggregation in the species (see below). Thus the "replicate" plots may provide more of an indication of local variations in dispersion and density of species at a site or treatment than a measure of sampling error.

Annual variations. One of the major goals of this research was to document the nature of yearly variations in avian populations at the various grassland sites. In these comparisons, only results from the first sample plots will be used, since these were located identically to the 1970 plots; "replicate" plots are not considered.

Total density was notably higher in 1971 than in 1970 at Pantex (grazed) and Pawnee (heavy winter), and less at Pantex (ungrazed) and Cottonwood (lightly grazed). Standing crop biomass was substantially higher in 1971 at Pantex (grazed), Pawnee (heavy winter), and Cottonwood (grazed), and lower at Pantex (ungrazed) and Cottonwood (lightly grazed) (Fig. 2,3,4). Little annual change was noted at Osage or Pawnee (heavy summer). Diversity was reduced in 1971 at Pantex (both treatments) and Pawnee (heavy summer), and increased at Pawnee (heavy winter), largely because of changes in the number of breeding species recorded (Table 3).

Individual species showed equally erratic annual changes in abundance. Horned Lark populations were reduced at all plots except Pantex (grazed), where there was a tremendous increase (Table 2). At Pawnee, where plot counts were started in 1968 (Wiens, 1970, 1971*a*, 1971*b*), Horned Lark density decreased on both plots after having increased during the previous 2 years (Fig. 5). Lark Buntings at Pawnee, on the other hand, have maintained fairly stable populations (at least on the heavy winter plot which is close to "optimal" habitat for this species in this region), while populations of Brewer's Sparrows have oscillated wildly. At the other sites, Grasshopper Sparrows were less abundant everywhere than in 1970, while meadowlarks were less abundant at Pantex (grazed), more abundant at Cottonwood (grazed) and Pawnee (heavy winter), and essentially unchanged elsewhere (Table 2).

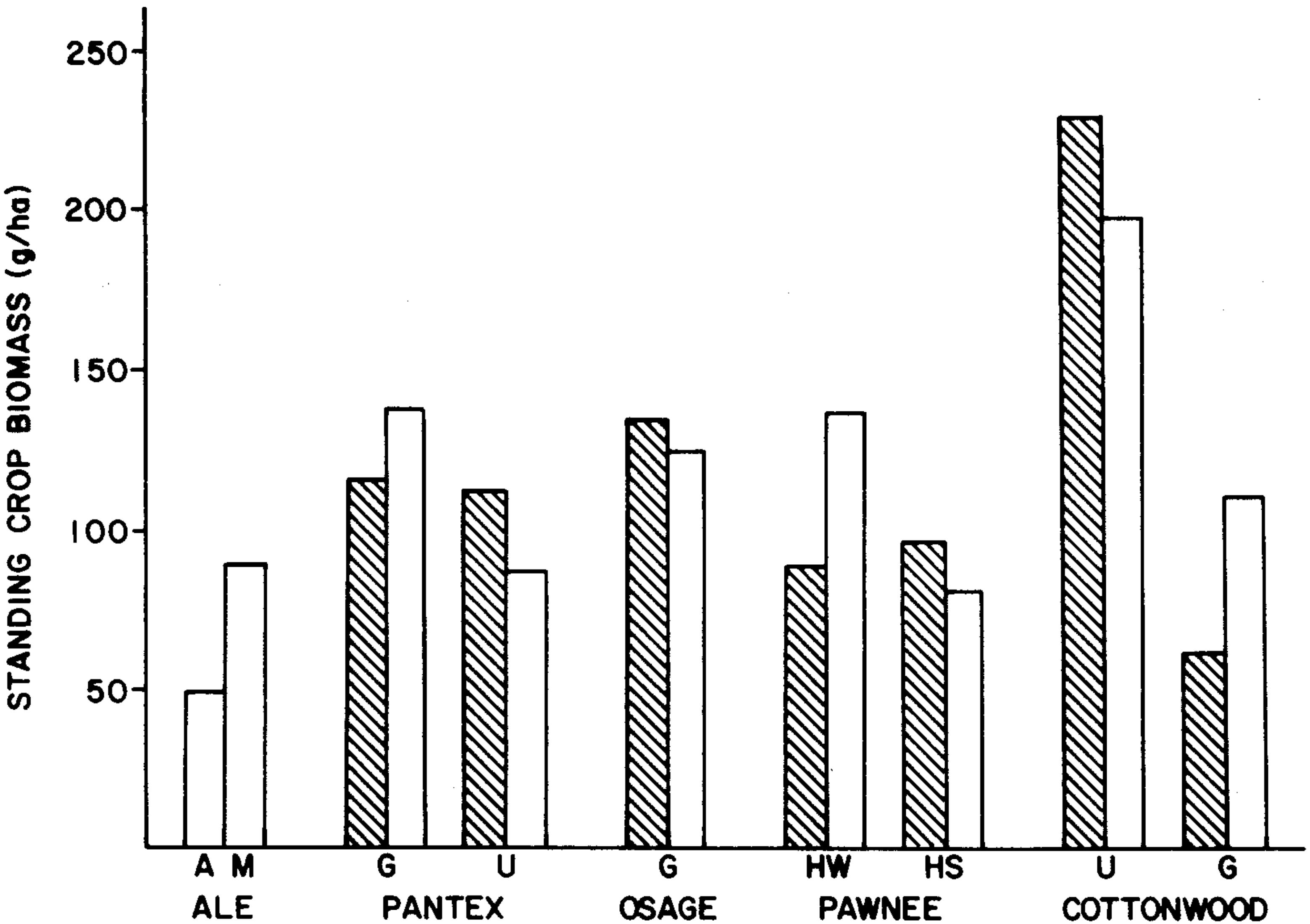


Fig. 4. Standing crop biomass of breeding bird populations in IBP sample plots. Lined bar = 1970 values, open bar = 1971 results. Only values from sample plot 1 are indicated for the 1971 data. Symbols are as in Fig. 2.

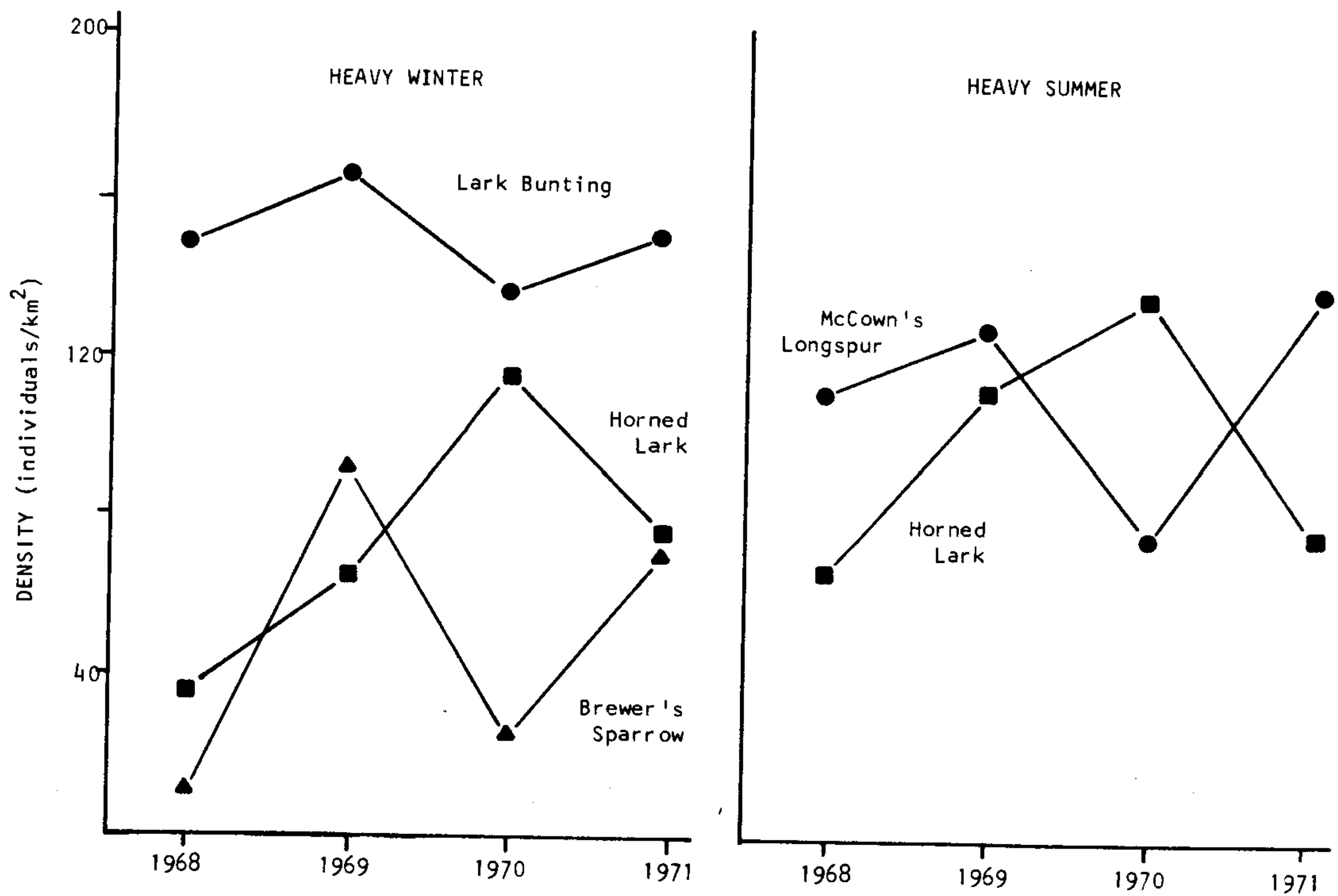


Fig. 5. Annual variations in population densities of breeding species on two plots at Pawnee.

It would be pleasing if these yearly changes in avian population densities and biomasses showed some direct relation to major environmental variables, such as precipitation [which does appear to influence small mammal abundance, perhaps through its more proximate effects on reproduction (Packard and Birney, personal communication)]. Unfortunately, no clear patterns seem apparent. Osage showed the least yearly variation [as perhaps should be expected of tallgrass populations (Wiens, in preparation)], but elsewhere changes did occur and frequently occurred in different directions among different treatments at the same site (Fig. 3). Further, the differences were inconsistent between sites with respect to grazing intensity. These inconsistencies make association of the shifts in avian density with basic abiotic variations or differences in production patterns difficult and ambiguous. At Pantex, for example, the extremely low rainfall during 1970 and the first half of 1971 might have been expected to lower 1970 breeding success and lead to lower densities in 1971. But on the grazed plot, total density was considerably higher in 1971 due to a tremendous increase in Horned Lark density (which, preferring open, relatively low grass cover, may have benefited from the dry climatic regime). On the ungrazed plot, however, total density and Horned Lark density were lower in 1971. The entire problem is confounded by the fact that here, and at the other IBP sites, a good share of the populations are seasonal migrants, so that their abundance at a site or plot in any given year may result from present and past conditions at that site *and* elsewhere as well.

The possibility exists also that these annual shifts in plot densities are not due to real changes in population sizes but to differences in dispersion. It may be that the number of individuals in an area of several kilometers square may change little between years, but that 0.01-km^2 plots sampled from this population record considerable changes due to yearly changes in dispersion patterns within the population which may be largely unrelated to local plot conditions.[1/] This may be especially likely if the functional involvement of birds in grassland ecosystems is marginal (Wiens, 1971*b*).

Thus, causal interpretations of yearly variations in plot census values will be difficult, with stochastic and deterministic effects of past and present conditions at a site and elsewhere intermingled in a continuously varying matrix. Perhaps the picture will begin to clear when more than two fixes on yearly variation are available.

Relations of the ALE Site. Since 1971 was the first year data were collected from the ALE Site, it is appropriate to examine briefly how it is related, avifaunistically, to the other sites. The number of breeding bird species and diversity of species and biomass were intermediate in the range of values for the IBP Grassland Biome Comprehensive Network. Only one species, the Sage Sparrow, was restricted to ALE in its distribution; the remainder of the breeding species was widely distributed through most of the Grassland Biome. In bird density, ALE was similar to Pawnee (heavy summer), Cottonwood (ungrazed), and Osage (Fig. 2), while the standing crop biomass most closely approximated that recorded at Pawnee (heavy summer), Cottonwood (grazed), and Pantex (ungrazed) (Fig. 4). In relation to annual precipitation regimes, however, ALE deviated markedly from the general

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1/ It is rather as if individual territories were checkers on a checkerboard with walled edges; every year the board is shaken to redisperse the checkers, and while the total number of checkers on the board may remain the same, the number encountered on any sample plot of, say, eight squares, may change. Further, the direction of changes on adjacent eight-square plots might well differ. Also, obviously the extent of such change would be related to the packing of checkers on the board; with a densely packed board there would be little room available for yearly redispersal, and plot counts would indicate relative stability.

increasing rainfall; increasing density and biomass relations are noted by Wiens (1971*b*, Fig. 6) for the other IBP sites. ALE appears to support far more individuals and biomass than would be expected for such a xeric site. ALE is similarly distinctive in its small mammal fauna (Harris, personal communication), and this deviation from the general precipitation relations shown by the other sites deserves closer study. Most (roughly 70%) of the precipitation at ALE falls in the non-growing season, and this, combined with the perennial growth form of the vegetation, may produce more favorable resource conditions for birds and small mammals than might be anticipated on the basis of rainfall alone (Wiens, in preparation).

ALE was sampled twice in 1971, in late April and in early May (Table 1). Breeding territories were established at the first census period and nesting was in progress (Appendices II and III). Yet breeding densities increased considerably by the time of the May sampling, when breeding activity and territorial stability were also much in evidence. These observations suggest that at ALE, avian breeding activity may begin earlier in spring than at the other sites and may involve a more gradual arrival of breeding individuals and establishment of territories than occurs elsewhere in the network. Most breeding at ALE is completed by mid-June (O'Farrell, personal communication), a month or so earlier than at the other sites.

Roadside Counts

Summarizations of roadside count results obtained by our IBP team and by local observers are presented in Tables 4 to 10. Several aspects of these results deserve discussion.

Comparisons between observers. Individual differences between observers pose difficulties in evaluation of roadside count results (Robbins and Van Velzen, 1967), and in order to fully utilize the counts conducted by volunteer

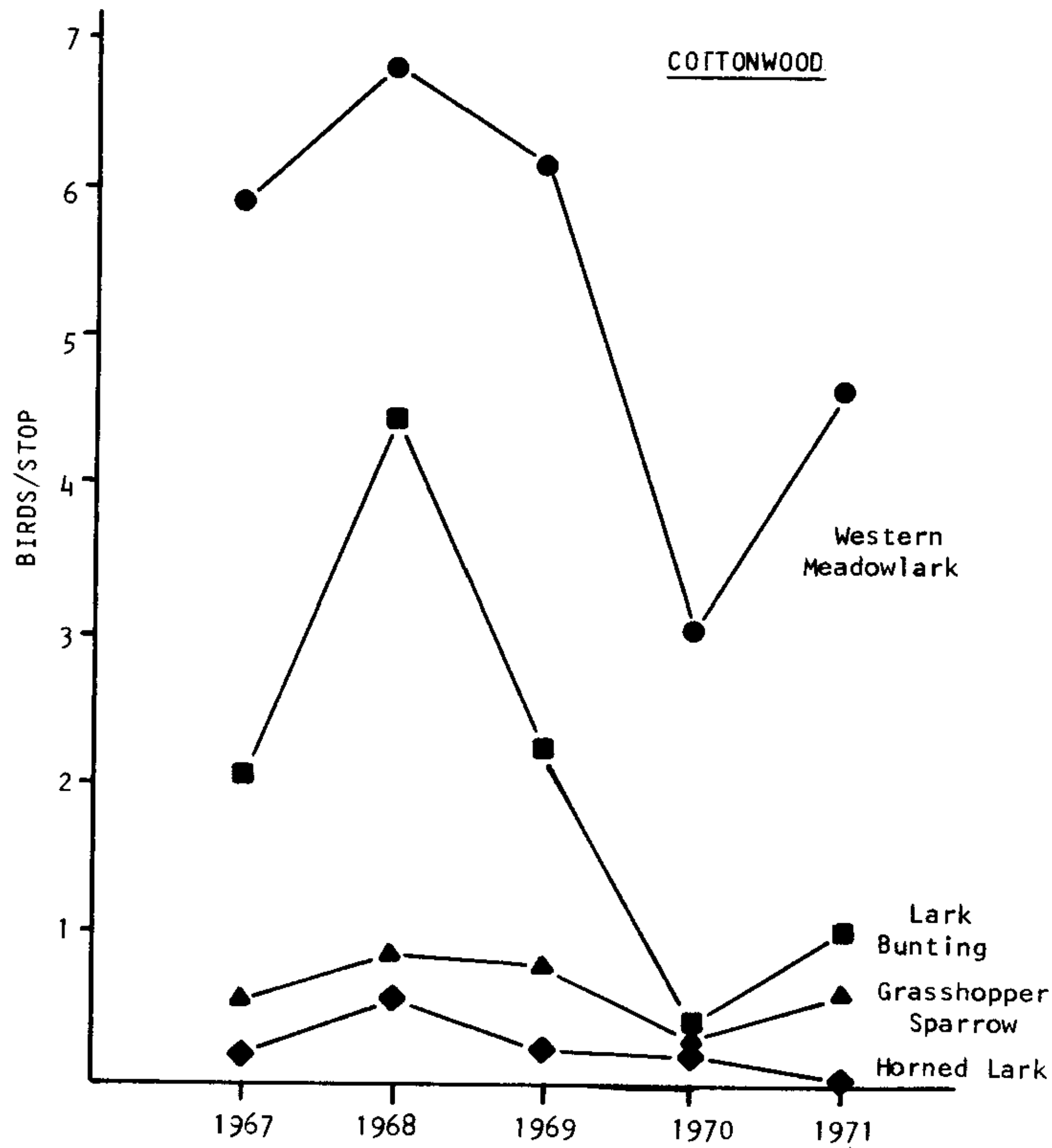


Fig. 6. Annual variations in abundance of some common breeding species at Cottonwood (1967 to 1971) from roadside counts of Whitney (Table 4).

Table 4. Results of yearly roadside counts taken at the Cottonwood Site (observed by Whitney).

Species[a]	28 June 1967			26 June 1968			22 June 1969			5 July 1970			27 June 1971		
	B/S[b]	B/S(T)[c]	Frequency[d]	B/S	B/S(T)	Frequency	B/S	B/S(T)	Frequency	B/S	B/S(T)	Frequency	B/S	B/S(T)	Frequency
AGPH	3.70	2.18	0.59	3.73	2.41	0.65	5.00	2.94	0.59	3.10	1.82	0.59	3.00	1.77	0.59
AMSA	1.67	0.59	0.35	1.86	0.88	0.47	1.63	0.77	0.47	1.50	0.18	0.12	1.67	0.59	0.35
ANDI	-	-	-	6.00	0.35	0.06	-	-	-	-	-	-	-	-	-
ANPL	5.33	0.94	0.18	-	-	-	-	-	-	-	-	-	-	-	-
BALO	1.40	0.42	0.29	1.75	0.41	0.24	2.60	0.77	0.29	1.63	0.77	0.47	1.40	0.41	0.29
BUSW	1.00	0.06	0.06	-	-	-	-	-	-	-	-	-	-	-	-
CAME	3.18	2.06	0.65	5.85	4.47	0.76	4.22	2.24	0.53	2.00	0.35	0.18	4.25	1.00	0.24
CAOR	-	-	-	-	-	-	2.50	0.29	0.12	1.67	0.29	0.18	3.00	0.18	0.06
CHGR	2.50	0.29	0.12	-	-	-	1.00	0.06	0.06	-	-	-	1.25	0.29	0.24
CHMI	-	-	-	-	-	-	-	-	-	1.00	0.06	0.06	-	-	-
CHVO	1.75	0.42	0.24	1.80	0.53	0.29	-	-	-	1.00	0.18	0.18	1.67	0.59	0.35
CICY	-	-	-	2.00	0.24	0.12	-	-	-	-	-	-	-	-	-
COCA	-	-	-	2.00	0.12	0.06	1.00	0.12	0.12	1.00	0.12	0.12	1.33	0.24	0.18
COER	-	-	-	-	-	-	1.00	0.06	0.06	-	-	-	-	-	-
COVI	-	-	-	1.00	0.06	0.06	-	-	-	-	-	-	-	-	-
DEPE	-	-	-	1.00	0.06	0.06	1.00	0.12	0.12	1.00	0.06	0.06	1.00	0.06	0.06
ERAL	3.00	0.18	0.06	2.50	0.59	0.24	2.00	0.24	0.12	2.00	0.24	0.12	-	-	-
EUCY	2.00	0.24	0.12	-	-	-	-	-	-	-	-	-	-	-	-
FASP	1.00	0.06	0.06	-	-	-	-	-	-	-	-	-	1.00	0.06	0.06
GETR	-	-	-	1.00	0.06	0.06	-	-	-	2.00	0.12	0.06	1.00	0.06	0.06
GUCA	-	-	-	-	-	-	-	-	-	1.00	0.06	0.06	1.00	0.06	0.06
HIRU	-	-	-	-	-	-	2.00	0.24	0.12	4.50	0.53	0.12	1.00	0.06	0.06
ICBU	-	-	-	-	-	-	1.00	0.06	0.06	-	-	-	-	-	-
ICSP	-	-	-	-	-	-	-	-	-	1.00	0.12	0.12	-	-	-
ICVI	-	-	-	-	-	-	1.00	0.06	0.06	-	-	-	-	-	-
LALU	2.00	0.12	0.06	-	-	-	-	-	-	1.00	0.06	0.06	-	-	-
MOAT	1.00	0.12	0.12	1.00	0.12	0.12	2.50	0.29	0.12	2.67	0.47	0.18	3.25	0.77	0.24
NUAM	1.00	0.12	0.12	2.33	0.41	0.18	1.00	0.12	0.12	-	-	-	-	-	-
PADO	-	-	-	-	-	-	1.67	0.29	0.18	2.00	0.12	0.06	-	-	-
PEPY	22.00	2.59	0.12	21.25	5.00	0.24	6.67	1.18	0.18	10.00	1.18	0.12	14.50	3.41	0.24
PHCO	1.00	0.12	0.12	1.00	0.06	0.06	1.00	0.12	0.12	-	-	-	1.00	0.18	0.18
PHME	-	-	-	1.00	0.06	0.06	-	-	-	-	-	-	-	-	-
PIPI	-	-	-	-	-	-	-	-	-	-	-	-	2.00	0.12	0.06
POGR	1.00	0.12	0.12	-	-	-	-	-	-	-	-	-	-	-	-
SASA	-	-	-	-	-	-	-	-	-	2.00	0.12	0.06	-	-	-
SPAM	2.90	1.71	0.59	2.50	0.59	0.24	-	-	-	-	-	-	2.00	0.24	0.12
SPTR	-	-	-	-	-	-	1.00	0.06	0.06	-	-	-	-	-	-
STNE	5.94	5.94	1.00	6.82	6.82	1.00	6.18	6.18	1.00	3.40	3.00	0.88	4.94	4.65	0.94
TORU	-	-	-	1.00	0.06	0.06	3.00	0.18	0.06	-	-	-	2.00	0.12	0.06
TRAE	2.00	0.12	0.06	-	-	-	2.00	0.12	0.06	1.00	0.06	0.06	1.00	0.12	0.12
TUMI	-	-	-	-	-	-	-	-	-	1.00	0.18	0.18	1.00	0.06	0.06
TYTY	6.00	0.35	0.06	1.33	0.24	0.18	1.60	0.47	0.29	1.00	0.12	0.12	1.50	0.18	0.12
TYVE	-	-	-	1.50	0.18	0.12	3.00	0.18	0.06	1.50	0.18	0.12	1.00	0.12	0.12
VIBE	-	-	-	-	-	-	1.00	0.06	0.06	1.00	0.06	0.06	-	-	-
ZEMA	1.75	0.82	0.47	1.33	0.24	0.18	2.70	1.59	0.59	1.20	0.35	0.29	2.44	1.29	0.53

a/ See Appendix IV for code name.

b/ Number of individuals recorded : number of stops at which species was recorded.

c/ Number of individuals recorded : total number of stops (17).

d/ Number of stops at which species was recorded : total number of stops (17).

Table 5. Results of roadside counts taken at the Pantex Site (observed by Wiens). 1970 Comb. = combined census results for 5 June 1970 to 6 June 1970; and 1971 = census results for 11 June 1971.

Species	Birds/Stop[a/]		Birds/Stop (Total)[b/]		Frequency[c/]	
	1970 Comb.	1971	1970 Comb.	1971	1970 Comb.	1971
AGPH	0.50	4.00	0.02	0.16	0.02	0.04
AICA	4.69	5.56	3.73	4.88	0.80	0.88
AMSA	1.25	2.00	0.08	0.08	0.07	0.04
BUJA	0.50	-	0.02	-	0.02	-
BUSW	1.50	-	0.05	-	0.03	-
CAAU	1.00	1.00	0.03	0.04	0.02	0.04
CASQ	1.00	-	0.07	-	0.07	-
CHGR	-	1.00	-	0.08	-	0.08
CHMI	1.87	1.00	0.18	0.04	0.10	0.04
CHVO	1.50	2.00	0.10	0.16	0.07	0.08
CICY	0.50	1.00	0.02	0.08	0.02	0.08
COBR	-	2.00	-	0.08	-	0.04
COVI	1.00	-	0.03	-	0.03	-
ERAL	4.64	6.82	2.40	4.64	0.50	0.68
FASP	1.00	-	0.05	-	0.03	-
HIRU	3.88	2.67	0.70	0.32	0.17	0.12
LALU	0.50	-	0.02	-	0.02	-
MIPO	1.73	1.50	0.38	0.48	0.20	0.32
MOAT	2.00	1.00	0.10	0.04	0.03	0.04
MUFO	0.75	-	0.05	-	0.03	-
PEPY	-	2.00	-	0.08	-	0.04
POGR	1.25	1.78	0.11	0.64	0.10	0.36
STNE	5.32	5.52	5.32	5.52	1.00	1.00
TYVE	0.58	1.00	0.12	0.08	0.10	0.08
ZEMA	2.55	2.33	1.47	1.68	0.57	0.72
TOTAL			14.65	19.08		

a/ Number of individuals recorded ÷ number of stops at which species was recorded.

b/ Number of individuals recorded ÷ total number of stops (1970 = 30, 1971 = 25).

c/ Number of stops at which species was recorded ÷ total number of stops (1970 = 30, 1971 = 25).

Table 6. Results of seasonal roadside counts taken at the Pantex Site (observed by Seyffert). Spring = 9 April 1971; Summer = 20 June 1972; Fall = 27 September 1971.

Species	Birds/Stop[a/]			Birds/Stop (Total)[b/]			Frequency[c/]		
	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall
AGPH	1.67	1.00	5.33	0.17	0.03	0.53	0.10	0.03	0.10
AICA	3.00	2.19	1.00	2.70	1.90	0.07	0.90	0.87	0.07
AMSA	1.50	-	-	0.10	-	-	0.07	-	-
BALO	1.00	-	-	0.03	-	-	0.03	-	-
BUSW	1.00	1.00	1.00	0.03	0.07	0.10	0.03	0.07	0.10
CAAU	2.00	-	19.00	0.07	-	0.63	0.03	-	0.03
CAME	6.50	-	-	0.87	-	-	0.13	-	-
CASQ	1.00	4.50	-	0.07	0.30	-	0.07	0.07	-
CHGR	1.23	1.67	-	0.53	0.67	-	0.43	0.40	-
CHMI	-	1.00	-	-	0.07	-	-	0.07	-
CHVO	1.00	1.20	1.33	0.17	0.20	0.13	0.17	0.17	0.10
CICY	-	-	1.00	-	-	0.03	-	-	0.03
COCA	-	-	1.00	-	-	0.03	-	-	0.03
COVI	-	1.00	-	-	0.03	-	-	0.03	-
ERAL	4.91	3.33	3.04	3.93	2.33	2.33	0.80	0.70	0.77
FASP	1.00	1.00	1.00	0.03	0.03	0.10	0.03	0.03	0.10
HIRU	2.00	1.25	2.67	0.27	0.17	0.27	0.13	0.13	0.10
ICBU	-	1.00	-	-	0.03	-	-	0.03	-
LALU	-	-	1.00	-	-	0.03	-	-	0.03
MIPO	1.17	1.20	-	0.23	0.20	-	0.20	0.17	-
MOAT	1.00	1.00	-	0.10	0.03	-	0.10	0.03	-
MUFO	-	1.00	-	-	0.03	-	-	0.03	-
PADO	3.50	3.67	-	0.47	0.37	-	0.13	0.10	-
PASA	-	-	1.80	-	-	0.30	-	-	0.17
PEPY	2.20	6.00	-	0.37	0.20	-	0.17	0.03	-
POGR	-	-	1.00	-	-	0.07	-	-	0.07
SPPA	1.00	-	3.00	0.03	-	0.10	0.03	-	0.03
STNE	6.27	3.76	2.96	6.27	3.76	2.57	1.00	1.00	0.87
STVU	-	-	1.00	-	-	0.03	-	-	0.03
TYVE	1.25	1.25	1.00	0.17	0.17	0.03	0.13	0.13	0.03
ZEMA	2.06	2.23	9.00	1.17	0.97	0.30	0.57	0.43	0.03
ZOLE	-	-	1.00	-	-	0.03	-	-	0.03
TOTAL				16.78	11.56	7.68			

a/ Number of individuals recorded ÷ number of stops at which species were recorded.

b/ Number of individuals recorded ÷ total number of stops (30).

c/ Number of stops at which species was recorded ÷ total number of stops (30).

Table 7. Results of roadside counts taken at the Osage Site (observed by Wiens). 1970 Comb. = combined census results for 13 June 1970 to 14 June 1970; and 1971 = census results for 16 June 1971.

Species	Birds/Stop[a/]		Birds/Stop (Total)[b/]		Frequency[c/]	
	1970 Comb.	1971	1970 Comb.	1971	1970 Comb.	1971
AGPH	2.92	3.63	1.43	1.93	0.50	0.53
AMSA	4.46	4.92	4.32	4.60	0.97	0.93
ARHE	1.00	1.00	0.07	0.07	0.07	0.07
BALO	3.11	2.40	2.43	1.60	0.77	0.67
BUJA	-	1.00	-	0.07	-	0.07
BUVI	0.50	-	0.02	-	0.02	-
CAAU	0.50	1.00	0.02	0.07	0.02	0.07
CHMI	1.37	1.00	0.13	0.07	0.07	0.07
CHVO	1.75	2.00	0.20	0.33	0.10	0.17
CICY	1.00	1.00	0.10	0.03	0.10	0.03
COBR	0.50	-	0.02	-	0.02	-
COVI	2.58	1.33	0.18	0.13	0.10	0.10
ERAL	1.62	1.80	0.28	0.30	0.17	0.17
HIRU	3.22	3.54	0.82	1.53	0.27	0.43
ICSP	1.00	1.00	0.03	0.03	0.02	0.03
LALU	1.25	-	0.07	-	0.03	-
MIPO	1.00	2.00	0.10	0.07	0.10	0.03
MOAT	1.50	3.22	0.05	0.97	0.02	0.30
MUFO	1.50	2.00	0.17	0.20	0.10	0.10
PEPY	4.75	7.00	0.32	0.47	0.07	0.07
QUQU	2.24	1.75	0.57	0.23	0.23	0.13
SPAM	7.27	9.30	7.27	9.30	1.00	1.00
STMA	7.73	11.37	7.73	11.37	1.00	1.00
STNE	1.17	-	0.07	-	0.07	-
STRU	1.50	-	0.05	-	0.02	-
TUMI	-	1.50	-	0.10	-	0.07
TYCU	1.50	1.00	0.05	0.03	0.02	0.03
TYTY	1.45	1.36	0.27	0.50	0.17	0.37
TYVE	0.50	1.67	0.02	0.17	0.02	0.10
ZEMA	1.99	1.90	0.43	0.63	0.20	0.33
TOTAL			27.21	34.80		

a/ Number of individuals recorded ÷ number of stops at which species was recorded.

b/ Number of individuals recorded ÷ total number of stops (30).

c/ Number of stops at which species were recorded ÷ total number of stops (30).

Table 8. Results of seasonal roadside counts taken at the Osage Site (observed by Messerly). Spring = 20 April 1971; Summer = 18 June 1971; and Fall = 27 September 1971.

Species	Birds/Stop[a/]			Birds/Stop (Total)[b/]			Frequency[c/]		
	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall
AGPH	2.69	2.06	5.50	1.43	1.23	1.10	0.53	0.60	0.20
AMSA	2.43	1.96	1.33	1.13	1.43	0.13	0.47	0.73	0.10
ARHE	1.00	-	-	0.03	-	-	0.03	-	-
BALO	2.18	1.71	-	1.23	1.20	-	0.57	0.70	-
BUJA	1.00	1.00	1.00	0.03	0.03	0.10	0.03	0.03	0.10
BUSW	2.00	-	-	0.07	-	-	0.03	-	-
BUVI	-	1.00	-	-	0.10	-	-	0.10	-
CAAU	-	-	2.00	-	-	0.20	-	-	0.10
CHVO	1.50	1.44	1.40	0.10	0.43	0.23	0.07	0.30	0.17
CICY	-	1.00	1.00	-	0.10	0.13	-	0.10	0.13
COAM	-	1.00	-	-	0.03	-	-	0.03	-
COAU	-	1.00	1.00	-	0.03	0.07	-	0.03	0.07
COBR	4.00	1.00	2.25	0.27	0.10	0.30	0.07	0.10	0.13
COVI	-	1.00	-	-	0.10	-	-	0.10	-
CYCR	1.00	-	-	0.03	-	-	0.03	-	-
ERAL	2.44	1.56	2.25	0.73	0.47	0.60	0.30	0.30	0.27
FASP	1.00	-	2.00	0.03	-	0.13	0.03	-	0.07
GUCA	-	1.00	-	-	0.03	-	-	0.03	-
HIRU	2.00	2.58	3.82	0.33	1.03	2.17	0.17	0.40	0.57
ICGA	-	1.00	-	-	0.03	-	-	0.03	-
ICSP	-	1.00	-	-	0.13	-	-	0.13	-
LALU	1.00	1.00	-	0.07	0.03	-	0.07	0.03	-
MOAT	2.67	1.89	15.11	0.27	0.57	4.53	0.10	0.30	0.30
MUFO	-	1.00	1.80	-	0.07	0.30	-	0.07	0.17
PASA	2.00	-	-	0.20	-	-	0.10	-	-
QUQU	6.00	2.00	-	0.40	0.27	-	0.07	0.13	-
SISI	2.00	1.00	-	0.07	0.07	-	0.03	0.07	-
SPAM	-	3.13	-	-	3.03	-	-	0.97	-
SPTR	-	-	2.00	-	-	0.07	-	-	0.03
STMA	5.83	4.10	4.40	5.83	4.10	3.70	1.00	1.00	0.83
STNE	1.00	-	-	0.03	-	-	0.03	-	-
STVU	2.00	-	2.00	0.07	-	0.07	0.03	-	0.03
TORU	-	1.00	-	-	0.03	-	-	0.03	-
TYCU	1.57	2.00	1.00	0.37	0.07	0.10	0.23	0.03	0.10
TYTY	-	1.00	-	-	0.13	-	-	0.13	-
ZEMA	3.22	1.79	1.25	0.97	0.53	0.17	0.30	0.30	0.13
TOTAL				13.69	15.37	14.10			

a/ Number of individuals recorded ÷ number of stops at which species was recorded.

b/ Number of individuals recorded ÷ total number of stops (30).

c/ Number of stops at which species was recorded ÷ total number of stops (30).

Table 9. Results of roadside counts taken at the Cottonwood Site (observed by Wiens). 1970 Comb. = combined census results for 26 June 1970 to 27 June 1970; and 1971 = census results for 26 June 1971.

Species	Birds/Stop[a/]		Birds/Stop (Total)[b/]		Frequency[c/]	
	1970 Comb.	1971	1970 Comb.	1971	1970 Comb.	1971
AGPH	4.64	4.29	3.42	3.43	0.73	0.80
AMSA	2.78	4.62	1.48	4.00	0.53	0.87
ANPL	2.25	-	0.13	-	0.03	-
BALO	1.48	2.07	0.28	0.90	0.17	0.43
BUJA	1.00	-	0.07	-	0.07	-
BUSW	0.50	1.00	0.02	0.03	0.02	0.03
CAME	3.17	4.00	0.85	1.73	0.27	0.43
CAOR	2.17	3.25	0.80	0.87	0.37	0.27
CHGR	1.50	-	0.07	-	0.03	-
CHVO	2.05	2.25	0.27	0.30	0.10	0.13
CICY	-	1.00	-	0.07	-	0.07
ERAL	3.73	3.32	2.78	2.43	0.73	0.73
FASP	1.00	1.00	0.03	0.03	0.03	0.03
HIRU	2.50	1.67	0.33	0.17	0.13	0.10
LALU	-	1.00	-	0.03	-	0.03
MOAT	2.25	2.00	0.10	0.40	0.03	0.20
NUAM	2.00	2.00	0.33	0.07	0.17	0.03
PEPH	-	1.00	-	0.03	-	0.03
PEPY	1.92	4.50	0.17	0.60	0.07	0.13
PHCO	1.00	1.00	0.05	0.03	0.03	0.03
PIPI	-	2.00	-	0.07	-	0.03
QUQU	1.50	-	0.12	-	0.07	-
SPAM	-	3.50	-	0.23	-	0.07
STNE	7.12	8.63	7.12	8.63	1.00	1.00
STVU	0.50	6.00	0.02	0.40	0.02	0.07
TORU	1.00	1.00	0.07	0.07	0.07	0.07
TUMI	1.00	-	0.07	-	0.03	-
TYTY	1.12	2.67	0.10	0.53	0.07	0.20
TYVE	1.38	1.33	0.35	0.27	0.23	0.20
ZEMA	1.67	1.91	0.50	0.70	0.30	0.37
TOTAL			19.48	26.02		

a/ Number of individuals recorded ÷ number of stops at which species was recorded.

b/ Number of individuals recorded ÷ total number of stops (30).

c/ Number of stops at which species was recorded ÷ total number of stops (30).

Table 10. Results of seasonal roadside counts taken at the Cottonwood Site (observed by Whitney). Spring = 16 May 1971; Summer = 27 June 1971; Fall I = 19 September 1971; and Fall II = 10 October 1971.

Species	Birds/Stop[a/]				Birds/Stop (Total)[b/]				Frequency[c/]			
	Spring	Summer	Fall I	Fall II	Spring	Summer	Fall I	Fall II	Spring	Summer	Fall I	Fall II
AGPH	3.07	3.00	1.00	-	1.43	1.77	0.03	-	0.47	0.59	0.03	-
AMSA	1.00	1.67	-	-	0.03	0.59	-	-	0.03	0.35	-	-
ANDI	-	-	-	1.00	-	-	-	0.03	-	-	-	0.03
ANPL	1.00	-	4.00	4.00	0.07	-	0.13	0.13	0.07	-	0.03	0.03
BALO	-	1.40	-	-	-	0.41	-	-	-	0.29	-	-
BUJA	-	-	2.00	-	-	-	0.13	-	-	-	0.03	-
BUSW	1.00	-	1.00	-	0.07	-	0.07	-	0.07	-	0.07	-
CAAU	-	-	1.00	-	-	-	0.03	-	-	-	0.03	-
CAME	6.00	4.25	2.00	-	0.80	1.00	0.07	-	0.13	0.24	0.03	-
CAOR	2.00	3.00	8.00	-	0.13	0.18	0.27	-	0.07	0.06	0.03	-
CHGR	-	1.25	-	-	-	0.29	-	-	-	0.24	-	-
CHVO	2.50	1.67	2.33	-	0.67	0.59	0.47	-	0.27	0.35	0.20	-
CICY	-	-	1.00	1.50	-	-	0.10	0.10	-	-	0.10	0.07
COCA	1.00	1.33	4.00	-	0.03	0.24	0.13	-	0.03	0.18	0.03	-
CYCR	2.00	-	-	-	0.07	-	-	-	0.03	-	-	-
DEPE	-	1.00	-	-	-	0.06	-	-	-	0.06	-	-
ERAL	2.00	-	1.77	5.43	0.47	-	0.77	3.80	0.23	-	0.43	0.70
FASP	-	1.00	-	-	-	0.06	-	-	-	0.06	-	-
GETR	-	1.00	-	-	-	0.06	-	-	-	0.06	-	-
GUCA	-	1.00	-	-	-	0.06	-	-	-	0.06	-	-
HIRU	2.33	1.00	2.33	-	0.23	0.06	0.23	-	0.10	0.06	0.10	-
MOAT	1.63	3.25	-	-	0.43	0.77	-	-	0.27	0.24	-	-
OXJA	10.00	-	-	-	0.33	-	-	-	0.03	-	-	-
PAAT	-	-	-	1.50	-	-	-	0.10	-	-	-	0.07
PADO	2.00	-	2.00	6.00	0.07	-	0.07	0.02	0.03	-	0.03	0.03
PEPH	1.00	-	-	1.50	0.03	-	-	0.10	0.03	-	-	0.07
PEPY	1.67	14.50	-	-	0.17	3.41	-	-	0.10	0.24	-	-
PHCO	1.67	1.00	-	1.00	0.17	0.18	-	0.03	0.10	0.18	-	0.03
PIPI	-	2.00	-	-	-	0.12	-	-	-	0.06	-	-
POGR	-	-	8.00	-	-	-	0.27	-	-	-	0.03	-
RIRI	-	-	1.00	-	-	-	0.03	-	-	-	0.03	-
SASA	-	-	2.00	-	-	-	0.07	-	-	-	0.03	-
SPAM	-	2.00	-	-	-	0.24	-	-	-	0.12	-	-
SPPA	1.00	-	-	-	0.03	-	-	-	0.03	-	-	-
STNE	5.57	4.94	4.50	4.35	5.57	4.65	3.30	3.33	1.00	0.94	0.73	0.77
STRU	-	-	1.00	-	-	-	0.03	-	-	-	0.03	-
STVU	-	-	-	4.00	-	-	-	0.13	-	-	-	0.03
TORU	-	2.00	-	-	-	0.12	-	-	-	0.06	-	-
TRAE	1.50	1.00	-	-	0.10	0.12	-	-	0.07	0.12	-	-
TUMI	-	1.00	2.67	8.00	-	0.06	0.27	0.53	-	0.06	0.10	0.07
TYTY	1.00	1.50	-	-	0.10	0.18	-	-	0.10	0.12	-	-
TYVE	1.00	1.00	-	-	0.13	0.12	-	-	0.10	0.12	-	-
ZEMA	1.50	2.44	-	-	0.30	1.29	-	-	0.20	0.53	-	-
TOTAL					11.43	16.63	6.47	8.30				

a/ Number of individuals recorded : number of stops at which species was recorded.

b/ Number of individuals recorded : total number of stops (30).

c/ Number of stops at which species was recorded : total number of stops (30).

observers for us, it is necessary to determine the extent of these differences. Each observer ran a breeding season census within a few days of our roadside count at each site; and if it is assumed that the observational biases of our team are constant between sites, then the divergences between our counts and those of the local observers at each site may be attributed, at least in part, to observational differences. Table 11 compares general features of the breeding counts conducted by the IBP team and by local observers at Pantex, Osage, and Cottonwood. While both groups saw roughly the same dominant species, our group saw considerably more individuals than Seyffert and Messerly, but somewhat fewer than Whitney. These differences are probably largely due to the fact that we employed two observers in our count, while the local observers conducted their counts with a single observer. But there were also apparent differences in the conspicuousness of different species to the different sets of observers (Fig. 7). At Cottonwood, for example, Whitney recorded few Horned Larks or Grasshopper Sparrows, while our group observed these species at relatively high frequencies and densities (Tables 9,10). On the other hand, Whitney censused considerably more Mourning Doves than we did. It might be argued that these differences result from differences in portions of the route censused, since in this summer count, Whitney censused only 17 stops along our 30-stop route. To examine this effect, we used our count results to consider separately the 17 stops also censused by Whitney; there were no differences between the results of these 17 stops and the remaining 13 stops of our route. At Pantex, Seyffert saw fewer Horned Larks than we recorded, while at Osage, Messerly recorded fewer Grasshopper Sparrows. All observers saw fewer meadowlarks than we recorded. The results compared in Fig. 7

Table 11. Comparisons of summer roadside count data for IBP team and local observers by site in 1971.

	Pantex		Osage		Cottonwood	
	Wiens 11 June	Seyffert 20 June	Wiens 16 June	Messerly 18 June	Wiens 26 June	Whitney 27 June
Total birds seen	477	347	1044	462	782	236
Ratio[a/]	1.37		2.26		3.31	
Number of stops	25	30	30	30	30	17
Total birds seen/stop	19.08	11.57	34.80	15.40	26.07	33.71
Ratio[a/]	1.64		2.26		0.77	
Number of species	18	20	25	27	25	25
Total birds seen/species/stop	1.06	0.58	1.39	0.57	1.04	0.56
Ratio[a/]	1.83		2.44		1.86	
Percent of species seen by both	52		53		56	

[a/] Ratio = data obtained by Wiens ÷ data obtained by other observer.

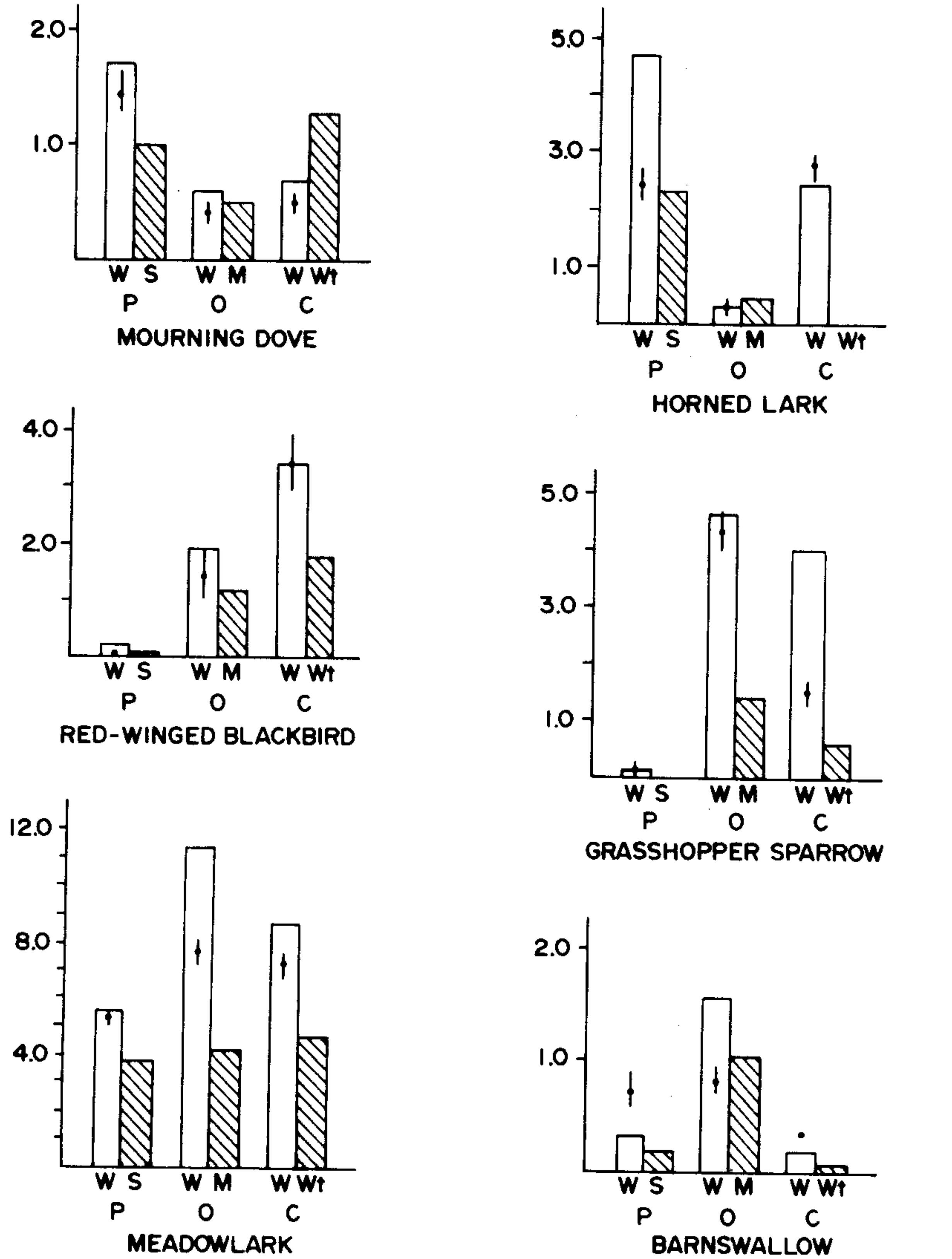


Fig. 7. Variations in abundance of some common breeding species at Pantex (P), Osage (O), and Cottonwood (C) (1971) as recorded by roadside counts. Lined bars = counts of local observers (S = Seyffert, M = Messerly, Wt = Whitney); open bars = counts of IBP team (W). Dots indicate mean census value recorded in two consecutive counts in 1970 (Wiens, 1971*a*); vertical lines represent the range in the two counts. Ordinate = mean densitv (number of individuals recorded ÷ total number of species).

have not been adjusted for the differences in total birds seen; however, somewhat higher counts for most species by our group are to be expected.

Annual variations. Yearly variations were assessed using the results of the IBP team censuses. Our group consistently recorded greater overall densities in 1971 than in 1970 (Table 12), even though in most cases fewer species were seen in 1971. Only 60 to 77% of the species recorded were seen in both years, although those recorded only once were generally "minor" species. As in 1970, a relatively small number of species dominated the counts.

Roadside count data provide only indices of species abundance rather than absolute density estimations (Wiens, 1971*a*), and as such, they are perhaps most useful when examined with respect to individual species. Annual changes in count values for some of the dominant species are indicated in Fig. 7. Higher Horned Lark density indices were recorded in 1971 at Pantex but not elsewhere (recall that plot counts indicated higher Horned Lark densities on the grazed but not the ungrazed plot at Pantex). Eastern Meadowlarks were apparently more abundant at Osage in 1971 (though not higher on plot counts), and Western Meadowlarks were recorded more frequently at Cottonwood in 1971 (this change was paralleled on the grazed plot, but not on the ungrazed plot). Grasshopper Sparrows had considerably higher roadside count indices at Cottonwood in 1971 (but markedly lower plot densities).

At Cottonwood, information on annual variations in roadside count values is available from the censuses Whitney has conducted since 1967 (Table 4). For the dominant species, Whitney's counts indicate a uniformly low density of Grasshopper Sparrows and Horned Larks over this 5-year period (Fig. 6), while densities of Lark Buntings and Western Meadowlarks have

Table 12. Comparison of roadside count results between 1970 and 1971 (obtained by Wiens).

Site	Year	Total Birds/Stop	Number of Species	Percent of Species Recorded Both Years
Pantex	1970	14.65	22	60
	1971	19.08	18	
Osage	1970	27.21	28	77
	1971	34.80	25	
Cottonwood	1970	19.48	25	67
	1971	26.02	25	

undergone parallel oscillations. It is worth noting that 1970, the year IBP studies were initiated, was apparently an unusually low year for both of these species at Cottonwood. Since Western Meadowlarks are an extremely important species on the Cottonwood plots [contributing 33% of the biomass on the lightly grazed plot (Table 3)], these long-term patterns perhaps provide an additional perspective on the 1970 and 1971 plot census results.

Seasonal variations. The roadside counts conducted by local observers in 1971 permit an evaluation of seasonal variations in species composition and abundances (Tables 6,8,10,13). At Pantex, the southernmost site, the number of species and total density were highest during spring migration, falling to lows in autumn. At Osage and Cottonwood, on the other hand, the highest counts of species and individuals were taken during the breeding season. The Osage counts recorded relatively little seasonal variation in total density, while variation at Cottonwood was extensive. The rates of seasonal species turnover were relatively high at all sites, although much of the turnover involved species recorded at low densities and/or frequencies. At Pantex and Cottonwood, the rate of spring-summer turnover was less than the summer-fall replacement. Further insight into seasonal dynamics may be obtained by examining census records for individual species (Fig. 8). For example, highest meadowlark densities were recorded at all sites in spring, and abundance decreased into the fall counts. At Osage, Dickcissels were absent in spring and fall censuses, but were abundant during the breeding season, reflecting their highly migratory nature and contracted breeding period. Eventually, the estimations of seasonal changes in abundance provided by these roadside counts should broaden our perspective on the state of breeding populations sampled in plot censuses.

Ecological structure. As in 1970, roadside count results were evaluated in terms of what they revealed of the ecological as well as the taxonomic

Table 13. Summary of seasonal variations in bird populations at IBP sites (1971) as reflected by roadside counts. From Tables 6, 8, and 10.

Site	Season	Total Birds/Stop	Number of Species	Species Turnover[a/]
Pantex	Spring	16.78	21	
	Summer	11.56	20	36
	Fall	7.68	19	66
Osage	Spring	13.69	22	
	Summer	15.37	27	56
	Fall	14.10	18	55
Cottonwood	Spring	11.43	23	
	Summer	16.63	25	33
	September	6.47	19	77
	October	8.30	11	75

[a/] Percent change in species composition between successive counts.

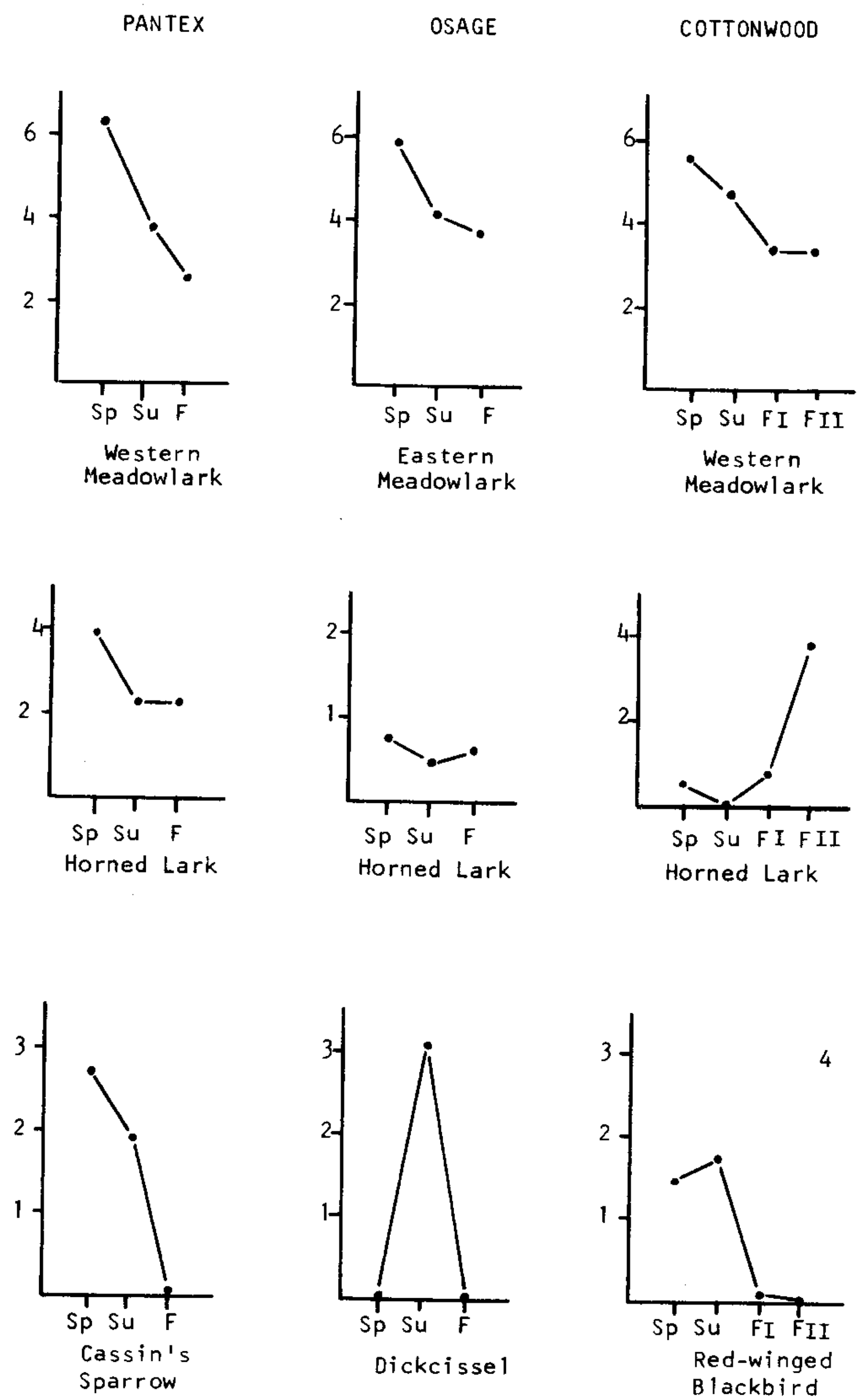


Fig. 8. Seasonal variations in abundance of some common species as recorded by roadside counts. Pantex data is from Seyffert (Table 6), Osage data from Messerly (Table 8) and Cottonwood data from Whitney (Table 10). Sp = spring count, Su = summer count, F = fall count(s). Ordinate = mean density (individuals/stop [total]).

composition of the local avifaunas. Species were categorized ecologically according to size, feeding location, and feeding behavior (Appendix IV); and roadside count values were summarized using these ecological categories rather than species. This analysis showed that the ecological structure of the breeding avifauna at each of the three sites remained essentially unchanged in 1971 from the 1970 composition (Table 14, Fig. 9). At Pantex, small ground-feeding forms comprised a somewhat greater proportion of the total count in 1971, while meadowlarks (medium ground feeders) and air-foraging forms decreased slightly in importance. At Osage and Cottonwood, changes were very minor indeed. These results suggest that breeding bird populations of grassland sites may have a fairly characteristic ecological structure which may remain stable, despite changes in the abundance or density of individual species.

The count results obtained by the local observers at these three sites provide an opportunity for examining seasonal changes in ecological structure as well. In order to do this in a manner which will permit between-site comparisons, however, it is necessary to somehow adjust count results to reduce the effects of differences between individual observers noted above. To do this, we used the IBP team breeding counts as a "standard" and, for each ecological category, calculated a ratio of our count to the local observer counts. These ratios were then used as conversion factors (Table 15), and counts were standardized by multiplying the total birds per stop for each ecological category at a site census by the conversion factor for that category at that site. The results of this bit of wizardry are summarized in Fig. 10. At Pantex, raptors were somewhat more abundant, proportionally, in spring than in summer and fall, as were roadside-brush forms. The proportion of small ground-feeding forms increased slightly from spring to fall.

Table 14. Mean density (number of individuals/total number of stops) and proportions (percent of total count, in parentheses) of various ecological categories recorded in roadside counts (observed by Wiens).

Site	Date	Ecological Category									
		Raptor	Aquatic	Roadside-Brush	Air-Swoop Feed	Air-Flycatching	Ground Shorebird	Large Ground	Meadowlark	Small Ground	Miscellaneous
Pantex	11 June 1971	0.12 (1)	- -	0.84 (4)	0.44 (2)	0.08 (*)	- -	- -	5.52 (29)	10.24 (54)	1.76 (9)
	1970 Comb.	0.17 (1)	- -	0.62 (4)	0.90 (6)	0.17 (1)	- -	0.10 (*)	5.32 (36)	6.35 (43)	1.48 (10)
Osage	16 June 1971	0.17 (*)	0.07 (*)	3.70 (11)	2.07 (6)	0.87 (2)	1.60 (5)	0.17 (*)	11.37 (33)	14.20 (41)	0.63 (2)
	1970 Comb.	0.12 (*)	0.08 (*)	2.45 (9)	1.32 (5)	0.45 (2)	2.43 (9)	0.23 (1)	7.82 (29)	11.87 (44)	0.45 (2)
Cottonwood	26 June 1971	0.13 (1)	- -	4.70 (18)	0.77 (3)	0.80 (3)	0.97 (4)	0.07 (*)	8.63 (33)	9.27 (36)	0.70 (3)
	1970 Comb.	0.12 (1)	0.62 (3)	4.05 (21)	0.50 (3)	0.45 (2)	0.62 (3)	0.05 (*)	7.12 (37)	5.97 (31)	- -

* Less than 1%

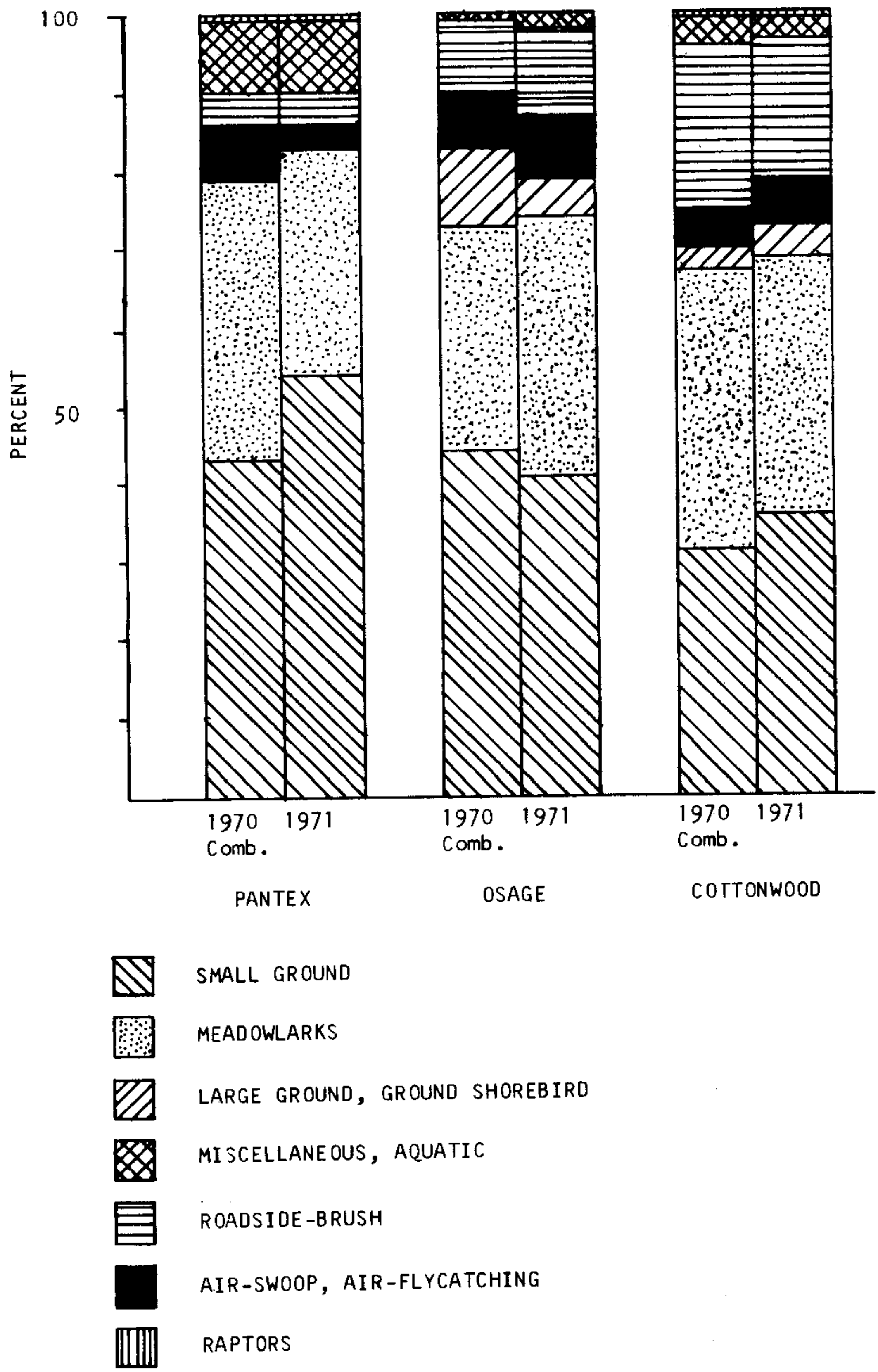


Fig. 9. Ecological composition of roadside counts taken by IBP team at three sites (1970, 1971). Ordinate = percent of total count consisting of the indicated ecological category (from Table 14).

Table 15. Correction factors applied to roadside count data on ecological categories from other observers, 1971.

Category	Correction Factors[a/]		
	Seyffert (Pantex)	Messerly (Osage)	Whitney (Cottonwood)
Raptor	1.00	1.25	4.00
Aquatic	1.00	0.67	1.00
Roadside-Brush	1.40	1.29	2.31
Air-Swoop Feed	0.85	2.00	0.39
Air-Flycatching	0.33	4.33	4.80
Ground Shorebird	1.00	1.33	4.14
Large Ground	1.00	1.00	0.67
Meadowlark	1.22	2.77	3.28
Small Ground	1.74	2.88	7.13
Miscellaneous	1.10	0.90	0.75

a/ Correction factor = number of individuals in a given category recorded by Wiens at a given site ÷ number of individuals in the same category recorded by the other observer, at the same site, at a comparable time.

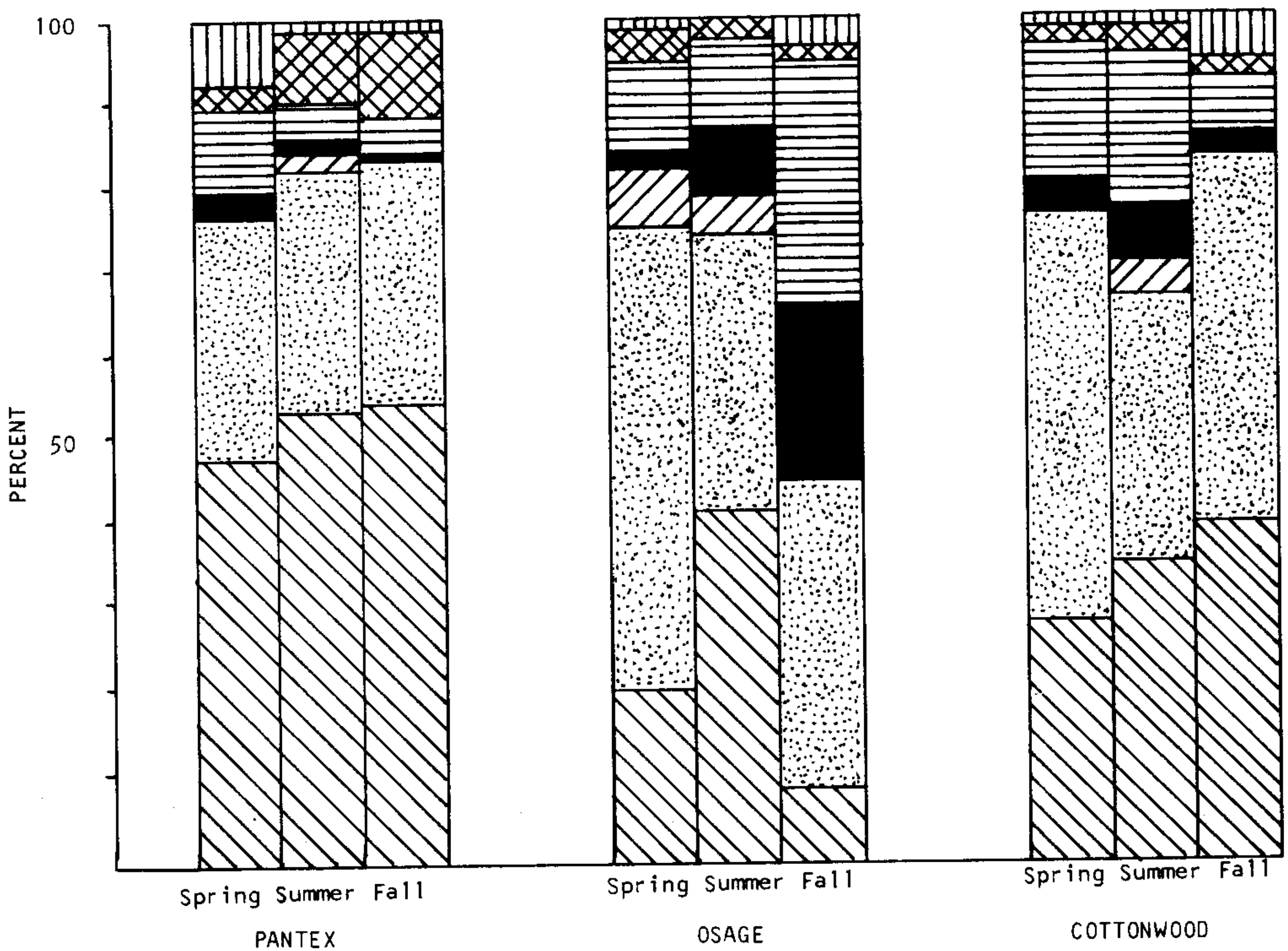


Fig. 10. Seasonal variation in the ecological composition of roadside counts taken by local observers at three IBP sites, 1971. Count results were adjusted using the correction factors given in Table 15 to make intersite comparisons unbiased. Ordinate and key as in Fig. 9.

At Cottonwood, small ground-feeding forms were proportionally less abundant than at Pantex [a difference also noted in the IBP team counts (Fig. 9)], but showed a similar seasonal trend. Roadside-brush forms comprised a higher proportion of the count than at Pantex (Fig. 9), and maintained a stable proportion in spring and summer, decreasing somewhat in fall. The proportional distribution of ecological categories showed greatest seasonal variation at Osage where meadowlarks dominated the spring count, but decreased in summer when small ground-feeding forms increased. In fall, small ground types contributed less than 10% of the individuals counted, but the proportion of air-feeding and roadside-brush species increased considerably.

Species dispersion: A model. Since roadside count data are collected as densities and frequencies of occurrence, they permit some analysis of the dispersion patterns of particular species or ecological categories. If there are consistent tendencies toward contagiousness or uniformity in the dispersion of a species or category, this may give some rather fundamental insight into their responsiveness to grassland habitats. In order to quantify spatial patterns from the roadside count data, we have developed the following graphical model (primarily a result of the efforts of John Rotenberry).

We may begin by examining the theoretical distribution of individuals among the stops of a census route (Fig. 11). If the *incidence* of any species (N/S_i, the number of individuals recorded divided by the number of stops at which that species was recorded) is graphed against its *mean density* (N/S_t, the number of individuals seen divided by the total number of census stops), the line $N/S_i = N/S_t$ represents the most uniform dispersion possible, in which the average number seen at one stop equals the average number seen at all stops. Values falling below and to the right of this line are not possible, since S_i is always $\leq S_t$, and thus N/S_i will always be $\geq N/S_t$. It

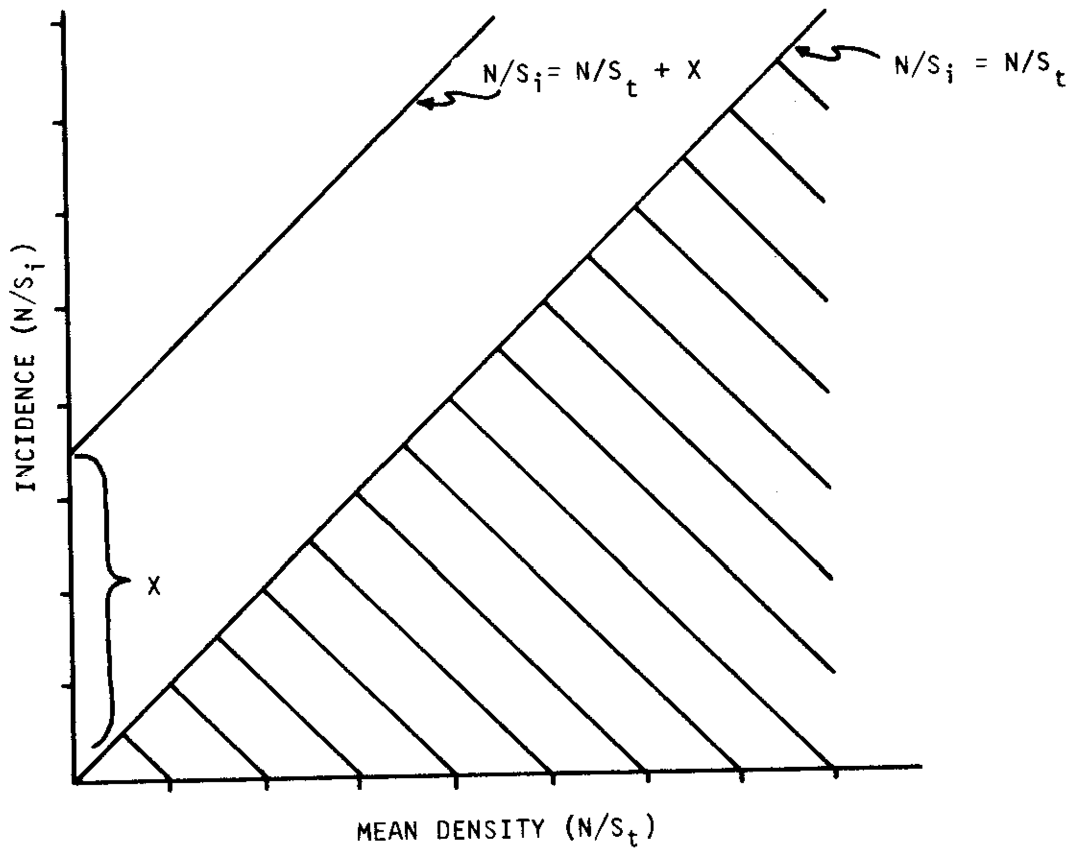


Fig. 11. Theoretical relation of mean density to incidence for a uniform dispersion ($N/S = N/S_t$) and a clumped dispersion ($N/S_i = N/S_t + X$). Hatching indicates the null area, where no observations may occur.

follows, then, that the further point is removed above and to the left of this line, the less uniformily dispersed (or the more clumped) the individuals are. The distance a point is removed from the $N/S_i = N/S_t$ line may be denoted by X (the "Clumping Index"), and thus all points falling on the line $N/S_i = N/S_t + X$ have the same patchiness in dispersion, regardless of the total number of individuals involved. All points falling above $N/S_i = N/S_t + X$ indicate a more contagious dispersion, while points falling below this line indicate a more uniform distribution pattern.

Given any total count of individuals (N) one can calculate, for a census of any given length (S_t), all values of N/S_i at different frequencies. For example, Fig. 12 depicts two such abundance-frequency curves; one for $N = 30$ and $S_t = 30$ and another for $N = 70$ and $S_t = 30$. These curves indicate variations in the dispersion of individuals for a constant total abundance, ranging from uniform where $S_i/S_t = 1.0$, to clumped at some lower frequency (in other words, all points on a line involve the same number of birds, regardless of the patchiness of their dispersion).

In order to determine the dispersion characteristics of a species or ecological category from census data, then, it is necessary to interpret the changes in incidence with decreasing frequency for a given N, using various arbitrarily-chosen Clumping Indices. For any given Clumping Index (X), it is possible to calculate the *frequency* of occurrence of a species (S_i/S_t) for all combinations of incidence (N/S_i) and census length (S_t). When graphed against frequency rather than mean density (Fig. 13a), the line $N/S_i = N/S_t + X$ describes a curve rather than a straight line, since

$$S_i = 1 - X\left[\frac{S_i}{N}\right] \text{ or } \left[\text{Frequency} = 1 - X \ \frac{1}{\text{incidence}}\right]$$

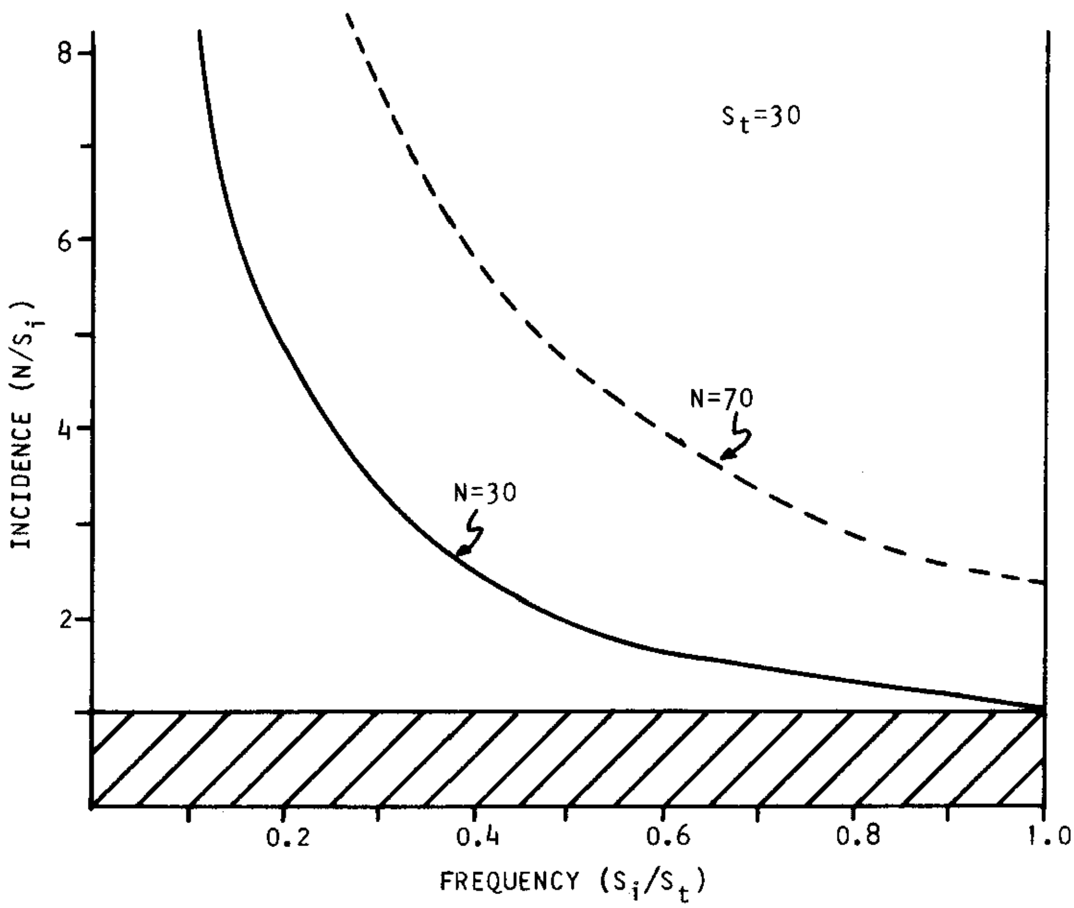


Fig. 12. Abundance-frequency curves for two different values of N. Since it is impossible to see less than one bird at a stop where birds are seen, observations will not occur in the hatched area.

a

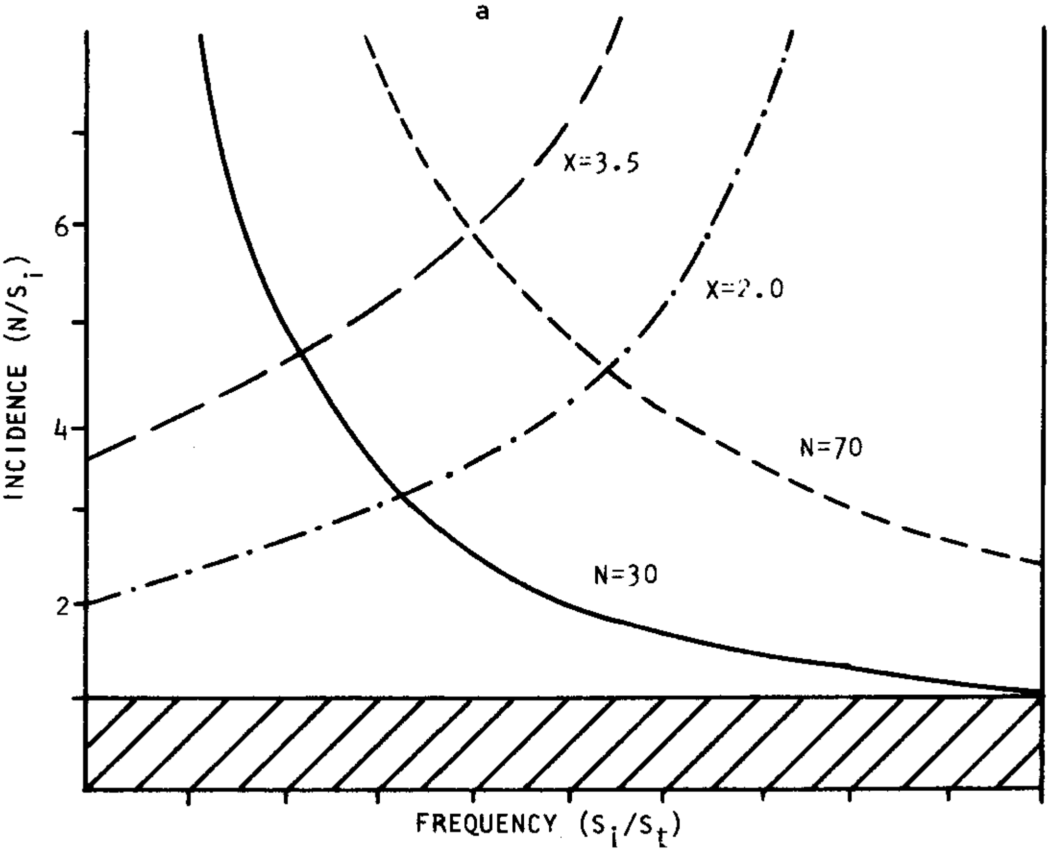


Fig. 13a. Relation of Clumping Index curves to incidence, frequency, and abundance-frequency curves. Two values of Clumping Index (X) are shown; census points lying to the upper left of the graph indicate progressively greater clumping of individuals.

b

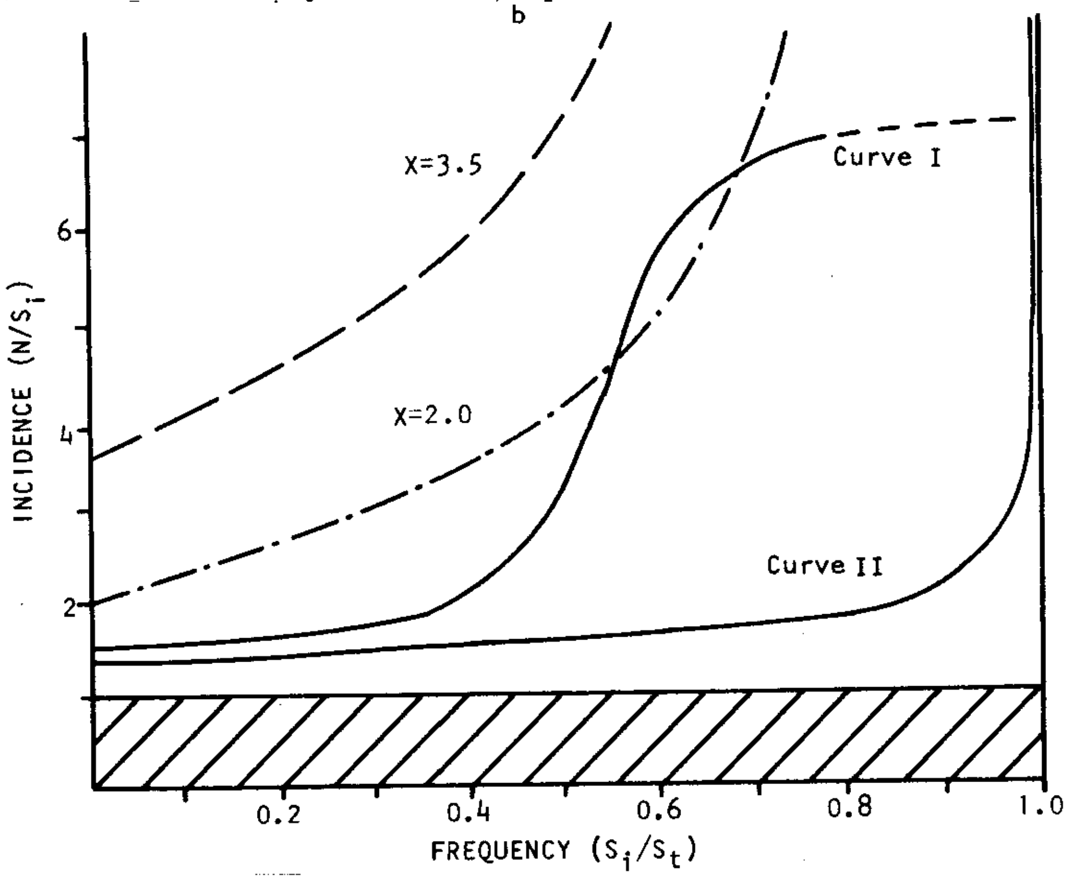


Fig. 13b. Relation of Clumping Index curves to density-frequency changes in ecological "specialist" (Curve I) and ecological "generalist" (Curve II). See text for explanation.

Thus, points falling above and to the left of any chosen Clumping Index curve for any given abundance-frequency curve indicate a particular degree of clumping. Census results are initially calculated in terms of incidence (N/S_i) and frequency (S_i/S_t) (Tables 4 to 10) and thus immediately yield points which can be graphed with relation to these Clumping Index curves to determine the degree of clumping or uniformity in dispersion.

The pattern resulting when incidence-frequency points for a species or ecological category from many censuses are plotted in this way may, in addition, provide a good indication of the habitat responsiveness or "niche breadth" of the species. Thus, a species which is ecologically rather restricted (i.e., for which only a portion of the different habitat conditions encountered among the 30 stops of a census are "optimal") or which responds only to a particular patch type in the environment may increase in abundance and spatial distribution according to Curve I of Fig. 13b. From an initial state of low abundance and low frequency, its increase may at first be represented as an increase in distributional spread (measured by frequency of occurrence) with little increase in the density where it does occur (measured by incidence). As it increases in spread, however, it soon may occupy all suitable habitat patches and begin to encounter suboptimal or unsuitable habitat patches. This limits further spread (and thus further increases in frequency) and restricts increase in abundance to increases in local density (e.g., greater territorial packing), thus increasing the tendency toward clumping (i.e., increasing the value of X). The point along this curve at which X is maximum, then, may represent the point at which the population has "saturated" optimal habitat patches. Finally, a point will be reached where further increase in local density is prohibited (e.g., by intraspecific intolerance), and increases in overall abundance must be through occupancy of additional habitat units; whether or not this occurs may be dictated by their ecological suitability to the species.

This pattern may be contrasted with that followed by an ecological generalist, a species for which all of the habitat patches encountered during censuses are more or less "optimal," or at least suitable (Curve II, Fig. 13b). Such a species may be expected initially to increase from a state of low abundance-low frequency via increased dispersion; as more and more habitat units are occupied, there will be little initial increase in incidence. For a "complete" generalist, local density may begin to increase only when all habitat areas have been occupied at low density (i.e., frequency = 1.0). There may, of course, be various intermediate conditions between these two extremes for different species or categories. Further, the form of this "ecological response curve" is dictated both by the ecological characteristics of the species *and* the patchiness of habitat types sampled in census stops. For example, Curve II may also occur if the habitat is entirely uniform, or if censusing takes place entirely *within* an individual patch type.

Model application. This model has been used to interpret both simulated data and 1970-71 roadside count results. In the simulation, three randomly derived data sets were used. The results of this exercise are presented in Fig. 14. First, using a random numbers table, 25 *single* points were distributed among 25 quadrats. Thus, $N = 25$ (the number of points), and $S_t = 25$ (the number of quadrats). From this, we computed N/S_i, N/S_t, and S_i/S_t (where S_i = number of quadrats containing points). This "census result" was graphed. Then 25 additional points were randomly added to the set so that $N = 50$, S_i was recorded, and incidence and frequency were computed as before. This result was graphed and the procedure repeated for $N = 75$ and $N = 100$.

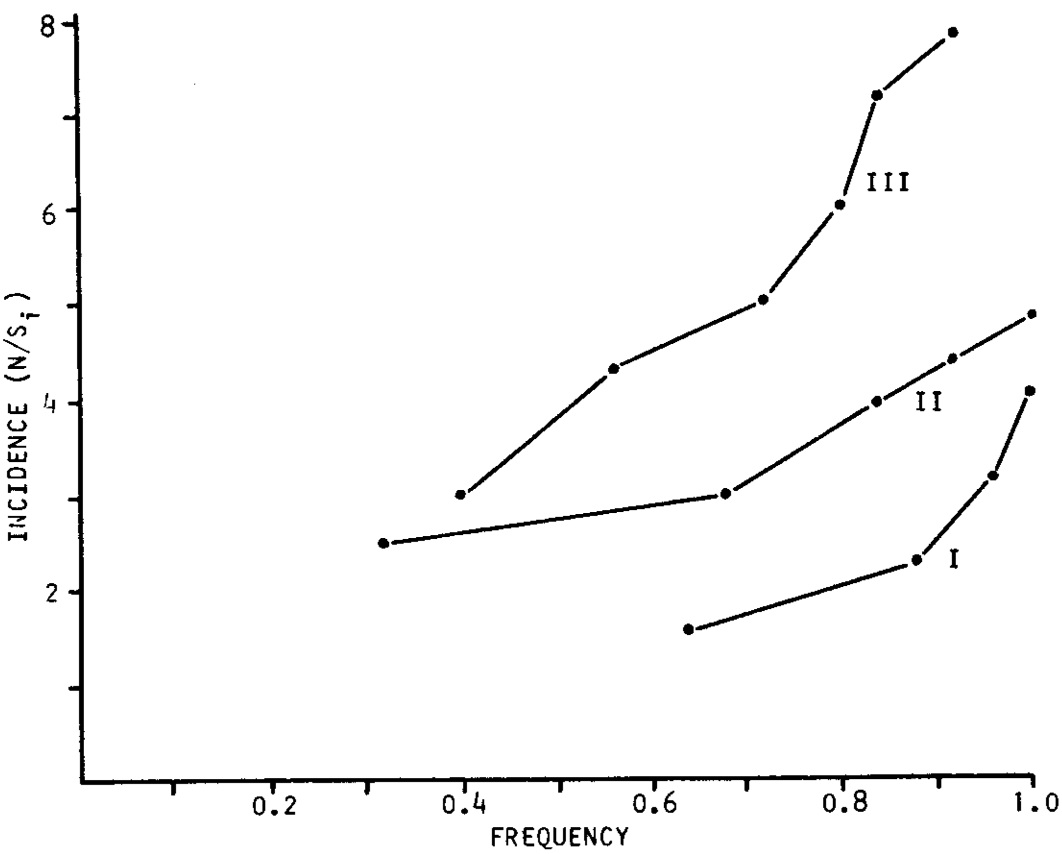


Fig. 14a. Changes in frequency of occurrence and incidence with increasing total abundance for random simulations. Curve I = individuals dispersed as single individuals; Curve II = individuals distributed in pairs; Curve III = individuals distributed in triplets.

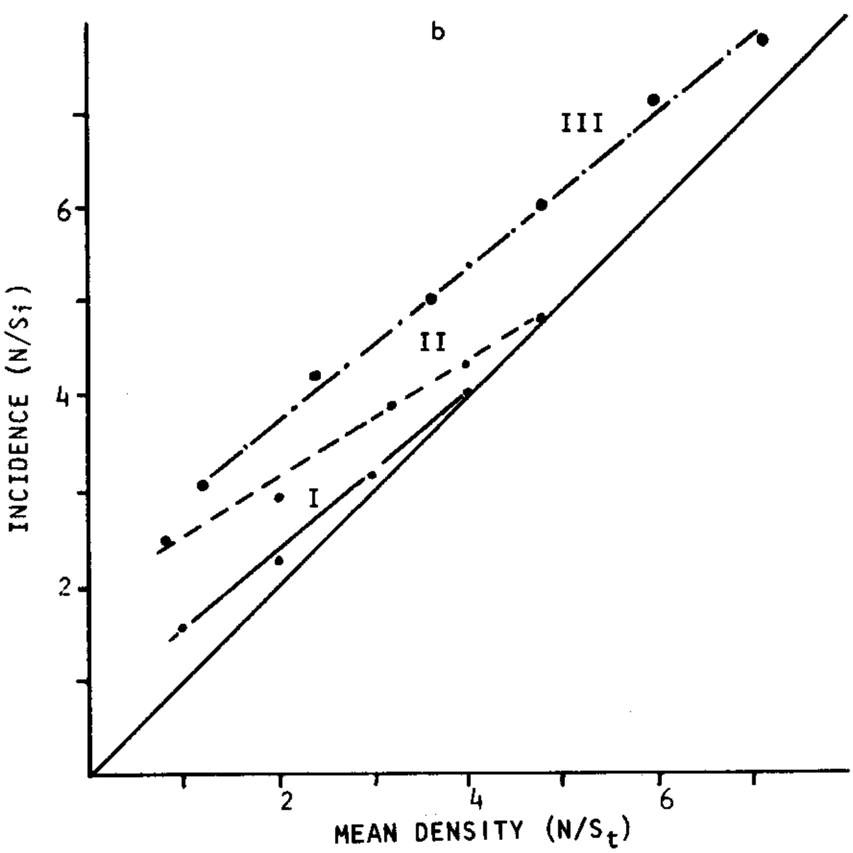


Fig. 14b. Relation between incidence and mean density for the simulated distributions. For the solid line, $N/S_i = N/S_t$, the extent of divergence from this line indicates increasing clumping in dispersion of individuals.

The "census results" produced in this manner are presented in Curve I of Fig. 14a. To simulate another type of species response, 20 *paired* points were initially distributed among 25 quadrats ($N = 20$, $S_t = 25$); data were recorded and calculated as above. We then randomly added 30 *paired* points to the census, then 30 more, then 20, then 20 ($N = 50, 80, 100, 120$). The results of this run are graphed as Curve II of Fig. 14a. Finally, we simulated a third dispersion pattern by initially locating 30 *triplet* points in the 25 quadrats at random ($N = 30$, $S_t = 25$). We then added 30 additional *triplet* points, then 30 more, then 30, then 30, then 30 ($N = 60, 90, 120, 150, 180$), treating each set of data as above. These data are presented as Curve III of Fig. 14a. This procedure thus simulates the "ecological response curve" for species responding *randomly* to environmental patchiness, but responding first as individuals, second as pairs, and finally in groups of three. The effects of this increase in clumping are perhaps more easily visualized if the data are graphed as incidence vs. mean density (N/S_t) (Fig. 14b). It is apparent that the fitted line representing the most contagious simulated distribution (Curve III of Fig. 14a) best approximates the definition of a clumped dispersion pattern derived above (Fig. 11), and is definitely more clumped than either of the other simulated distributions. Note, however, that all of the lines of Fig. 14b converge to the $N/S_i = N/S_t$ line (in other words, as the absolute number of individuals increases, the dispersion tends toward uniform). This is reasonable since we are using N/S_i to equal the *average* number of individuals seen per stop at which a species is present. Also, for a census of given length, at higher absolute densities the probability of encountering at least one bird at every stop increases.

The graphical model developed above was also applied to selected 1970 and 1971 roadside count data (Fig. 15 to 18). At Osage, for example (Fig. 15),

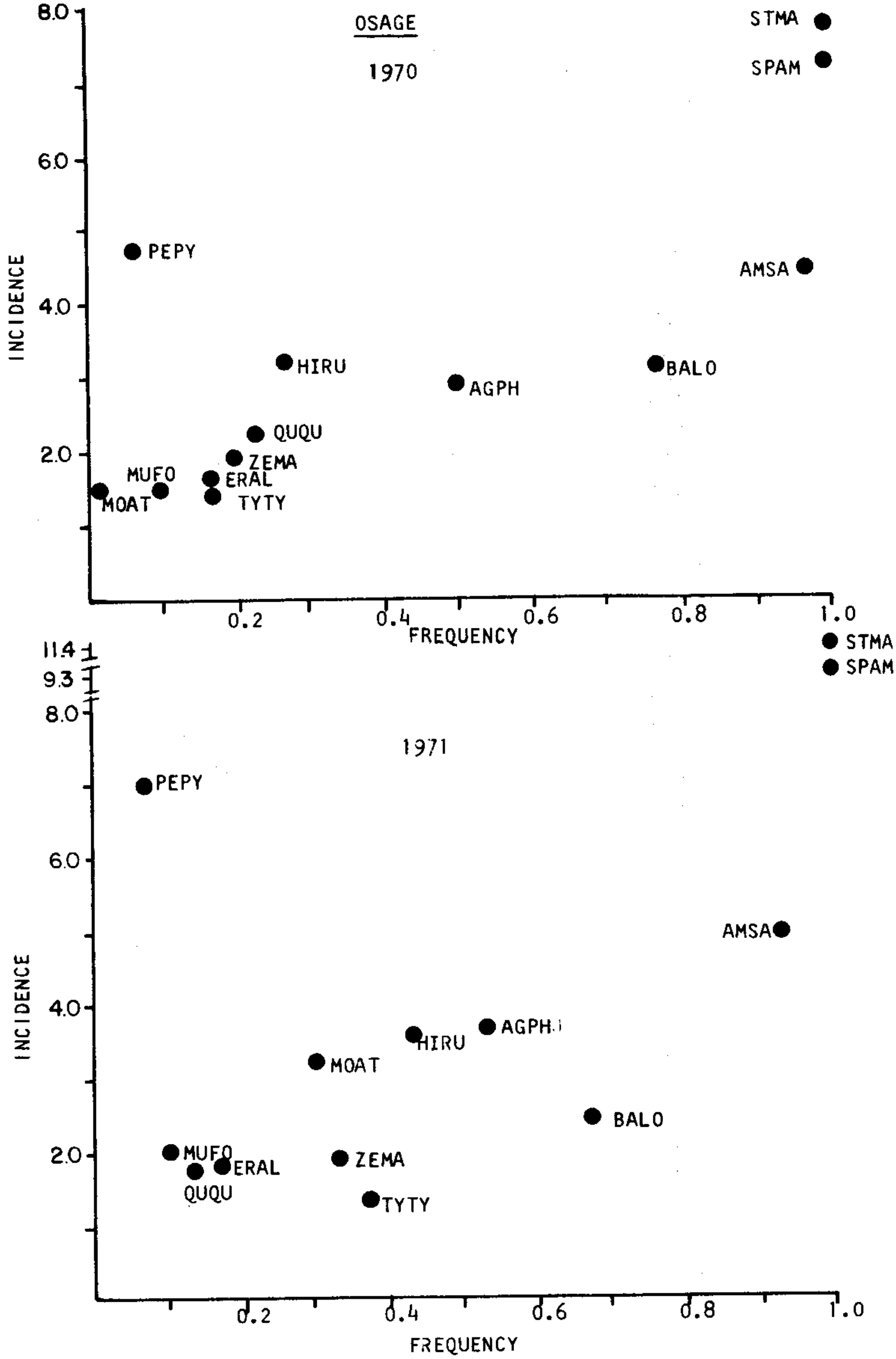
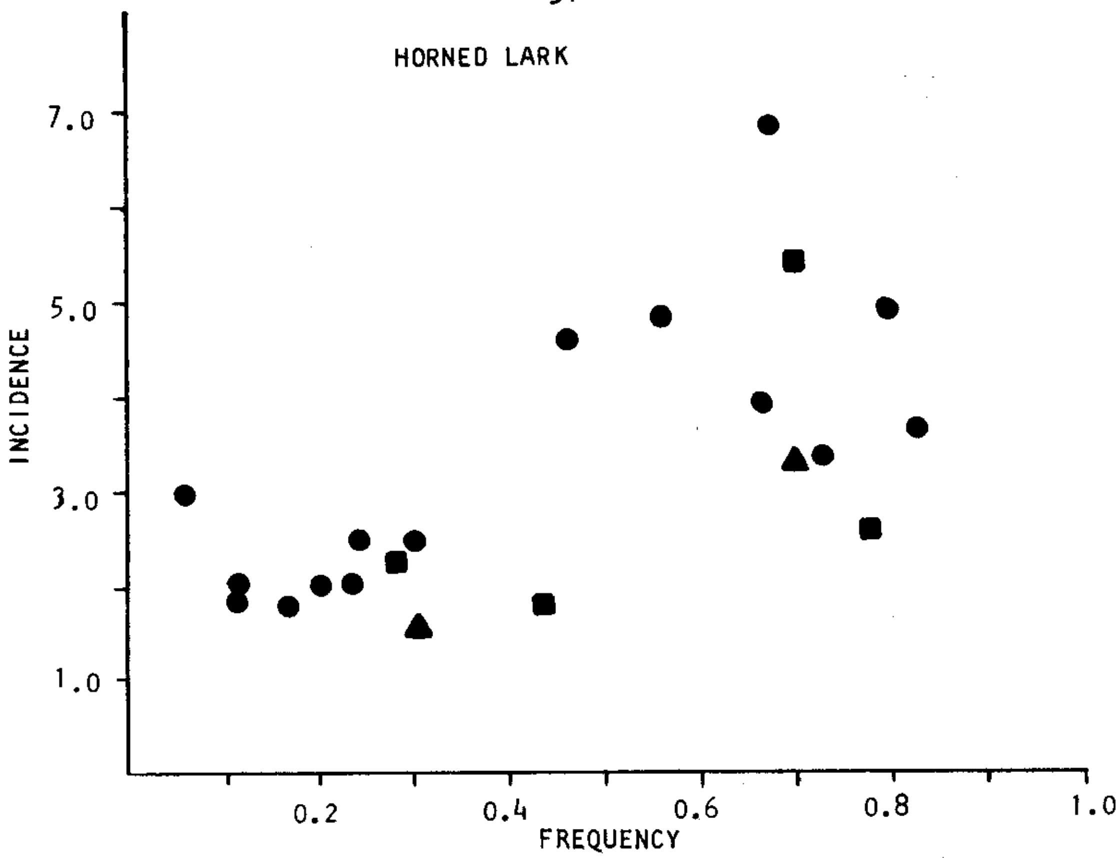


Fig. 15. Dispersion characteristics of major breeding species recorded on roadside counts taken at Osage, 1970 (above) and 1971 (below). Species codes are given in Appendix IV.



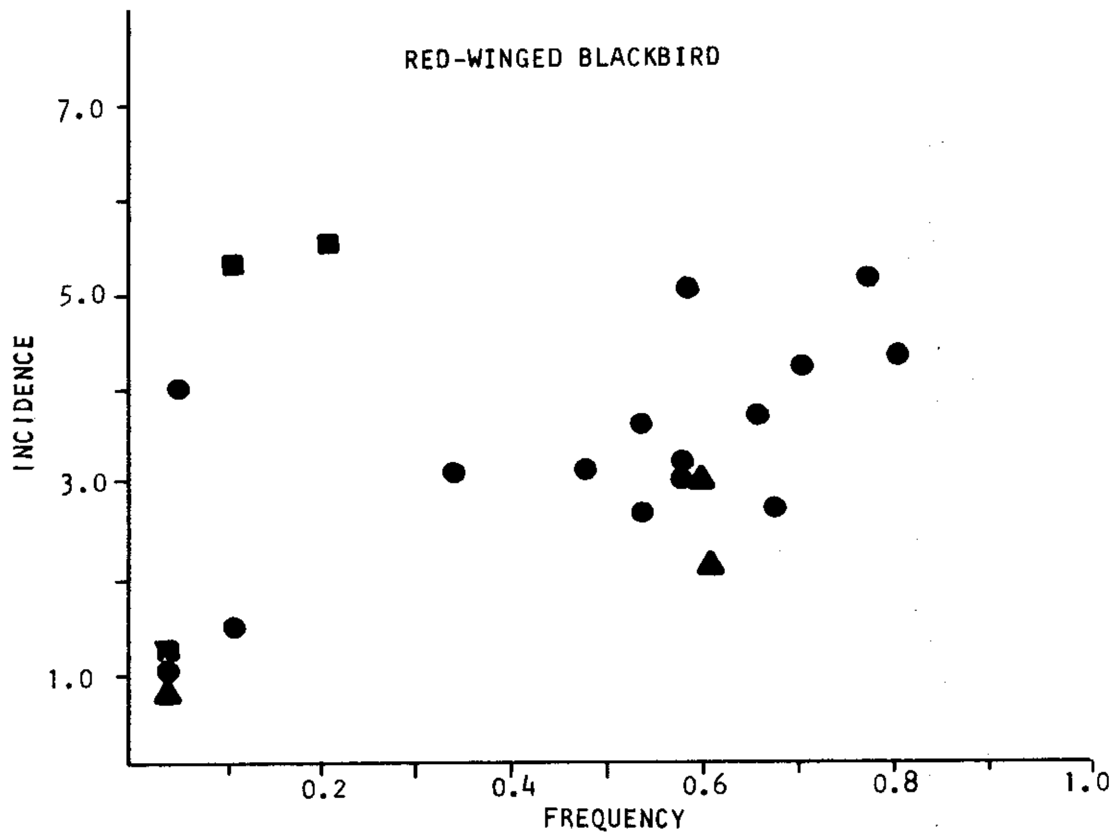
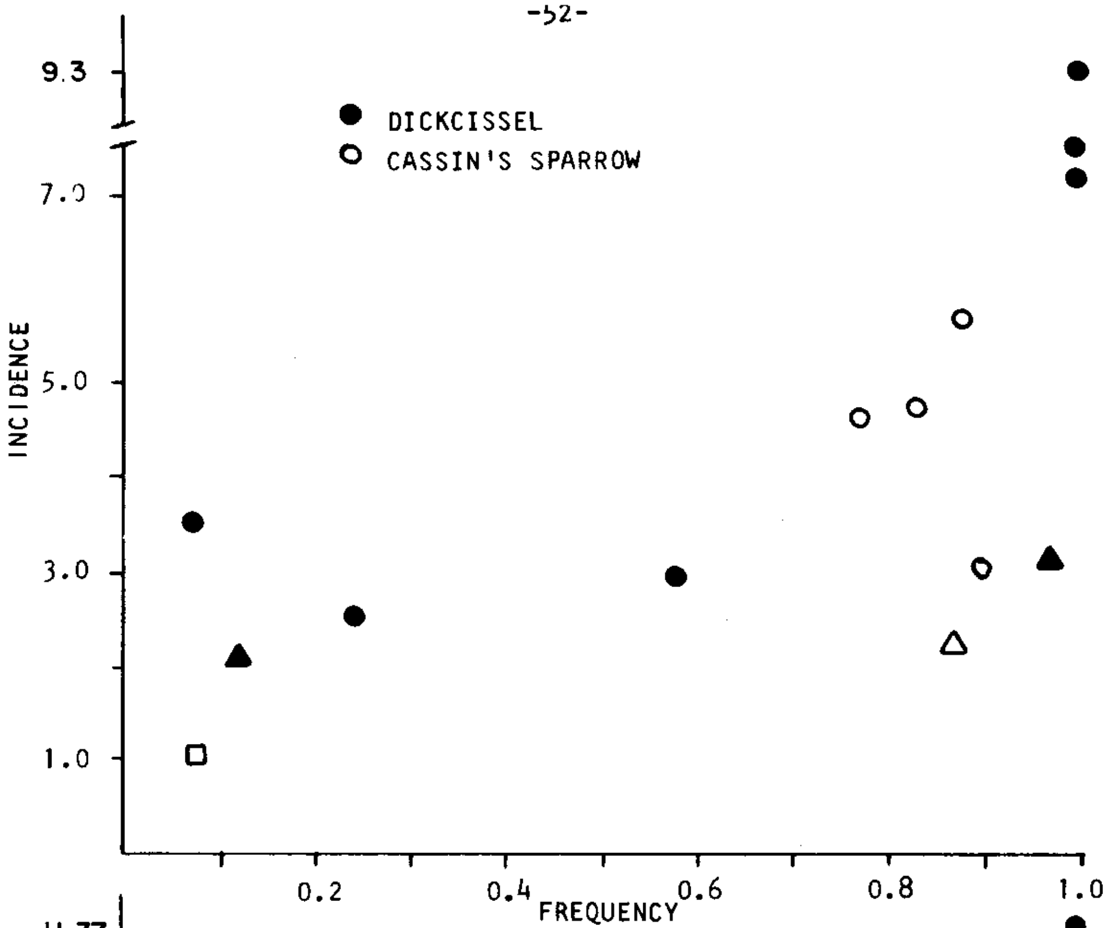


Fig. 16. Dispersion characteristics of Horned Larks (above) and Red-winged Blackbirds (below) from all IBP roadside counts (1970 and 1971). Ordinate = incidence (N/S_i) and abscissa = frequency (S_i/S_t). Triangles = spring counts, circles = summer counts, squares = fall counts.



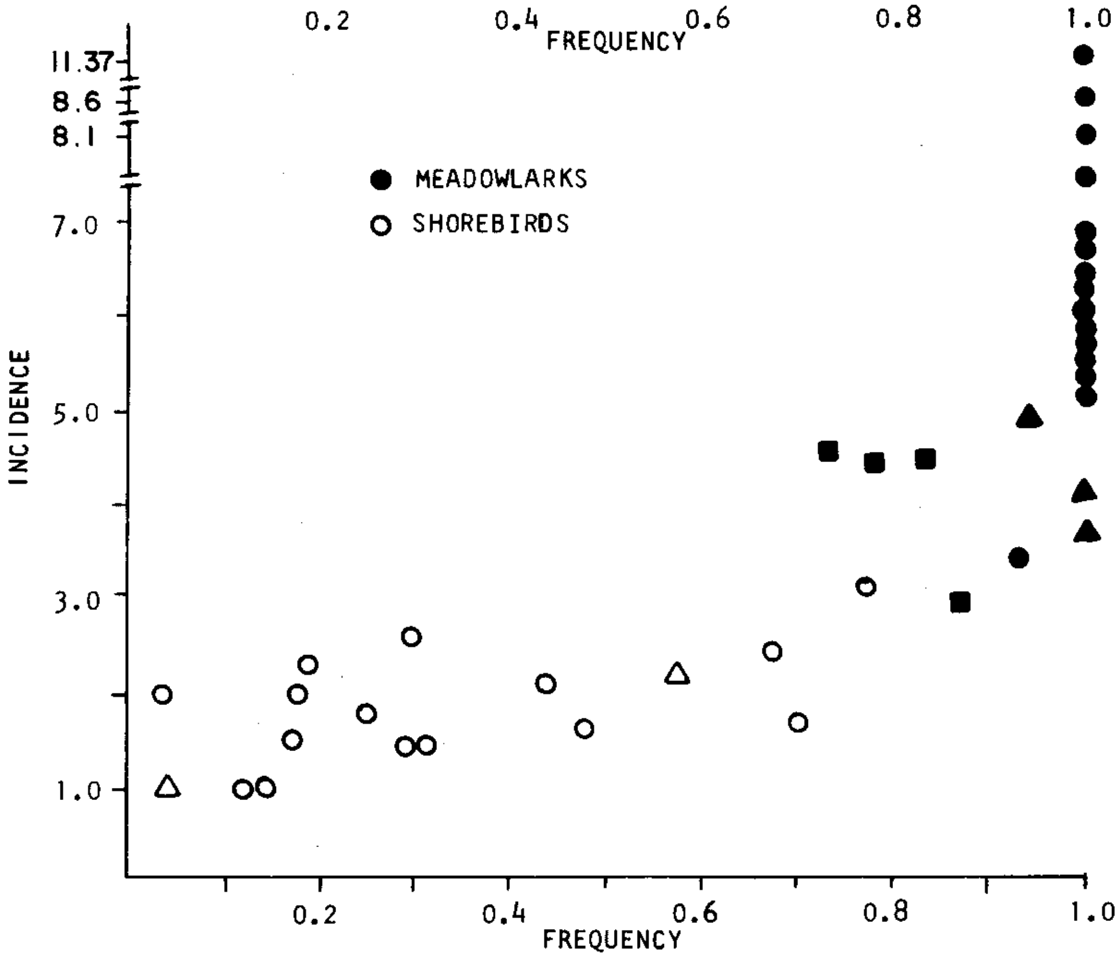
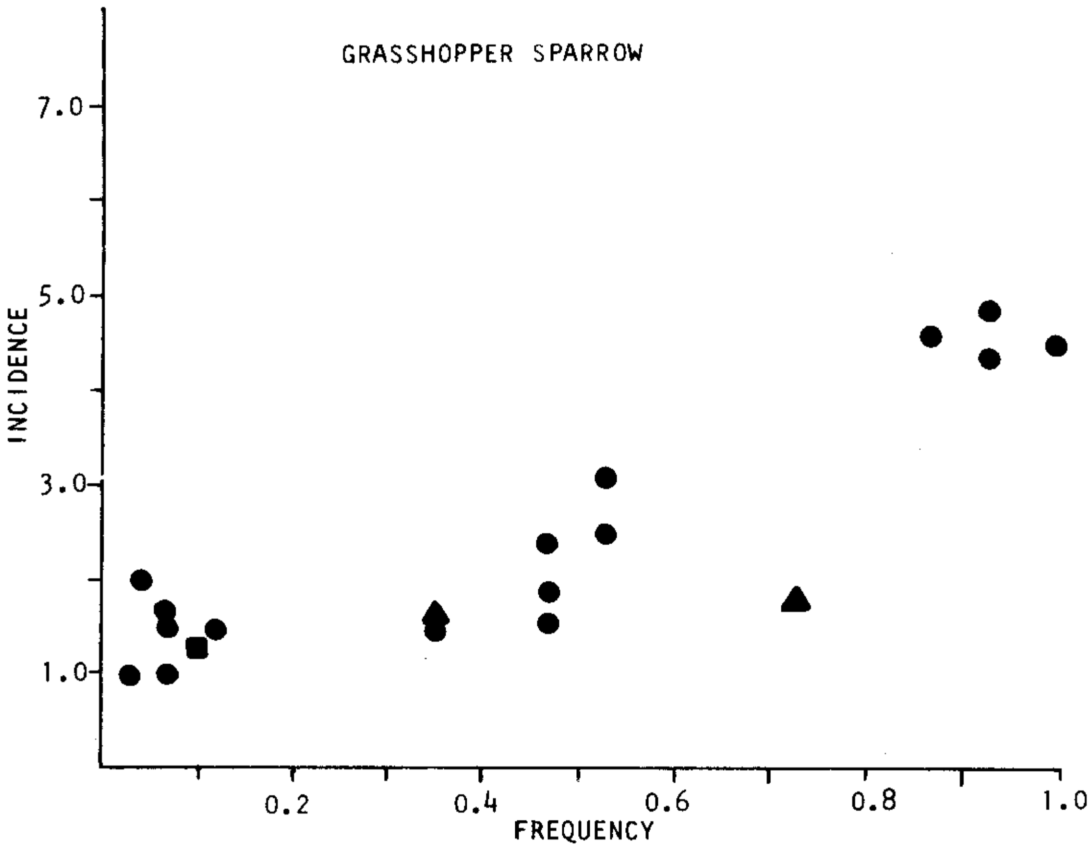


Fig. 17. Dispersion characteristics of Dickcissels and Cassin's Sparrows (above) and meadowlarks and shorebirds (Upland Plover and Long-billed Curlew) from all IBP roadside counts (1970 and 1971). Symbols are as in Fig. 16.



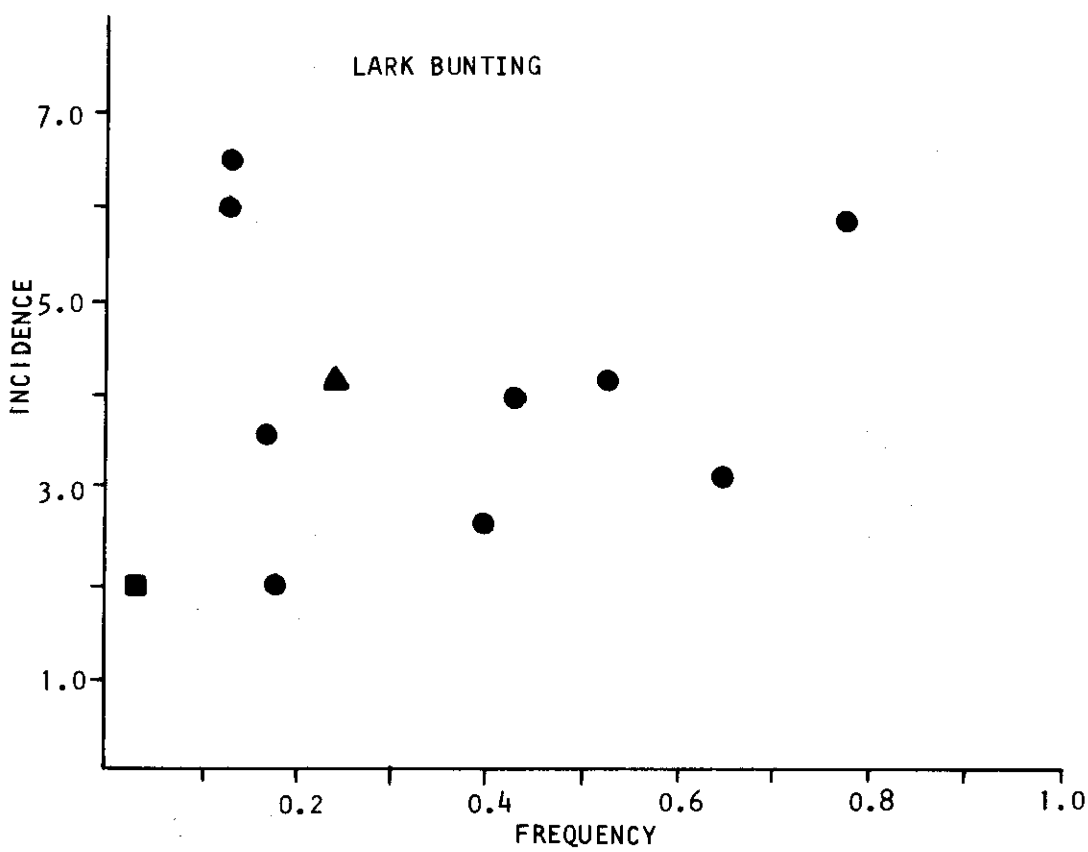


Fig. 18. Dispersion characteristics of Grasshopper Sparrows (above) and Lark Buntings (below) from all IBP roadside counts (1970 and 1971). Symbols are as in Fig. 16.

the breeding species showed varying states of incidence and frequency: Eastern Meadowlarks and Dickcissels were ubiquitous and abundant, while Cliff Swallows had high incidence but low frequency (i.e., they were highly clumped). Barn Swallows and Red-winged Blackbirds showed tendencies toward a clumped dispersion, while Mourning Doves and Eastern Kingbirds, although occurring at relatively low frequencies, tended toward more uniform dispersion. In general, patterns for 1970 and 1971 were similar.

Analysis of dispersion patterns of individual species across all sites may be more revealing than single-site analyses. Horned Larks and Red-winged Blackbirds, for example, showed a fairly rapid increase in incidence with increasing frequency (Fig. 16), while the "response curve" of Grasshopper Sparrows (Fig. 18) is shallower, and shorebirds (Fig. 17) showed little increase in incidence with increasing frequency. Increasing population density in the former species may thus be accompanied by an increased degree of aggregation, either as a result of habitat patch discrimination or social behavior. In the latter species, on the other hand, individuals added to populations are apparently more likely to occupy new (unoccupied) habitat patches than to select areas already occupied at intermediate density. Lark Buntings (Fig. 18) showed a variable pattern, but here the clumping (low frequency, high incidence) recorded by some censuses probably reflects the tendency of this species (especially males) to from seminomadic flocks during the breeding season. This sort of analysis also demonstrates the differences in social behavior between the two major species of swallows recorded on the counts (Fig. 19). Cliff Swallows are highly colonial and are restricted in their habitat utilization, remaining in the general vicinity of nesting colonies; this clumping tendency is evident in the distribution of points in Fig. 19. Barn Swallows, on the other hand, are more widely dispersed as relatively solitary breeding pairs.

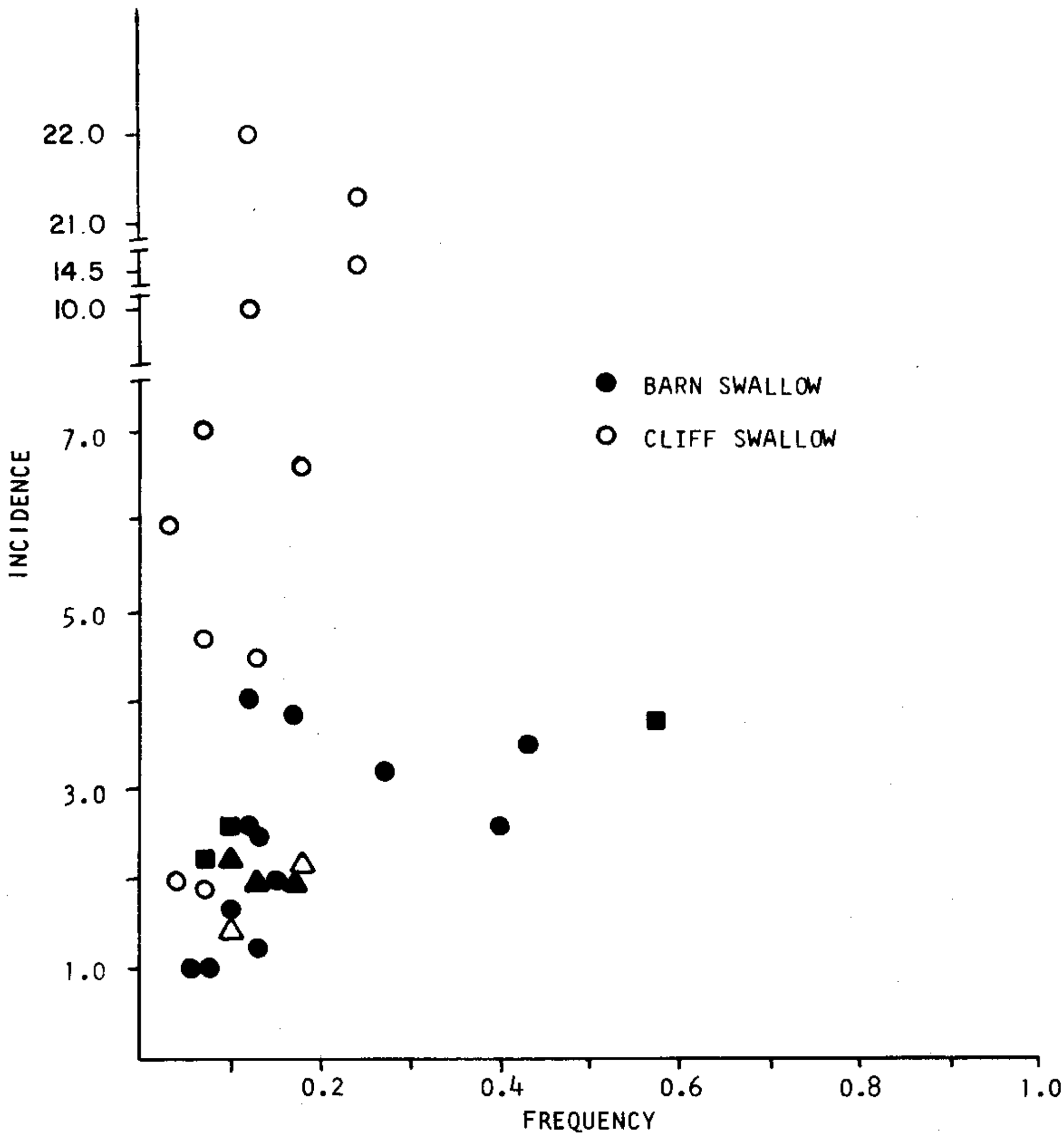


Fig. 19. Dispersion characteristics of Cliff Swallows and Barn Swallows from all IBP roadside counts (1970 and 1971). Symbols are as in Fig. 16.

The results of the application of this graphical model are intriguing, and we suggest that this model may have general applicability to situations in which census data are recorded as incidence and frequency (e.g., quadrat sampling of trees). Its usefulness is probably restricted, however, to censuses of relatively uniform habitat (e.g., all grassland or all forest, rather than a mixture of the two).

Specimen Collections

As indicated earlier in this report, most data obtained from specimens collected at the sites deal with dietary habits and will be discussed in another technical report. Similarly, there seems no point in reporting external morphological characteristics at this time; these data are currently being examined to determine whether patterns of morphological variation among the species co-occupying a site might be associated with possible modes of niche differentiation (e.g., Cody, 1968). Here we report data of more immediate utility; live weights of the specimens collected in 1971 are summarized in Table 16, while Fig. 20 to 22 present measures of gonad dimensions for species in which sample sizes were sufficient to make such analyses worthwhile. Such measurements may provide some indication of the breeding stage of local populations and potentially allow an evaluation of phenological relations between sites.

The measurements of gonad development are rather difficult to interpret. Horned Lark testis length (Fig. 20) was fairly consistent at all sites, but this is probably a rather insensitive index of breeding activity, since testes may enlarge in early spring and remain in this condition well past the onset of nesting. Female follicular development is more closely related to actual nesting activities, but this measure may be *too* sensitive; follicles do not begin to enlarge significantly until just before egg laying, and

Table 16. Live body weight for species breeding on five IBP grassland sites (1971). 1970 values (Wiens, 1971) are included for comparison. N = sample size.

Species	Site	Date	Age Class	Sex	1971 Mean Weight (g)	1971 Standard Deviation	1971 Sample Size	1970 Mean Weight (g)	1970 Standard Deviation	1970 Sample Size
Upland Plover	Osage	June	Adult	M	138.6	-	1	128.7	-	1
				F	121.7	2.76	2			
Horned Lark	ALE	April	Juvenile	-	23.6	-	1			
			Adult	M	30.9	0.41	4			
				F	32.1	3.35	3			
		May	Juvenile	-	31.0	4.95	2			
			Adult	M	29.7	2.00	7			
				F	33.8	1.27	3			
	Pantex	June	Juvenile	-	27.1	2.33	2			
			Adult	M	31.3	1.30	14	32.3	1.33	16
				F	31.8	2.46	9	30.1	2.15	9
	Cottonwood	June	Juvenile	-	21.6	-	1			
			Adult	M	31.1	1.40	13	32.4	1.62	14
				F	30.3	2.80	7	31.3	1.60	9
Western Meadowlark	ALE	May	Adult	M	115.9	1.06	2			
	Pantex	June	Adult	M	112.4	5.63	4	106.7	0.50	2
				F	88.6	5.09	2	90.4	9.50	10
	Cottonwood	June	Juvenile	-	57.1	40.40	11			
			Adult	M	109.3	7.03	6	111.7	6.37	7
				F	82.6	4.20	5	89.9	7.81	4
Eastern Meadowlark	Osage	June	Juvenile	-	96.8	-	1			
			Adult	M	111.4	5.66	11	111.2	6.82	7
				F	-	-	-	84.9	10.67	3
Dickcissel	Osage	June	Adult	M	28.8	0.89	5	29.5	1.80	9
				F	24.3	1.44	5	25.5	0.71	2
Sage Sparrow	ALE	April	Adult	M	19.0	1.02	4			
		May	Juvenile	-	16.2	-	1			
			Adult	M	19.2	0.86	6			
				F	19.8	1.18	4			
Grasshopper Sparrow	Osage	June	Adult	M	17.2	0.57	9	16.6	0.51	3
				F	17.1	-	1	17.0	-	1
	Cottonwood	June	Adult	M	17.0	0.44	9	16.7	1.28	5
				F	15.6	-	1	18.2	0.57	2
Savannah Sparrow	ALE	April	Adult	M	21.2	-	1			
Chestnut-collared Longspur	Cottonwood	June	Adult	M	19.7	0.92	2	19.4	0.78	2
				F	19.8	2.26	2	17.9	0.78	2

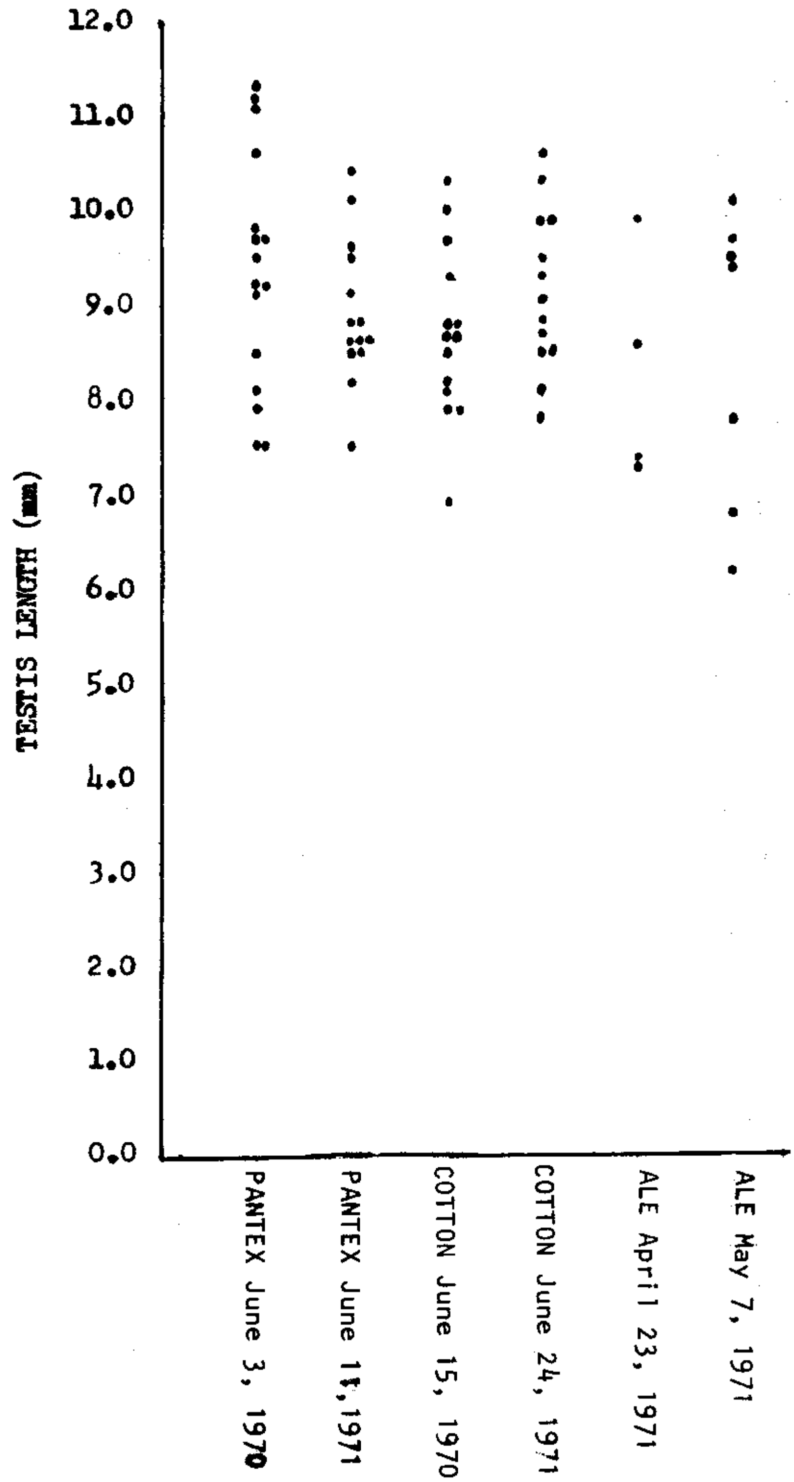


Fig. 20. Lengths of testes of male Horned Larks collected at IBP sites (1970 and 1971).

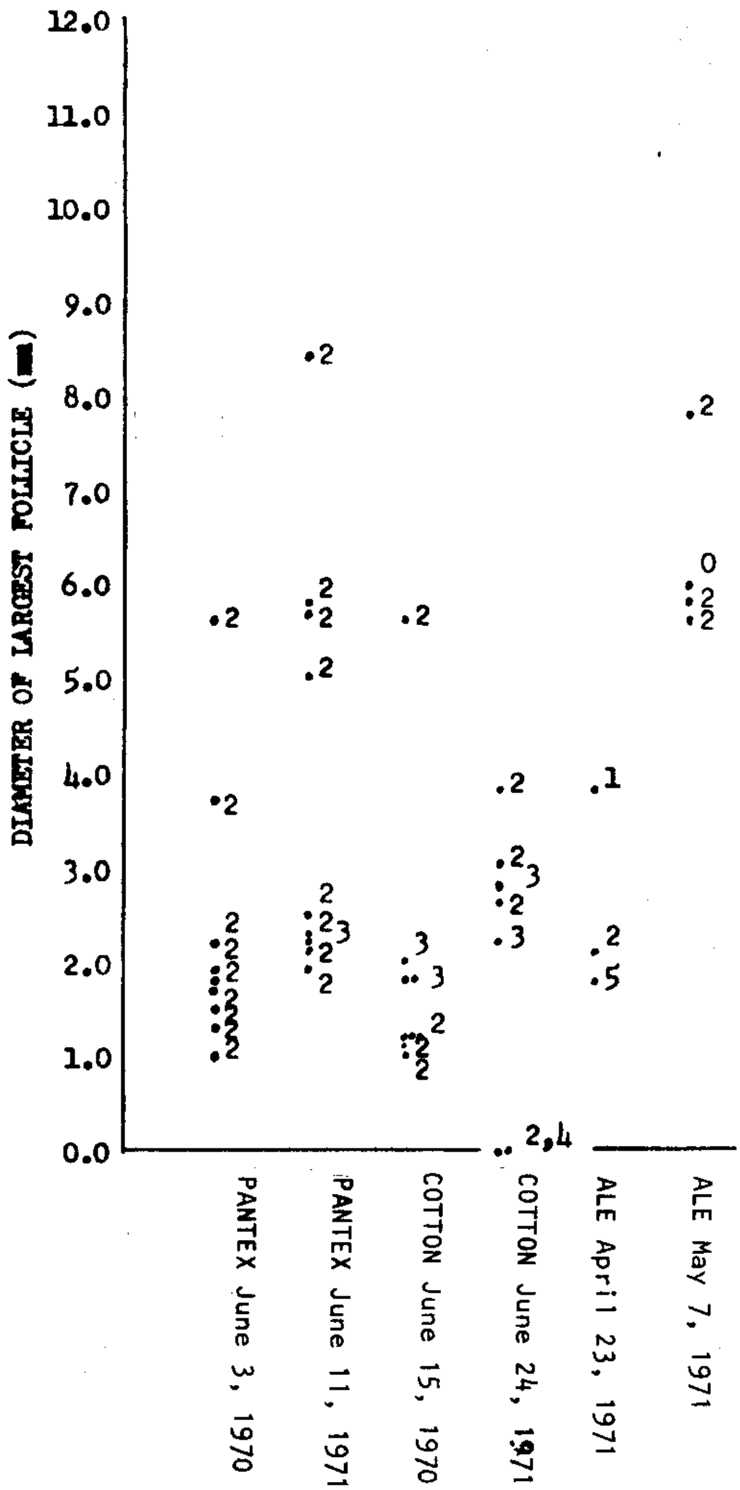


Fig. 21. Follicle diameters for female Horned Larks collected at IBP sites (1970 and 1971). Numbers refer to state of brood patch: 0 = not noted, 1 = feathers dropped, 2 = vascular, 3 = edematous, 4 = regressing, 5 = no evidence.

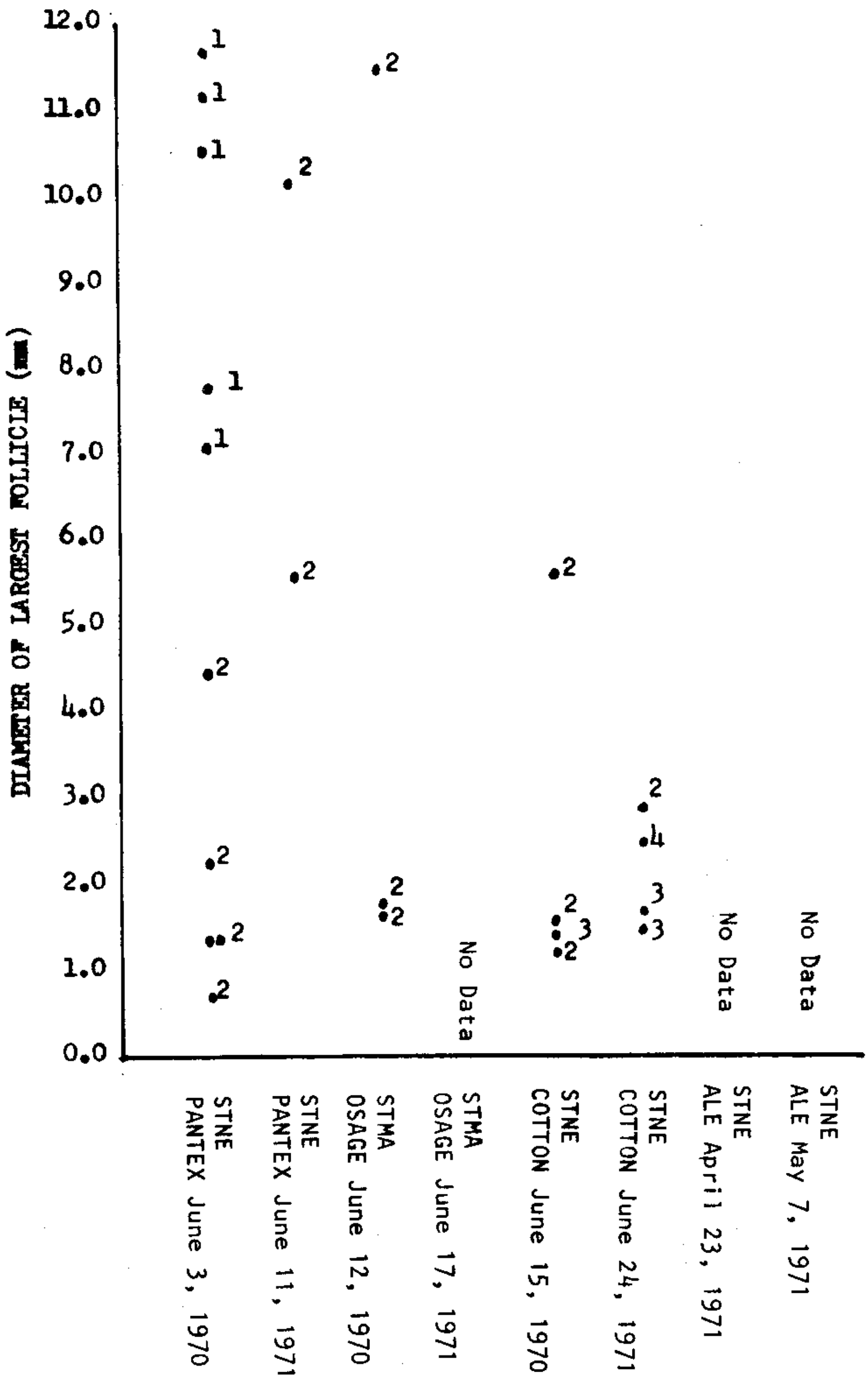


Fig. 22. Follicle diameters for female meadowlarks collected at IBP sites (1970 and 1971). Brood patch code is as in Fig. 21.

degenerate quickly following the termination of laying. Thus, there is considerable variation in follicle dimensions among females in a local breeding population (Fig. 21,22). Note, however, that most of the females collected had well-developed brood patches, indicating that populations of these two species were generally engaged in nesting activities at the time of sampling at all sites.

Qualitative Observations

In addition to the results summarized above, several unconnected qualitative observations made during the 1971 field season seem worth recording.

1. At ALE, as noted in the discussion of plot census results, the phenology of avian reproductive activity started early and seemed prolonged in relation to the other sites. This led to a co-occupancy of the site by migrants and breeding individuals. In late April, for example, White-crowned Sparrows were abundant, especially in brush about gulleys or small washes. They consistently were observed in mobile flocks but seemed spatially unattached, however, and the one specimen collected had heavy fat deposits. By early May, most of these migrants had left the area, and only a few stragglers were observed. Nonetheless, their occupancy of the site did overlap that of the breeding species considerably, and examination of the ecological relationships between these two groups would be interesting. This degree of migrant-breeder overlap was not observed elsewhere.

2. "Peripheral species" in grasslands are bird species which are not tied to the grassland ecosystem for all of their breeding activities, but do consistently occur there for a portion of their activities. Such species were potentially important only at Osage. There, Barn Swallows foraged

during most of the day in the air 1 to 4 m over the plots, while flycatchers (Eastern and Western Kingbirds and Scissortailed Flycatchers) hawked flying insects from forb perches in the grassland habitat. Mourning Doves nested on the ground in the grassland near sample plot 1, but seemed to forage in non-grassland areas. Red-winged Blackbirds nested in brush along an intermittent stream near plot 1 and foraged in nearby vegetation (including grassland), but generally their activities were associated with brushy edges rather than the grassland proper. These peripheral species may have effects on the dynamics of the system, however, and probably warrant investigation.

3. One minor (trivial?) question which has been posed in consideration of energy flow is "What happens to bird droppings?" It has been estimated (Wiens, 1971*b*) that 0.07 to 0.45 kcal/m^2 may be "released" from the bird populations of a plot as excrement during the breeding season. At Pantex, at least, it appears that a good deal of the bird droppings may be gathered by ants (*Pogonomyrmex*) and taken into their underground chambers. We spent over an hour closely observing the gathering activities of ants about nests, and during this time, seeds and bird droppings were the items most frequently taken into the nest, in that order.

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APPENDIX I

IBP GRASSLAND BIOME
INSTRUCTIONS FOR AVIAN ROAD COUNT

The procedures followed in IBP Roadside censuses are similar to those used in the North American Cooperative Breeding Bird Survey (NACBBS), with which you are familiar. Our procedures do differ somewhat, however, so follow the version given below.

Weather: As in the NACBBS surveys, counts should not be attempted in fog, steady drizzle or rain, heavy snow, or high wind. Use the Beaufort Weather codes and the Weather Bureau sky codes on the report sheet, as given below:

Weather codes (enter Beaufort Numbers on Summary Sheet)

Beaufort Number	Wind Speed miles per hr.	Indicators of Wind Speed
0	Less than 1	Smoke rises vertically.
1	1 to 3	Wind direction shown by smoke drift.
2	4 to 7	Wind felt on face; leaves rustle.
3	8 to 12	Leaves and small twigs in constant motion; wind extends light flag.
4	13 to 18	Raises dust and loose paper; small branches are moved.
5	19 to 24	Small trees in leaf begin to sway; crested wavelets form on inland waters.

Sky condition (enter these Weather Bureau code numbers on Summary Sheet)

0	Clear or a few clouds.	4	Fog or smoke.
1	Partly cloudy (scattered) or variable sky.	5	Drizzle.
2	Cloudy (broken) or overcast.	8	Shower(s).

Count Procedures: Start the count anytime 30 min to 2 hrs after local sunrise (not before sunrise, as in the NACBBS). Our census routes include only 30 stops, which should be located 0.5 mi apart along the route shown on the map supplied with these instructions. At each stop look and listen for exactly 3 min, and record the number of birds of each species heard or seen within 1/4 mi in all directions. Count all wild birds seen or heard that can be identified to species. Do not estimate numbers or species "expected" but not seen or heard.

Stops should be made only in grassland or rangeland habitat. Thus, if one stop falls in woods, thickets, plowed fields, riverbottom, lake edge, urban area, or other non-grassland habitat, that stop should be skipped; you should proceed 0.5 mi to the next scheduled stop. Stops at which some roadside brush is present, or at which less than 1/4 of the observation area is plowed, or at which there is a stream or pond with little brush or tree vegetation, are all acceptable. The important point is that the vegetation of the observation area be predominately grassland, pasture, abandoned weedy field, or rangeland (which may include cactus and sagebrush). Regardless of how many "unsuitable" stops are skipped, there should be a total of 30 stops at which species counts are made.

Recording Counts: The form used in IBP work employs a species code designation which can be processed directly by computer. These are a bit awkward, and I'd prefer that you simply write the common name of the species across the columns labelled "group", "genus," "species", and "sex". Different species should be entered on successive rows; you needn't worry about the sequence in which these are entered - whatever system is best for you is ok with me, as long as the species are clearly indicated. The numbered columns refer to stops; there should be an entry in each column (i.e., each stop) for each species, either the number of individuals seen or heard, or a dash to indicate its absense at that stop. Since the route will include 30 "good" stops, you will need 1 1/2 pages to record the results of a count. Don't summarize the count; this I will do when you return the forms.

Completed Forms, together with the information sheet, should be sent immediately to

Dr. John A. Wiens
Department of Zoology
Oregon State University
Corvallis, Oregon 97331

I will send you a copy of your report by return mail, and at the end of the year will send you a summary report giving your results and those obtained by other workers at other IBP sites.

Also, please return the route map, with the approximate positions of your stops recorded. I will make sure you have another copy of the route map prior to the next count.

IBP

GRASSLAND BIOME

U.S. INTERNATIONAL BIOLOGICAL PROGRAM

FIELD DATA SHEET - AVIAN ROAD COUNT

GROUP
0 Waterfowl
1 Falconiform
2 Galli- and Gruiform
3 Charadriiform
4 Doves, owls, nighthawks, woodpeckers
5 Flycatchers, swallows, jays, titmice, wrens
6 Thrashers, bluebirds, gnatcatchers, pipits
7 Shrikes, starlings, vireos
8 Icterids
9 Fringillids

SEX
0 Unknown
1 Male
2 Female

GROUP / GENUS / SPECIES / SEX	STATIONS 01	2	3	4	5	6	7	8	9	0	11	2	3	4	5	6	7	8	9	0
Grasshopper Sparrow	1	3	–	2	6	–	–	4	1	3	2	–	7	–	–	6				
Eastern Meadowlark	2	3	4	3	7	–	6	2	–	–	3	–	8	6	–	11				
Redwinged Blackbird	1	–	–	2	–	7	–	–	–	–	–	3	–	–	–	–	–	–	etc.	
Red-tailed Hawk	–	–	1	–	–	–	–	–	2	–	–	–	–	–	–	–				
etc																				

IBP GRASSLAND BIOME

AVIAN ROAD COUNT - INFORMATION

Count Location: ______________________________

Date: ____________________

Observer: ______________________

	Start	Finish
Time	________	________
Temp (F)	________	________
Wind (Beaufort Scale)	________	________
Sky Code	________	________

Comments:

APPENDIX II

SUMMARY OF NESTING RECORDS FOR IBP GRASSLAND BIOME SITES (1971)

Site	Species	Nest No.	Comments
ALE	Horned Lark	1	Three eggs April 25; empty May 7
		2	One egg May 7; empty May 8
		3	Two eggs May 8; two eggs May 9; three eggs May 10; male seen feeding fledgling in same territory May 9
		-	Juveniles collected April 24, May 9
	Sage Sparrow	1	Two eggs, one newly hatched young April 24; two young April 25; empty (young apparently fledged) May 7
		-	Juvenile collected May 8
	Mourning Dove	1	One egg May 9
		2	One egg May 10
Pantex	Horned Lark	4	One egg June 9; same June 10; in grazed treatment
		-	Two juveniles collected June 11
Osage	Dickcissel	1	Four 1 to 2 day-old young June 15; three young June 18
		2	Four eggs June 16; unchanged June 18
		3	Five eggs June 16; unchanged June 18
	Eastern Meadowlark	1	Five eggs June 17
		-	Juvenile collected June 17
Pawnee (heavy winter)	Lark Bunting	1	Four pinfeathered young June 19; fledged June 20
		2	Three large young June 19; fledged June 20
		3	Three large young June 20; predation later in day
		4	Five eggs June 20
		5	Four 3 to 5 day-old young June 20
		6	Four eggs June 20
	Brewer's Sparrow	1	Three young June 19; predation June 20
		2	Four young June 19; predation June 20
		3	Four young June 20; fledged later in day
	Mourning Dove	3	Two eggs June 19
Pawnee (heavy summer)	Western Meadowlark	1	One egg June 21
	Mourning Dove	4	Two eggs June 21

APPENDIX II

(Continued)

Site	Species	Nest No.	Comments
Cottonwood (grazed)	Horned Lark	5	One egg, one Cowbird egg June 25
		-	Fledglings seen being fed on plot June 25; juvenile collected
	Western Meadowlark	2	Three well-feathered young, one egg near nest June 25; young fledged June 26
		3	Five 3 to 5 day-old young June 27; nest of plot; young collected
		-	Juvenile collected June 25

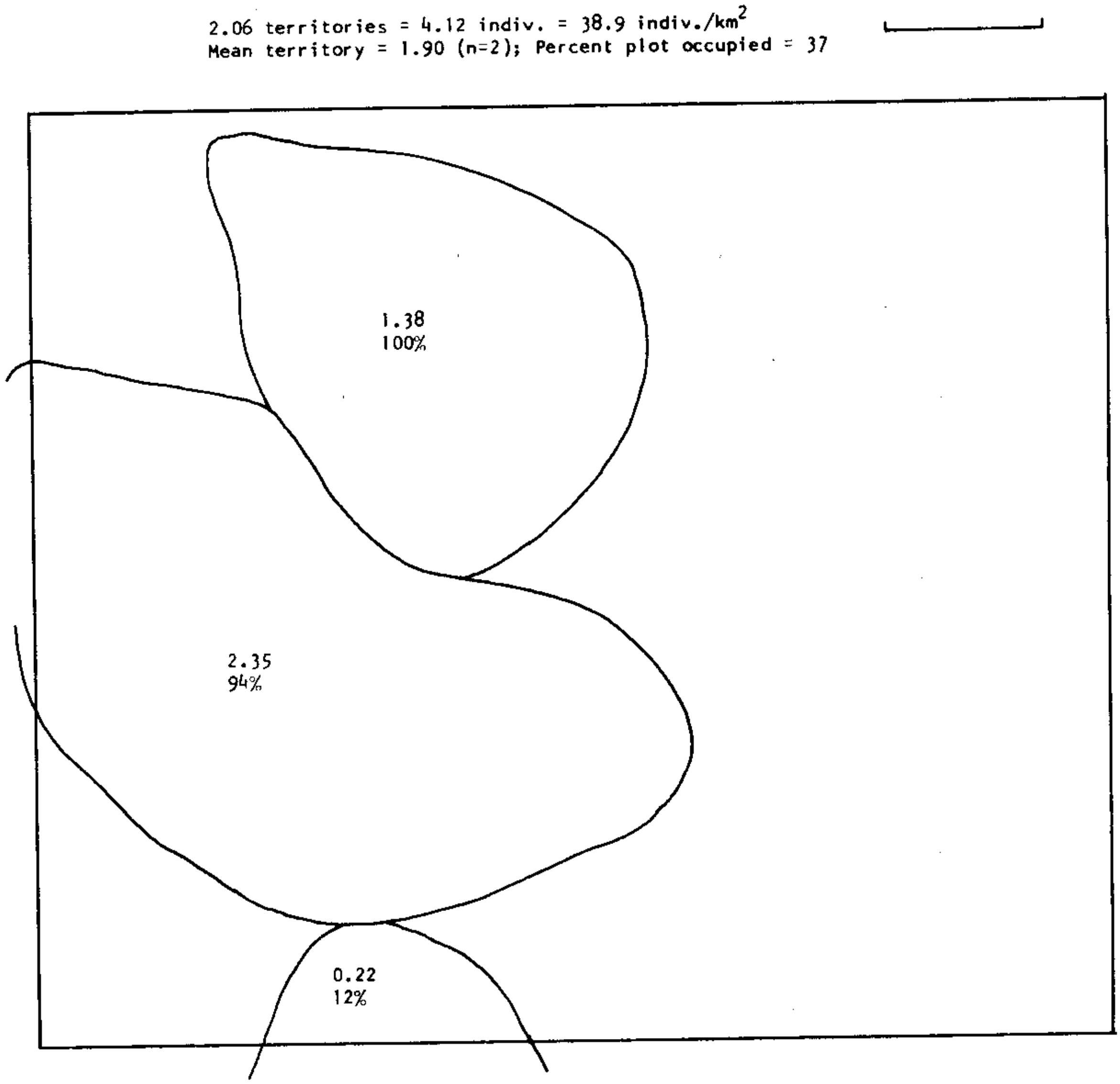
APPENDIX III

TERRITORY MAPPINGS ON IBP GRASSLAND BIOME SAMPLE PLOTS, 1971

The following territory mappings summarize individual flushings (Wiens, 1969) and are the data from which plot-based population density estimates were derived. Within each territory are two figures, the upper is the area of the portion of the territory within the plot (in hectares), and the lower is the proportion of the entire territory lying within the plot. The scale indicator in the upper right is equivalent to 50 m.

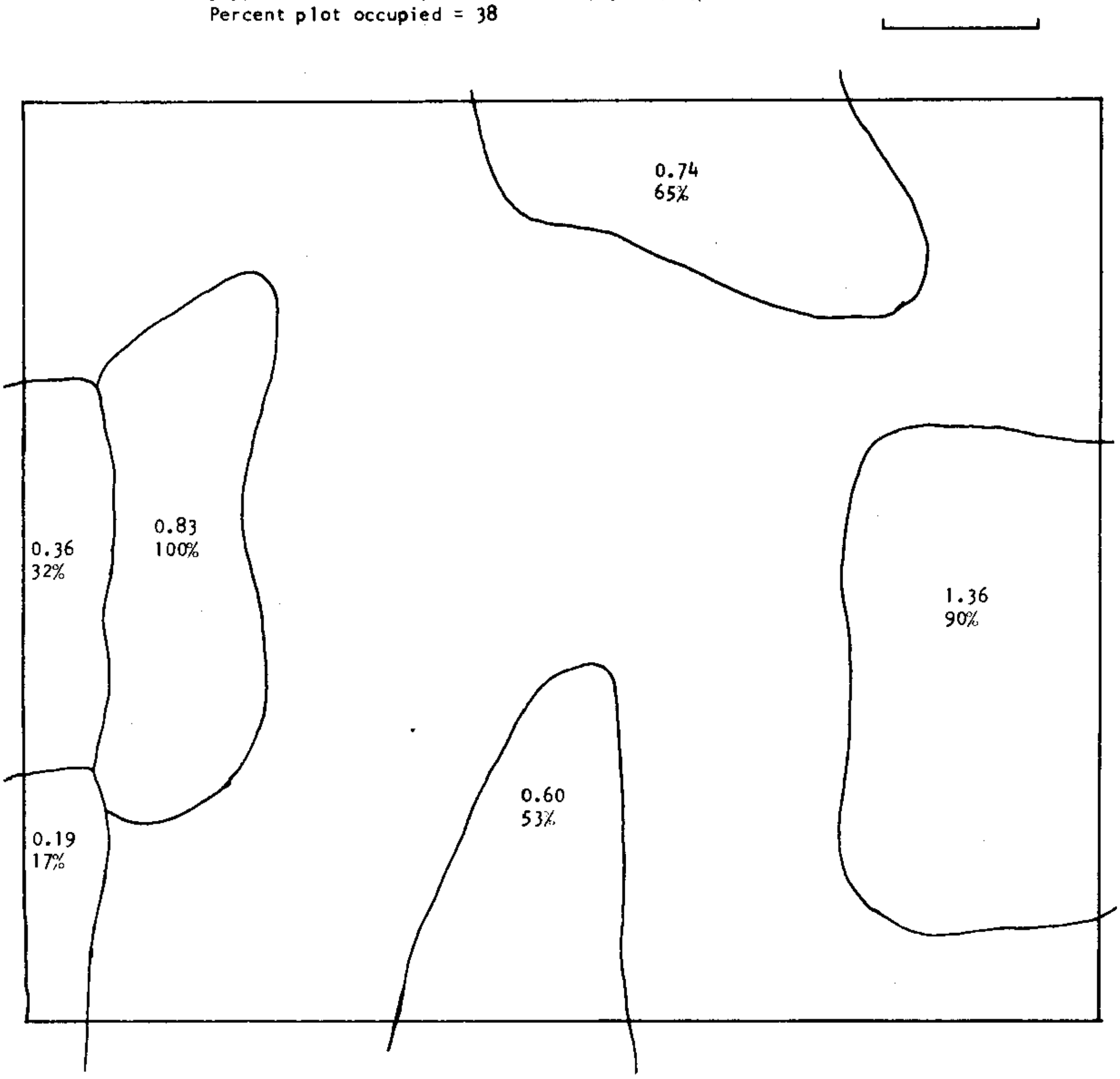
Site: ALE (April) Treatment: Ungrazed   Sample Plot: 1 Species: AM BE

2.06 territories = 4.12 indiv. = 38.9 indiv./km^2
Mean territory = 1.90 (n=2); Percent plot occupied = 37



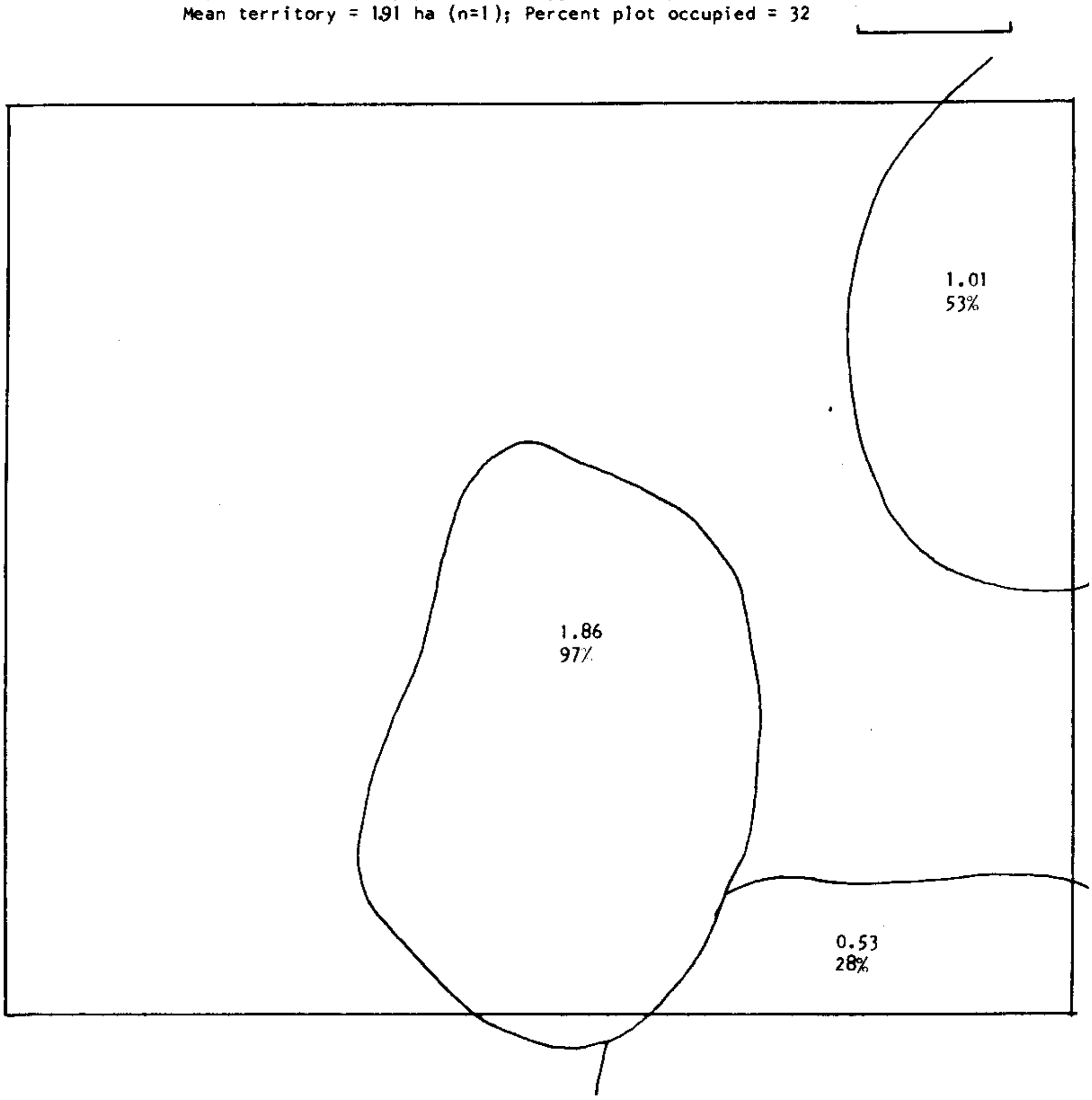
Site: ALE (May) Treatment: Ungrazed Sample Plot: 1 Species: AM BE

3.57 territories = 7.14 indiv. = 67.5 indiv./km^2
Percent plot occupied = 38



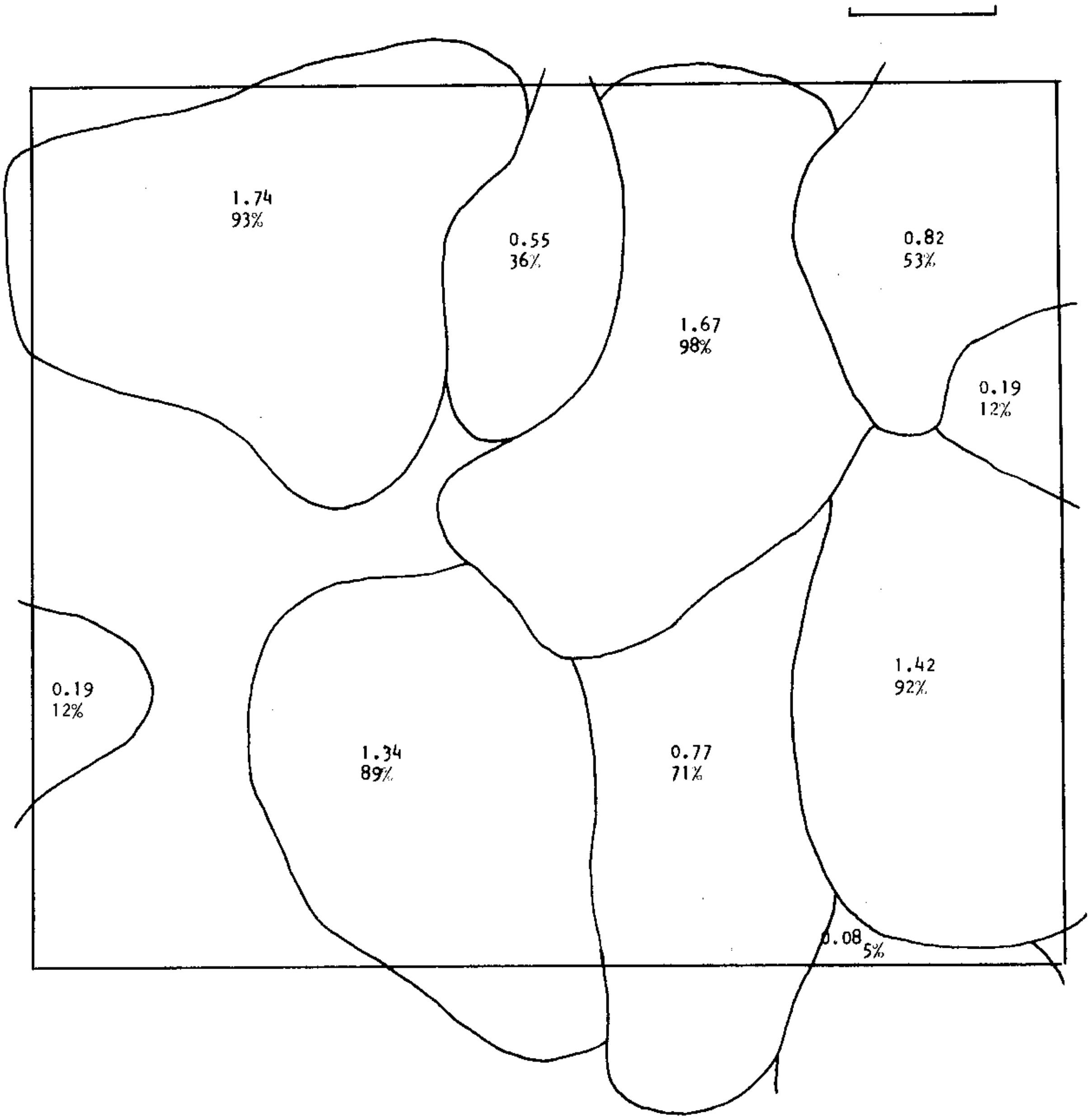
Site: ALE (April) Treatment: Ungrazed Sample Plot: 1 Species: ER AL

1.78 territories = 3.56 indiv. = 33.6 indiv./km^2
Mean territory = 1.91 ha (n=1); Percent plot occupied = 32



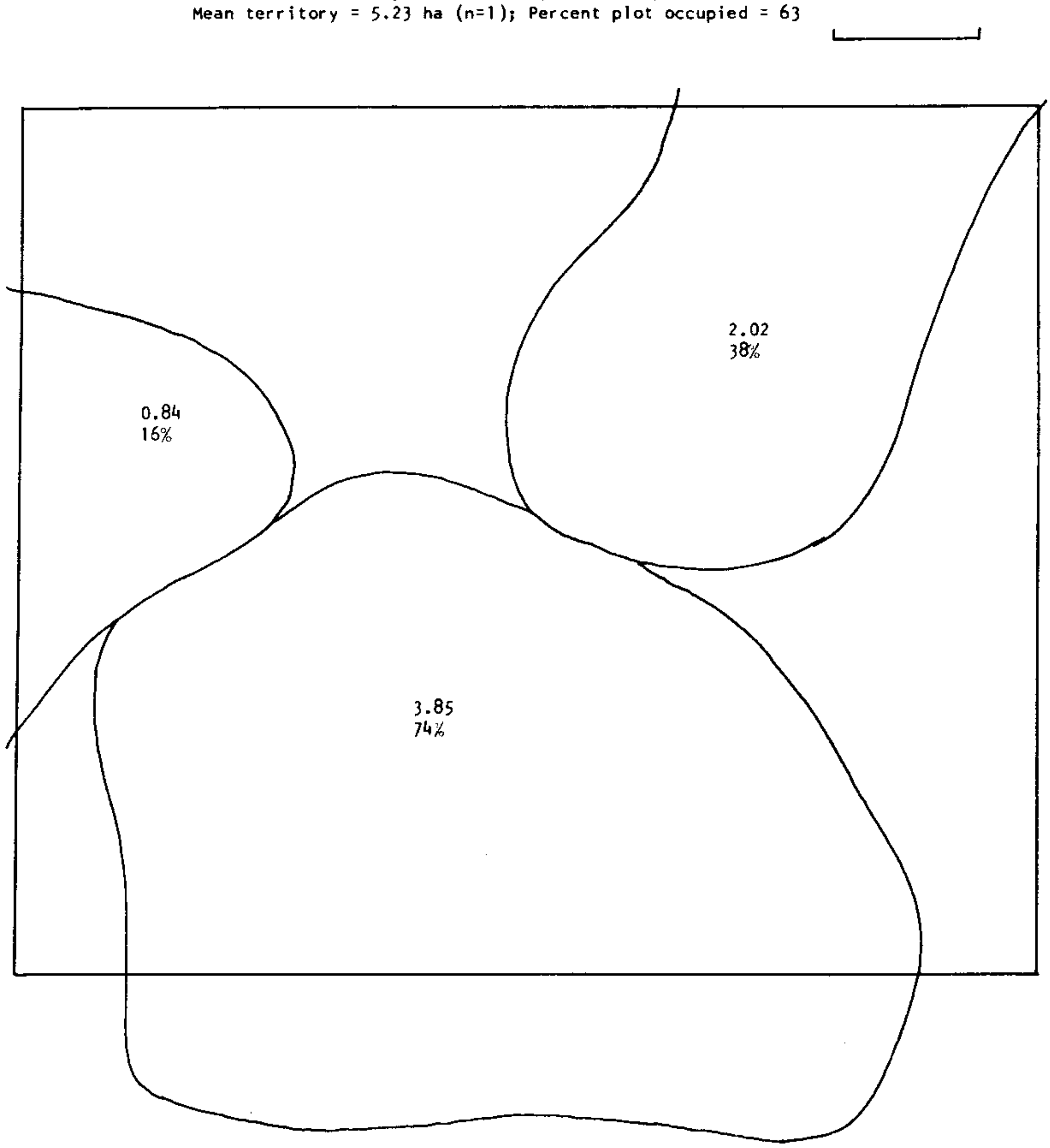
Site: ALE (May) Treatment: Ungrazed Sample Plot: 1 Species: ER AL

5.61 territories = 11.22 indiv. = 106.0 indiv./km^2
Mean territory = 1.54 ha (n=4); Percent plot occupied = 83



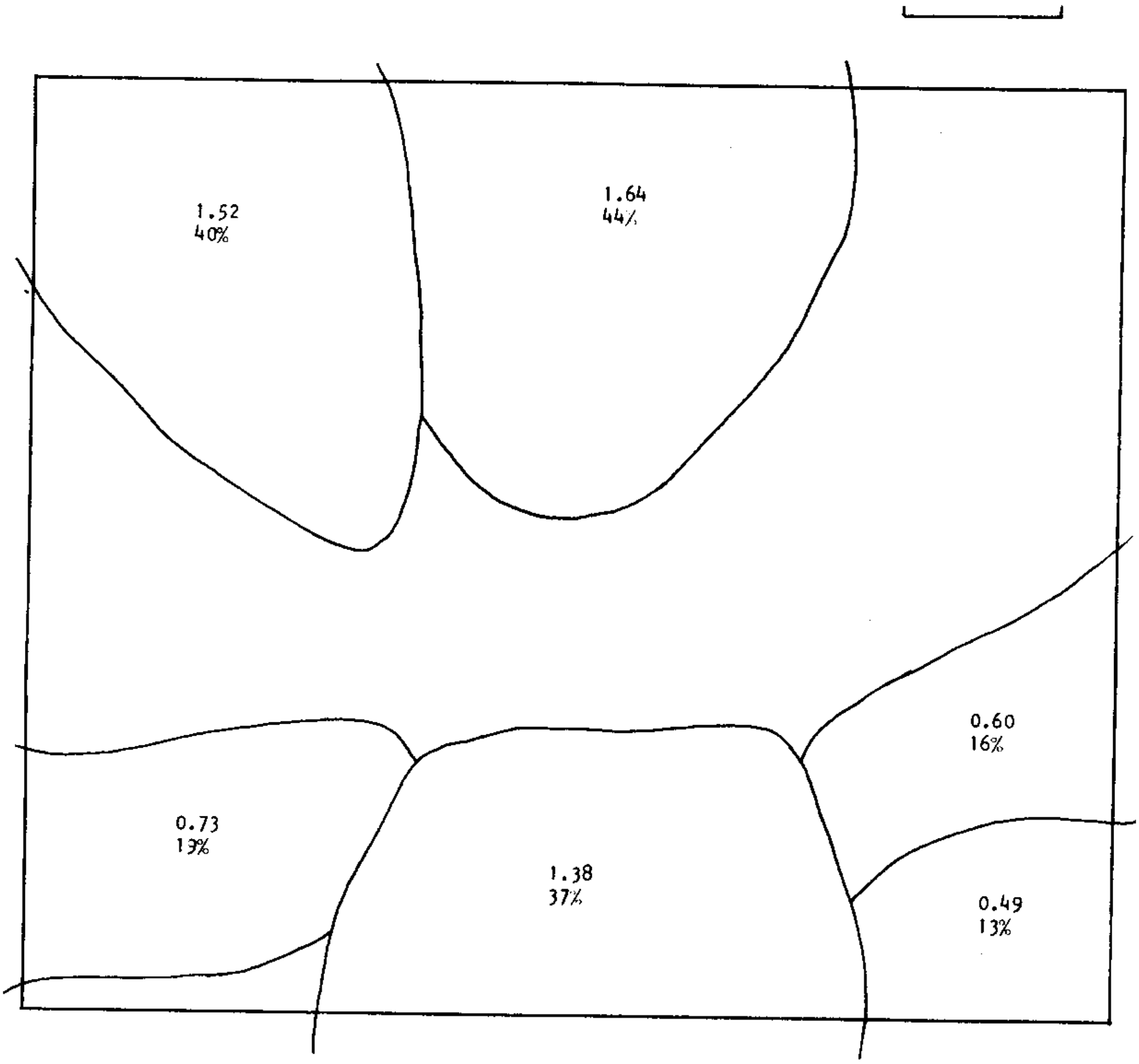
Site: ALE (April) Treatment: Ungrazed Sample Plot: 1 Species: ST NE

1.28 territories = 3.20 indiv. = 30.2 indiv./km^2
Mean territory = 5.23 ha (n=1); Percent plot occupied = 63



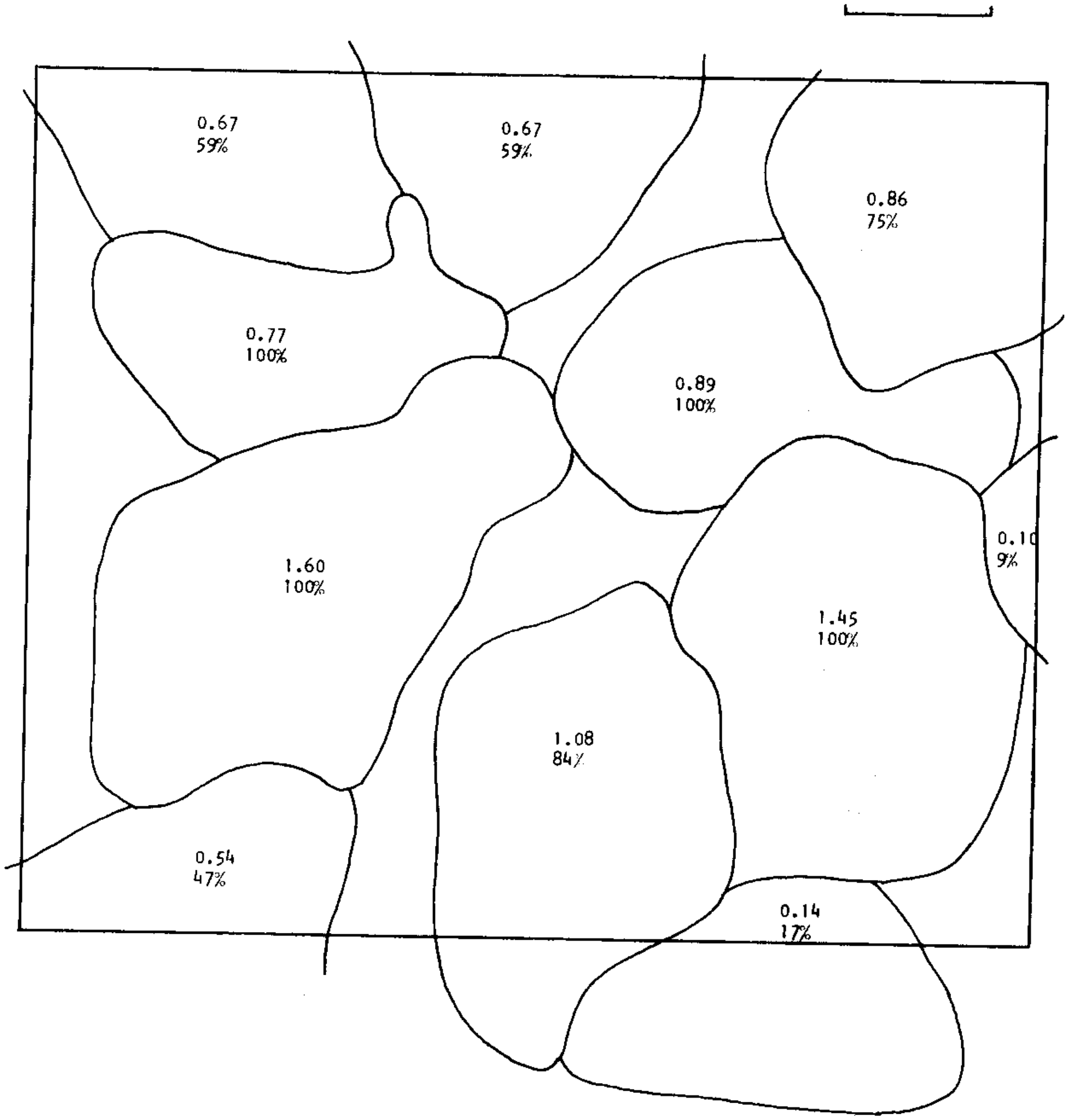
Site: ALE (May) Treatment: Ungrazed Sample Plot: 1 Species: ST NE

1.69 territories = 4.22 indiv. = 39.9 indiv./km^2
Percent plot occupied = 60



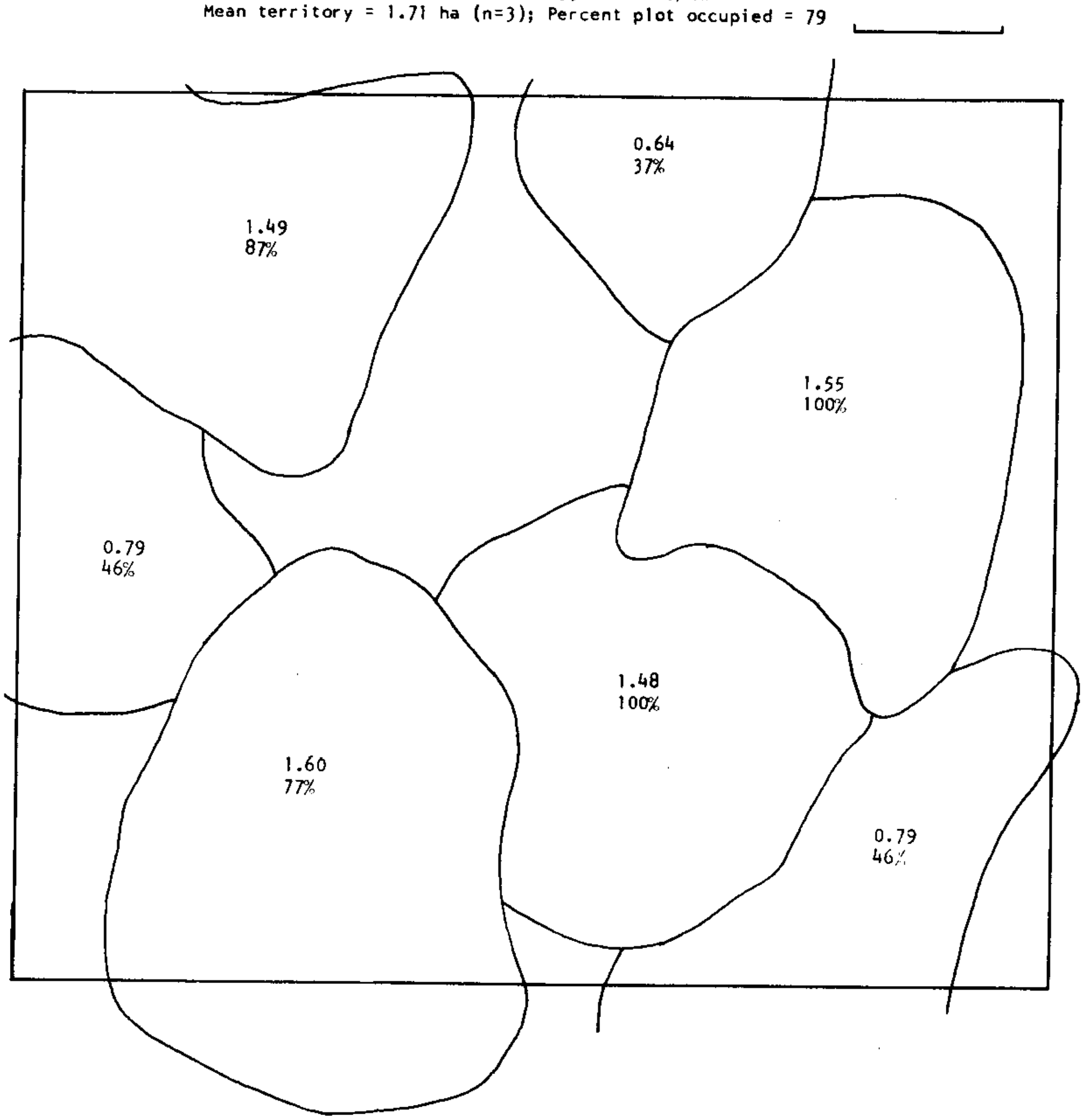
Site: ALE (May) Treatment: Ungrazed Sample Plot: 2 Species: AM BE

7.50 territories = 15.0 indiv. = 141.7 indiv./km^2
Mean territory = 1.14 ha (n=6); Percent plot occupied = 83



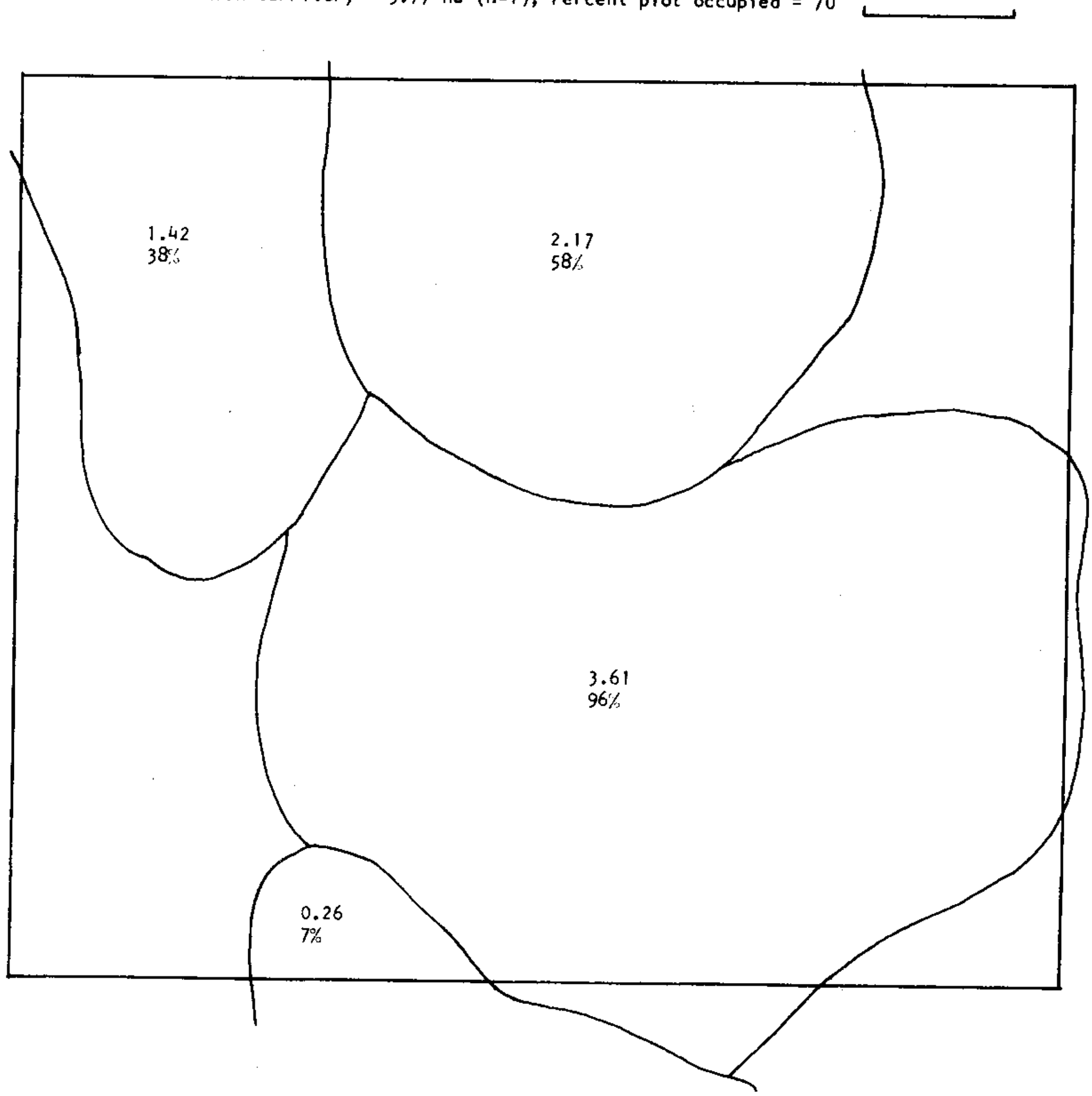
Site: ALE (May) Treatment: Ungrazed Sample Plot: 2 Species: ER AL

4.93 territories = 9.86 indiv. = 93.2 indiv./km^2
Mean territory = 1.71 ha (n=3); Percent plot occupied = 79



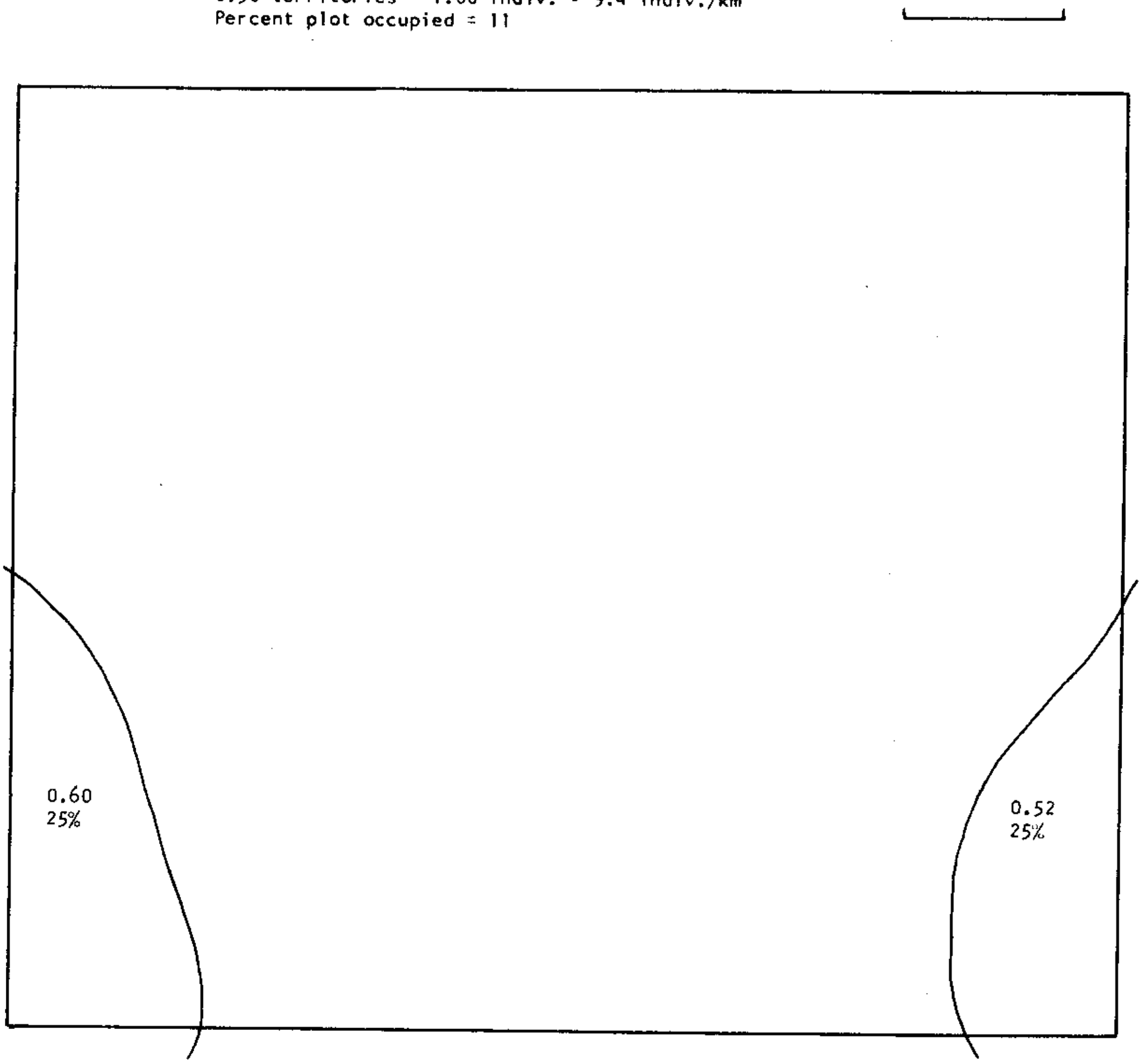
Site: ALE (May) Treatment: Ungrazed Sample Plot: 2 Species: ST NE

1.99 territories = 4.97 indiv. = 47.0 indiv./km^2
Mean territory = 3.77 ha (n=1); Percent plot occupied = 70



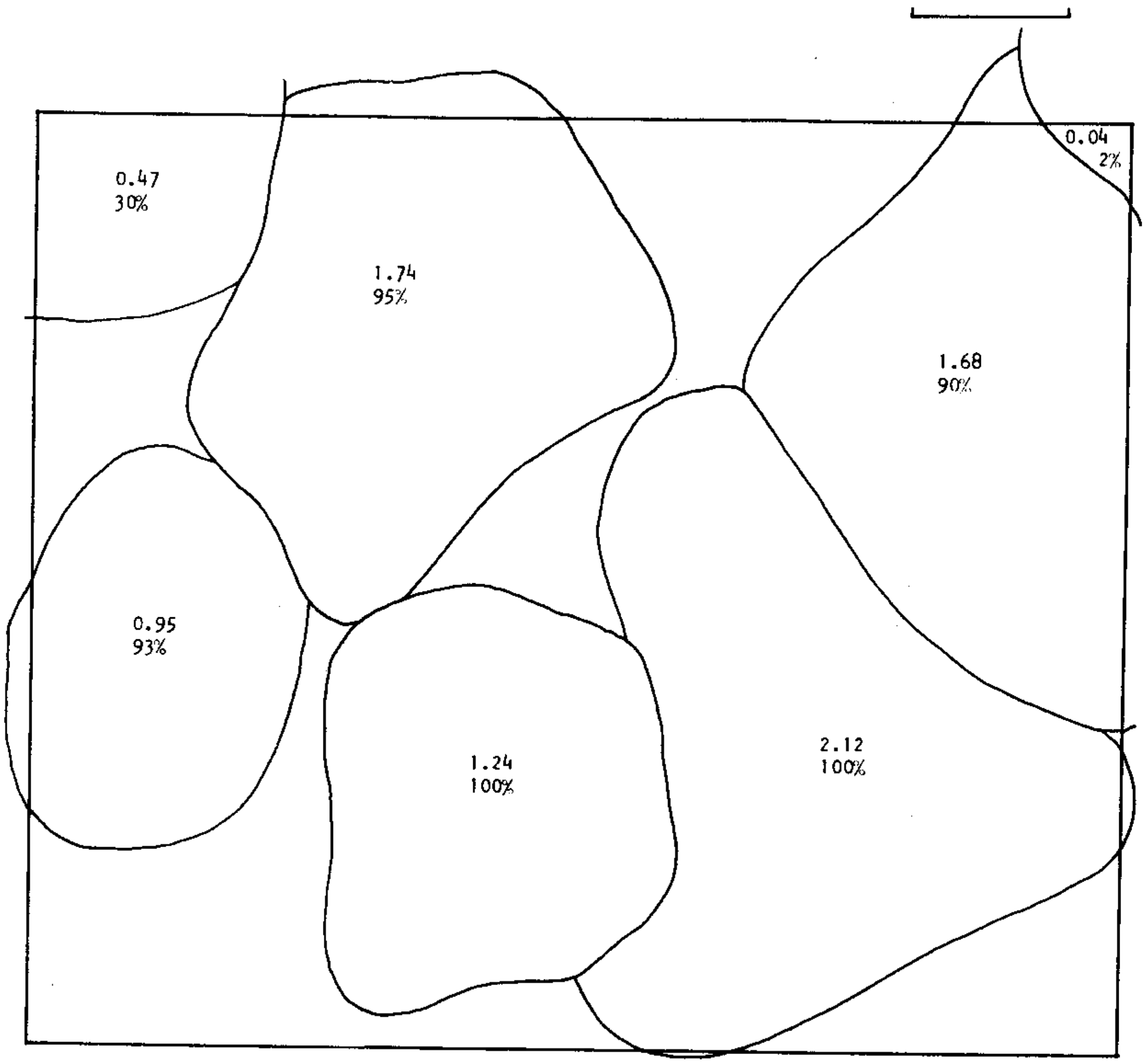
Site: ALE (May) Treatment: Ungrazed Sample Plot: 2 Species: ZE MA

0.50 territories = 1.00 indiv. = 9.4 indiv./km^2
Percent plot occupied = 11



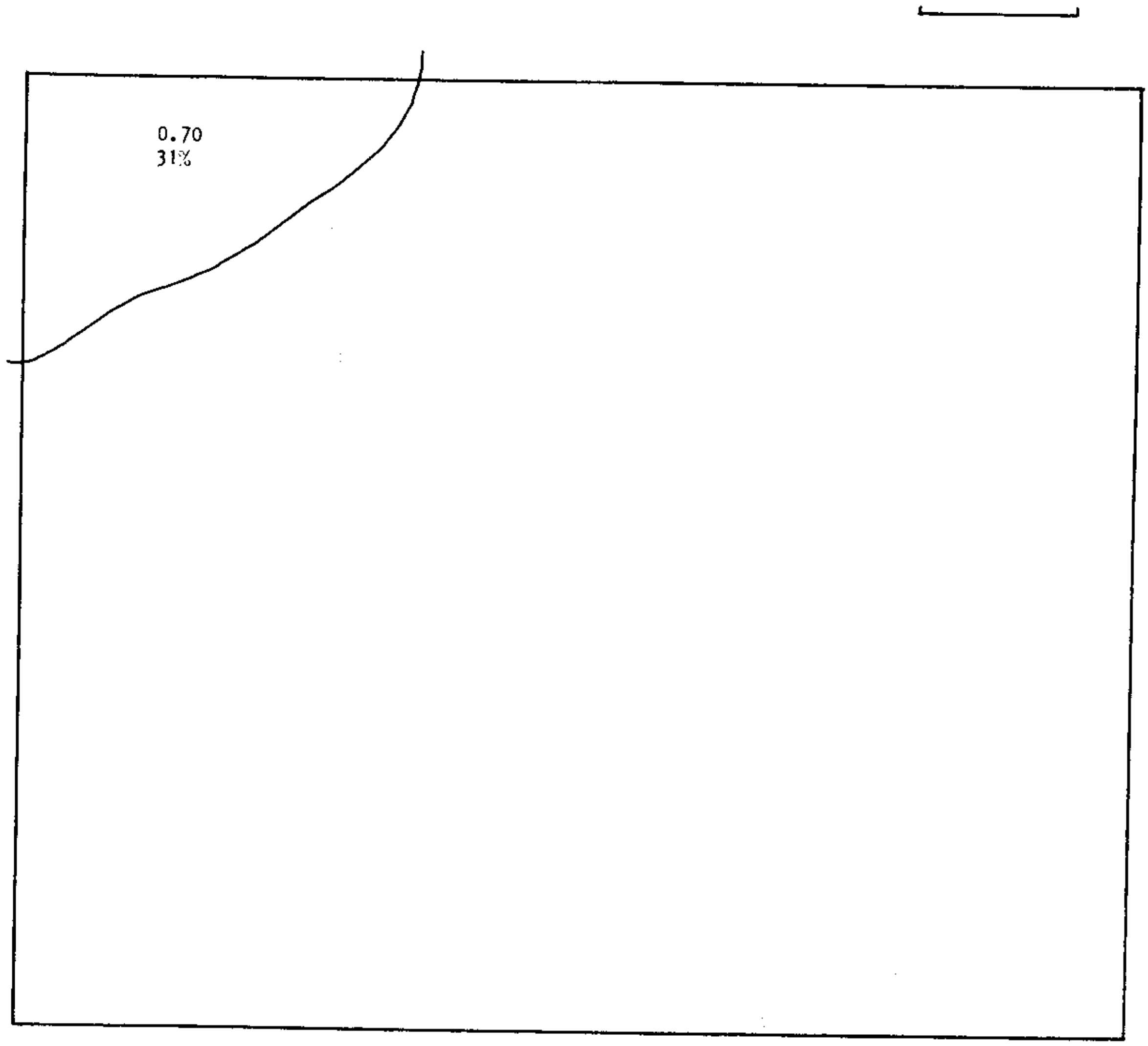
Site: COTTONWOOD Treatment: Lightly Grazed Sample Plot: 1 Species: AM SA

5.10 territories = 10.2 indiv. = 96.4 indiv./km^2
Mean territory = 1.56 ha (n=4); Percent plot occupied = 78



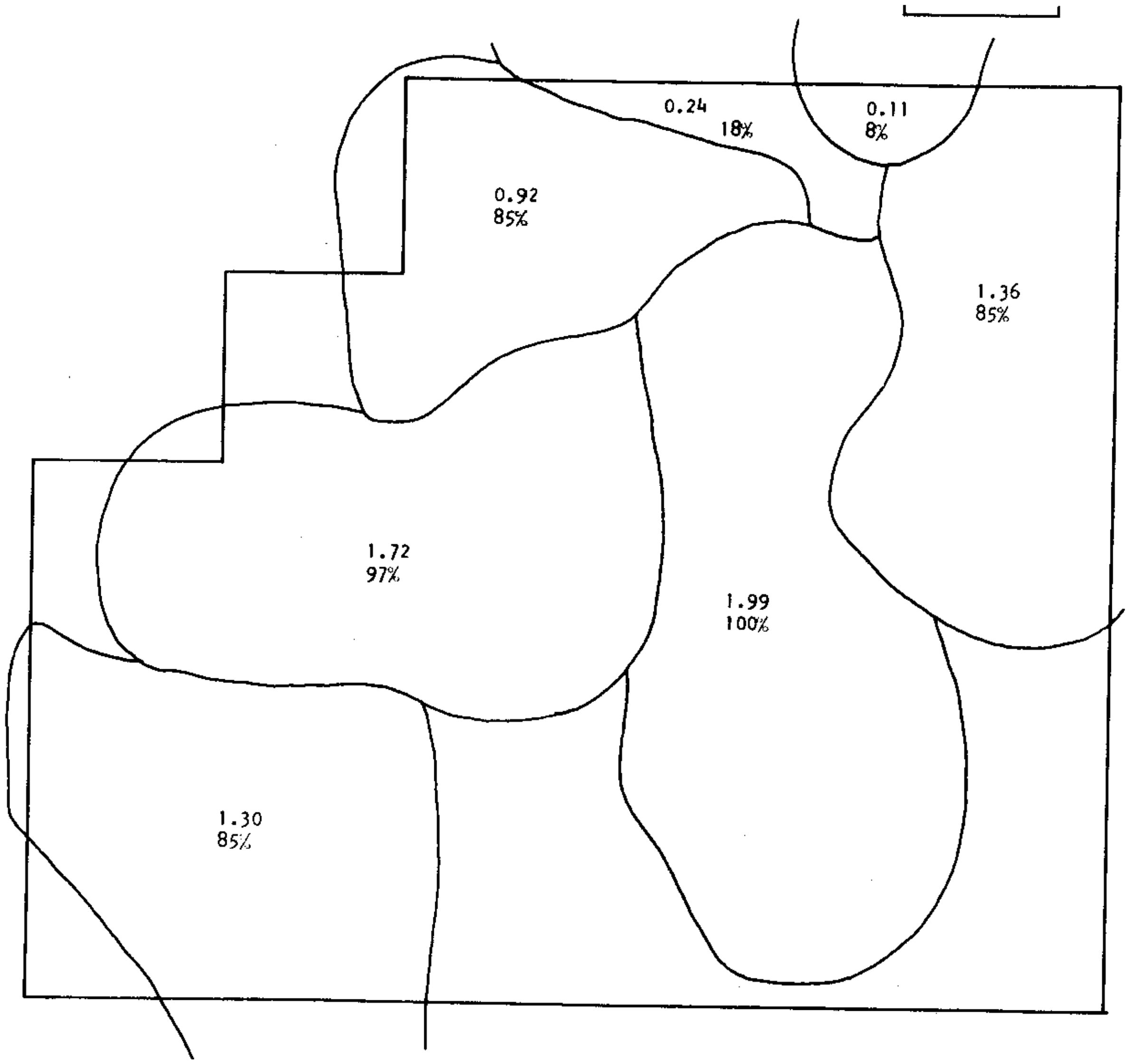
Site: COTTONWOOD Treatment: Lightly Grazed Sample Plot: 1 Species: CA OR

0.31 territories = 0.62 indiv. = 5.9 indiv./km^2
Percent plot occupied = 7



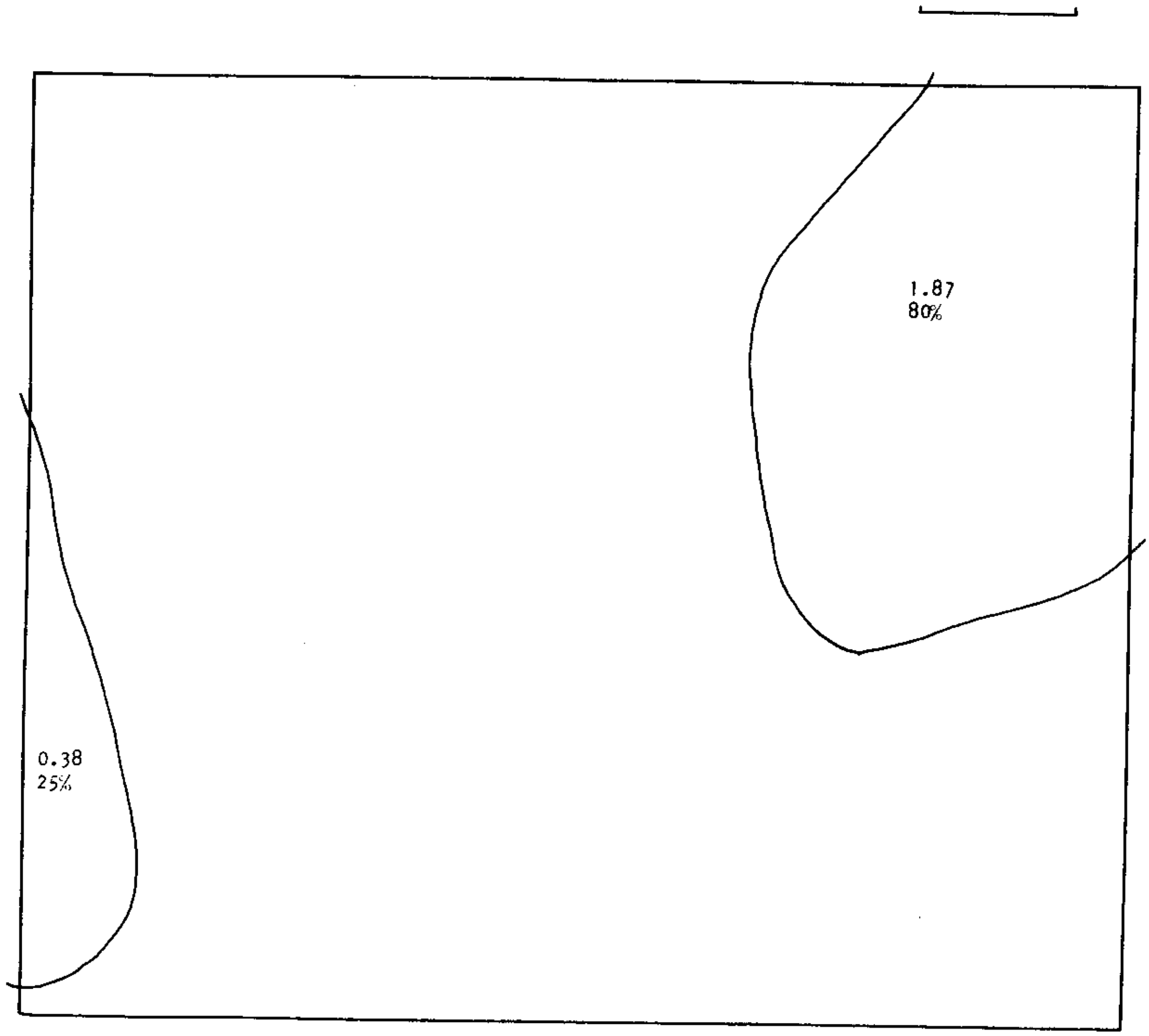
Site: COTTONWOOD Treatment: Grazed Sample Plot: 1 Species: ER AL

4.78 territories = 9.56 indiv. = 99.1 indiv./km^2
Mean territory = 1.31 ha (n=3); Percent plot occupied = 79



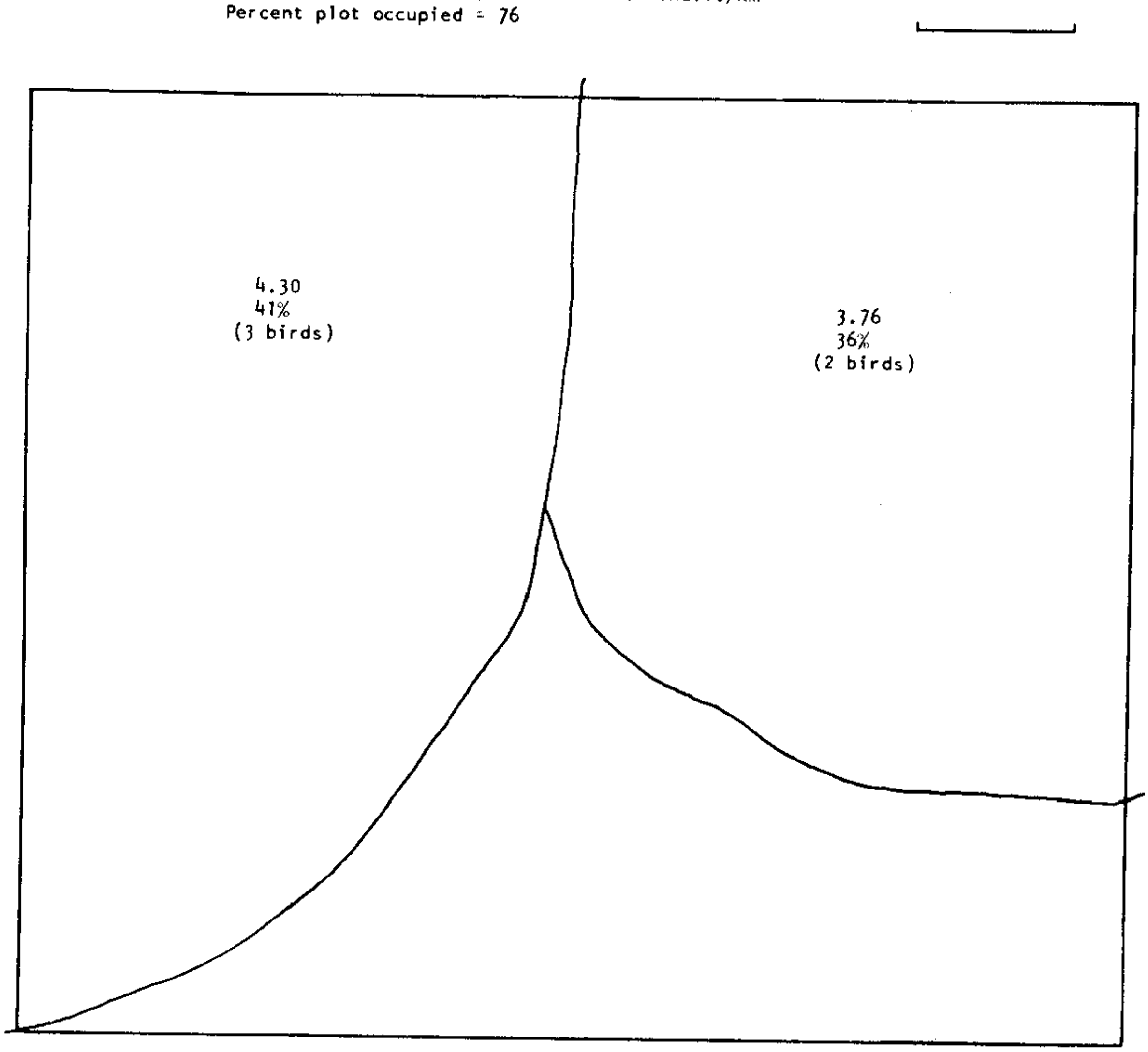
Site: COTTONWOOD Treatment: Lightly Grazed Sample Plot: 1 Species: ER AL

1.05 territories = 2.10 indiv. = 19.8 indiv./km^2
Percent plot occupied = 21



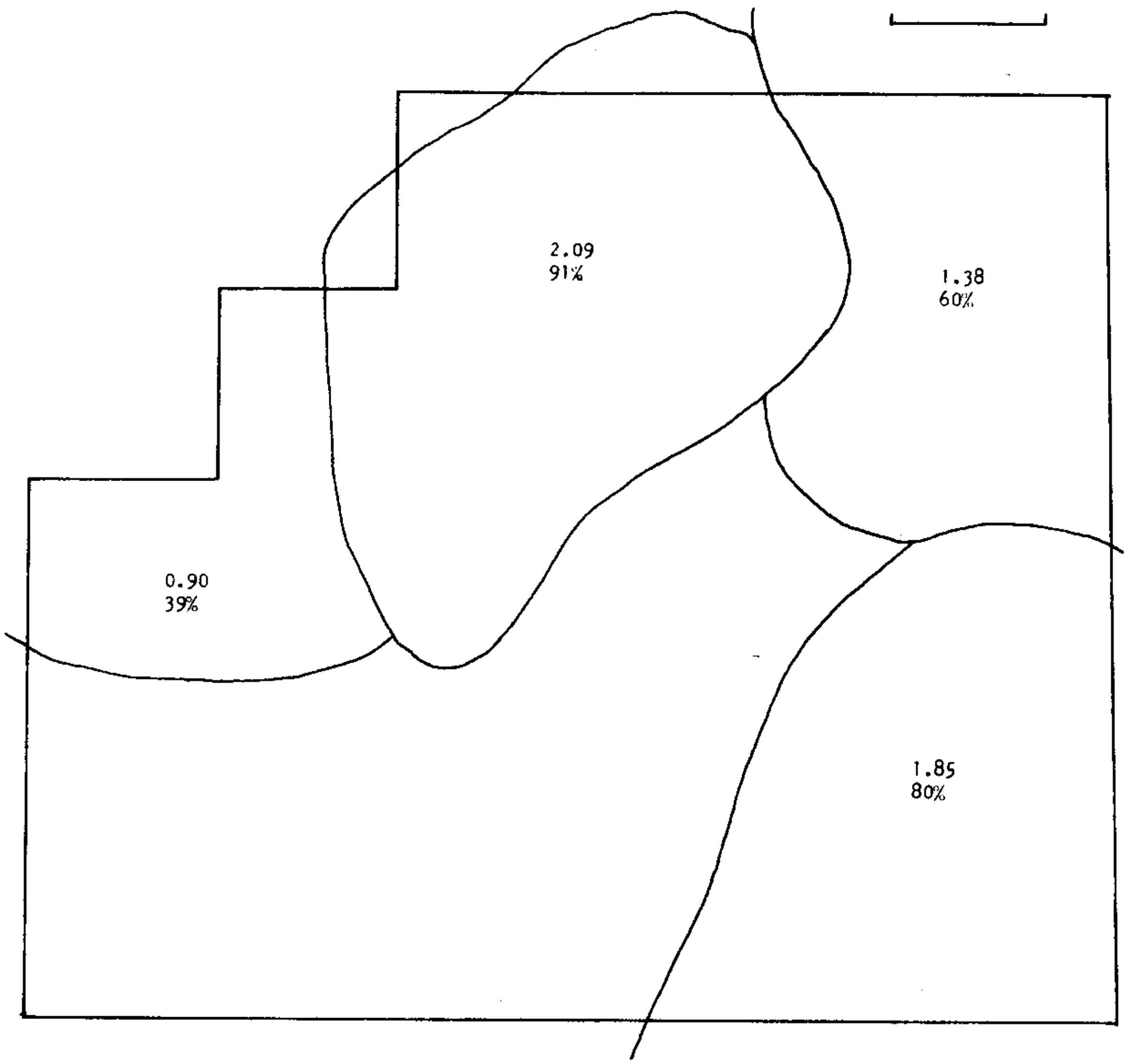
Site: COTTONWOOD Treatment: Lightly Grazed Sample Plot: 1 Species: NU AM

0.77 territories = 1.95 indiv. = 18.4 indiv./km^2
Percent plot occupied = 76



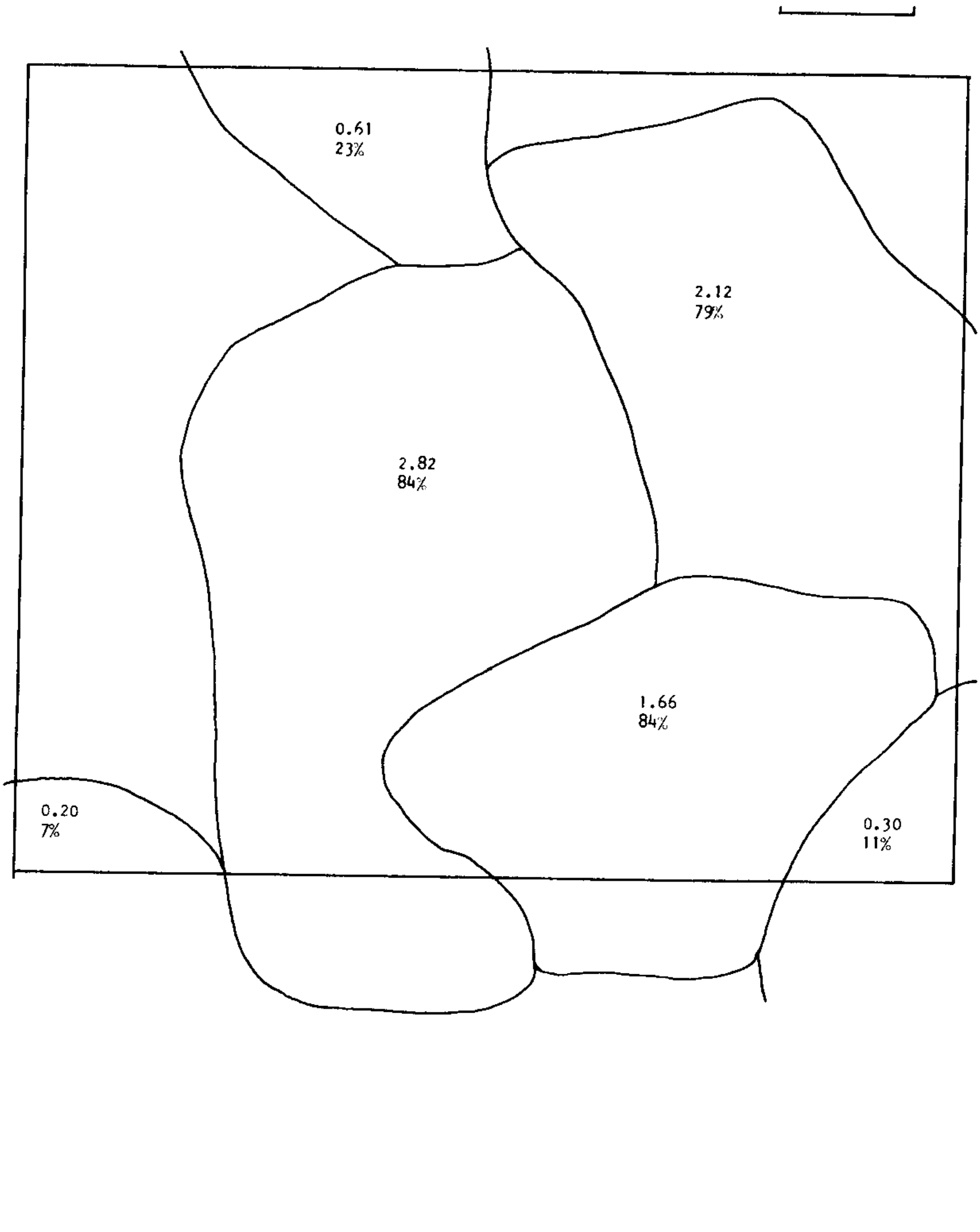
Site: COTTONWOOD Treatment: Grazed Sample Plot: 1 Species: ST NE

2.70 territories = 6.75 indiv. = 70.0 indiv./km^2
Mean territory = 2.30 ha (n=1); Percent plot occupied = 65



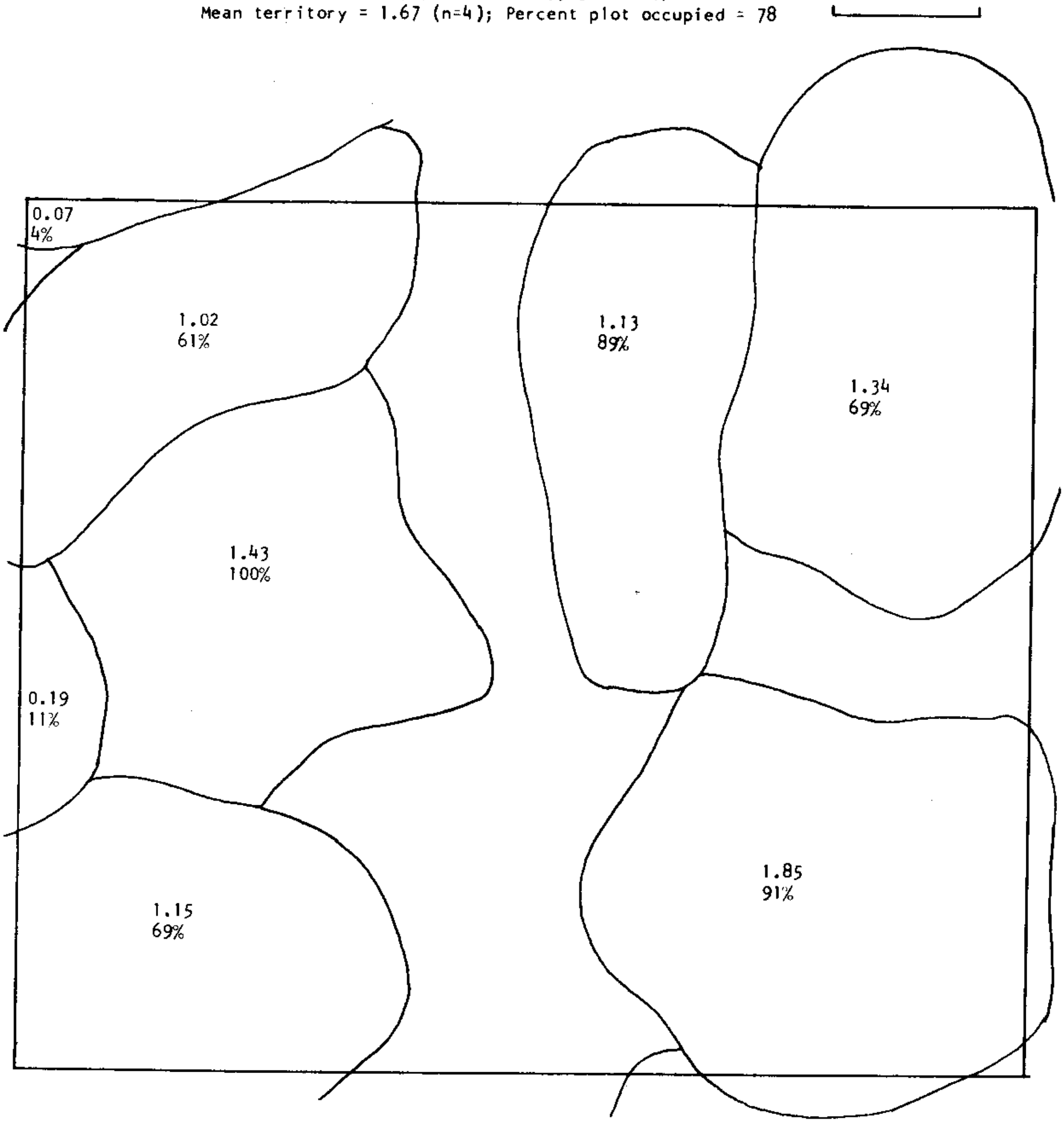
Site: COTTONWOOD Treatment: Lightly Grazed Sample Plot: 1 Species: ST NE

2.88 territories = 7.20 indiv. = 68.0 indiv./km^2
Mean territory = 2.67 ha (n=2); Percent plot occupied = 73



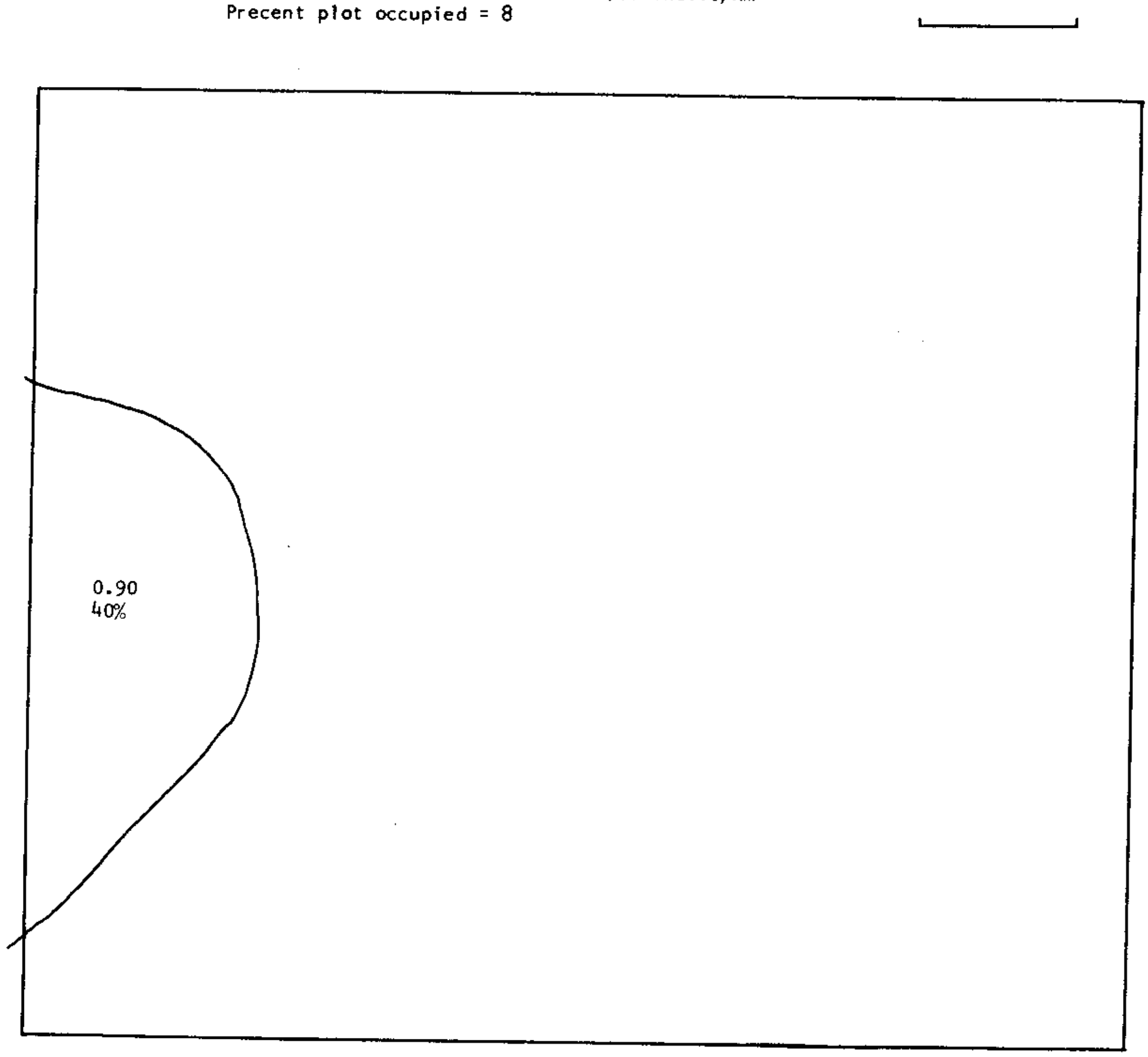
Site: COTTONWOOD Treatment: Lightly Grazed Sample Plot: 2 Species: AM SA

4.97 territories = 9.94 indiv. = 93.9 indiv./km^2
Mean territory = 1.67 (n=4); Percent plot occupied = 78



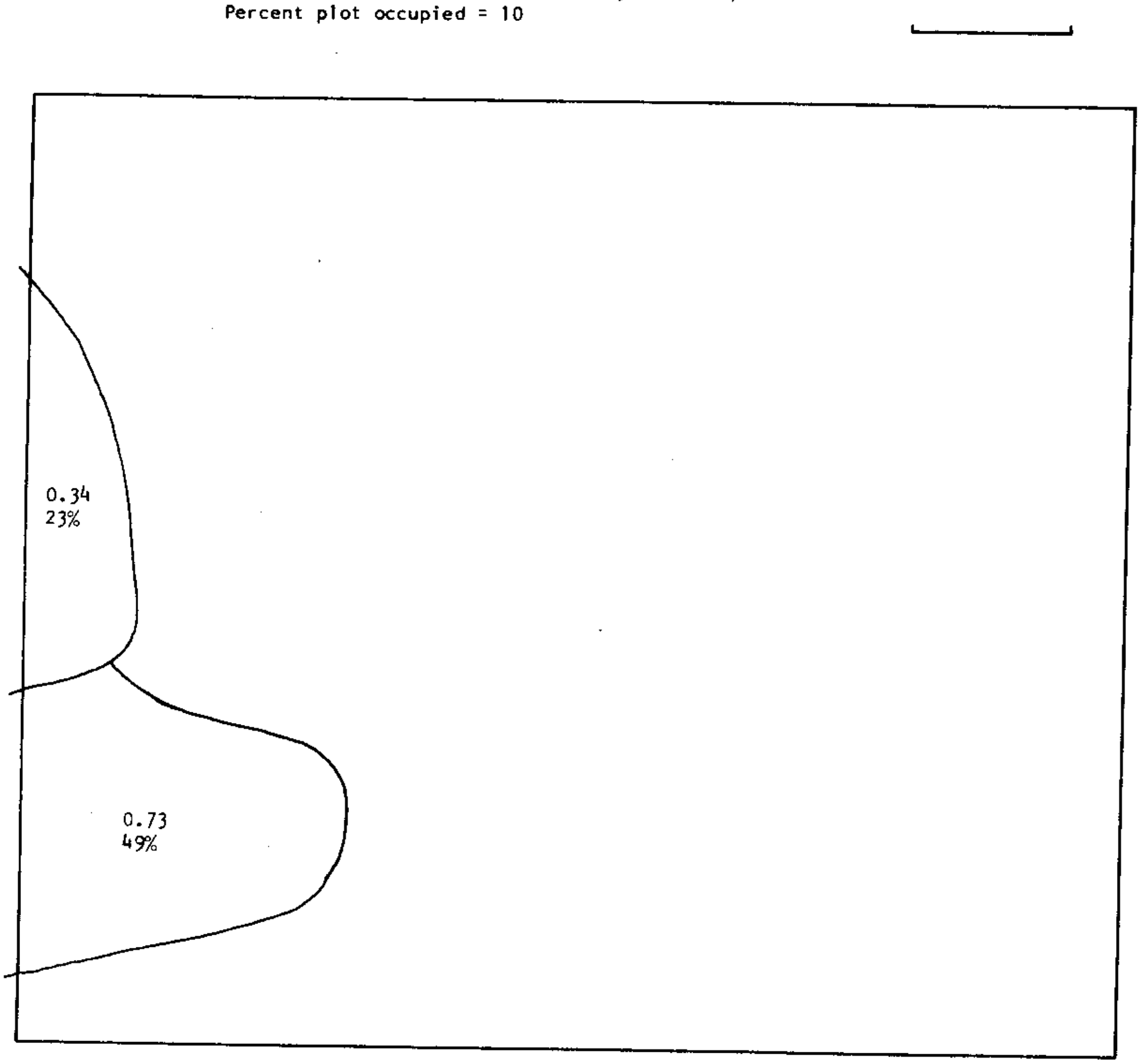
Site: COTTONWOOD Treatment: Lightly Grazed Sample Plot: 2 Species: CA OR

0.40 territories = 0.80 indiv. = 7.6 indiv./km^2
Precent plot occupied = 8



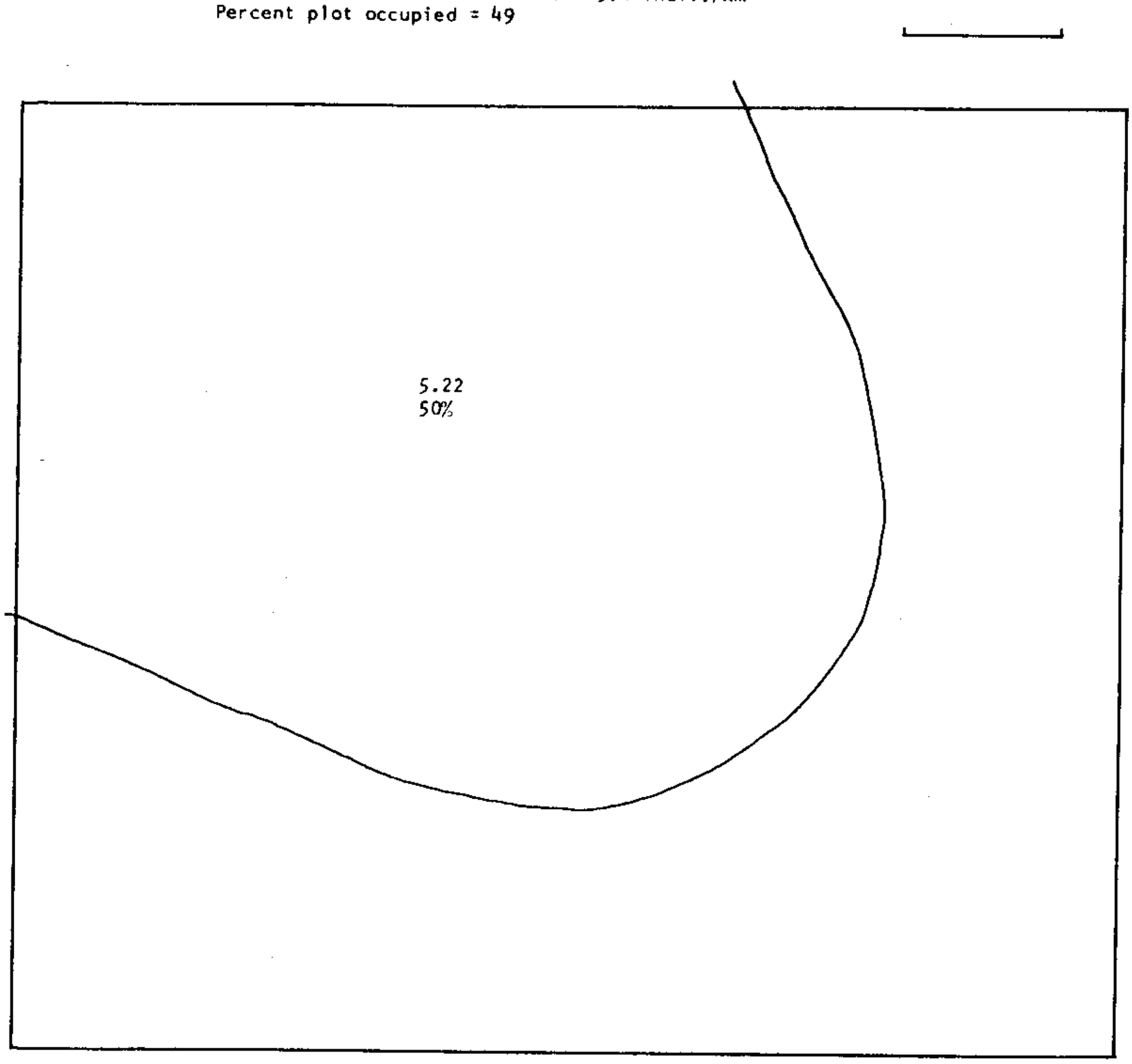
Site: COTTONWOOD Treatment: Lightly Grazed Sample Plot: 2 Species: ER AL

0.72 territories = 1.44 indiv. = 13.6 indiv./km^2
Percent plot occupied = 10



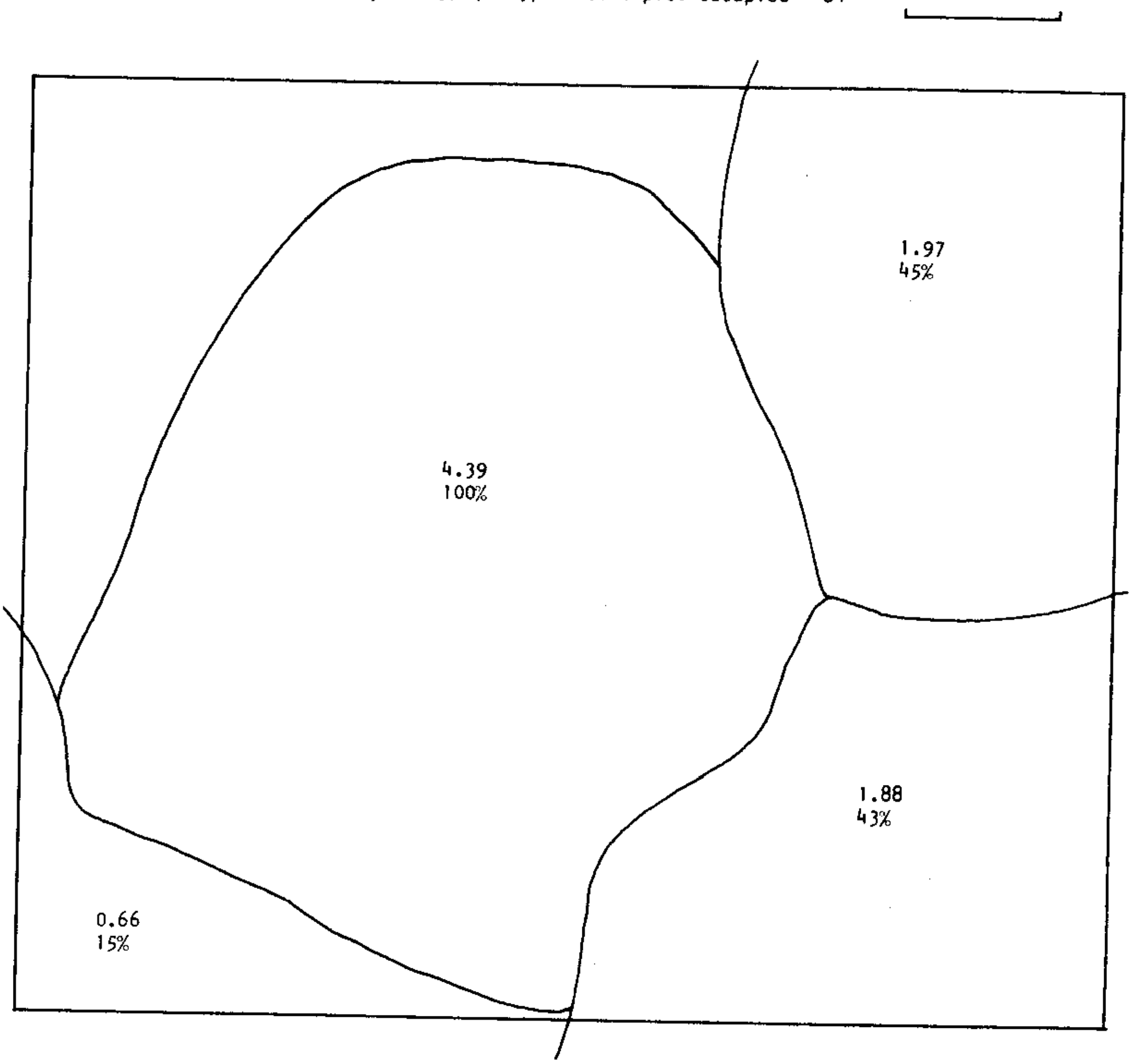
Site: COTTONWOOD Treatment: Lightly Grazed Sample Plot: 2 Species: NU AM

0.50 territories = 1.00 indiv. = 9.4 indiv./km^2
Percent plot occupied = 49



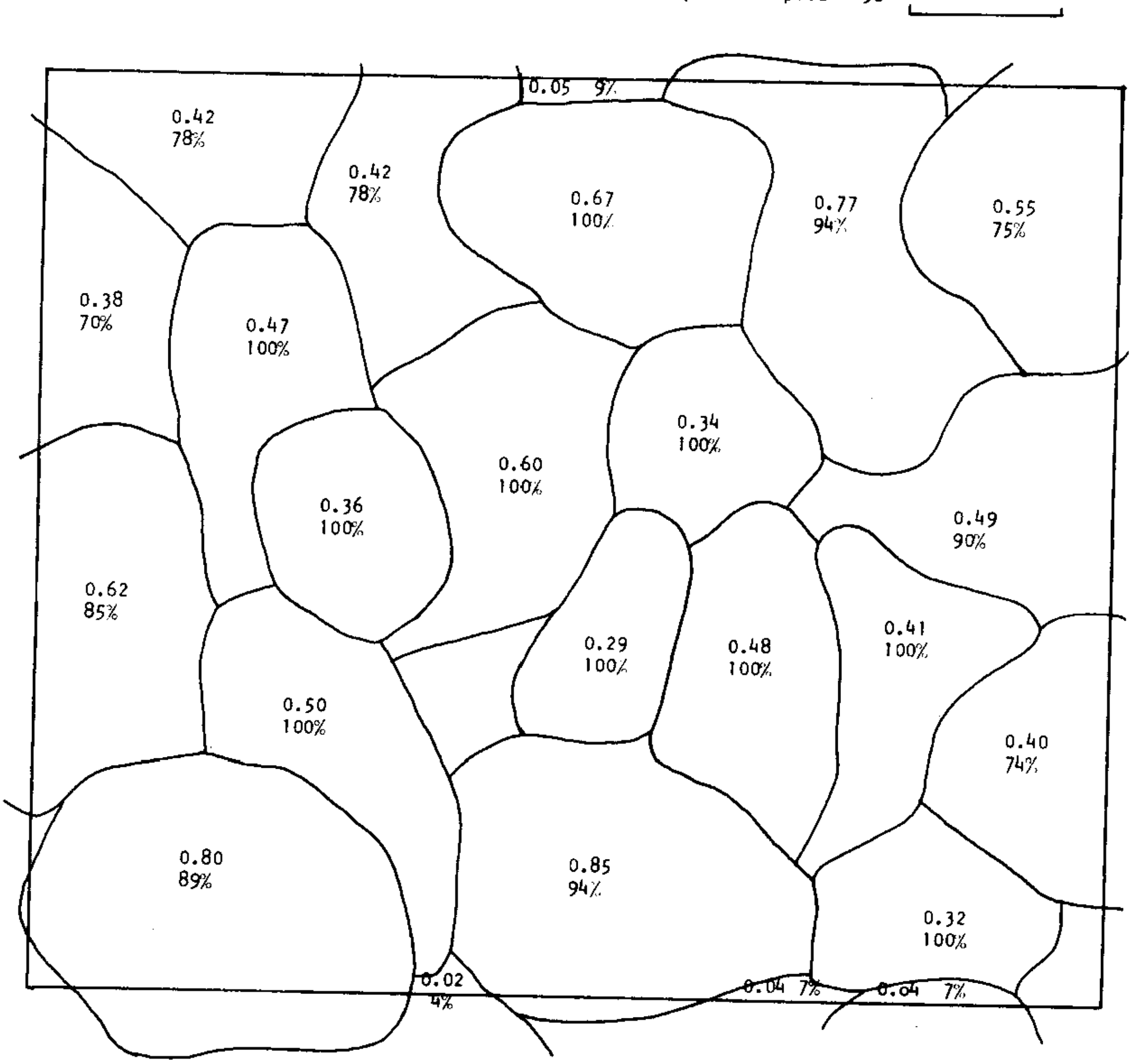
Site: COTTONWOOD Treatment: Lightly Grazed Sample Plot: 2 Species: ST NE

2.03 territories = 5.07 indiv. = 48.0 indiv./km^2
Mean territory = 4.39 (n=1); Percent plot occupied = 84



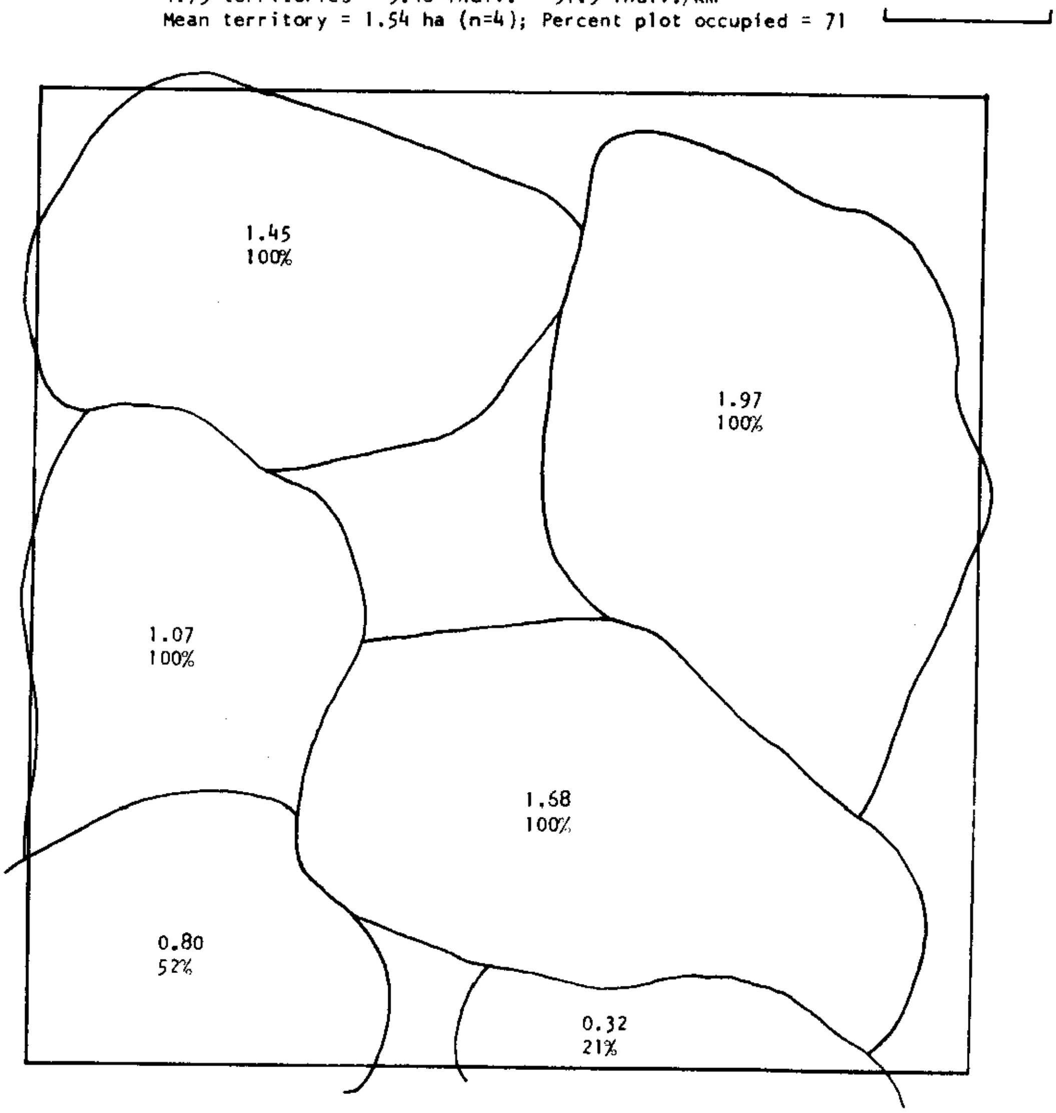
Site: PANTEX Treatment: Grazed Sample Plot: 1 Species: ER AL

18.54 territories = 37.08 indiv. = 350.4 indiv./km^2
Mean territory = 0.54 ha (n=13); Percent plot occupied = 98



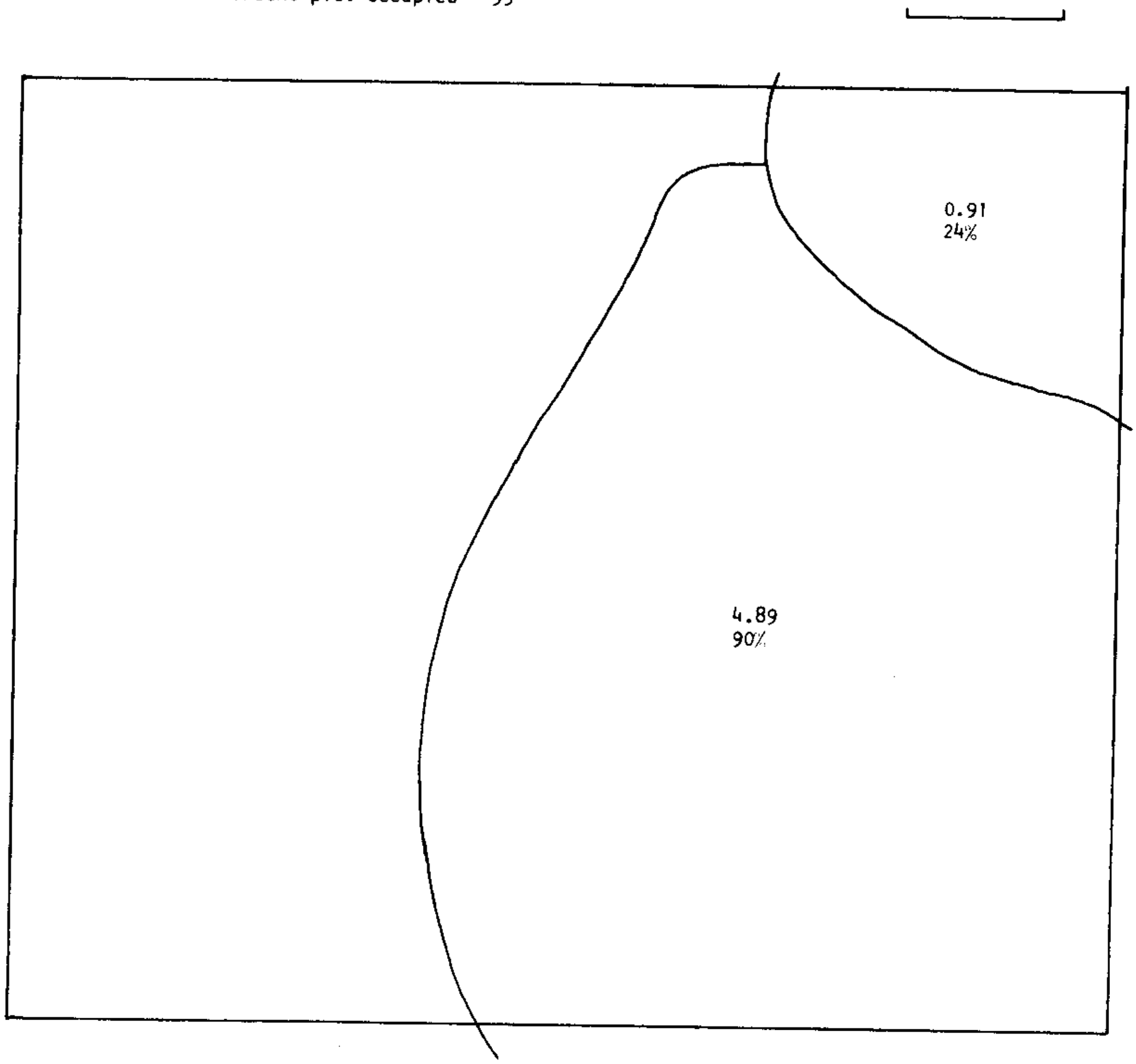
Site: PANTEX Treatment: Ungrazed Sample Plot: 1 Species: ER AL

4.73 territories = 9.46 indiv. = 91.9 indiv./km^2
Mean territory = 1.54 ha (n=4); Percent plot occupied = 71



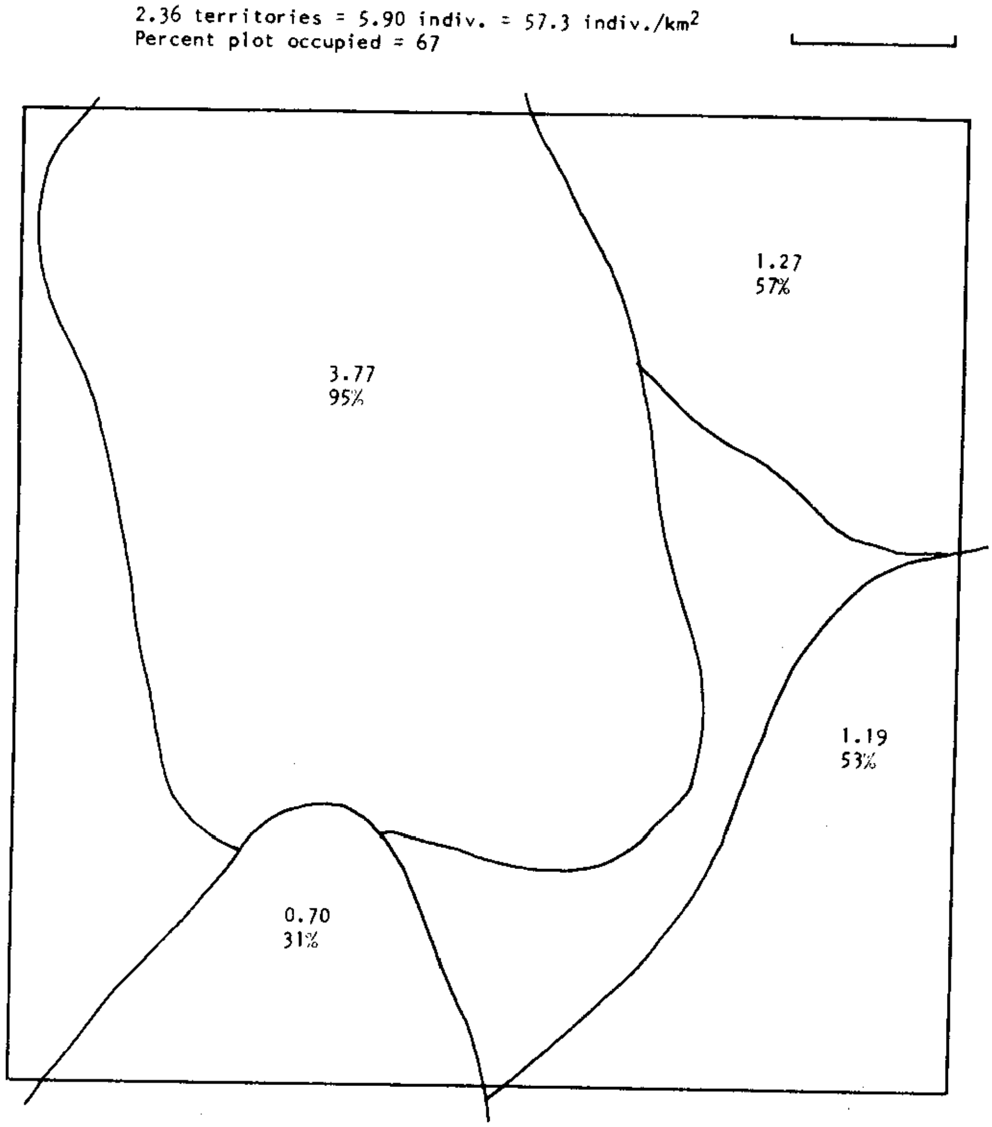
Site: PANTEX Treatment: Grazed Sample Plot: 1 Species: ST NE

1.14 territories = 2.85 indiv. = 26.9 indiv./km^2
Percent plot occupied = 55



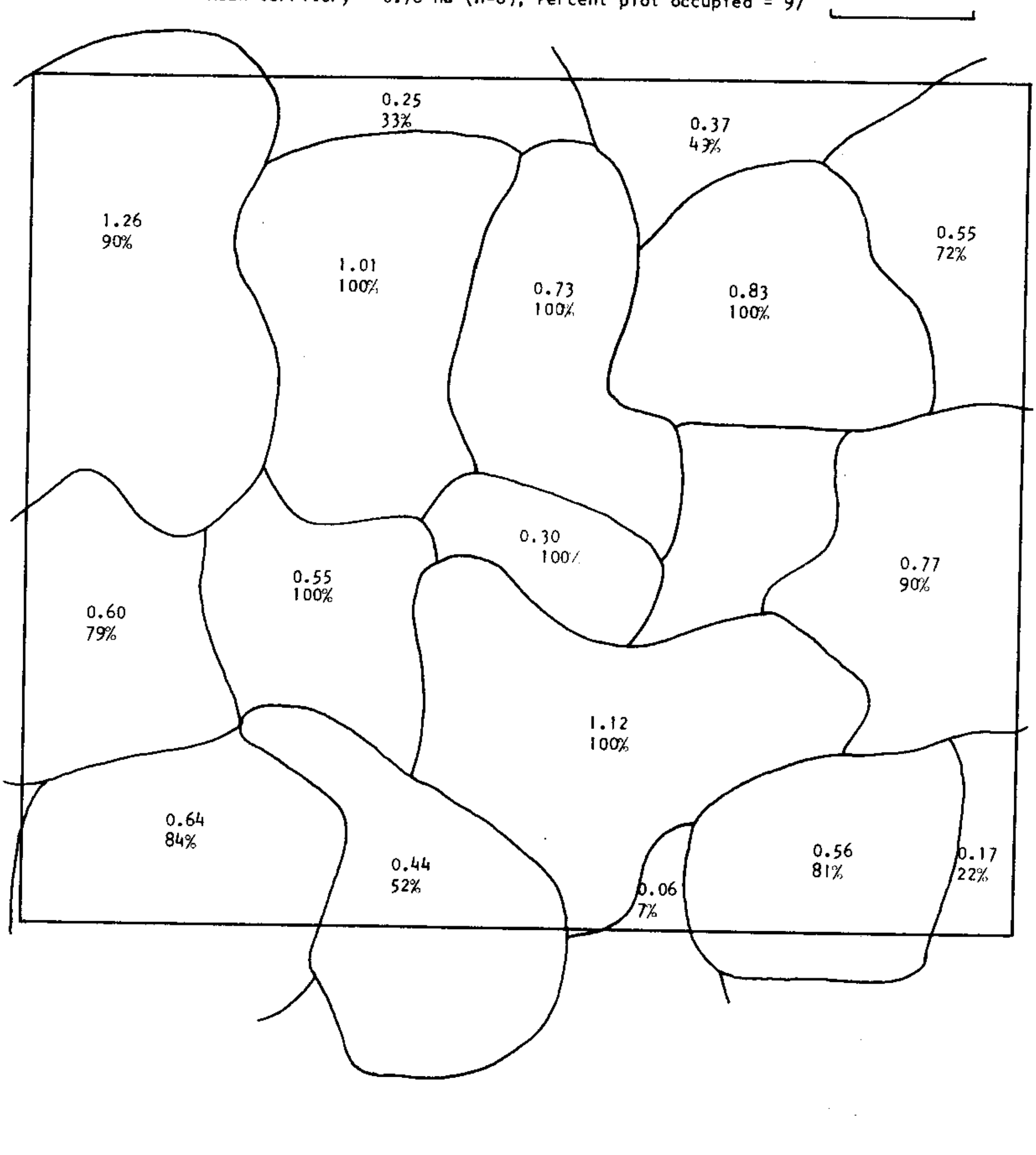
Site: PANTEX Treatment: Ungrazed Sample Plot: 1 Species: ST NE

2.36 territories = 5.90 indiv. = 57.3 indiv./km^2
Percent plot occupied = 67



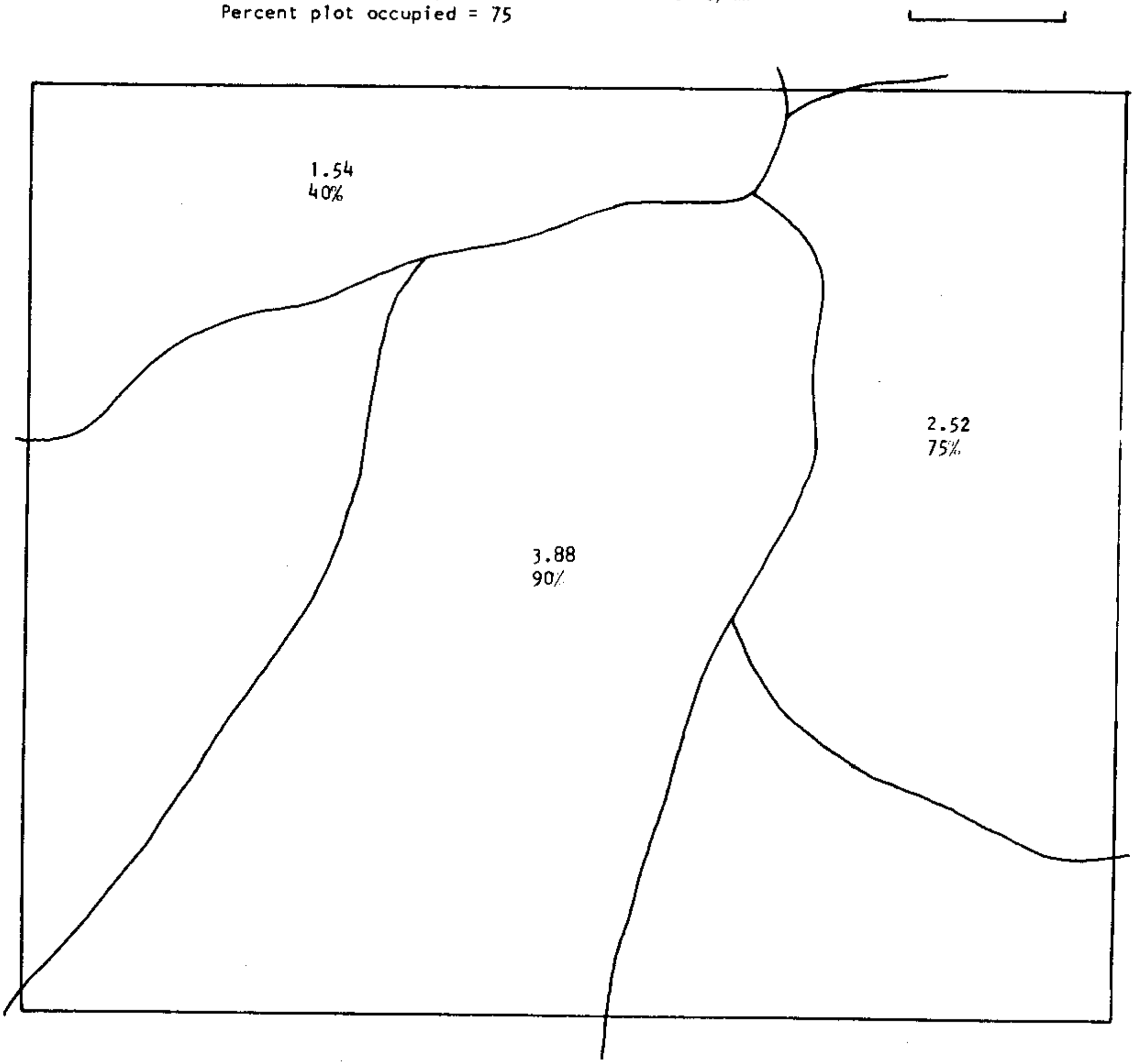
Site: PANTEX Treatment: Grazed Sample Plot: 2 Species: ER AL

12.59 territories = 25.18 indiv. = 237.9 indiv./km^2
Mean territory = 0.76 ha (n=8); Percent plot occupied = 97



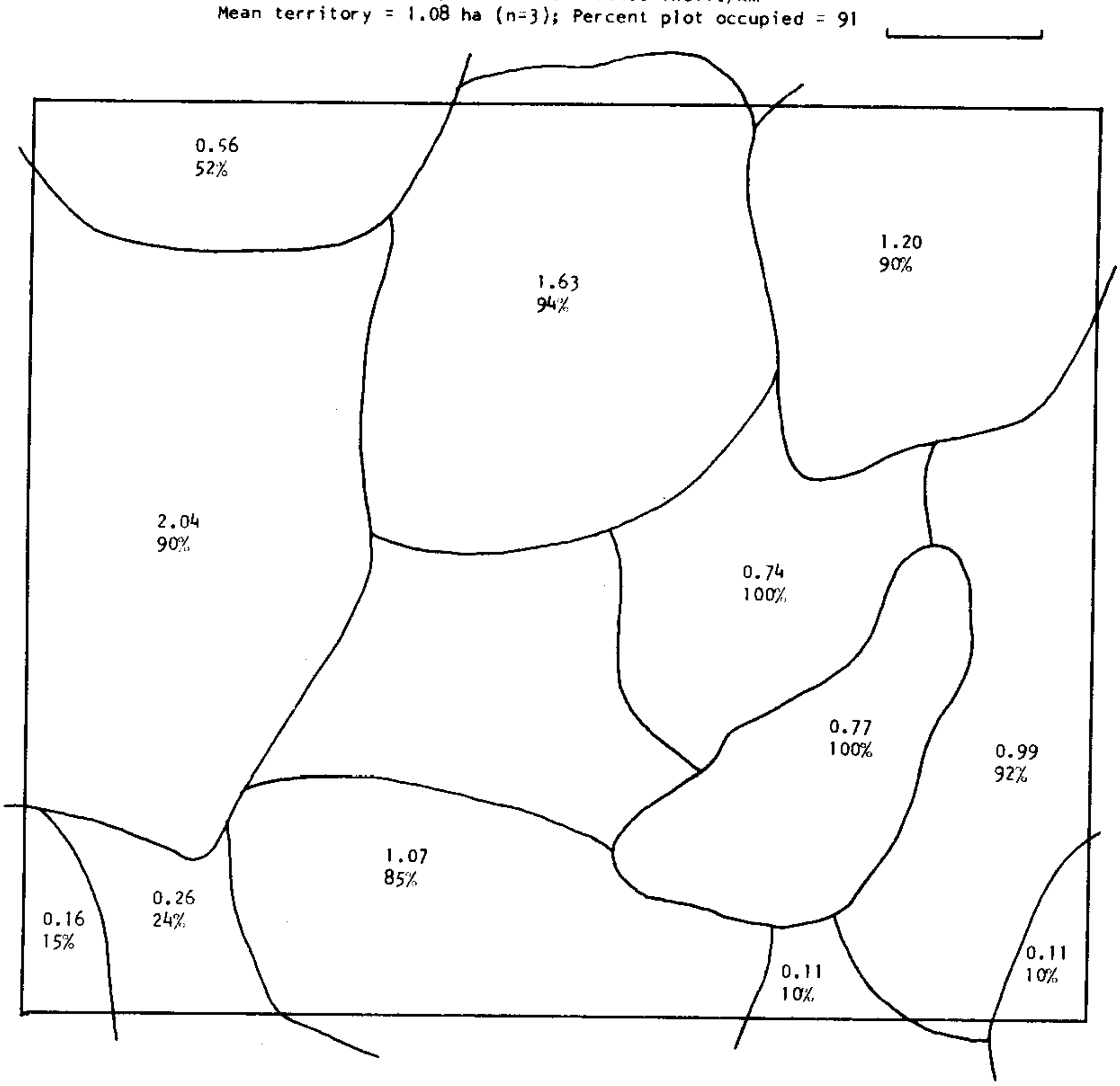
Site: PANTEX Treatment: Grazed Sample Plot: 2 Species: ST NE

2.05 territories = 5.12 indiv. = 48.4 indiv./km^2
Percent plot occupied = 75



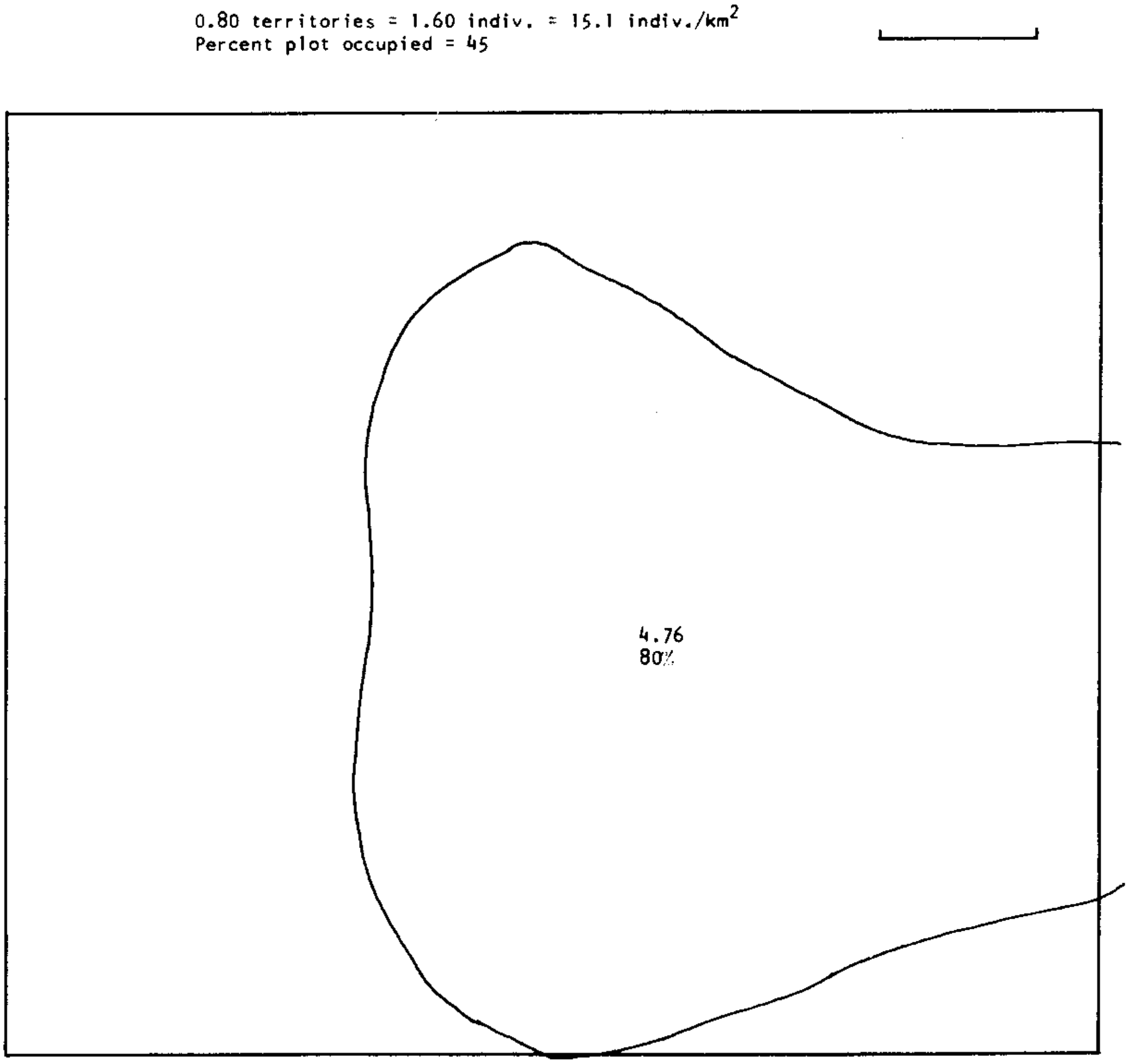
Site: PAWNEE   Treatment: Heavy Winter   Sample Plot: 1   Species: CA ME

7.62 territories = 15.24 indiv. = 144.0 indiv./km^2
Mean territory = 1.08 ha (n=3); Percent plot occupied = 91



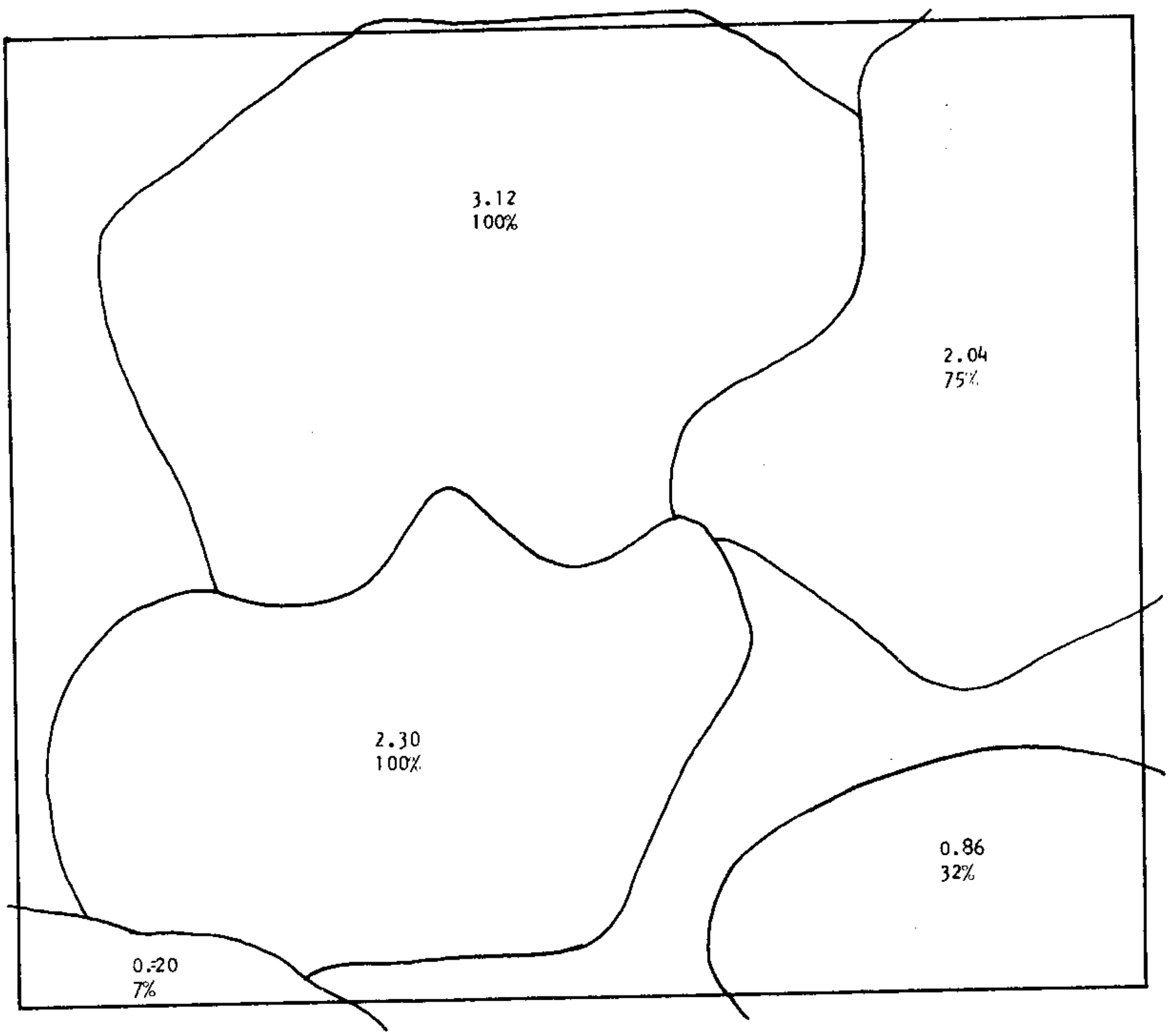
Site: PAWNEE Treatment: Heavy Winter Sample Plot: 1 Species: CH MI

0.80 territories = 1.60 indiv. = 15.1 indiv./km^2
Percent plot occupied = 45



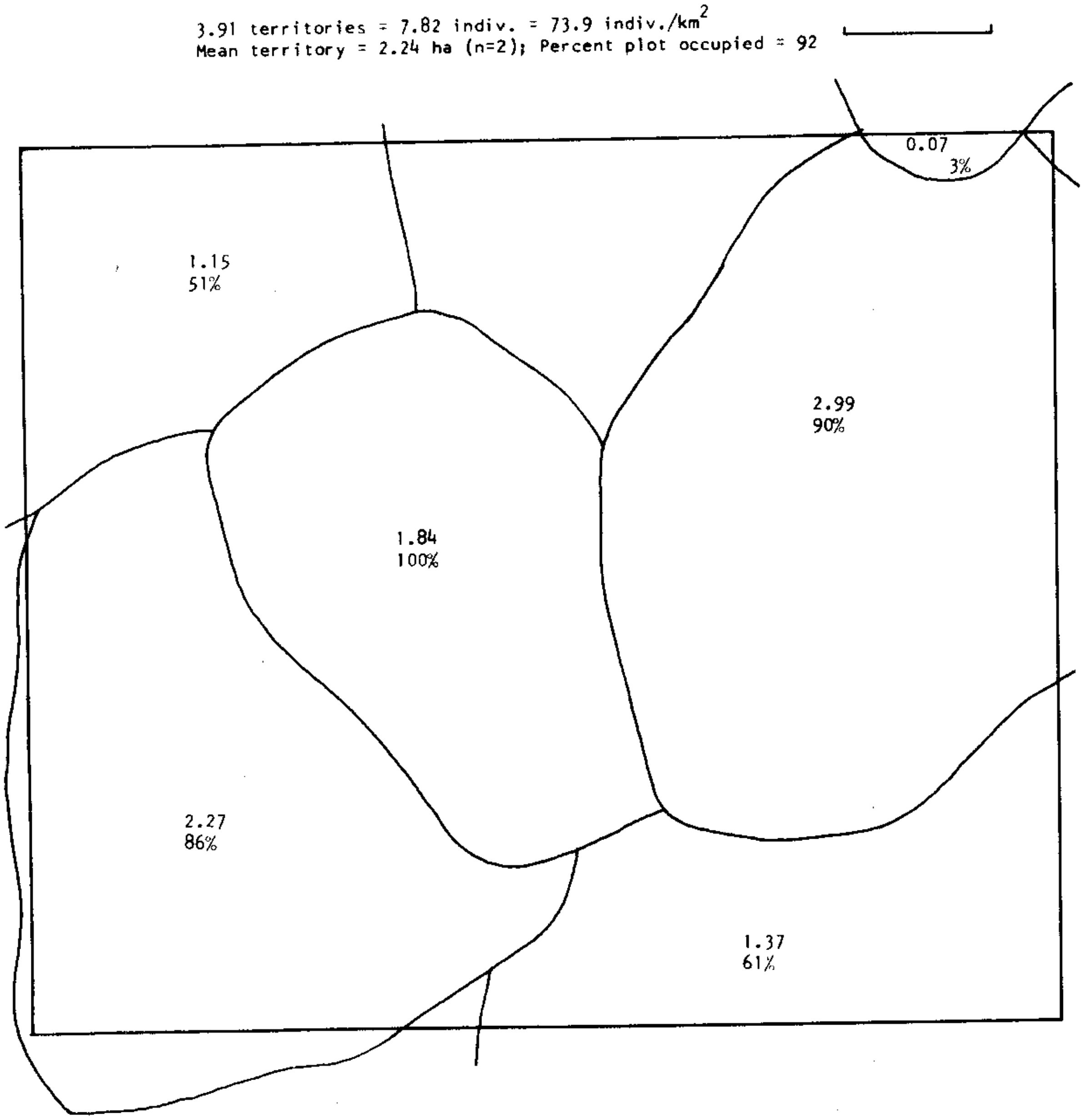
Site: PAWNEE   Treatment: Heavy Summer   Sample Plot: 1   Species: ER AL

3.77 territories = 7.54 indiv. = 71.3 indiv./km^2
Mean territory = 2.71 ha (n=2); Percent plot occupied = 80



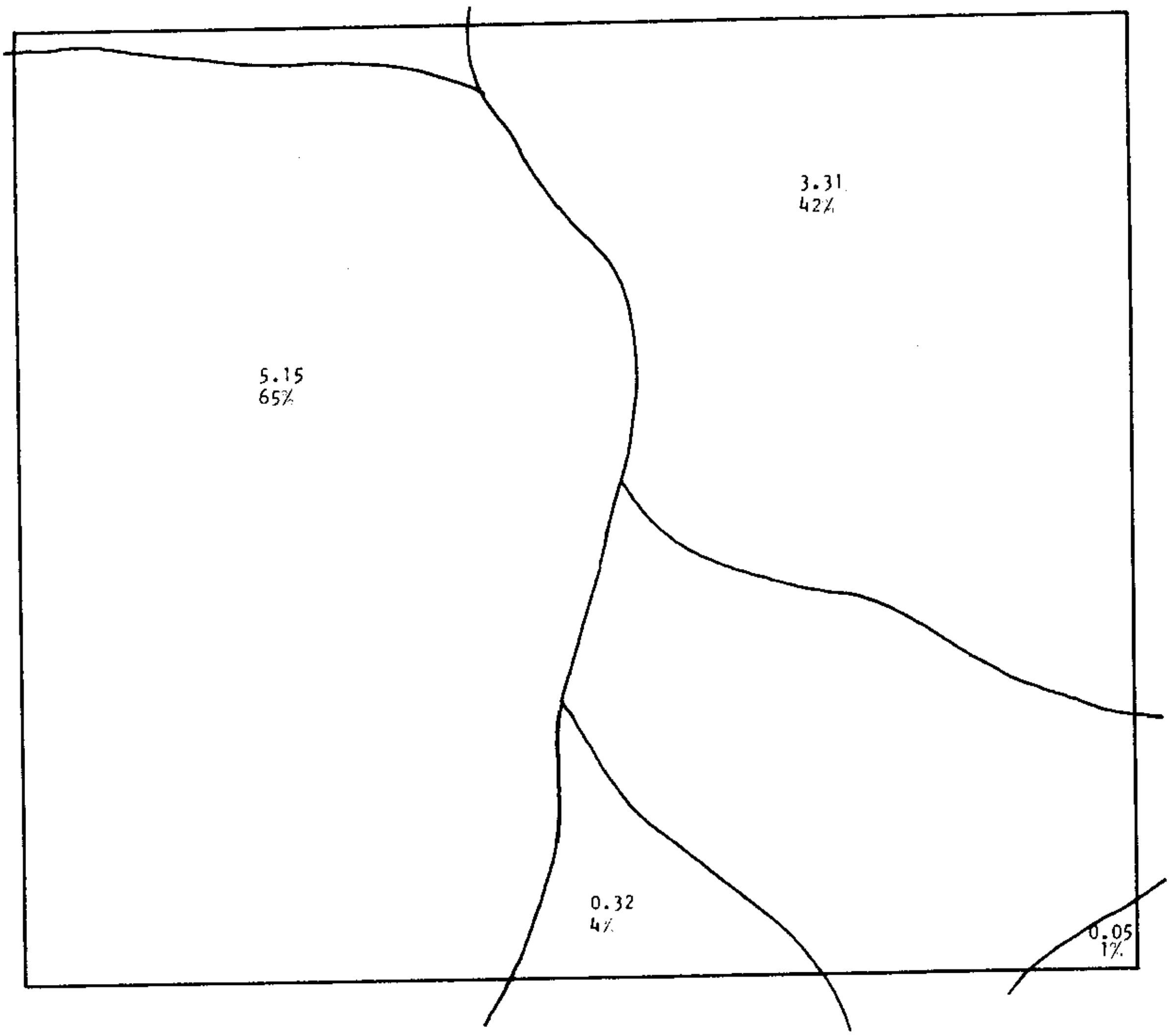
Site: PAWNEE Treatment: Heavy Winter Sample Plot: 1 Species: ER AL

3.91 territories = 7.82 indiv. = 73.9 indiv./km^2
Mean territory = 2.24 ha (n=2); Percent plot occupied = 92



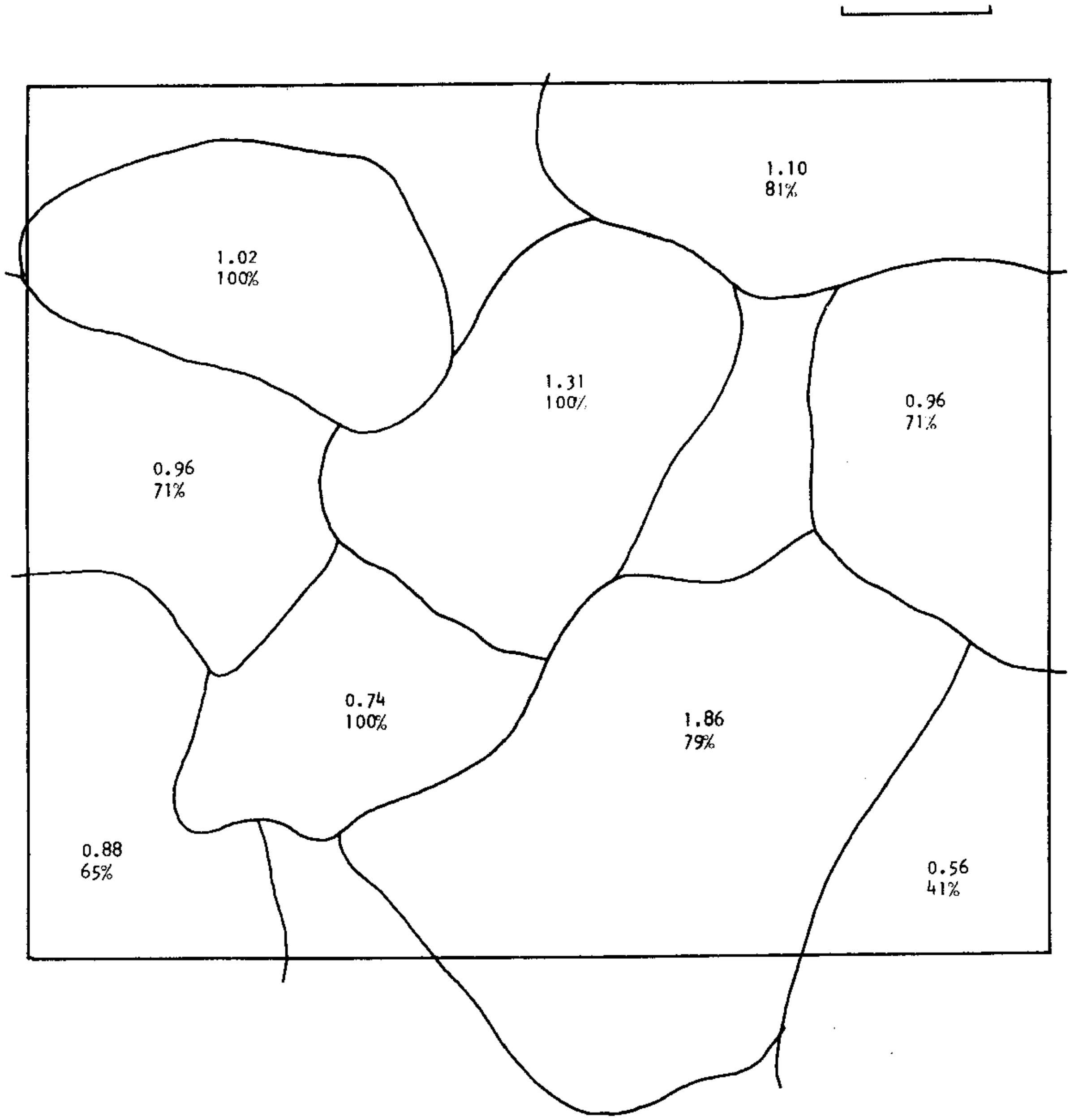
Site: PAWNEE Treatment: Heavy Summer Sample Plot: 1 Species: EU MO

1.12 territories = 2.24 indiv. = 21.17 indiv./km^2
Percent plot occupied = 83



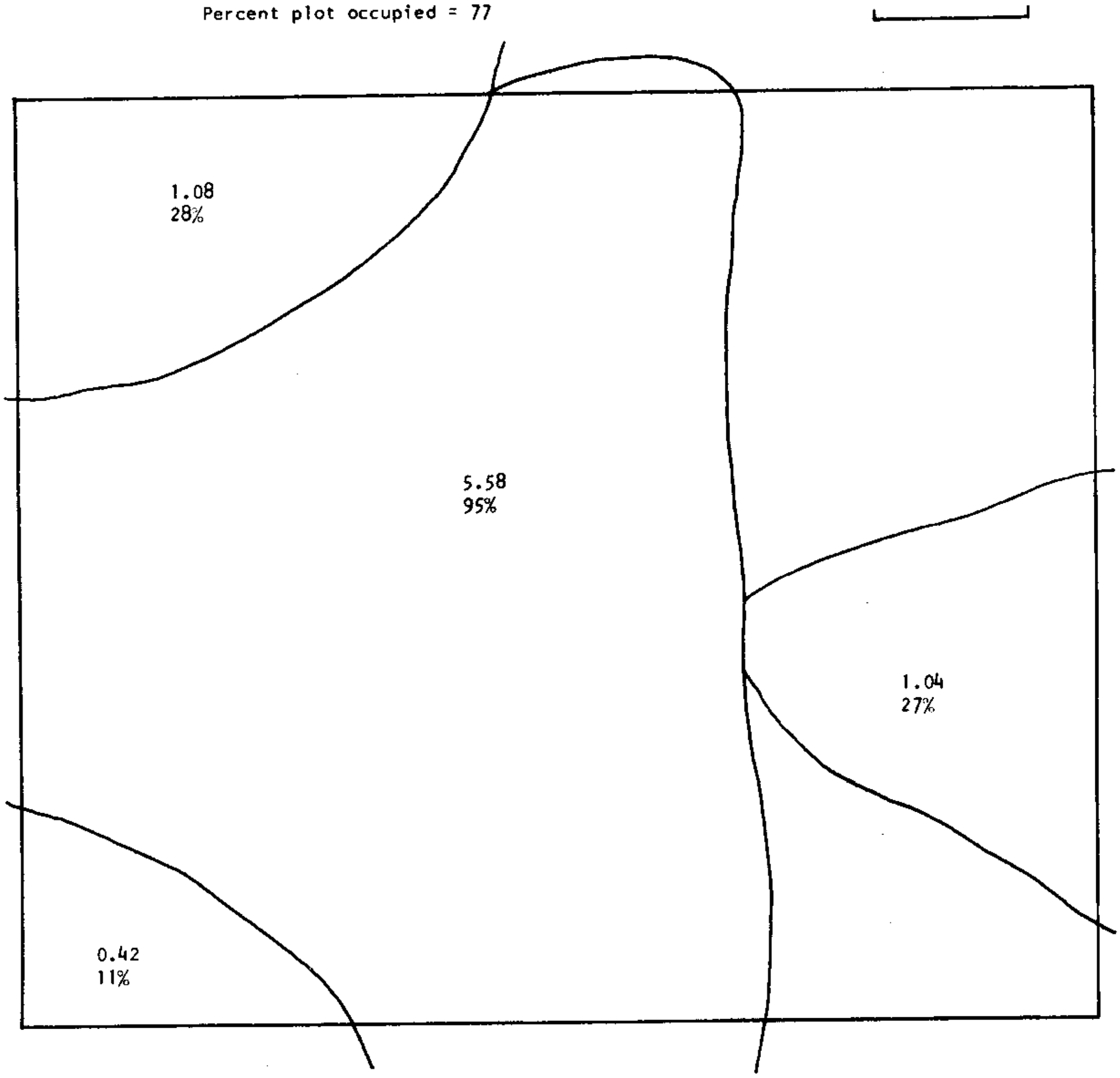
Site: PAWNEE Treatment: Heavy Summer Sample Plot: 1 Species: RH MC

7.08 territories = 14.16 indiv. = 133.8 indiv./km^2
Mean territory = 1.36 ha (n=4); Percent plot occupied = 89



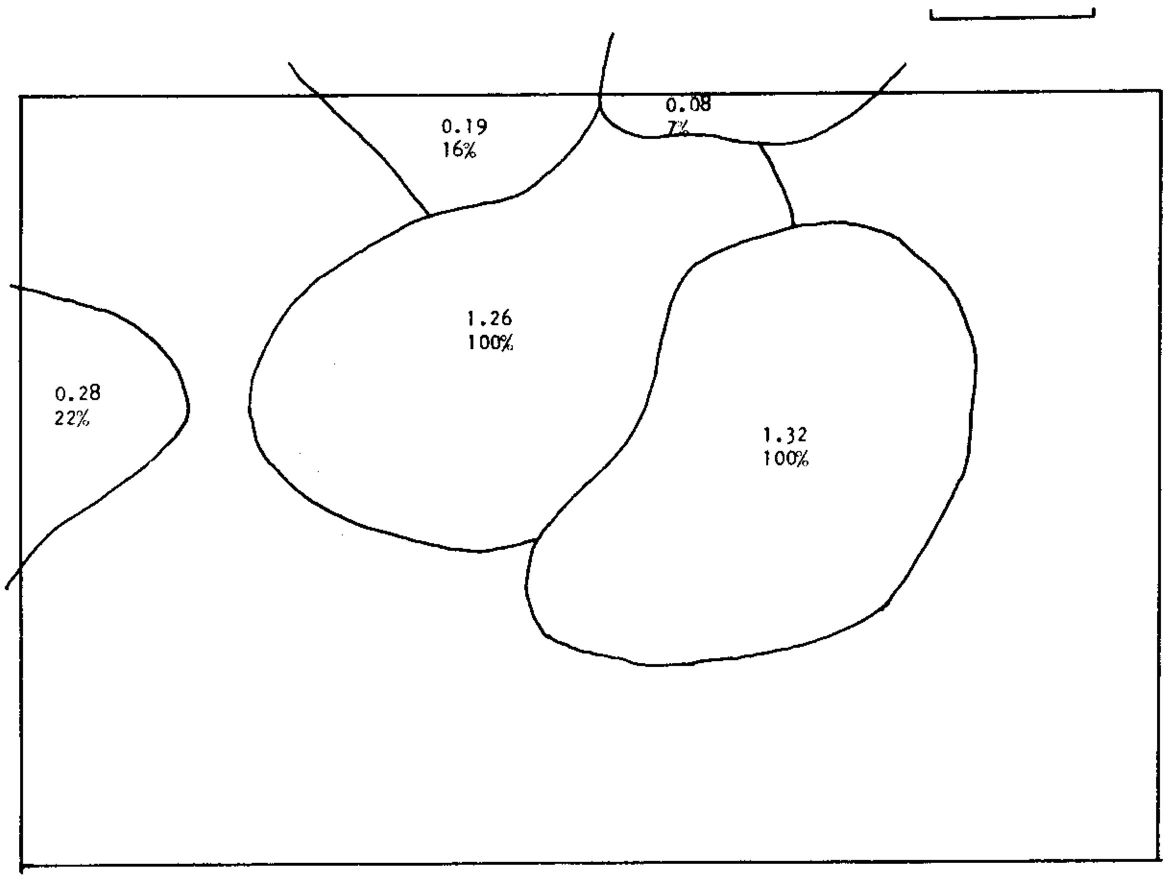
Site: PAWNEE Treatment: Heavy Winter Sample Plot: 1 Species: ST NE

1.61 territories = 4.02 indiv. = 38.0 indiv./km^2
Percent plot occupied = 77



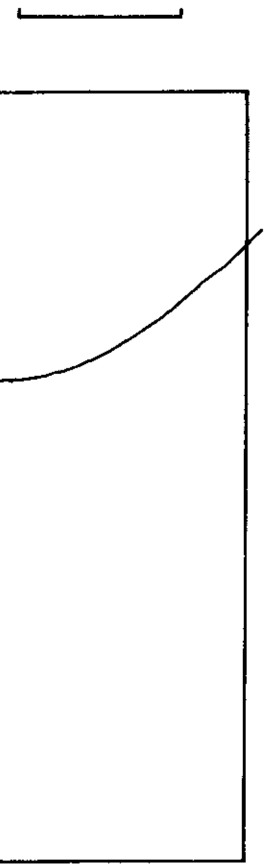
Site: OSAGE Treatment: Grazed Sample Plot: 1 Species: AM SA

2.45 territories = 4.90 indiv. = 58.3 indiv/km^2
Mean territory = 1.29 ha (n=2); Percent plot occupied = 30



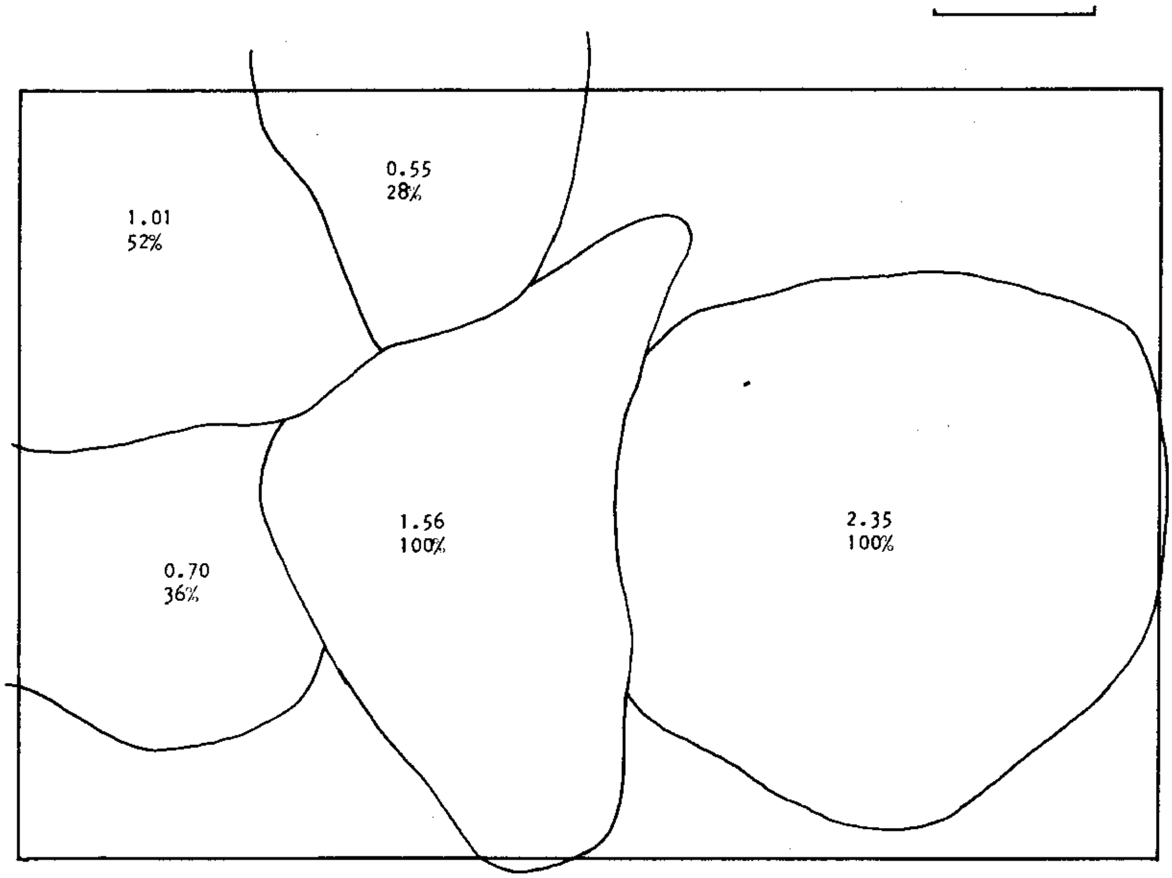
Site: OSAGE   Treatment: Grazed   Sample Plot: 1 Species: BA LO

0.29 territories = 0.58 indiv. = 6.9 indiv./km^2
Percent plot occupied = 19



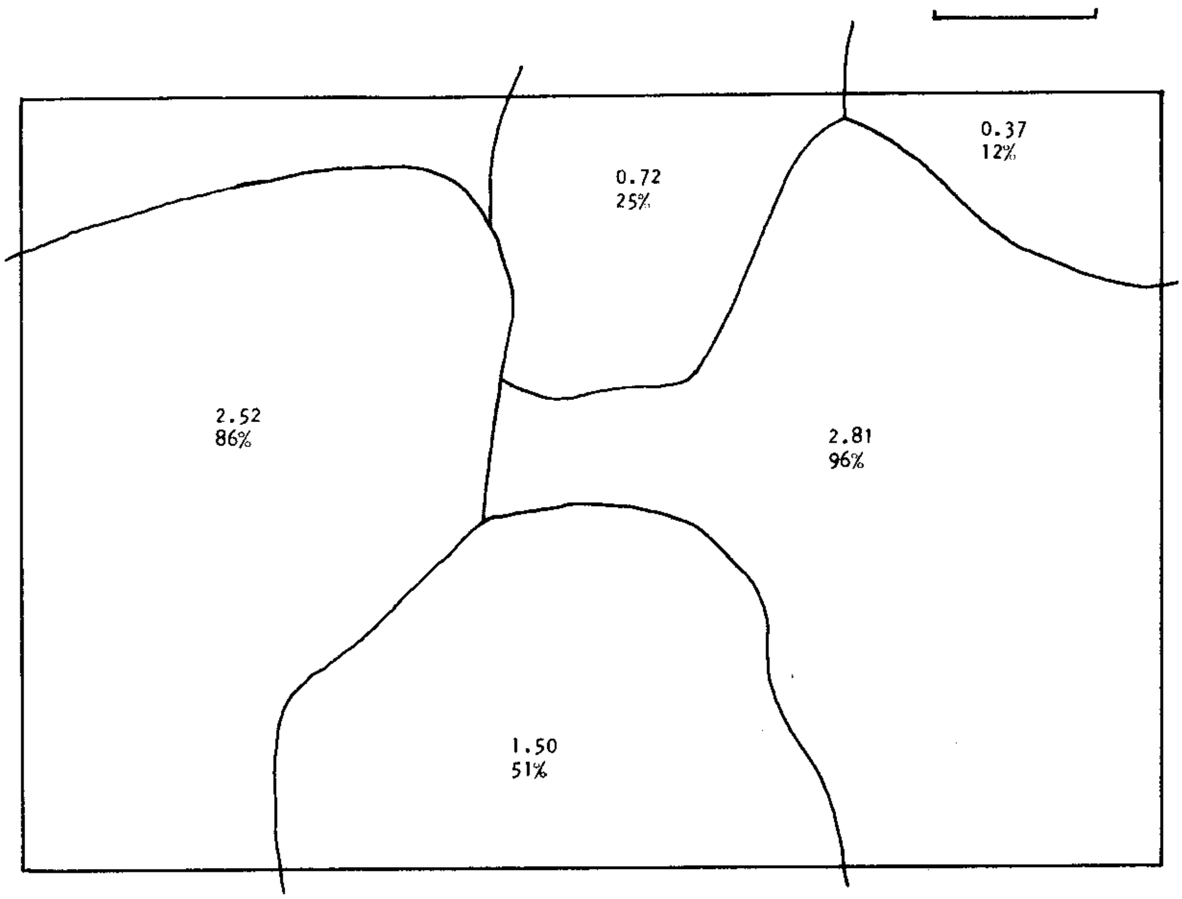
Site: OSAGE   Treatment: Grazed   Sample Plot: 1 Species: SP AM

3.16 territories = 7.90 indiv. = 94.0 indiv./km^2
Mean territory = 1.95 ha (n=2); Percent plot occupied = 73



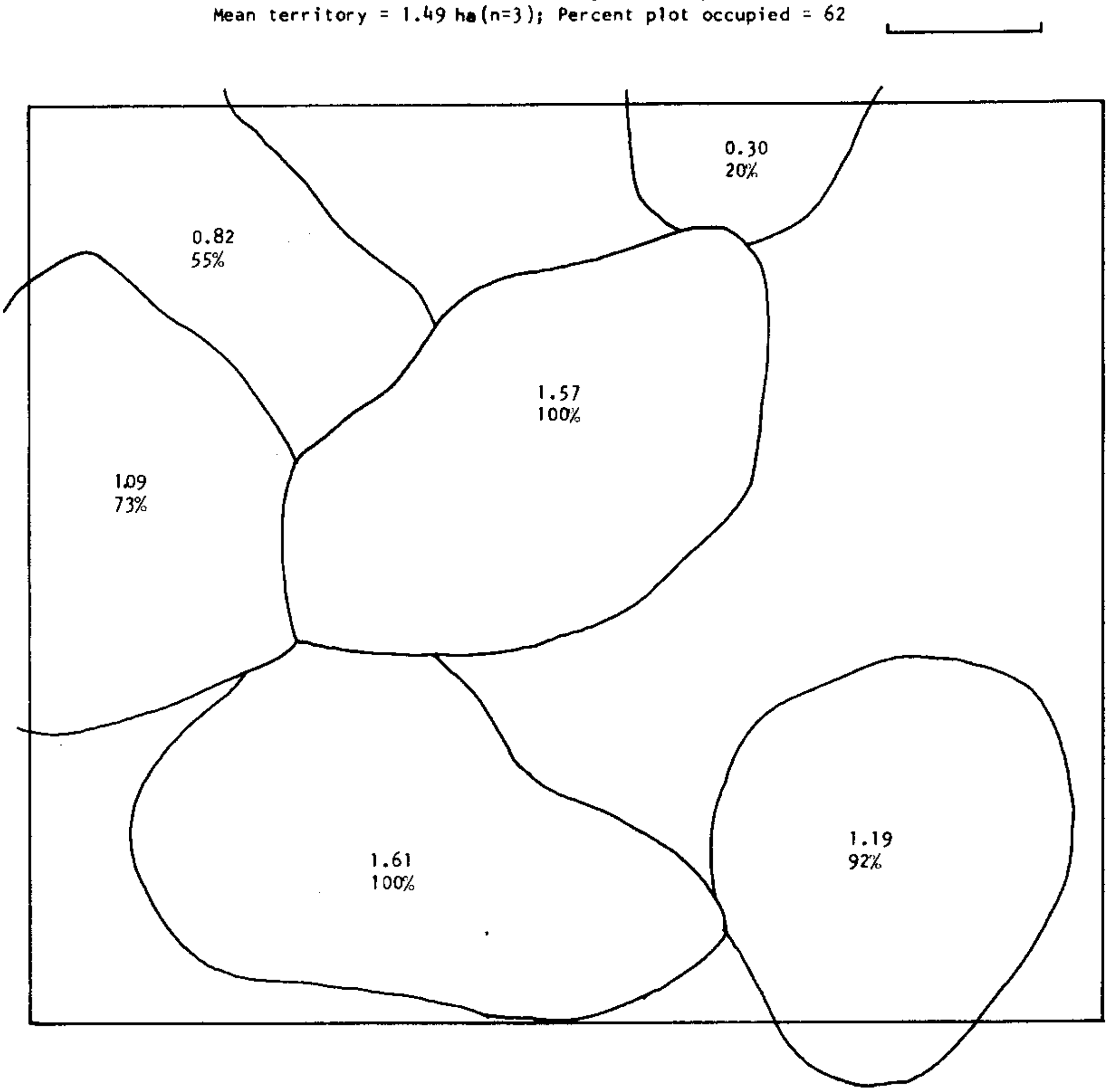
Site: OSAGE Treatment: Grazed Sample Plot: 1 Species: ST MA

2.70 territories = 6.75 indiv. = 80.3 indiv./km^2
Percent plot occupied = 94



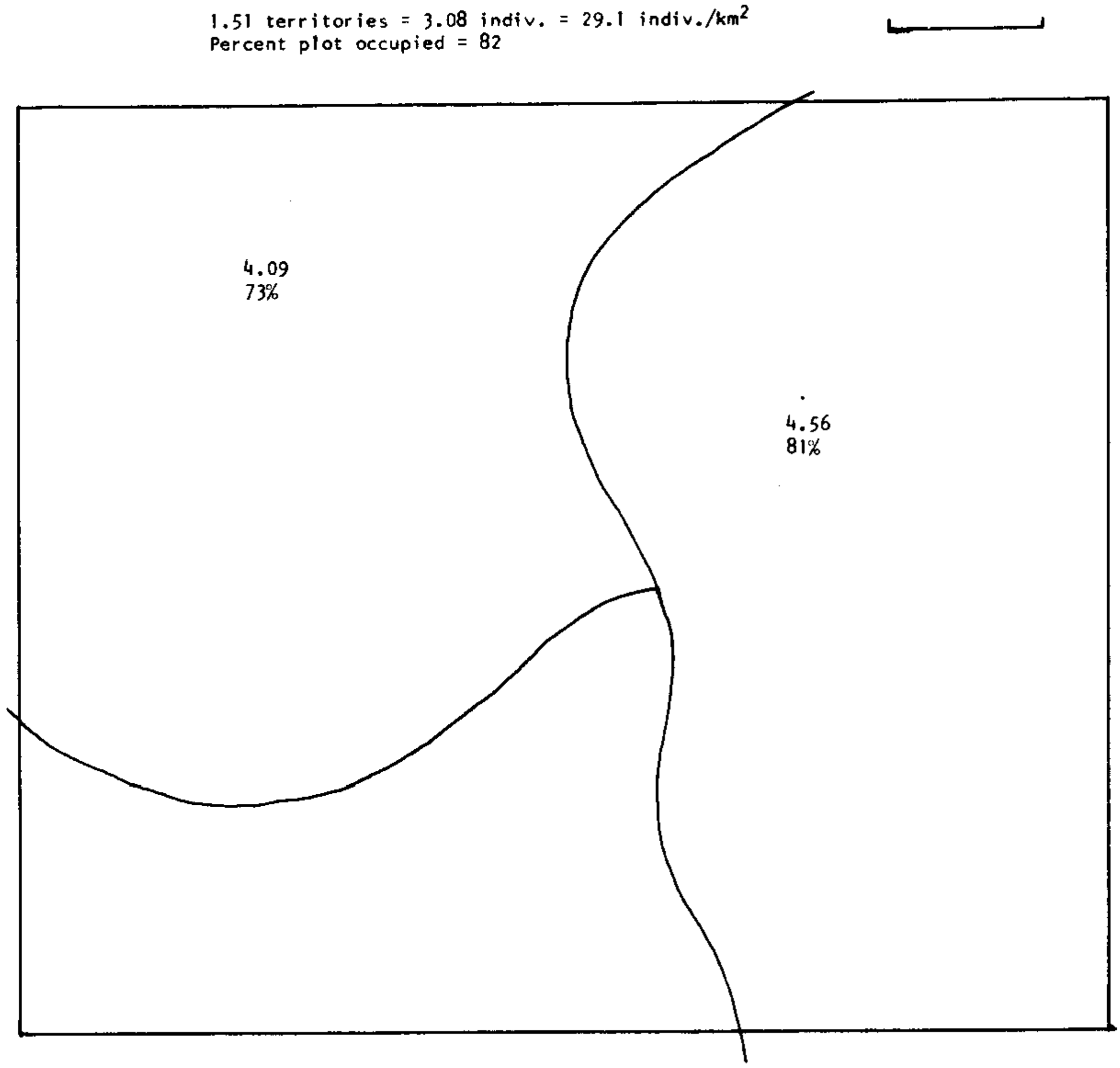
Site: OSAGE Treatment: Grazed Sample Plot: 2 Species: AM SA

4.40 territories = 8.80 indiv. = 83.2 indiv./km^2
Mean territory = 1.49 ha (n=3); Percent plot occupied = 62



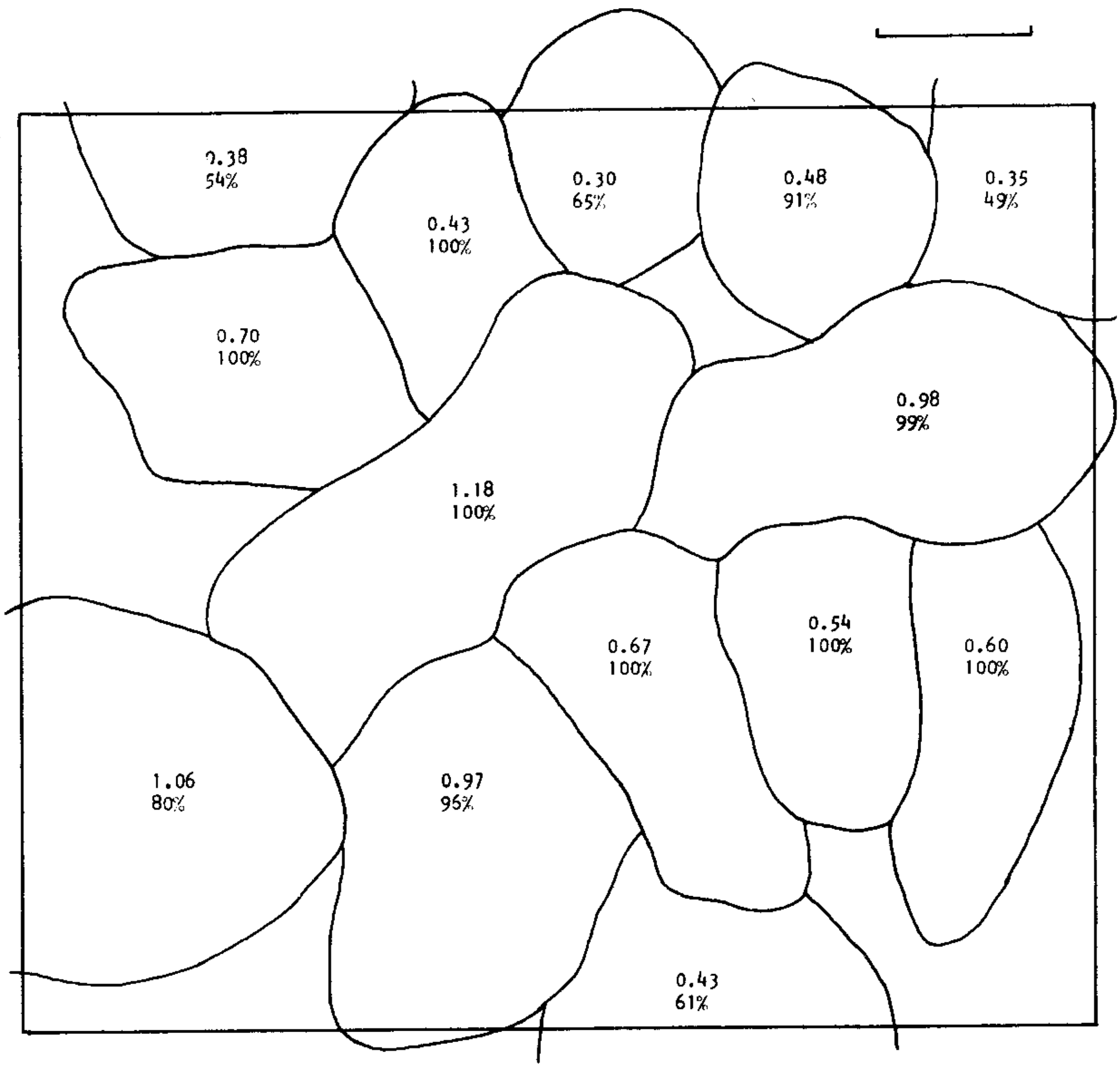
Site: OSAGE Treatment: Grazed Sample Plot: 2 Species: BA LO

1.51 territories = 3.08 indiv. = 29.1 indiv./km^2
Percent plot occupied = 82



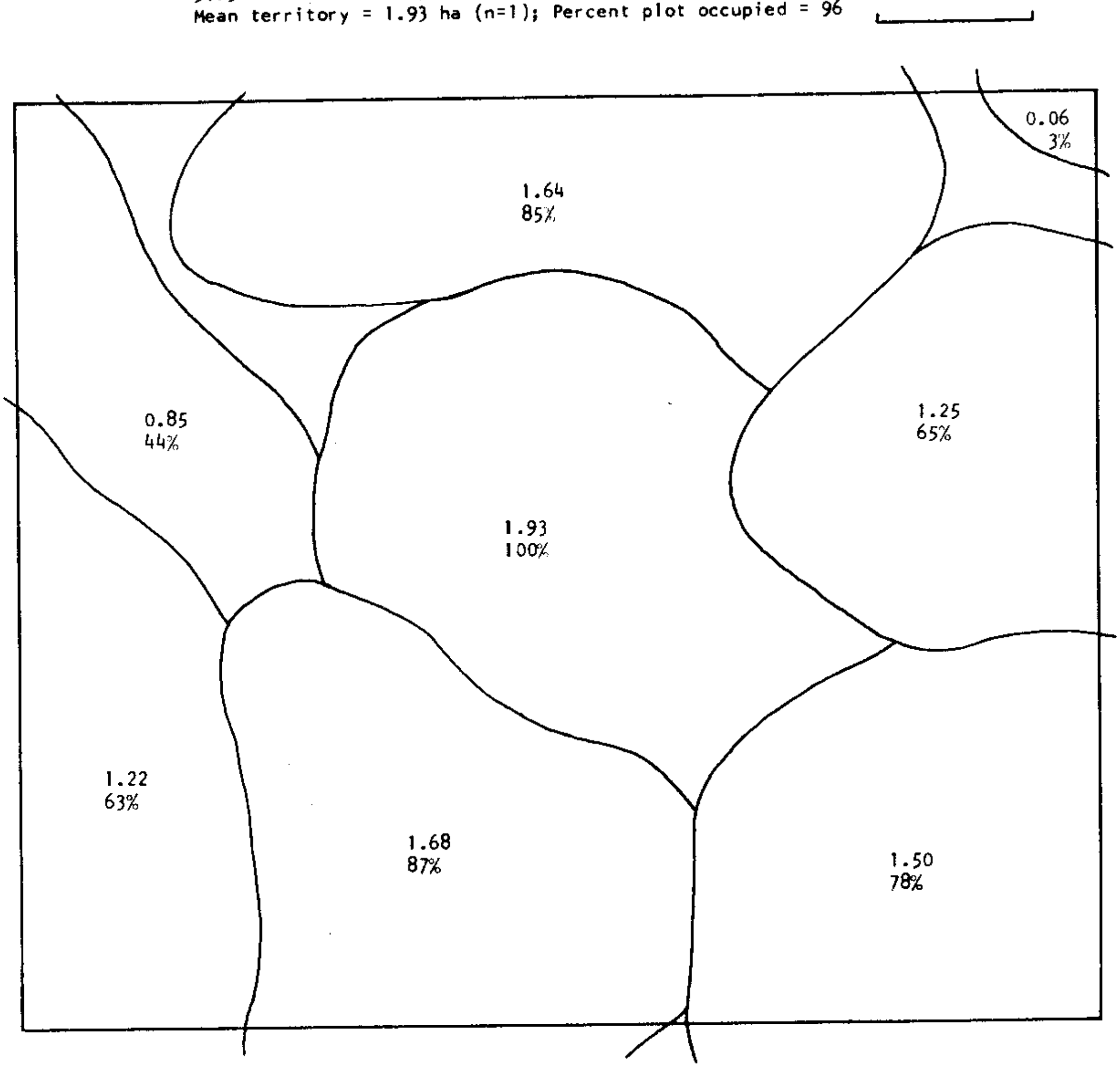
Site: OSAGE Treatment: Grazed Sample Plot: 2 Species: SP AM

11.95 territories = 29.87 indiv. = 282.3 indiv./km^2
Mean territory = 0.71 ha (n=10); Percent plot occupied = 86



Site: OSAGE   Treatment: Grazed   Sample Plot: 2 Species: ST MA

5.25 territories = 13.12 indiv. = 124.03 indiv./km^2
Mean territory = 1.93 ha (n=1); Percent plot occupied = 96



APPENDIX IV

LISTING OF SPECIES RECORDED IN ROADSIDE COUNTS AND ARRANGED ACCORDING TO ECOLOGICAL CATEGORY

Category	Code	Species
Raptor	BUJA	Red-tailed Hawk (*Buteo jamaicensis*)
	BUSW	Swainson's Hawk (*Buteo swainsoni*)
	CAAU	Turkey Vulture (*Cathartes aura*)
	CICY	Marsh Hawk (*Circus cyaneus*)
	FASP	Sparrow Hawk (*Falco sparverius*)
Aquatic	ANDI	Blue-winged Teal (*Anas discors*)
	ANPL	Mallard (*Anas platyrhynchos*)
	ARHE	Great Blue Heron (*Ardea herodias*)
	BUVI	Green Heron (*Butorides virescens*)
	OXJA	Ruddy Duck (*Oxyura jamaicensis*)
Roadside-Brush	AGPH	Red-winged Blackbird (*Agelaius phoeniceus*)
	CHVO	Killdeer (*Charadrius vociferus*)
	COAM	Yellow-billed Cuckoo (*Coccyzus americanus*)
	EUCY	Brewer's Blackbird (*Euphagus cyanocephalus*)
	GUCA	Blue Grosbeak (*Guiraca caerulea*)
	ICBU	Bullock's Oriole (*Icterus bullockii*)
	ICSP	Orchard Oriole (*Icterus spurius*)
	LALU	Loggerhead Shrike (*Lanius ludovicianus*)
	MIPO	Mockingbird (*Mimus polyglottis*)
	MOAT	Brown-headed Cowbird (*Molothrus ater*)
	PIPI	Black-billed Magpie (*Pica pica*)
	QUQU	Grackle (*Quisculus quiscula*)
	SPTR	American Goldfinch (*Spinus tristis*)
	STVU	Starling (*Sturnus vulgaris*)
	TRAE	House Wren (*Troglodytes aedon*)
	TUMI	Robin (*Turdus migratorius*)
	VIBE	Bellis Vireo (*Vireo belli*)
Air-Swoop Feed	CHMI	Common Nighthawk (*Chordeiles minor*)
	HIRU	Barn Swallow (*Hirundo rustica*)
	PEPY	Cliff Swallow (*Petrochelidon pyrrhonota*)
	RIRI	Bank Swallow (*Riparia riparia*)
	STRU	Rough-winged Swallow (*Stelgidopteryx ruficollis*)
Air-Flycatching	COVI	Eastern Wood Pewee (*Contopus virens*)
	MUFO	Scissortailed Flycatcher (*Muscivora forficata*)
	SASA	Say's Phoebe (*Sayornis sayi*)
	TYTY	Eastern Kingbird (*Tyrannis tyrannis*)
	TYVE	Western Kingbird (*Tyrannis verticalis*)

APPENDIX IV

(Continued)

Category	Code	Species
Ground Shorebird	BALO	Upland Plover (*Bartramia longicauda*)
	EUMO	Mountain Plover (*Eupoda montana*)
	NUAM	Long-billed Curlew (*Numenius americana*)
Large Ground	CASQ	Scaled Quail (*Callipepla squamata*)
	COVI	Bobwhite Quail (*Colinus virginianus*)
	PEPH	Sharp-tailed Grouse (*Pedioecetes phasianellus*)
	PHCO	Ring-necked Pheasant (*Phasianus colchicus*)
	TYCU	Greater Prairie Chicken (*Tympanuchus cupido*)
Meadowlark	STMA	Eastern Meadowlark (*Sturnella magna*)
	STNE	Western Meadowlark (*Sturnella neglecta*)
Small Ground	AICA	Cassin's Sparrow (*Aimophila cassinii*)
	AMBE	Sage Sparrow (*Amphispiza belli*)
	AMSA	Grasshopper Sparrow (*Ammodramus savannarum*)
	CAME	Lark Bunting (*Calamospiza melanocorys*)
	CAOR	Chestnut-collared Longspur (*Calcarius ornatus*)
	CHGR	Lark Sparrow (*Chondestes grammacus*)
	ERAL	Horned Lark (*Eremophila alpestris*)
	PASA	Savannah Sparrow (*Passerculus sandwichensis*)
	POGR	Vesper Sparrow (*Pooecetes gramineus*)
	RHMC	McCown's Longspur (*Rhynchophares mccownii*)
	SPAM	Dickcissel (*Spiza americana*)
	SPBR	Brewer's Sparrow (*Spizella breweri*)
	SPPA	Chipping Sparrow (*Spizella passerina*)
	ZOLE	White-crowned Sparrow (*Zonotrichia leucophrys*)
Miscellaneous	COAU	Yellow-shafted Flicker (*Colaptes auratus*)
	COBR	Crow (*Corvus brachyrhynchos*)
	COCA	Red-shafted Flicker (*Colaptes cafer*)
	COER	Roadrunner (*Coccyzus erythropthalmus*)
	CYCR	Blue Jay (*Cyanocitta cristata*)
	DEPE	Yellow Warbler (*Dendroica petechia*)
	GETR	Yellowthroat (*Geothlypis trichas*)
	ICGA	Baltimore Oriole (*Icterus galbula*)
	ICVI	Yellow-breasted Chat (*Icteria virens*)
	PAAT	Black-capped Chickadee (*Parus atricapillus*)
	PADO	House Sparrow (*Passer domesticus*)
	PHME	Black-headed Grosbeak (*Pheucticus melanocephalus*)
	ZEMA	Mourning Dove (*Zenaidura macroura*)

APPENDIX V

FIELD DATA

Avian Collection--Internal and External

The avian collection internal data for 1971 were collected on form NREL-23. Avian collection external data for 1971 were collected on form NREL-24. Both internal and external data were collected at the following sites: ALE, Cottonwood, Osage, and Pantex. Data set designation for the internal data are:

ALE	A2U2011
Cottonwood	A2U2014
Osage	A2U2019
Pantex	A2U201A

Data set designation for the external data are:

ALE	A2U2021
Cottonwood	A2U2024
Osage	A2U2029
Pantex	A2U202A

Examples of each data form follow. A listing of the ALE avian collection data, chosen as representative of all sites, follows each respective data form.

IBP

GRASSLAND BIOME

U.S. INTERNATIONAL BIOLOGICAL PROGRAM

FIELD DATA SHEET - AVIAN COLLECTION - INTERNAL

DATA TYPE	SITE	INITIALS	DATE			TREATMENT	REPLICATE	PLOT SIZE	GROUP	GENUS	SPECIES	SUBSPECIES	SPEC. NO.	TIME	STATE	COUNTY	TWNSHP	RANGE	SECTION	HABITAT	CAPTURE	SEX	BROOD PATCH	GONAD		FOLLICLE	OVIDUCT	SKULL OSS.	CROP	STOMACH	BURSA	FAT			SPECIMEN
			Day	Mo	Yr																			LENGTH	WIDTH							Subcut-Ant	SubcutPost	Visceral	
1-2	3-4	5-7	8-9	10-11	12-13	14	15	16-19	21	22-23	24-25	26	27-30	32-35	36-37	38-41	42-44	45-47	48-49	51-52	53	55	56	57-60	61-64	65-68	69-70	71	72	73	74-75	76	77	78	79

DATA TYPE
01 Aboveground Biomass
02 Litter
03 Belowground Biomass
10 Vertebrate - Live Trapping
11 Vertebrate - Snap Trapping
12 Vertebrate - Collection
20 Avian Flush Census
21 Avian Road Count
22 Avian Road Count Summary
23 Avian Collection - Internal
24 Avian Collection - External
25 Avian Collection - Plumage
30 Invertebrate
40 Microbiology - Decomposition
41 Microbiology - Nitrogen
42 Microbiology - Biomass
43 Microbiology - Root Decomposition
44 Microbiology - Respiration

SITE
01 Ale
02 Bison
03 Bridger
04 Cottonwood
05 Dickinson
06 Hays
07 Hopland
08 Jornada
09 Osage
10 Pantex
11 Pawnee

BROOD PATCH
0 Not noted
1 Feathers dropped
2 Vascular
3 Edematous
4 Regressing
5 No evidence

TREATMENT
1 Ungrazed
2 Lightly grazed
3 Moderately grazed
4 Heavily grazed
5 Grazed 1969, ungrazed 1970
6
7
8
9

STATE
AK Alaska
AZ Arizona
CT Connecticut
MD Maryland
ME Maine
MN Minnesota
MS Mississippi
MR Missouri
NV Nevada
TN Tennessee

CAPTURE
0 Not noted
1 Gun
2 Mist net
3 Trap
4 Found dead

FAT
0 Not noted
1 None
2 Little
3 Moderate
4 Much
5 Extreme

SKULL
0 Not noted
1 Quarter or less
2 Half or less
3 Three-quarters or less
4 Up to fully oss.

SPECIMEN
0 Not saved
1 Skin
2 Skeleton
3 Skin & skeleton

HABITAT
0 Not noted
1 Grassland
2 Grass-forb
3 Savannah
4 Shrub-steppe
5 Deciduous
6 Coniferous
7 Riparian

CROP/STOMACH
0 Not noted
1 Empty
2 Quarter
3 Half
4 Three-quarters
5 Full

GROUP
0 Waterfowl
1 Falconiform
2 Galli- and Gruiform
3 Charadriiform
4 Doves, owls, nighthawks, woodpeckers
5 Flycatchers, swallows, jays, titmice, wrens
6 Thrashers, bluebirds, gnatcatchers, pipits
7 Shrikes, starlings, vireos
8 Icterids
9 Fringillids

SEX
0 Unknown
1 Male
2 Female

FIELD DATA

```
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

2301JAW2304711      5ERAL   201 1815WARENT11N26E28 041 22 8.2 5.8 2.1   00      0
2301JAW2404711      9AMBF   202 0705WARENT11N26E28 041 1509.205.9       00      1
2301JAW2404711      5ERAL   203 0740WARENT11N26E28 041 1508.604.4       00      1
2301JAW2404711      5ERAL   204 1300WARENT11N26E28 041 2108.905.303.8   00      0
2301JAW2404711      9AMBF   205 1330WARENT11N26E28 041 1508.606.8               1
2301JAW2404711      5ERAL   209 1600WARENT11N26E28 041 05
2301JAW2404711      5ERAL   207 1530WARENT11N26E28 041 1507.404.4
2301JAW2404711      5ERAL   208 1545WARENT11N26E28 041 1509.906.4
2301JAW2404711      9AMBF   206 1500WARENT11N26E28 041 1505.904.3       00      0
2301JAW250471       9DASA   210 1000WARENT11N26E28 041 1502.101.6      4     3340
2301JAW250471       9AMBF   211 1010WARENT11N26E28 041 1508.404.9      4        0
2301JAW250471       5ERAL   212 1020WARENT11N26E28 041 1507.305.1      4        0
2301JAW250471       5ERAL   213 1040WARENT11N26E28 041 2507.304.801.8  4        0
2301JAW070571       9AMBF   214 1930WARENT11N26E28 041 1006.505.4               1
2301JAW070571       8STNF   215 1945WARENT11N26E28 041 1012.408.1               1
2301JAW070571       5ERAL   216 1915WARENT11N26E28 041 1009.405.1               0
2301JAW080571       9AMBF   223 1100WARENT11N26E28 041 20                       1
2301JAW080571       9AMBF   220 1015WARENT11N26E28 041 10                       0
2301JAW080571       5ERAL   219 1005WARENT11N26E28 041 2011.407.506.0           0
2301JAW080571       9AMBF   222 1100WARENT11N26E28 041 1007.905.3               0
2301JAW080571       9AMBF   221 1100WARENT11N26E28 041 2105.703.602.4           0
2301JAW080571       9AMBF   218 0945WARENT11N26E28 041 2007.804.301.9           0
2301JAW080571       9AMBF   217 0945WARENT11N26E28 041 1008.805.6               0
2301JAW080571       9AMBF   224 [illegible]WARENT11N26E28 041 1506.904.5        1
2301JAW090571       9AMBF   226 [illegible]WARENT11N26E28 041 1008.505.3        0
2301JAW090571       5ERAL   227 0920WARENT11N26E28 041 2211.106.907.8           0
2301JAW090571       9AMBF.  228 0930WARENT11N26E28 041 1008.905.2               0
2301JAW090571       9AMBF   229 0930WARENT11N26E28 041 2207.706.804.8           0
2301JAW090571       5ERAL   230 0945WARENT11N26E28 041 2210.305.305.6           0
2301JAW090571       5ERAL   231 0945WARENT11N26E28 041 1009.705.6               0
2301JAW090571       5ERAL   232 1000WARENT11N26E28 041 1007.805.8               0
2301JAW090571       9AMBF   233 1[illegible]5WARENT11N26E28 041 2209.206.505.6  0
2301JAW090571       5ERAL   234 10[illegible]5WARENT11N26E28 041 10             0
2301JAW090571       5ERAL   225 0[illegible]WARENT11N26E28 041 1009.505.3       0
2301JAW090571       5ERAL   23[illegible] 1935WARENT11N26E28 041 1006.805.0     0
2301JAW100571       5ERAL   23[illegible] [illegible]WARENT11N26E28 041 2211.[illegible]5.505.8  0
2301JAW100571       5ERAL   23[illegible] [illegible] 041 1006.204.5            0
2301JAW100571       [illegible] [illegible] 041 1010.[illegible]6.2             0
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GRASSLAND BIOME

U.S. INTERNATIONAL BIOLOGICAL PROGRAM

FIELD DATA SHEET - AVIAN COLLECTION - EXTERNAL

DATA TYPE	SITE	INITIALS	DATE			TREATMENT	REPLICATE	PLOT SIZE	GROUP	GENUS	SPECIES	SUBSPECIES	SPECIMEN NUMBER	SEX	DEVELOPMENT	AGE	AGE UNITS	WEIGHT	WING LENGTH	TAIL LENGTH	BILL			TARSUS	MIDDLE TOE	
			Day	Mo	Yr																Length	Height	Width			
1-2	3-4	5-7	8-9	10-11	12-13	14	15	16-19	21	22-23	24-25	26	28-31	33	34	35-36	37	39-43	45-49	51-55	57-60	61-64	65-68	70-74	76-79	

DATA TYPE
01 Aboveground Biomass
02 Litter
03 Belowground Biomass
10 Vertebrate - Live Trapping
11 Vertebrate - Snap Trapping
12 Vertebrate - Collection
20 Avian Flush Census
21 Avian Road Count
22 Avian Road Count Summary
23 Avian Collection - Internal
24 Avian Collection - External
25 Avian Collection - Plumage
30 Invertebrate
40 Microbiology - Decomposition
41 Microbiology - Nitrogen
42 Microbiology - Biomass
43 Microbiology - Root Decomposition
44 Microbiology - Respiration

SEX
0 Unknown
1 Male
2 Female

DEVELOPMENT
0 Not noted
1 Nestling
2 Juv. or imm.
3 Subadult
4 Adult

AGE UNITS
0 No observation
1 Hour
2 Days
3 Weeks
4 Months
5 3 months
6 Years

SITE
01 Ale
02 Bison
03 Bridger
04 Cottonwood
05 Dickinson
06 Hays
07 Hopland
08 Jornada
09 Osage
10 Pantex
11 Pawnee

GROUP
0 Waterfowl
1 Falconiform
2 Galli- and Gruiform
3 Charadriiform
4 Doves, owls, nighthawks, woodpeckers
5 Flycatchers, swallows, jays, titmice, wrens
6 Thrashers, bluebirds, gnatcatchers, pipits
7 Shrikes, starlings, vireos
8 Icterids
9 Fringillids

TREATMENT
1 Ungrazed
2 Lightly grazed
3 Moderately grazed
4 Heavily grazed
5 Grazed 1969, ungrazed 1970
6
7
8
9

FIELD DATA

1 2 3 4 5 6 7 8

1234567890123456789012345678901234567890123456789012345678901234567890123[illegible]7890

2401JAW2304711	5FRAL	2012	4	32.3	99.1	64.7	9.3	4.6	4.4	22.5
2401JAW2404711	9AMBE	2021	4	17.5	77.5	73.3	8.1	5.7	5.2	22.2
2401JAW2404711	5FRAL	2031	4	30.4	103.1	68.5	9.7	4.4	4.8	21.6
2401JAW2404711	5FRAL	2042	4	35.4	96.7	65.7	10.1	4.3	4.4	21.5
2401JAW2404711	9AMBE	2051	4	19.8	75.7	66.5	8.5	5.1	5.0	21.4
2401JAW2404711	5FRAL	2090	2 24	23.6						
2401JAW2404711	5FRAL	2071	4	31.4	105.6	70.6	10.3	4.2	4.4	22.3
2401JAW2404711	5FRAL	2081	4	30.3	105.0	70.8	9.6	4.6	4.8	21.0
2401JAW2404711	9AMBF	2061	4	19.3	77.9	69.7		5.2	5.2	22.1
2401JAW250471	9PASA	2101	4	21.2	73.0	52.2	7.9	4.9	4.5	19.6
2401JAW250471	9AMBF	2111	4	19.4	80.1	70.3	8.4	5.4	5.0	21.3
2401JAW250471	5FRAL	2121	4	30.9	103.8	70.6	9.5	4.1	4.8	22.0
2401JAW250471	5FRAL	2132	4	29.7	97.1	63.0	9.3	4.5	4.3	20.6
2401JAW070571	9AMBF	2141	4	20.8	73.2	70.9	8.7	5.2	5.0	21.0
2401JAW070571	8STNE	2151	4	116.6	120.9	74.3	21.9	7.2	6.7	39.4
2401JAW070571	5FRAL	2161	4	28.3	102.3	66.7	9.7	4.4	4.6	21.3
2401JAW080571	9AMBF	2232	2	16.2	69.7	57.7	6.3	4.9	5.2	21.0
2401JAW080571	9AMBF	2201	1	19.1	76.5	72.6	8.0	5.2	4.9	21.9
2401JAW080571	5FRAL	2192	1	34.5	94.1	64.5	9.6	4.3	4.3	21.3
2401JAW080571	9AMBE	2221	1	18.4	77.6	73.0	8.6	5.5	4.9	21.1
2401JAW080571	9AMBF	2212	1	18.6	75.4	67.4	6.4	5.3	5.2	21.2
2401JAW080571	9AMBF	2182	1	19.2	74.4	69.6	7.8	5.3	5.1	20.4
2401JAW080571	9AMBF	2171	1	14.3	78.4	76.3	7.9	5.1	5.0	21.7
2401JAW080571	9AMBF	224	1	19.5	75.5	68.3	8.3	5.3	5.0	21.3
2401JAW090571	9AMBF	2261	4	19.3	79.5	71.7	7.9	5.2	5.0	21.5
2401JAW090571	5FRAL	2272	4	33.2	95.6	61.7	10.4	4.2	4.9	20.8
2401JAW090571	9AMBF	2281	4	20.3	75.5	71.8	8.7	5.3	5.4	22.5
2401JAW090571	9AMBF	2292	4	20.2	74.4	67.1	7.9	5.1	4.6	20.5
2401JAW090571	5FRAL	2302	4	35.3	98.6	0.0	10.5	4.5	4.7	21.3
2401JAW090571	5FRAL	2311	4	30.7	109.7	74.3	10.2	4.6	4.7	21.7
2401JAW090571	5FRAL	2321	4	27.5	102.5	74.4	10.7	4.4	4.4	21.1
2401JAW090571	9AMBF	2332	4	21.3	76.0	67.5	7.5	5.6	5.0	21.5
2401JAW090571	5FRAL	2341	2	27.5	92.6	56.3	7.7	3.8	4.2	21.4
2401JAW090571	5FRAL	2251	4	26.4	105.3	72.7	10.1	4.3	4.4	20.9
2401JAW090571	5FRAL	2351	4	32.6	105.6	71.3	10.3	4.3	4.7	22.0
2401JAW100571	5FRAL	2362	4	33.0	97.1	64.6	9.5	4.5	4.4	21.3
2401JAW100571	5FRAL	2391	4	41.0	105.[illegible]	65.4	10.6	4.4	4.5	21.6
2401JAW100571	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	38.6

Avian Road Count Summary

The avian road count summary data for 1971 were collected on form NREL-22 at the following sites: Cottonwood, Osage, and Pantex. Data set designation are:

Cottonwood	A2U2004
Osage	A2U2009
Pantex	A2U200A

Examples of the data forms follow. A listing of the Cottonwood avian road count summary data, chosen as representative of all sites, follows the data form.

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GRASSLAND BIOME

U.S. INTERNATIONAL BIOLOGICAL PROGRAM

FIELD DATA SHEET - AVIAN ROAD COUNT SUMMARY

DATA TYPE	SITE	INITIALS	DATE			TREATMENT	REPLICATE	PLOT SIZE	GROUP	GENUS	SPECIES	SEX	PAGE TOTALS					NO. STOPS
			Day	Mo	Yr								1	2	3	4	5	

DATA TYPE
01 Aboveground Biomass
02 Litter
03 Belowground Biomass
10 Vertebrate - Live Trapping
11 Vertebrate - Snap Trapping
12 Vertebrate - Collection
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43 Microbiology - Root Decomposition
44 Microbiology - Respiration

SITE
01 Ale
02 Bison
03 Bridger
04 Cottonwood
05 Dickinson
06 Hays
07 Hopland
08 Jornada
09 Osage
10 Pantex
11 Pawnee

TREATMENT
1 Ungrazed
2 Lightly grazed
3 Moderately grazed
4 Heavily grazed
5 Grazed 1969, ungrazed 1970
6
7
8
9

FIELD DATA

1 2 3 4 5 6

123456789012345678901234567890123456789012345678901234567890

2204NRW160571	5	TY	TY	2	1	0	1	30
2204NRW160571	3	CH	VO	6	7	5	4	30
2204NRW160571	5	FR	AL	4	10	0	7	30
2204NRW160571	5	HT	PU	0	2	5	3	30
2204NRW160571	8	ST	NE	74	57	37	30	30
2204NRW160571	8	AG	PR	15	12	13	14	30
2204NRW160571	9	CA	ME	20	4	0	4	30
2204NRW160571	9	AM	SA	0	0	1	1	30
2204NRW160571	9	CA	OR	0	2	2	2	30
2204NRW160571	8	MO	AT	4	6	3	8	30
2204NRW160571	0	OX	JA	10	0	0	1	30
2204NRW160571	0	AN	PI	2	0	0	2	30
2204NRW160571	2	PH	CO	5	0	0	3	30
2204NRW160571	5	TY	VE	2	2	0	3	30
2204NRW160571	4	ZE	MA	1	4	4	6	30
2204NRW160571	1	RU	SW	0	2	0	2	30
2204NRW160571	5	PE	PY	0	3	2	4	30
2204NRW160571	5	CY	CR	0	2	0	1	30
2204NRW160571	5	TR	AF	0	2	1	2	30
2204NRW160571	7	PA	CC	0	2	0	1	30
2204NRW160571	9	SP	FA	0	1	0	1	30
2204NRW160571	2	PF	PH	0	0	1	1	30
2204NRW160571	4	CO	CA	0	0	1	1	30
2204JAW260671	9	AM	SA	45	50	25	25	30
2204JAW260671	5	FR	AL	26	23	22	22	30
2204JAW260671	8	MO	AT	7	2	2	5	30
2204JAW260671	3	RA	LC	7	13	7	13	30
2204JAW260671	3	CH	VO	4	4	1	4	30
2204JAW260671	8	AG	PR	25	43	35	24	30
2204JAW260671	9	CA	OR	5	20	1	6	30
2204JAW260671	5	TY	TY	1	0	15	6	30
2204JAW260671	5	TY	VE	3	2	3	6	30
2204JAW260671	4	ZE	MA	5	8	8	11	30
2204JAW260671	9	CA	ME	6	31	15	13	30
2204JAW260671	5	HT	PU	1	0	4	3	30
2204JAW260671	1	CT	CY	2	0	0	2	30
2204JAW260671	8	ST	NE	42	91	76	30	30
2204JAW260671	9	SP	AM	7	0	0	2	30
2204JAW260671	7	ST	VU	12	0	0	2	30
2204JAW260671	6	TC	RU	1	0	1	2	30
2204JAW260671	1	FA	SE	1	0	0	1	30
2204JAW260671	7	LA	LU	1	0	0	1	30
2204JAW260671	2	DE	DH	0	1	0	1	30
2204JAW260671	5	PE	PY	0	9	9	4	30
2204JAW260671	2	PH	CO	0	1	0	1	30
2204JAW260671	3	NU	AM	0	2	0	1	30

2204JAW260671	1	RU	SW	0	0	1	1	30
2204JAW260671	5	PI	PT	0	0	2	1	30
2204NRW270671	1	FA	SP	01	00		01	17
2204NRW270671	2	PH	CO	03	00		03	17
2204NRW270671	3	CH	VO	05	05		06	17
2204NRW270671	3	RA	LO	05	02		05	17
2204NRW270671	4	ZE	MA	05	17		09	17
2204NRW270671	4	CO	CA	02	02		03	17
2204NRW270671	5	TY	TY	02	01		02	17
2204NRW270671	5	TY	VE	01	01		02	17
2204NRW270671	5	HI	RU	00	01		01	17
2204NRW270671	5	PE	PY	07	51		04	17
2204NRW270671	5	PI	PI	00	02		01	17
2204NRW270671	5	TR	AE	01	01		02	17
2204NRW270671	6	TO	RU	00	02		01	17
2204NRW270671	6	TU	MI	00	01		01	17
2204NRW270671	7	OE	PT	01	00		01	17
2204NRW270671	7	GE	TR	00	01		01	17
2204NRW270671	8	ST	NE	45	34		16	17
2204NRW270671	8	AG	PH	20	10		10	17
2204NRW270671	8	MO	AT	05	08		04	17
2204NRW270671	9	SP	AM	01	03		02	17
2204NRW270671	9	CA	ME	09	08		04	17
2204NRW270671	9	GU	CA	01	00		01	17
2204NRW270671	9	AM	SA	08	01		05	17
2204NRW270671	9	CH	GR	02	03		04	17
2204NRW270671	9	CA	OR	03	00		01	17
2204NRW270671	1	FA	SP	01	00		01	17
2204NRW270671	2	PH	CO	03	00		03	17
2204NRW270671	3	CH	VO	05	05		06	17
2204NRW270671	3	RA	LO	05	02		05	17
2204NRW270671	4	ZE	MA	05	17		09	17
2204NRW270671	4	CO	CA	02	02		03	17
2204NRW270671	5	TY	TY	02	01		02	17
2204NRW270671	5	TY	VE	02	00		02	17
2204NRW270671	5	HI	RU	00	01		01	17
2204NRW270671	5	PE	PY	07	51		04	17
2204NRW270671	5	PI	PI	00	02		01	17
2204NRW270671	5	TR	AE	01	01		02	17
2204NRW270671	6	TO	RU	00	02		01	17
2204NRW270671	6	TU	MI	00	01		01	17
2204NRW270671	7	OE	PT	01	00		01	17
2204NRW270671	7	GE	TR	00	01		01	17
2204NRW270671	8	ST	NE	45	34		16	17
2204NRW270671	8	AG	PH	20	10		10	17
2204NRW270671	8	MO	AT	05	08		04	17
2204NRW270671	9	SP	AM	01	03		02	17
2204NRW270671	9	CA	ME	09	08		04	17
2204NRW270671	9	GU	CA	01	00		01	17
2204NRW270671	9	AM	SA	09	01		05	17
2204NRW270671	9	CH	GR	02	03		04	17
2204NRW270671	9	CA	OR	03	00		01	17
2204NRW190971	8	ST	NE	47	33	19	22	30
2204NRW190971	7	RA	OO	02	00	00	01	30

2204NRW190971	3	CH	VO	11	03	00	06	30
2204NRW190971	1	CT	CY	02	01	00	02	30
2204NRW190971	5	FR	AL	08	12	03	13	30
2204NRW190971	0	AN	OT	04	00	00	01	30
2204NRW190971	5	HT	RU	03	02	02	03	30
2204NRW190971	5	ST	EU	01	00	00	01	30
2204NRW190971	5	RT	PT	01	00	00	01	30
2204NRW190971	5	SA	SA	02	00	00	01	30
2204NRW190971	1	HU	SW	01	00	01	02	30
2204NRW190971	6	TU	KT	04	04	00	03	30
2204NRW190971	8	AG	EH	01	00	00	01	30
2204NRW190971	4	CO	CA	04	00	00	01	30
2204NRW190971	9	PO	GR	00	08	00	01	30
2204NRW190971	9	CA	HF	00	02	00	01	30
2204NRW190971	1	RU	JA	00	04	00	02	30
2204NRW190971	9	CA	OR	00	08	00	01	30
2204NRW190971	1	CA	AU	00	00	01	01	30
2204NRW101071	6	TU	[illegible]	10	06	00	02	30
2204NRW101071	9	ST	HF	06	14	30	[illegible]	30
2204NRW101071	7	PA	[illegible]	08	00	00	01	30
2204NRW101071	5	FR	[illegible]	[illegible]	45	[illegible]	[illegible]	30
2204NRW101071	2	PE	PH	03	00	00	02	30
2204NRW101071	7	ST	VU	04	00	00	01	30
2204NRW101071	0	AN	PL	04	00	00	01	30
2204NRW101071	0	AN	OI	01	00	00	01	30
2204NRW101071	5	PA	AT	01	00	02	02	30
2204NRW101071	2	PE	CO	01	00	02	01	30
2204NRW101071	1	CT	CY	00	03	00	02	30