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INVERTEBRATE STUDIES AT THE JORNADA SITE, 1972

Mark A. Ellstrom

New Mexico State University

Las Cruces, New Mexico

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ABSTRACT

The results of 1972 invertebrate sampling at the Jornada Site are summarized. Comparisons with previous years' data and problems encountered in sampling are discussed.

INTRODUCTION

Both above- and belowground invertebrates were sampled during the 1972 field season. Both numbers and diversity increased significantly over the 1971 season, probably due to the greater precipitation realized during 1972. Population estimates based on these samples showed extreme variations and fluctuations during the sampling period, but it is suspected that this problem is due to an artifact of the sampling technique as it is now employed. Biomass data has not yet been examined, pending completion of sampling for the season.

METHODS

Sampling methods were essentially the same as reported by Swift and French (1972) with a few exceptions. Rather than place clipped vegetation in a separate container, it was included with the material that had been removed by D-vac. This presented no problem due to the paucity of vegetation in most samples; at the same time, the extraction procedure was simplified.

Every sample was hand-sorted following Berlese extraction, thus insuring that insects unable to escape the heat source would still be included in the count. Consequently, it was considered unnecessary to report Berlese efficiency for each sample, although it is known to be in the realm of 90 to 95%. No attempt was made to search for barely macroscopic organisms when hand-sorting.

Soil macroarthropod cores were taken with the same tool used for root coring. Samples were hand-sorted and counted in the field, thus eliminating the necessity of floatation. This task was accomplished quite readily by means of sieving the sandy soil through a 16-mesh hardware cloth. The invertebrates that were retained in the cloth were identified, counted, and placed in 70% ethanol for return to the lab.

The soil microarthropod extractions were accomplished according to previously established procedures, although it was necessary to saturate the cores with water to keep them intact. Problems were encountered during the first extraction when the interior of the refrigerator heated to greater than 40°C. Subsequent samples are being extracted in a larger, walk-in refrigerator which has sufficient cooling capacity to maintain the required temperature gradient.

RESULTS AND DISCUSSION

More than 110 families have been collected representing 18 invertebrate orders. This reflects a two-fold increase in family diversity over the previous year. Table 1 summarizes this data. Included are trophic levels and method of collection if other than quick trap. Taxa indicated as quick trap collections may have been taken by other methods as well.

Although most of the groups indicated in Table 1 have been collected by means of quick trap, other organisms exist which have been taken only in pitfalls or at night. Camel crickets (Gryllacrididae) and sun spiders (Solpugida) are examples. In the spring of 1972 a transect of 25 pitfall traps was placed on the ungrazed plot. Each trap had a mouth opening of 8 cm and was situated 1.5 m from the next closest trap. Approximately 200 camel crickets and 20 to 30 Solpugids were captured per week in April and May. The fact that both of these arthropods are nocturnal may account for their absence from other types of samples.

Table 1. List of families collected at the Jornada Site during the 1972 field season.

Order	Family	Trophic Level[a]	Method of Collection[b]
Collembola	Sminthuridae[c]	1	
	Entomobryidae	1 or 8	
	Poduridae	1 or 8	
Thysanoptera	Phloeothripidae[c]	1 or 5	
	Thripidae	1	
Neuroptera	Chrysopidae	5	
	Myrmeleontidae	5	
Isoptera	Termitidae[c]	7 or 8	
Orthoptera	Acrididae[c]	1	
	Blattidae	7	
	Gryllidae	1 or 7	
	Gryllacrididae[c]	1 or 7	P
	Mantidae	5	H
	Phasmidae	1	H
	Tettigoniidae	1	H
Homoptera	Aphididae	1	
	Cixidae	1	
	Coccidae	1	
	Cicadidae	1	
	Cicadellidae[c]	1	
	Cercopidae	1	
	Fulgoridae	1	
	Membracidae	1	
	Psyllidae	1	
Hemiptera	Coreidae	1 or 5	
	Coriscidae	1	
	Cydnidae	7	H
	Corimelaenidae	7	H
	Lygaeidae[c]	1 or 5	
	Miridae	1	
	Nabidae	5	
	Pentatomidae	1	H
	Phymatidae	5	
	Reduviidae	5	
	Tingidae[c]	1	
Coleoptera	Buprestidae	1	H
	Cerambycidae	1	H
	Cicindelidae	5	L
	Carabidae	5	
	Silphidae	8	P
	Pselaphidae	8	
	Cantharidae	5; 1	
	Cleridae	5	H
	Elateridae	1	P
	Cebrionidae	0	1

Table 1 (continued).

Order	Family	Trophic Level[a]	Method of Collection[b]
Coleoptera cont'd.	Mordellidae	8 or 5	
	Nitidulidae	1 or 8	
	Erotylidae	8	H
	Phalacridae	1	
	Coccinellidae	5	
	Meloidae	5; 1	
	Tenebrionidae[c]	1	
	Bostrichidae	1	H
	Scarabaeidae[c]	1 or 8	P
	Trogidae	8	P
	Histeridae	5	P
	Chrysomelidae	1	
	Bruchidae	1	
	Curculionidae	1	
	Ptinidae	0	
Diptera	Asilidae	5	
	Bombyliidae	6; 1	
	Pipunculidae	6	
	Syrphidae	7	
	Chloropidae	7	
	Anthomyidae	7	
	Muscidae	7	
	Tachinidae	6	
	Calliphoridae	8	
	Sarcophagidae	6 or 8	
	Sciaridae	1 or 8	
	Mycetophilidae	1 or 8	
Lepidoptera	Pieridae	1	H
	Lycaenidae	1	H
	Nymphalidae	1	H
	Sphingidae	1	
	Geometridae	1	
	Arctiidae	1	
	Noctuidae	1	
	Pyromorphidae	1	H
	Pyralidae	1	
	Tortricidae	1	
Hymenoptera	Braconidae	6	
	Ichneumonidae	6	
	Eulophidae	6	
	Encyrtidae	6	
	Euchartidae	6	
	Chalcididae	6	
	Eurytomidae	1 or 6	
	Ceraphronidae	6	
	Chrysididae	6	P
	Cynipidae	6	

Table 1 (continued).

Order	Family	Trophic Level[a/]	Method of Collection[b/]
Hymenoptera Cont'd	Tiphiidae	6	
	Mutilidae	6	P
	Formicidae[c/]	7	
	Pompilidae	6	
	Vespidae	5	
	Sphecidae	5	
	Andrenidae	1	
	Apidae	1	
	Xylocopidae	1	
Acarina	Caeculidae[c/]	1	
	Oribatulidae	1	
	Tetranychidae	6	
	Trombidiidae	1	H
Araneida[c/]	Lycosidae	5	
	Salticidae	5	
	Thomisidae	5	
	Theridiidae	5	
	Argiopidae	5	
	Linyphiidae	5	
	Gnaphosidae	5	
	Agelenidae	5	
	Dictynidae	5	
	Theraphosidae	5	H
Phalangida	Phalangiidae	7	
Chelonethida	Chermetidae	5	
Solpugida		5	P
Scorpionida	Buthidae	5	P
Scolopendromorpha		5	
Class Diplopoda		1	P

a/ Taken from observations as well as literature. 0 = unknown; 1 = herbivore; 5 = predator; 6 = parasite or parasitoid; 7 = omnivore; 8 = scavenger; 9 = non-feeding stage. A trophic level such as 1; 9 refers to feeding habits of the immature and adult.

b/ Specimens regularly collected by quick-trap are not noted. Otherwise, P = pitfall; L = light trap; H = by hand.

c/ Considered functionally important, by numbers or biomass.

Aboveground Invertebrates

Fig. 1 shows the invertebrate population trends from August 10, 1970 to October 29, 1972. The lowest points on both the grazed and the ungrazed mark the dry growing season of 1971. In general, the densities measured in 1972 are higher than the previous year, although the treatments vary greatly from one sample date to the next.

Some of this variability is explainable in the type of plants sampled. On July 7, for example, the grazed exceeded the ungrazed chiefly because a large broom snakeweed [*Gutierrezia sarothrae* (Pursh) Britt. & Rusby] harboring numerous lace bugs (Hemiptera:Tingidae) was sampled. Similarly, the ungrazed exceeded the grazed on August 8; in October the reverse held true. On both of these dates yucca harboring large numbers of invertebrates were sampled.

Mites of the family Caeculidae (Fig. 2) have shown a general decline in population since the peak on July 30, 1970. The drought of 1971 may have induced a high mortality on these organisms which are reported to be fungal feeders (Crossley and Merchant, 1971). Although variations exist with sample date, they seem to be equally numerous in the grazed and ungrazed treatments (Fig. 3).

Ants are considered functionally important on the desert grassland, although their density did not exceed $15/m^2$ this season (Fig. 4). Populations usually consist of spatially separated aggregates, the foragers being sampled in low numbers but at regular intervals. Peak density occurred September 25 on the grazed treatment when an area adjacent to a nest was sampled.

Among the exclusively herbivorous insects, the leafhoppers were collected most consistently. In general, populations have been higher on the ungrazed

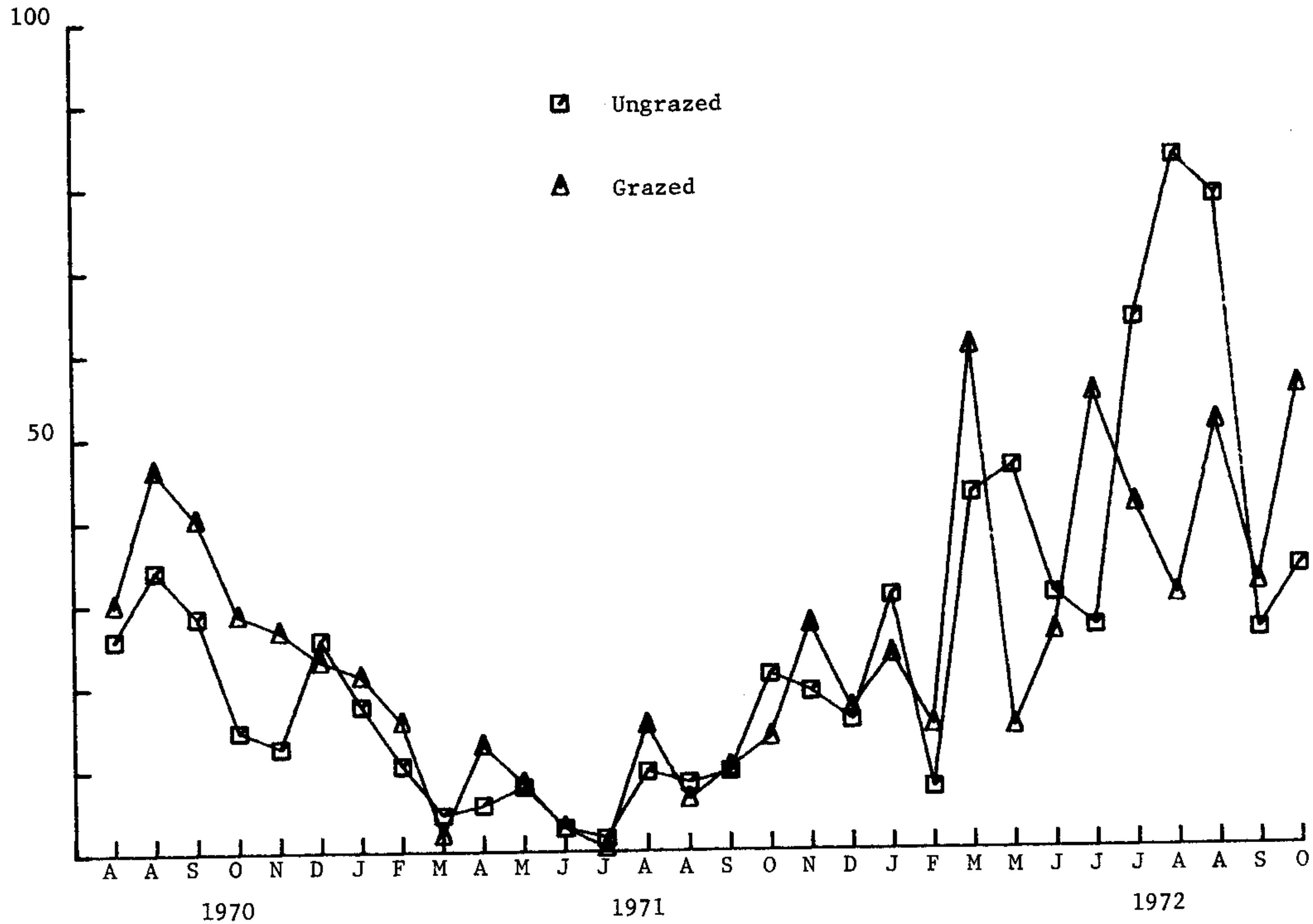

Fig. 1. Aboveground invertebrate populations, August 1970 to October 1972 (no./m^2).

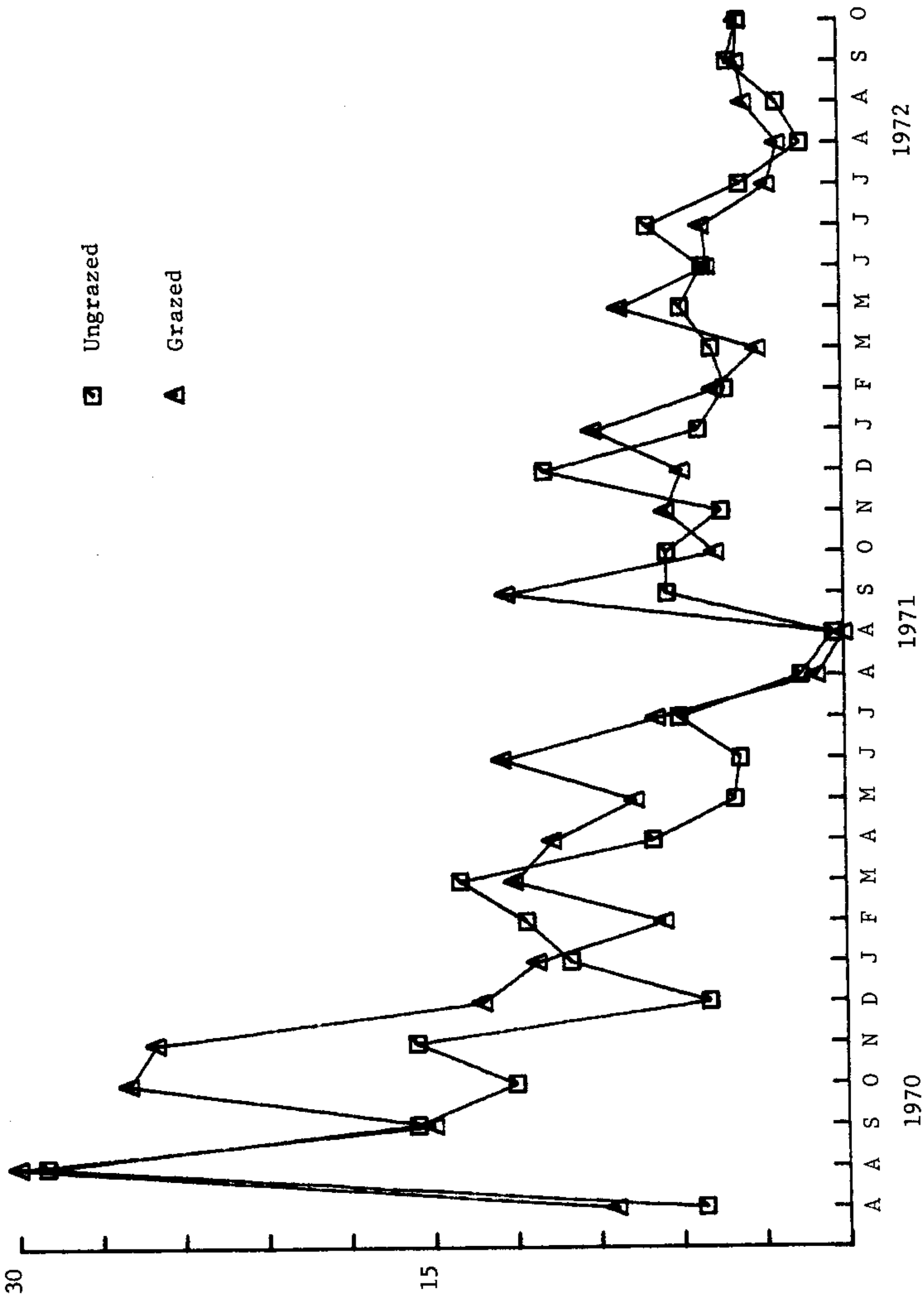

Fig. 2. Acarina: Caeculidae, July 1970 to August 1972 (no./m^2).

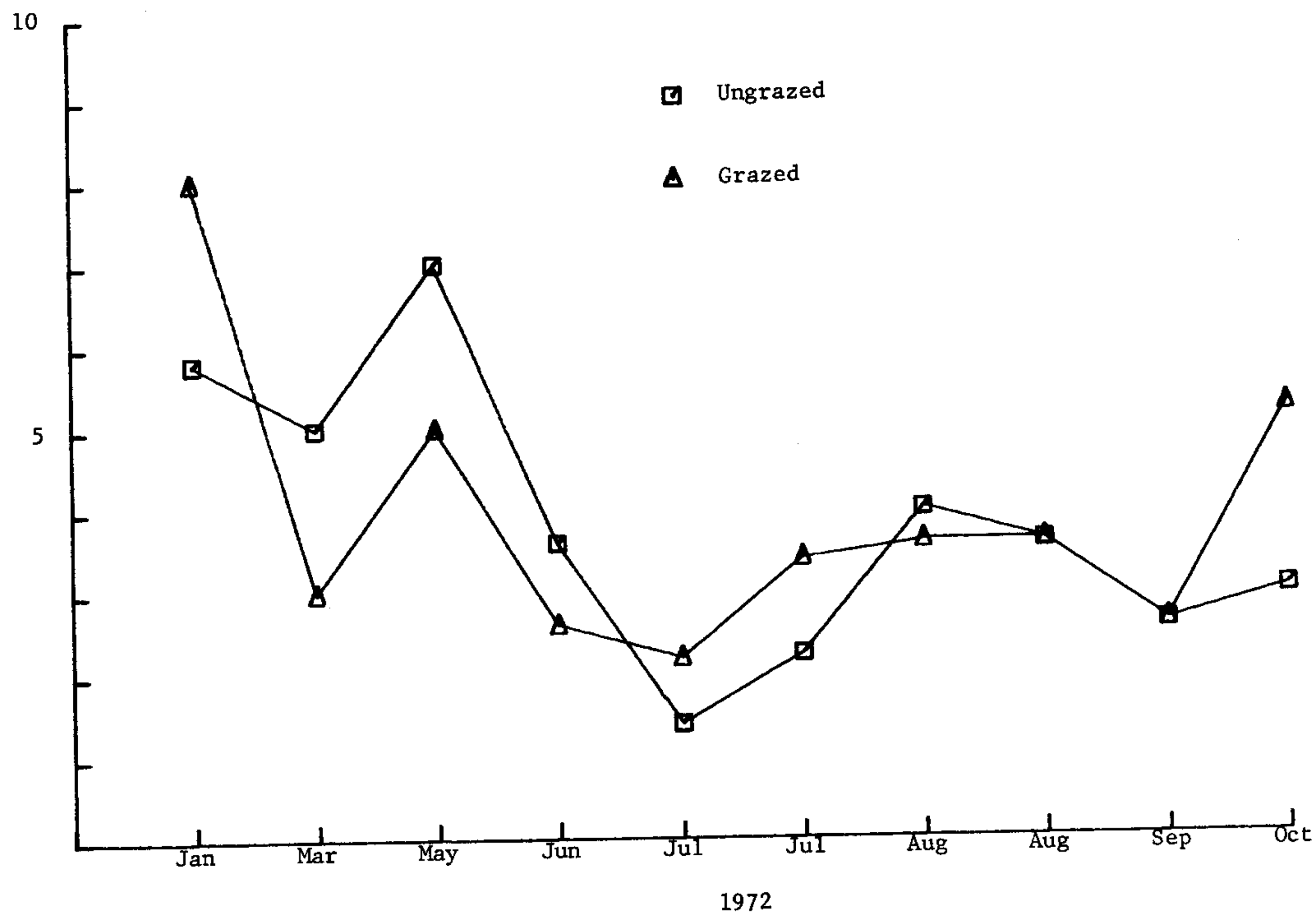

Fig. 3. Acarina: Caeculidae, January 1972 to October 1972 (no./m^2).

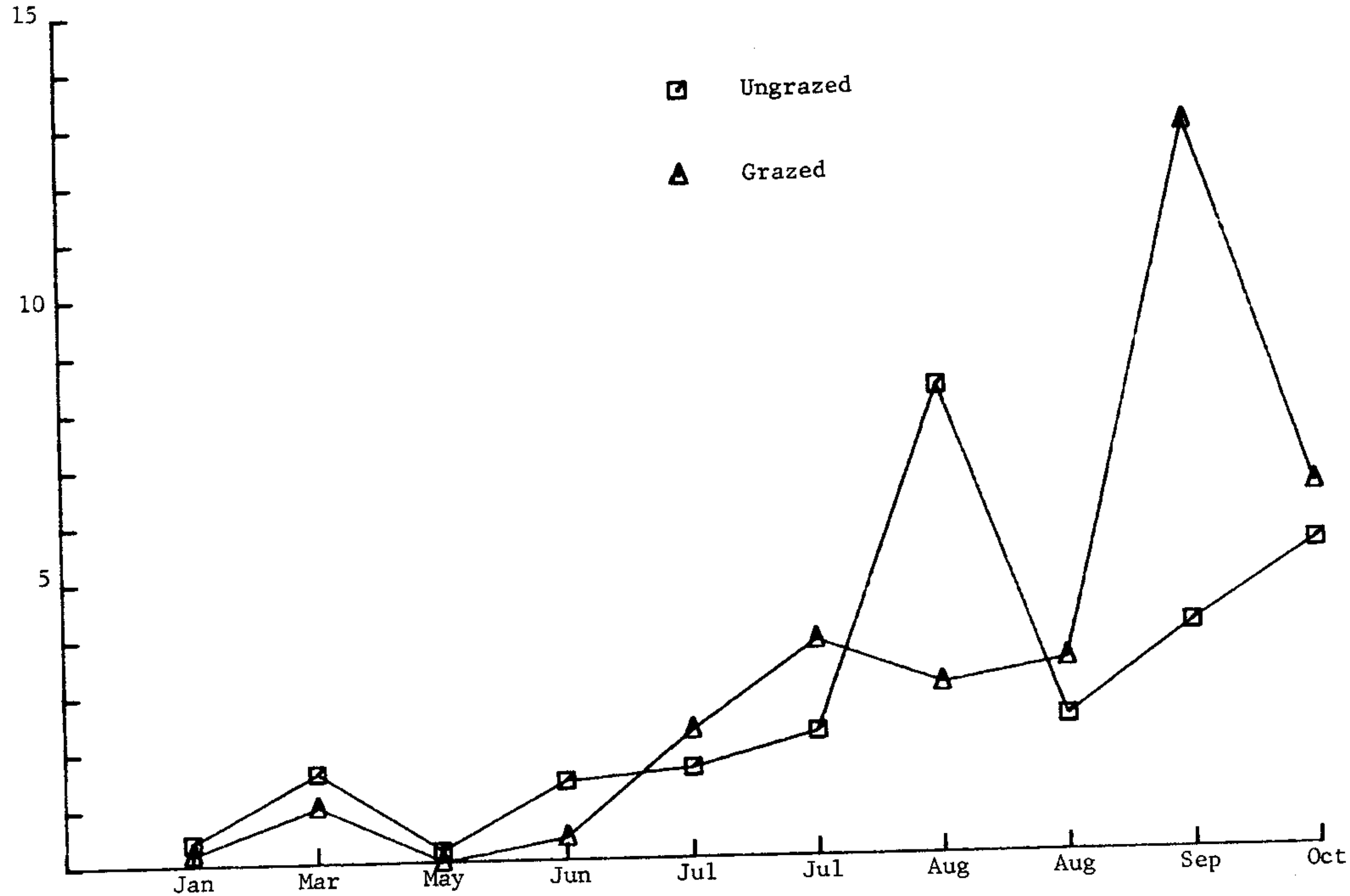

Fig. 4. Hymenoptera: Formicidae, January 1972 to October 1972 (no./m^2).

treatment, probably due to the presence of more vegetation (Fig. 5). Other Homoptera, including the aphids, are frequently collected but usually in small numbers. The scale insects (Coccoidea) were taken in high numbers only in May on the ungrazed treatment when the density reached $28/m^2$. Grasshoppers (Acrididae) were collected intermittently and only in low numbers.

Spiders, likewise, have been taken in low numbers, although they peaked on August 8 when the density exceeded $11/m^2$ on the ungrazed. Most of these spiders were found in the yucca sampled on this date.

Sampling Problems

Several problems exist with the sampling of larger and more sparsely distributed shrubs including mesquite [*Prosopis juliflora* (Sw.) Dc.] and yucca (*Yucca elata* Engelm.). Data from this season indicates that a far richer fauna with greater numbers and biomass exists on these plants than in the surrounding area which may contain grass or bare ground.

Although hand collections were made, no attempt to obtain quantitative population estimates on mesquite was undertaken this season. In July and August of 1971, however, D-vac samples were taken in an area adjacent to the site. Results are summarized in Table 2. Numbers are not reported due to their extreme variability. For example, a 25 sq ft sample contained 650+ psyllids on July 16 but only 46 on August 16. More samples must be taken before quantitative estimates will become meaningful.

During the latter part of May and June sampling of yucca blooms was initiated. A 32-mesh Lumite bag was quickly placed over the flower and tied around the stalk, which was then cut from the plant and returned to the lab for Berlese extraction. Table 3 summarizes the results for the sample taken

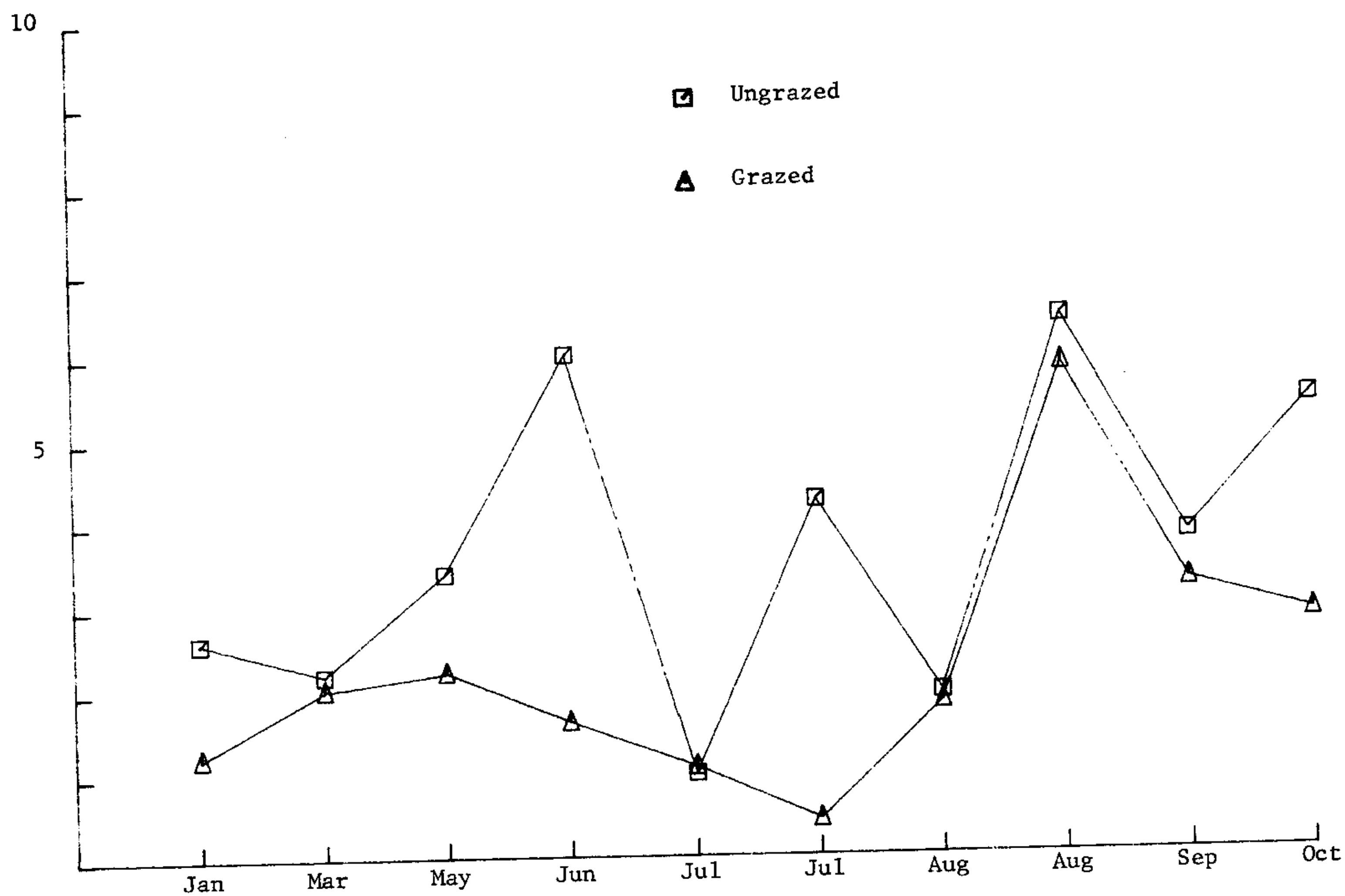

Fig. 5. Homoptera: Cicadellidae, January 1972 to October 1972 (no./m^2).

Table 2. List of families collected on mesquite, July 16 and August 16, 1971.

Order	Family
Homoptera	Psyllidae
	Membracidae
	Fulgoridae
	Cicadellidae
	Cercopidae
Orthoptera	Mantidae
	Phasmidae
Hemiptera	Tingidae
Neuroptera	Chrysopidae
	Myrmeltontidae
Diptera[a/]	Asilidae
	Phoridae
	Tachinidae
Lepidoptera[a/]	Geometridae
	Tortricidae
Coleoptera	Bruchidae
	Cerambycidae
	Curculionidae
	Nitidulidae
	Tenebrionidae
Thysanoptera	Phloeothripidae
Collembola	Sminthuridae
Hymenoptera[a/]	Formicidae
	Pompilidae
	Cynipidae
Acarina[a/]	Caeculidae
Araneida	Lycosidae
	Salticidae
	Thomisidae
	Argiopidae

a/ Not all specimens were taken to family.

Table 3. Summary of yucca flower sample, May 24, 1972.

Order	Family	Life Stage[a/]	Total Catch
Thysanoptera	Thripidae	10	228
		40	17
Homoptera	Aphididae	40	3000+
Hemiptera	Miridae	10	6
		40	2
Diptera		10	1
Lepidoptera[b/]		10	7
Hymenoptera	Formicidae	10	33
Coleoptera	Coccinellidae	10	5
	Nitidulidae	10	2
Araneida	Salticidae	10	1

a/ 10 = adult; 40 = larva or nymph.

b/ At least two families of microlepidoptera were collected.

May 24. The preponderance of aphids on the yucca flower was observed throughout the blooming season. A subsequent sample taken on June 21 showed a decrease in thrips populations, while an increase in lady beetles (Coccinellidae) was seen. It should be mentioned that only incompletely opened blooms were sampled. It is expected that thrips would parallel aphids in numbers if the flowers had been fully open (J. G. Watts, personal communication). In addition, two species of stink bug (Pentatomidae) were seen frequenting most plants in June.

None of the relations involved here have been taken into consideration in the routine sampling. The aphids undoubtedly exert an influence on the system through their consumption and excretion of large quantities of sugars or "honey dew" which are either collected by ants or dropped to the ground, eventually being decomposed. It is considered essential that the population dynamics of the yucca flower be reported with other aboveground data in the coming field season. An appropriate method of integrating the two data must be developed in order to give the figures some real meaning which may be applied to the model. This idea will be discussed in further detail below.

As indicated from the earlier discussion of population densities, it will be recalled that entire yucca plants were also sampled during the season using the quick trap method. Four yucca of small size (never any larger than the quick trap itself) were processed in the same manner as other samples in July, August, and October. None of the plants had bloomed earlier in the season. Table 4 lists the taxa found in association with them.

Forty-one invertebrate families have been identified from the yucca samples to date. Some groups, including the Lygaeidae, Gryllidae, Blattidae, Termitidae, and Oribatid mites were found in high numbers in yucca but rarely

Table 4. Families encountered on yucca - July 21, August 8, August 30, and October 29, 1972.

Order	Family	Life Stage[a/]
Homoptera	Coccidae	40
	Aphididae	40
	Membracidae	10
Hemiptera	Tingidae	10, 40
	Lygaeidae	10, 40
	Nabidae	10
	Miridae	40
	Coreidae	40
Thysanoptera	Phloeothripidae	10
	Thripidae	10, 40
Orthoptera	Blattidae	10, 40
	Gryllidae	10, 40
	Acrididae	10, 40
Neuroptera	Myrmeleontidae	40
Isoptera	Termitidae	40
Coleoptera	Elateridae	10
	Tenebrionidae	10
	Cebrionidae	10
	Chrysomelidae	10
Diptera	Muscidae	10
	Chloropidae	10
Lepidoptera	Noctuidae	10
Hymenoptera	Formicidae	10
	Vespidae	10
	Encyrtidae	10
Collembola	Sminthuridae	10
	Entomobryidae	10
Araneida	Agelenidae	10
	Argiopidae	10
	Gnaphosidae	10, 40
	Lycosidae	10, 40
	Linyphiidae	10
	Salticidae	10
	Thomisidae	10
Phalangida	Phalangiida	10
Chelonethida	Chermetidae	10
Scorpionida	Buthidae	10
Acarina	Caeculidae	10
	Oribatulidae	10
	Tetranychidae	10
Scolopendromorpha		10

a/ 10 = adult; 40 = larva or nymph.

collected with the quick trap on other vegetation. Three additional groups, the "daddy-long-legs" or harvestmen (Phalangida), pseudoscorpions (Celonethida) and scorpions (Scorpionida) have not been collected on vegetation other than yucca when using the quick trap. The scorpions, however, have occasionally been taken in pitfall traps.

Fig. 6 shows the density (no./m^2) of invertebrates in yucca on each of the four sampling dates. Values range from a low of 192 on July 21 to a high of 458 on August 8. Also indicated is the overall density for the treatment in which the yucca was sampled. The disparity between yucca and non-yucca samples is apparent. Table 5 is a further indication of the differences encountered. The density estimate for the treatment with the yucca sample removed is less than one-tenth of the yucca population density in all cases. A comparison of the computed standard errors for overall treatment and treatment not including yucca indicates the degree of variability that the yucca sample contributes to the overall population estimate.

Approximately 300 yucca occur in the southern half of the ungrazed plot, while nearly 100 exist on the smaller grazed plot. These plants are obviously reservoirs for large numbers of insects and should be sampled more consistently or systematically. One possibility is to sample an arbitrary plant during each sampling period and report it separately as a yucca sample. This would reduce the margin of sampling error for other samples and still give an idea of population fluctuations in yucca. Problems would still be encountered due to the variations in size of the plants. A 0.5 m tall yucca would likely have fewer insects than a 3 m plant.

Another alternative is to sample a specific number of shrubs, the number being decided from the overall distribution. Aerial photographs of the site

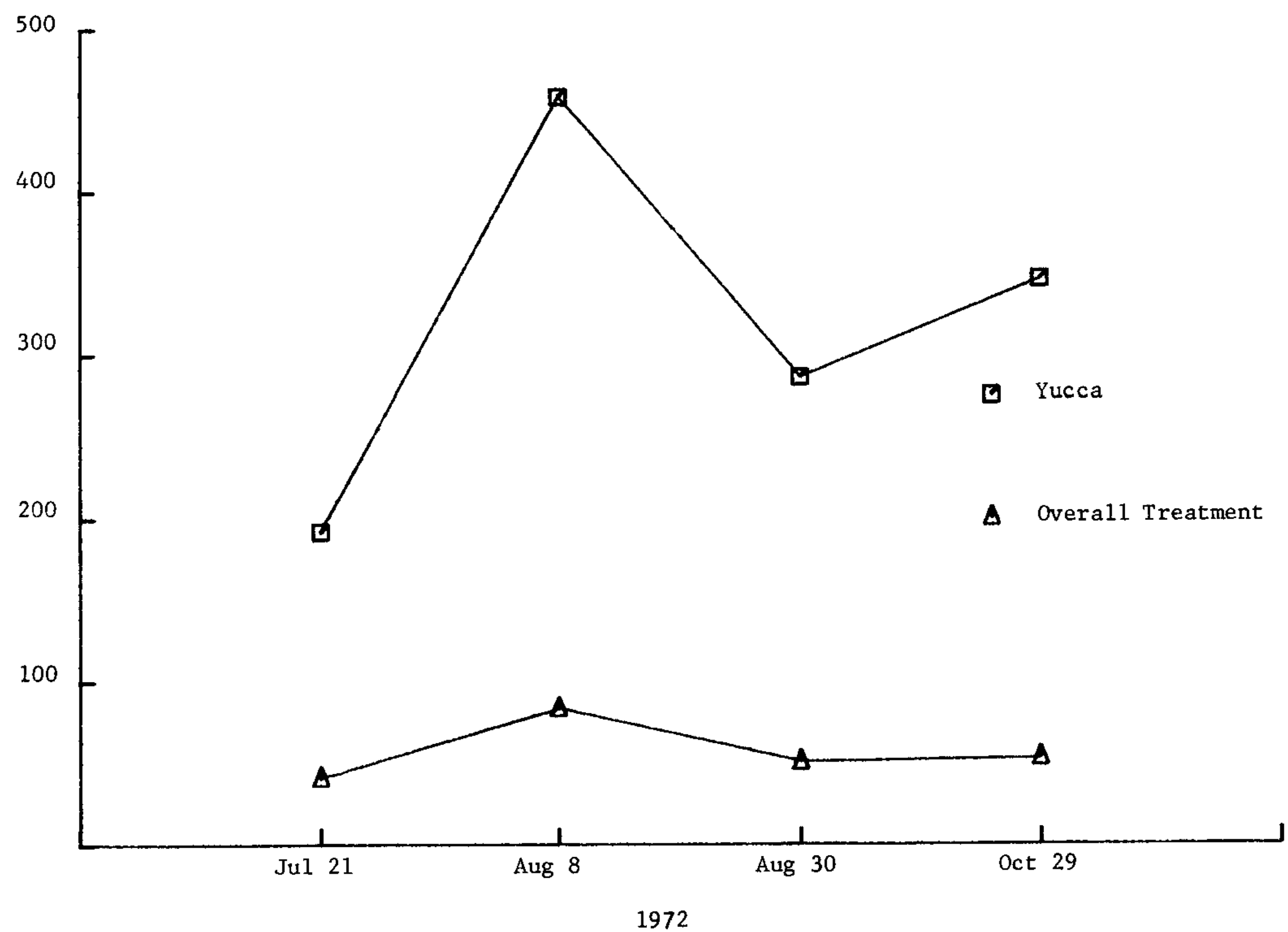

Fig. 6. Aboveground invertebrates in yucca, 1972 (no./m^2).

Table 5. Comparison of invertebrates on yucca vs. non-yucca samples for for 1972. Density is no./m^2.

Sample Data[a/]	Density on Yucca	Density for Treatment	Treatment minus Yucca Density	Standard Error: Treatment	Standard Error Treatment minus Yucca	Sample Range[b/]
July 21	192	41.4	24.67	18.76	7.38	2-39
Aug. 8	458	81.4	38.25	43.88	17.34	4-42
Aug. 30	286	51.0	22.0	26.19	2.29	6-17
Oct. 29	346	55.2	22.89	32.42	2.96	7-19

a/ August 8 is ungrazed treatment, others are grazed.

b/ Minimum and maximum numbers caught per quadrat for the treatment excluding yucca.

have been taken, and it is possible with these to get a total count of mesquite, yucca, and Mormon tea (*Ephedra trifurca* Torr.). Area covered by bare ground can also be estimated and mapped from these photographs.

If 20 samples were to be taken on the ungrazed plot, then the number of the various shrubs to be sampled could be assigned from the distributional data. The remaining samples could then be taken randomly as in the present manner.

These ideas are admittedly in contrast to the uniform sampling procedure now being used by the comprehensive network, yet they can still be related to area and yield population density measurements. Furthermore, shrub sampling is even more important during dry seasons when the relative area occupied by grasses and forbs is low, and the bare ground is much greater. This situation occurred during 1971. No shrubs were sampled then and population figures remained low. However, pitfall and light traps revealed a diversity not indicated in the quick trap samples; similarly, hand collections on shrubs revealed large numbers and diversity (1971 annual report for Jornada Site, in press).

Soil Cores

The data for macroarthropod cores is presented in Table 6. For the two samples taken to date, the ants, termites, and beetle larvae are the most prominent taxa. Thirty-nine Diptera pupae were also taken in July in one core. Caeculid mites have also occurred in the samples.

Of the 19 microarthropod cores taken July 11, only three insects were collected. Problems encountered with this sample have been mentioned in the methods section. The second series of cores had a higher yield and consisted of taxa similar to the macro cores, although two springtails were also collected (Table 7).

Table 6. Macroarthropod core samples, 1972.

Sample Date	Treat- ment	Repli- cate	Quadrat	Depth Top	Depth Bottom	Order	Family	Life Stage	Total Number
July 11	1	1	248	0	15				0
				15	30	Cole.	Scar.	40	1
			150	0	15				0
				15	30				0
			114	0	15				0
				15	30	Isop.	Term.	10	36
	1	2	84	0	15				0
				15	30				0
			66	0	15				0
				15	30				0
			24	0	15	Cole.	Scar.	40	2
				15	30	Dipt.		40	1
	5	1	606	0	15				0
				15	30				0
			672	0	15	Hyme.	Form.	10	74
						Hyme.	Form.	20	24
						Hyme.	Form.	30	10
						Hemi.	Miri.	10	1
				15	30	Hyme.	Form.	10	150
						Hyme.	Form.	20	46
						Hyme.	Form.	30	63
			344	0	15				0
				15	30	Hyme.	Form.	10	1
						Isop.	Term.	10	1
	5	2	714	0	10				0
				10	20				0
			356	0	15	Dipt.		20	39
				15	30				0
			206	0	15				0
				15	30				0
Oct. 31	1	1	42	0	10	Acar.	Caec.	10	1
						Hyme.	Form.	10	1
				10	20	Hyme.	Form.	10	1
				20	30				0
			218	0	10				0
				10	20				0
				20	30				0
			460	0	10	Acar.	Caec.	10	1
				10	20				0
				20	30				0
				0	10				0

Table 6 (continued).

Sample Date	Treat- ment	Repli- cate	Quadrat	Depth Top	Depth Bottom	Order	Family	Life Stage	Total Number
	1	2	12	10	20				0
				20	30				0
			34	0	10	Hyme.	Form.	10	14
				10	20	Hyme.	Form.	10	8
				20	30	Hyme.	Form.	10	9
			712	0	10				0
				10	20	Cole.	Scar.	40	1
				20	30				0
	5	1	12	0	10	Cole.		40	1
				10	20				0
				20	30				0
			54	0	10	Hyme.	Form.	10	7
				10	20	Hyme.	Form.	10	3
						Isop.	Term.	40	1
				20	30				0
			556	0	10				0
				10	20	Cole.		40	1
				20	30				0
				0	10				0
	5	2	6	10	20				0
				20	30	Dipt.		40	1
			406	0	10	Isop.	Term.	40	28
				10	20	Isop.	Term.	40	15
				20	30	Isop.	Term.	40	17
			618	0	10	Hyme.	Form.	10	1
				10	20				0
				20	30				0

Table 7. Microarthropod cores, 1972.

Sample Date	Treat-ment	Repli-cate	Quadrat	Depth[a] Top	Depth[a] Bottom	Order	Family	Life Stage	Total Number
July 11	1	1	12						0
			326						0
			248						0
			150						0
			114						0
	1	2	66						0
			24						0
			362						0
			212						0
			84						0
	5	1	344						0
			178						0
			606						0
			90						0
				0	5				0
			672	5	10	Cole.		40	1
				0	5				0
	5	2	714	5	10	Hyme.	Form.	10	1
						Cole.		40	1
			448						0
			206						0
			156						0
Oct. 31	1	1	424						0
			460						0
			430						0
				0	5	Cole.		40	1
			218	5	10				0
				0	5				0
			42	5	10	Acar.		10	1
	1	2	424						0
			34						0
			678						0
				0	5				0
			12	5	10	Acar.	Caec.	10	1
				0	5	Hyme.	Form.	10	2
			712	5	10	Hyme.	Form.	10	1

Table 7 (continued).

Sample Date	Treat-ment	Repli-cate	Quadrat	Depth[a/] Top	Bottom	Order	Family	Life Stage	Total Number
	5	1	556						0
			24						0
				0	5	Acar.	Caec.	10	1
			12	5	10				0
				0	5	Coll.	Smin.	10	2
			54	5	10				0
				0	5				0
			460	5	10	Cole.		40	1
	5	2	224						0
			618						0
				0	5	Acar.		10	1
			180	5	10				0
				0	5	Hyme.	Form.	10	1
			406			Isop.	Term.	40	1
				5	10	Isop.	Term.	40	3
			6	0	5	Cole.		40	1
				5	10				0

a/ Depths are not indicated for samples that were void of insects.

LITERATURE CITED

Crossley, D. A., and V. A. Merchant. 1971. Feeding of caeculid mites on fungus detected with radioactive tracers. Ann. Entomol. Soc. Amer. 64(4): 760-762.

Swift, D. M., and N. R. French [Coordinators]. Basic field data collection procedures for the Grassland Biome 1972 season. U.S. IBP Grassland Biome Tech. Rep. No. 145. Colorado State Univ., Fort Collins. 86 p.

APPENDIX I

FIELD DATA

Aboveground invertebrate data collected at the Jornada Site were recorded on form NREL-30. These data are stored as Grassland Biome data set A2U30E8. A sample data form and an example of the data are attached.

IBP

GRASSLAND BIOME

U.S. INTERNATIONAL BIOLOGICAL PROGRAM

FIELD DATA SHEET - INVERTEBRATE

DATA TYPE	SITE	INITIALS	DATE Day	DATE Mo	DATE Yr	TREATMENT	REPLICATE	PLOT SIZE	QUADRAT	TROPHIC	HOST	ORDER	FAMILY	GENUS	SPECIES	SUBSPECIES	LIFE STAGE	TOTAL NO.	DRY WT.	NO. WEIGH

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
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

TROPHIC
0 Unknown
1 Plant feeding (tissue)
2 Plant feeding (sap)
3 Plant feeding (pollen and nectar)
4 Plant feeding (seed)
5 Predator
6 Parasitoid
7 Parasite
8 Scavenger
9 Non-feeding stage

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

LIFE STAGE
00 Undetermined
10 Adult
20 Pupae
30 Egg
40 Nymph or Larva
41 Nymph or Larva, early
42 Nymph or Larva, middle
43 Nymph or Larva, late
50 Instar
51 Instar, 1st
52 Instar, 2nd
53 Instar, 3rd

+++ EXAMPLE OF DATA +++

```
         1         2         3         4         5
1234567890123456789012345678901234567890123456789012345678901234567

3008MAF23067211   .548          NEURMYRM          10       1
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3008MAF23067211   .548          HOMOCIC1          40       1
3008MAF23067211   .548          HOMOCIC1          10       1
3008MAF23067211   .5102         HOMOCIC2          10       1
3008MAF23067211   .5102         COLLSMIN          10       1
3008MAF23067211   .5102         HOMOCOCC          10       1
3008MAF23067211   .5102         NEURMYRM          10       1
3008MAF23067211   .5102         ORTHACRI          40       1
3008MAF23067211   .5102         HOMOCIC1          10       1
3008MAF23067211   .5102         HOMOCIC1          40       2
3008MAF23067211   .5162         HYMEEULO          10       1
3008MAF23067211   .5162         COLEPSEL          10       1
3008MAF23067211   .5162         HOMOCIC1          10       3
3008MAF23067211   .5162         HOMOCIC1          40       4
3008MAF23067211   .5162         HYMEFORM          10       6
3008MAF23067211   .5162         HOMOCOCC          40       1
3008MAF23067211   .5162         HEMIMIRI          40       4
3008MAF23067211   .5162         HEMIMIRI          10       2
3008MAF23067211   .5162         COLE              40       2
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3008MAF23067211   .5162         DIPTCHLOSA PR     10       1
3008MAF23067211   .5162         COLECURC          10       1
3008MAF23067211   .5162         HOMOMEMB          40       1
3008MAF23067211   .5162         COLLSMIN          10       2
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3008MAF23067211   .5162         HYMEBRAC          10       1
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3008MAF23067211   .5532         DIPTMUSC          10       1
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3008MAF23067211   .5532         HOMOCIC1          10       1
3008MAF23067211   .5532         HOMOAPHI          40       1
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3008MAF23067211   .5278         COLE              40       1
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3008MAF23067212	.566	DIPT	10	1
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3008MAF23067212	.566	COLECHRY	10	1
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3008MAF23067212	.5144	COLE	40	1
3008MAF23067212	.5144	HOMOPSYL	10	1
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3008MAF23067212	.5586	ACARCAEC	10	3
3008MAF23067212	.5586	HYMESPHE	10	1
3008MAF23067212	.5586	HEMITING	10	4
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3008MAF23067212	.5586	HEMIMIRI	10	1
3008MAF23067212	.5586	HOMOCOCC	40	2
3008MAF23067212	.5586	HEMILYGA	40	1
3008MAF23067212	.5586	HEMISCUT	40	1
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3008MAF23067212	.5272	COLECOCC	10	1
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3008MAF23067212	.5272	HYMESPHE	10	1
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3008MAF23067251	.548	HYMEEULO	10	1
3008MAF23067251	.548	DIPTSARC	10	3
3008MAF23067251	.548	COLLSMIN	10	5
3008MAF23067251	.548	COLECHRY	10	1
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3008MAF23067251	.548	HOMOCOCC	40	3
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3008MAF23067251	.5498	HOMOCOCC	40	1
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3008MAF23067251	.5498	HOMOCICI	10	1
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3008MAF23067251	.5498	HYME	10	1

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3008MAE23067251	.5586	HOMOCIC2	10	1
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3008MAE23067251	.5586	THY2THRI	40	1
3008MAE23067251	.5586	HYMECHA2	10	1
3008MAE23067251	.5586	ACARCAEC	10	1
3008MAE23067251	.5586	COLLSMIN	10	1
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3008MAE23067251	.5356	HEMI	40	2
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3008MAE23067251	.5356	HYMEBRAC	10	1
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3008MAE23067252	.5436	HEMILYGA	10	2
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3008MAE23067252	.5436	HYMEICHN	10	1
3008MAE23067252	.5436	HYMEHALI	10	1
3008MAE23067252	.5436	HYME	10	1
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3008MAE23067252	.5132	DIPT	10	1
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3008MAE23067252	.5666	ACARCAEC	10	3
3008MAE23067252	.5666	COLLSMIN	10	6
3008MAE23067252	.5666	HOMOCOCC	10	2
3008MAE23067252	.5666	ACARORIB	10	2
3008MAE23067252	.5666	ARANLYCO	10	1
3008MAE23067252	.5666	NEURMYRM	40	1
3008MAE23067252	.5666	ORTHACRI	40	1
3008MAE23067252	.5666	DIPT	10	1
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3008MAE23067252	.5666	HEMILYGA	10	1
3008MAE23067252	.5666	HEMITING	10	3

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3008MAE23067252	.5750	HOMOCICI	10	2
3008MAF23067252	.5750	DIPTTACH	10	1
3008MAF23067252	.5750	COLLSMIN	10	1
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3008MAE23067252	.5750	ORTHACRI	10	1
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