1971

The Jornada Validation Site (Playa- NMSU Ranch) Validation Study

Walter G. Whitford

John Ludwig

IBP

DESERT BIOME

US/IBP ANALYSIS OF ECOSYSTEMS

1970

PROGRESS REPORT

VALIDATION STUDY

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New Mexico State University

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Objectives

The objectives of the validation measurements are four-fold:

1. To conduct an initial inventory (standing-crop measurements) of energy, nitrogen, phosphorus, carbon, and water in as many as possible of the biotic (species) and abiotic components of the site.
2. To make periodic standing-crop estimates of the major biotic and abiotic components of the system.
3. To make periodic measurements of the physical factors and inputs in the site.
4. To develop equipment and facilities to accomplish the above.

Methods

The following project list enumerates the specific methods being used for the site.

Project: Air Temperature (DSCODE = A3UWJ02)

Data recorded -- Air Temperature (2 hr. intervals)

Experimental methods -- Hygrothermograph -- continuous Recording -- seven day clock

Experimental design -- Instrument located in an instrument shelter of standard height, color, and ventilation. The shelter is placed at the edge of the playa bottom.

Project: Air Relative Humidity (DSCODE = A3UWJ03)

Data recorded -- Air relative humidities (2 hr. intervals)

Experimental methods -- Hygrothermograph -- continuous recording -- seven day clock.

Experimental design -- Instrument located in an instrument shelter of standard height, color, and ventilation. The shelter is placed at the edge of the playa bottom.

Project: Solar Radiation - Total incoming (DSCODE = A3UWJ04)

Data recorded -- Solar radiation (2 hr. intervals)

Experimental methods -- Pyraheliograph instrument (Sci. Assoc.)

Experimental design -- Instrument located in an instrument shelter of standard height, color, and ventilation. The shelter is placed at the edge of the playa bottom.

Project: Soil temperatures and soil water potentials (DSCODE = A3UWJ05)

Data recorded -- Soil temperatures at the 3 depths. Soil water potentials -- estimates from calibration curve of blocks. Resistance to atm. to tension

Experimental methods -- Soil gypsum blocks with attached thermistor. Blocks of special design for measurement of high water tensions.

Experimental design -- 24 blocks located at 8 different locations and at 3 depths per location in the playa bottom. 36 blocks located at 12 different locations and at 3 depths per location in the playa fringe. 12 blocks located at 4 different locations and at 3 depths per location in the playa bottom edge (*Hilaria*). Locations correspond to location of fenced enclosures of the study area. (see map, Desert Biome Reports, 1970)

Literature citations --
Desert Biome, 1970, Reports Volume, Section 2.2.2.3.

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Project: Precipitation (DSCODE = A3UWJ07)

Data recorded -- Number of rain periods/day, time rain started, time rain stopped, amount of rain (inches).

Experimental methods -- Rain gauge (sci. assoc. #502).

Experimental Design -- Gauge is located next to the instrument shelter in the SW corner of the playa edge.

Project: Small mammal mark-recapture live trap (DSCODE = A3UWJ11)

Data recorded -- Density, species composition, breeding condition, sex, weight (grams), location on grid, recapture status.

Species -- Peromyscus maniculatus, Dipodomys merriami, Dipodomys ordii, Perognathus flavus, Perognathus penincillatus, Neotoma albigula, Dipodomys spectabilis, Sigmodon hispidus, Reithrodontomys megalotis, Onychomys leucogaster.

Experimental methods -- Sherman live traps placed adjacent to permanent grid stakes. Trap open and baited with grain at night. Checked following AM. Individuals identified by unique toe clip for each animal. Weighed and released.

Experimental design -- Four trapping grids of five lines, 10 traps per line. Grids randomly placed in each of 4 cardinal quarters of playa. Sic trap rows in playa, four in fringe (see map file (A3U#005). (See Fig. 1).

Literature Citations --
Hayne, D. W., 1949. Two methods for estimating populations of mammals from trapping records. J. Mammal 30 (399-411).

Project: Reptile density (DSCODE = A3UWJ13)

Data recorded -- Density, home range, breeding condition, snout-vent length (mm), weight (grams), sex, body temperature, time of capture.

Species -- Phrynosoma cornutum, Phrynosoma modestum, Holbrookia maculata, Sceloporus magister, Crotaphytus wislizeni, Uta stansburiana, Crotalus viridis, Pituophis melanoleucus, Crotalus atrox, Terepenne ornata.

Experimental methods -- Lizards caught by hand or noosed. Marked with individual code by toe clipping. Selected species which are difficult to capture also marked with paint color code on base of tail. All lizards weighed and released.

Experimental design -- Mark-capture encompassing entire study area.

Literature Citations --
Blair, W. Frank, 1960. The Rusty Lizard. A population study. University Texas Press, Austin.

Tinkle, P. W., 1967. The Life and demography of the side-blotched lizard, Uta stansburiana. Misc. publ. mus. zool. University of Michigan #132 PP 1-182.

Project: Plant Production - above ground biomass (DSCODE = A3UWJ51)

Data recorded -- Grams of living and standing dead material by species per 18th square meter quadrat.

Species -- Panicum obtusum, Hilaria mutica, Muhlenbergia porteri,Scleropogon brevifolius, Sporoblous flexuosus, Tridens pulchellus, Asclepias brachystephana, Astragalus wootoni, Calliandra humilis, Cassia bauhinoides, Chenopodium incanum, Circium ochrocentrum, Croton corymbulosus, Cucurbita foetidissum, Descurainia pinnata, Eriogonum abertianum, Eriogonum rotundifolium, Eriogonum trichopodum, Escholtzia mexicana, Euphorbia albomarginata, Helianthus ciliaris, Hoffmannseggia densiflora, Hymenoxys odorata, Lesquerella fendleri, Luecelene ericoides, Perezia nona, Salsola kali-tenuifolia, Sida lepidota, Solanum elaeagnifolium, Sphaeralcea caccinea, Verbena ambrosifolia, Xanthium saccharatum, Condalia lyciodies, Ephedra torreyana, Ephedra trifurca, Gutierrezia sarothrae, Larrea divaricata, Prosopis juliflora, Yucca elata, Zephyranthes longifolia.

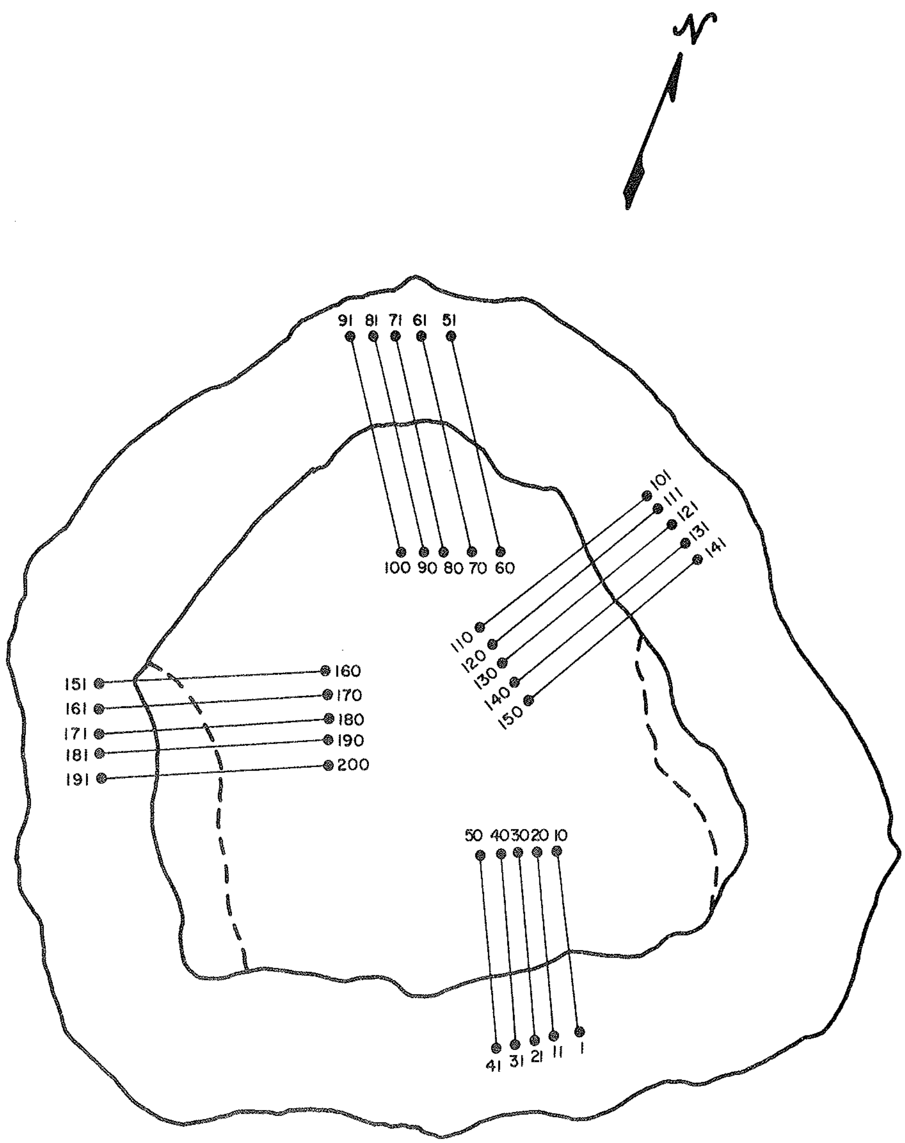

Figure 1. Location of Small mammal trapping grids on the NMSU Ranch playa. The numbers at the ends of the lines indicate the numbers assigned the terminal stakes in each line.

Experimental methods -- Harvest - clipping a measured area of vegetation

Experimental design -- Stratified random placement of quadrats (see desert biome, 1970, for details and maps)

Literature Citations --

Milner, C., and R. Elfyn Hyghes. 1968. Methods for the Measurement of the Primary Production of Grassland. IBP. Handbook No. 6, Blackwell, Oxford England.
Desert Biome, 1970, reports volume section 2.2.2.3.

Project: Plant Production on ground biomass (litter) estimates (DSCODE = A3UWJ52)

Data recorded -- Grams of litter material by species per 1/8th square meter quadrat

The Jornada Validation Site (Playa NMSU Ranch)

Species -- Panicum obtusum, Hilaria mutica, Muhlenbergia porteri, Scleropogon brevifolius, Sporoblous flexuosus, Tridens pulchellus, Asclepias brachystephana, Astragalus wootoni, Calliandra humilis, Cassia bauhinoides, Chenopodium incanum, Circium ochrocentrum, Croton corymbulosus, Cucurbita foetidissum, Descurainia pinnata, Eriogonum abertianum, Eriogonum rotundifolium, Eriogonum trichopodum, Escholtzia mexicana, Euphorbia albomarginata, Helianthus ciliaris, Hoffmannseggia densiflora, Hymenoxys odorata, Lesquerella fendleri, Luecelene ericoides, Perezia nona, Salsola kali-tenuifolia, Sida lepidota, Solanum elaeagnifolium, Sphaeralcea coccinea, Verbena ambrosifolia, Xanthium saccharatum, Condalia lyciodies, Ephedra torreyana, Ephedra trifurca, Gutierrezia sarothrae, Larrea divaricata, Prosopis juliflora, Yucca elata, Zephyranthes longifolia.

Experimental methods -- Harvest-collecting a measured area.

Experimental design -- Stratified random placement of quadrats (see Desert Biome Report for details)

Literature Citations --
Milner, C. and R. Elfyn Hughes, 1968. Methods for the Measurement of the Primary Production of Grassland. Biome Handbook No. 6, Blackwell, Oxford, England.

Desert Biome, 1970, Reports volume, section 2.2.2.3.

Project: Plant Production -- below ground biomass (DSCODE = A3UWJ53)

Data recorded -- Root material (grams/232 CM3) taken within each quadrat.

Species -- Panicum obtusum, Hilaria mutica.

Experimental methods -- Soil cores -- extraction of roots by sieving.

Experimental design -- Stratified random placement of quadrats (for details and maps see Desert Biome Reports, 1970).

Literature Citations --
Milner, C. and R. Elfryn Hyghes, 1968. Methods for the Measurement of the Primary Production of Grassland. IBP. Handbood No. 6., Blackwell, Oxford, England.

Desert Biome Reports, 1970, section 2.2.2.3.

Project: Lagamorph density (DSCODE = A3UWJ15)

Data recorded -- Number and species of lagamorphs flushed and distance from observer.

Species -- Lepus californicus, Sylvilagus auduboni.

Experimental methods -- Lagamorphs driven from shelter and recorded over predetermined distance.

Experimental design -- Observer walks two fixed distance transects around playa recording species flushed and distance from the observer. For transect detail see Figure 2.

Literature Citations --
Hayne, D. W. 1949. An examination of the Strip Census Method for Estimating Animal Populations. J. Wildlife Management. 13: 145-157.

Hanson, W. R. 1968. Estimating the Number of Animals: A Rapid Method for Unidentified Individuals. Science 162: 675-676.

Project: Avian Census (DSCODE = A3UWJ16)

Data recorded -- Active nests, singing individuals, sightings of individuals and groups.

Species -- Callipepla squamata, Geococcyx californianus, Camphlorhynchus brunneicopillum, Lanius ludovicianus, Mimus polyglottas, Zenaidura macroura, Toxastoma dosale, Icterus parisorum, Amphispiza bilincata, Buteo swainsoni, Chordeiles acutipennis, Myiarchus cinerascens, Cornus cryptoleucus.

Experimental methods-- Count, identify and spot map individual birds.

Experimental design -- One or two observers cruising area at least twice per observing day. Record location of birds on map.

Literature Citations --
Raitt, R. J. and R. L. Maze, 1968. Densities and species composition of breeding of a creosote community in Southern New Mexico. Condor. 70: 193-205.

Kendeigh, S. C. 1944. Measurement of bird populations. Ecol. Monogr. 14: 67-106.

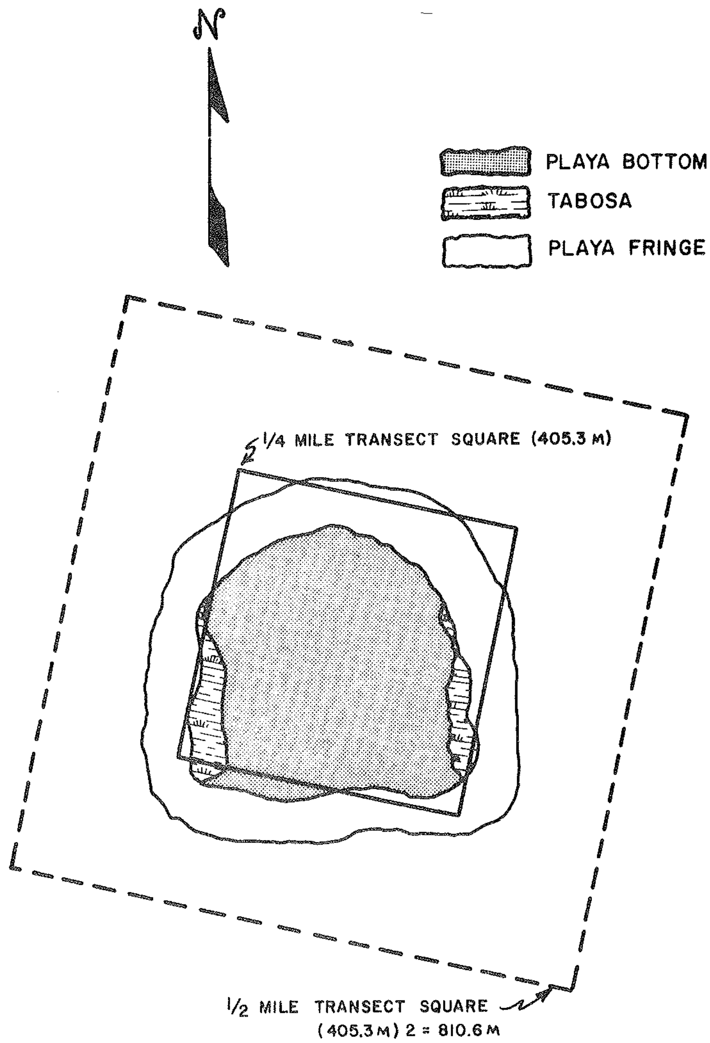

Figure 2. Location of lagamorph drive transects in relation to the NMSU Ranch playa.

Project: Soil microorganisms -- plate counts (DSCODE = A3UW)

Data recorded -- Aerobic, anaerobic and fungal plate counts.

Experimental methods -- Ten grams of soil sub-sample transferred to 90ml standard diluting solution (0.01MKPO$_4$ buffer, pH 7.2) Samples vigorously shaken 60 times through a 20 inch are allowed to stand for 1 minute to settle coarse particles. A 10ml aliquot added to 90ml standard diluting solution treated as above. A 1 ml aliquot of the 10^2 dilution was thoroughly mixed with 9ml standard diluting solution to provide plate counts of 30-300 colonies per dish. Aerobic and anaerobic bacterial counts were on standard plate count agar. Anaerobic plates were incubated under N_2. Fungal samples were plated on Saborand dextrose agar at pH 4.5. All incubations were at 25C. Bacterial counts were at 48 hours; fungal counts at 5 days.

Experimental design -- Sub samples were taken from root soil cores at selected clip quadrats (Quadrat locations given in Table 1 refer to quadrats shown in Figure 2.2.2.3.-3, Desert Biome Reports, 1970, pp. 2.2.2.3.-6).

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Project: Arthropods - Census plant arthropods (DSCODE = A3UWJ21)

Data recorded -- Species collected by sweep netting selected plant species.

Species -- See lists, 1971 annual report.

Experimental methods -- Sweep netting with standard insect net.

Experimental design -- Intensive sweep netting in and around selected plant species.

Literature Citations --
Borrer, D. J. and D. M. DeLong, 1964. An Introduction of the Study of Insects. Holt, Rinehart and Winston, Inc., New York.

Smith, M. R. 1947. A generic and subgeneric synopsis of the United States ants based on the workers (Hymenoptera: Formicidae) Am. Midl. Nat. 37: 521-647.

Project: Arthropods - sweep samples (DSCODE = A3UWJ25)

Data recorded -- Indices of abundance of arthropods on various plant species.

Species -- See tables, annual report 1971.

Experimental methods -- Sweep grass with standard 12" diameter insect net.

Experimental design -- Random movement across playa bottom sweeping with standard 12" diameter insect net. Sweeping in 1 meter arcs. Number of sweeps from 500 to 1000 depending on the lushness of the vegetation. Panicum obtusum areas and Hilaria mutica areas sampled separately.

Literature Citations --
Menhinick, E. F. 1963. Estimation of Insect population density in herbaceous vegetation with emphasis on removal sweeping. Ecol. 44: 617-622.

Menhinick, E. F. 1967. Structure, stability and energy flow in plants and arthropods in Sericia Lespedeza. Ecol. Monogr. 37: 255-272.

Project: Arthropods - ground dwelling (DSCODE = A3UWJ22)

Data Recorded -- Number per unit area, movements.

Species -- Calisoma sp., Eleodes sp.

Experimental methods -- Beetles captured in pit-fall traps marked with individual numbers on the elytra with red airplane dope.

Experimental design -- Pitfall traps 1 meter west of mammal stakes. Grid area 2.1 hectares. Seventy-one can traps adjacent to stakes 51-100 (see mammal trap grid., Fig. 1). Additional traps numbered 51A, 51B, 51C, 61A, 61B - 91C.

Literature Citations --
Southwood, T. R. E. 1966. Ecological methods. Meuthen and Co. Ltd., London 391 pp.

Project: Invertebrate sutdies (DSCODE = A3UWD01). Charles R. Ward, Louis G. Richardson, Ellis W. Huddleston, and Donald Ashdown.

Data recorded --

Date	Type of Sample	No. of Samples	Counted	Not Counted
27/07/70	nest	10	x	
	traps	10	x	
31/07/70	nets	20	x	
03/08/70	nets	10	x	
	traps	10	x	
05/08/70	nets	20	x	
06/07/70	nets	64	x	
(24 hour study)	traps	39	x	
10/08/70	traps	6	x	
	nets	6	x	
12/08/70	nets	5	x	
	traps	2	x	
14/08/70	nets	3	x	
17/08/70	nets	2	x	

Data recorded con't.

Date	Type of Sample	No. of Samples	Counted	Not Counted
19/08/70	nets	3	x	
	traps	3	x	
30/08/70	nets	2	x	
	traps	2	x	
18/09/70	nets	2	x	
	traps	2	x	
03/10/70	nets	2	x	
	traps	1	x	
16/10/70	nets	2	x	
	traps	2	x	
All bottom samples				x
All core samples				x

Experimental methods -- The main sampling device used in this study is a modification of the Bellville trap used to obtain quantitative samples of mosquito larvae. The trap consisted of a galvanized sheet metal cylinder enclosing an area of 1/4 square meter. The traps range in height from 1 to 3 feet with traps for each six-inch interval.

The trap is dropped from the end of a boom which supports the trap approximately 8 feet in front of the nearest sampler and 2 to 3 feet above the water surface. The trap is then forced into the lake bottom by hand to insure a good seal, and the water enclosed by the trap is dipped out and strained through a 120 mesh plankton net. The sample is then preserved in a 50% solution of 10% neutral buffered formalin and 95% ethanol.

After removal of the water, a bottom sample consisting of the upper 3-4 cm of bottom mud and a core sample approximately 10 cm in diameter and 10 cm deep are taken. These samples are subsequently washed throgh a 100 mesh screen and preserved. Also taken in conjunction with each trap sample is a 5 m sweep with a 30.5 cm "D" frame aquatic sweep net.

Samples were taken randomly at or as near to the six selected sites as possible, plus four other sites selected to provide data from the center portion of the lake and an additional sample on the north end. The ten trap samples were taken on a weekly rather than a twice weekly basis to prevent excessive disturbance of the lake bottom caused by the removal of the mud samples. The first set of samples was taken on the 27th of July, after rains on the 25th and 26th filled the lake. On July 31 a set of samples consisting of 2 sweep net samples and a plankton sample at each site was taken. Another complete set of 10 trap samples was taken on August 3. On August 6-7 a 24-hour study was undertaken with a series of three trap and five net samples being taken every two hours from 6 PM August 6 through 6 PM August 7.

On August 10 only six sites remained under water and seven samples were taken with the additional sample being taken at the staff gauge between sites II and III. Due to the very rapid drying of the lake, an additional set of two samples was taken on August 12. By August 17 water remained only in the tank and two samples were taken from the tank on that date. Another three samples were taken on August 19 and again on August 30. Sampling was continued through October 16.

The difficulties encountered during sampling were numerous. The removal of all the water and insects associated with the water from the trap was a serious problem. Getting a good seal around the bottom edge of the trap was difficult and sometimes impossible if the trap was set across a deep pothole. When sampling was attempted on July 31, and later, the separation of the numerous tadpoles from the samples in the field to prevent destructive sampling of these vertebrates became a serious problem. However, a series of soil sieves was used to separate most of the tadpoles, their numbers were then noted and they were returned to the lake.

The problem of a shadow being cast by the suspended trap was minimized by dropping the traps in the early morning or late afternoon, except during the diel study. The disturbance of the water and lake bottom by the other researchers, a microbiologist and a water chemist who took concurrent samples, was a possible source of error, but the use of alternate sampling dates could reduce this possible source of error in future studies.

One of the most serious problems encountered in sampling the study playa was the time required in taking the trap samples. A time analysis shows that a minimum of 30 minutes is required to take each trap sample (dipping water from the trap, taking the 3-4 cm mud sample, and the 10 cm core sample), the supplementary 5m D frame sweep net sample, and the standard 4 pint plankton sample. In addition it takes 1-1/2 to 2 hours to drop the 10 traps prior to initiation of actual sampling. This results in a greater time-of-day factor entering into the sweep net and plankton samples on days when the traps are used.

Sorting and Weighing Procedures -- The preserved samples are hand sorted, using a dissecting scope and a white enamel pan. The time involved in sorting is extremely variable, depending on the amount of soil and plant material collected with any one sample. Generally, the net samples can be sorted in 5-30 minutes, while the trap samples, which usually contain some soil, require from 15 minutes to as long as 6 hours in some extreme cases. The average time for sorting and recording the count of a net sample is approximately 30 minutes, and the same procedure for a trap sample requires approximately two hours.

After sorting to obvious taxa, the specimens are measured according to body length to the nearest millimeter and placed in particular size groups. Some groups such as the Anostraca may have up to 18 larval stages, and will have to be arbitrarily divided into size group intervals, but most larval insects will have a much smaller number of instars and thus be easier to group. The time required for this procedure is directly dependent upon the number of specimens to be measured.

The measured specimens are placed in one-dram vials (or larger if necessary) and placed in a drying oven (set at 70 degrees C) for 48 hours, after which they are removed and weighed. The weights are recorded to the nearest 0.01 mg. The time required for weighing will also be directly proportional to the number of groups which need to be weighed.

After enough of the specimens have been measured and weighed, a correlation of size to weight will be calculated, in hopes of eliminating the need to weigh all the specimens in a given set of samples.

Experimental design -- Random sampling based on ten fixed sampling points. (see map, Fig. 1).

Plant Studies

Inventory of Study Area -- In early 1970, a specific study area was delimited within the Jornada Validation Site Area (see 1970 Desert Biome Reports - Section 2.2.2.3.1-10). This study was sampled for plant cover and composition by methods described in the above mentioned report. Precent cover data for the 25 most prevalent species at 208 random sampling positions or transects was subjected to association analysis (Williams and Lambert, 1959) to determine community relationships. The result of this subdivisive technique was to first split the playa area from non-playa areas. The latter was then divided into those transects representing creosote-bush (*Larrea divaricata*) and those representing grassland. The creosote-bush area split into a few transects heavy in russian thistle (*Salsola kali*), indicating disturbance areas and into those transects representing relatively undisturbed creosote-bush areas. This latter group split into a set of transects of creosote-bush with mormon-tea (*Ephedra trifurca*) and fluff-grass (*Tridens pulchellus*) as important components and into a set of nearly pure creosote-bush transects. The grassland split into those areas with mormon-tea (*Ephedra trifurca*) as a component in the transect and into those areas with mesquite (*Prosopis juliflora*) as a component. The p cent cover of the species in each of these communities is shown in Table 1. In general, most species show a consistent fidelity to one or two communities. However, a few species such as fluff-grass (*Tridens pulchellus*) occur in almost all the communities. Considering the total area covered by each of the communities (Table 1), the creosote-bush dominated comm nities occupy most of the study area, but there are significant areas of grassland.

Playa Bottom Productivity Studies. The playa bottom can be divided into two major communities, one dominated by vine-mesquite gras (*Panicum obtusum*) and the other by tobosa (*Hilaria mutica*). A number of other species occur on the playa bottom, many showing a high fidelity to one of the two communities. These two playa bottom communities were sampled by the harvest method (see 1970 Desert Biome Reports) seven times in 1970. The time span covered was early spring to early winter. The seasonal trends in standing crop biomass (kg/ha) for vine-mesquite grass and tobosa are shown in Table 2. Vine-mesquite grass trends in living, standing dead, and litter plant parts are illustrated in Figure 3. for May to October, 1970. These trends are quite marked and fit what one might hypothesize given the environmental conditions of the Jornada Playa. In the spring and early summer, very little change occurs. There is a slight decrease in amount of green living biomass. Over this same period, there was a slight increase in litter with a corresponding decrease in standing dead. With the flooding of the playa in late July and the following disappearance of the standing water in mid-August, there was a subsequent burst of growth from 22 kg/ha to 70 kg/ha in less than a month. Vine-mesquite grass reached full seed production by late October, with about 80 kg/ha of seed heads. For tobosa, the same general seasonal trends held except that the growth response is generally a few weeks earlier because of its location at the edge of the playa giving it an earlier start as the playa dried. A small amount of living basal leaves persisted under the heavy standing dead cover of tobosa into December.

In summary, the findings for the 1970 sampling of the playa bottom characterized the growth responses of the two major species occurring on the bottom of the playa, vine-mesquite grass and tobosa. These responses seem to relate strongly to the environmental conditions of the site.

Table 1. Average percent cover[1] for 25 species in 6 plant communities on the Jornada Study Area and percentage of the entire study area occupied by each community based on the number of random samples representing each community as a percent of the total (208).

	COMMUNITIES					
	Playa Bottom & Fringe	Creosote-Bush + Salsola	Creosote-Bush + Ephedra	Creosote-Bush	Grassland + Ephedra	Grassland + Prosopis
SPECIES - PERCENT COVER						
Aristida adscensioni		.3			.4	
Aristida purpurea					.3	.8
Bouteloua eriopoda		.6			1.6	3.7
Hilaria mutica	1.2					2.1
Muhlenbergia porteri			1.7	.7	.5	
Munroa squarrosa					.1	
Panicum obtusum	19.6					
Scleropogon brevifolius		.6			.5	2.5
Sporobolus flexuosus						.5
Tridens pulchellus		1.5	1.8	.7	2.2	1.3
Croton corymbulosus						
Ephedra torreyana						
Ephedra trifurca	.6	.4	1.2		1.7	.5
Flourensia cernus			.8	.8		
Gutierrezia sarothrae			.8	.2	.8	.9
Larrae divaricata		4.8	12.0	18.9		
Opuntia sp.						
Parthenium incanum						
Prosopis juliflora	1.9			1.9	.4	1.5
Yucca baccata				.2		
Yucca elata		.3	.3	.2	.2	
Zinnia pumila				.1		
Eriogonum sp.						
Perezia nana						
Salsola kali		1.5			.7	.5

[1]Cover values of less than 1.% are not shown.

Table 2. Seasonal trends in standing crop biomass (kg/ha) for the major Jornada Playa Bottom species, *Panicum obtusum* (vine-mesquite grass) and *Hilaria mutica* (Tobosa).

		DATE						
SPECIES	Part	2 May	30 May	30 June	17 Aug	10 Sept	20 Oct	10 Dec
Panicum obtusum	Green living	66.9	50.4	39.4	22.4	704.4	753.9	0.0
	Reproductive	0.0	0.0	0.0	19.4	72.2	80.2	76.9
	Standing dead	388.8	163.0	178.2	14.5	8.6	0.0	676.4
	Litter	1090.6	1101.2	1132.7	757.0	260.2	31.6	512.1
	Roots	156.9	35.3	54.4	-[1]	-	-	-
	Total	1703.2	1349.9	1404.7	813.3	1045.4	865.7	1265.4
		2 May	30 May	30 June	10 Aug	5 Sept	22 Oct	8 Dec
Hilaria mutica	Green living	146.6	253.6	62.8	1125.2	2153.6	1859.0	488.4
	Reproductive	0.0	0.0	0.0	33.8	176.4	3.8	0.0
	Standing dead	3834.6	3845.6	3880.6	477.6	2371.8	2499.7	2649.2
	Litter	2114.4	2859.4	5463.4	560.0	3023.2	1841.4	156.2
	Roots	61.8	181.4	93.4	-	-	-	-
	Total	6157.4	7140.4	9500.2	2196.6	7725.0	3704.2	3293.8

[1] The - denotes data which at present is not available due to the time lag in sample processing.

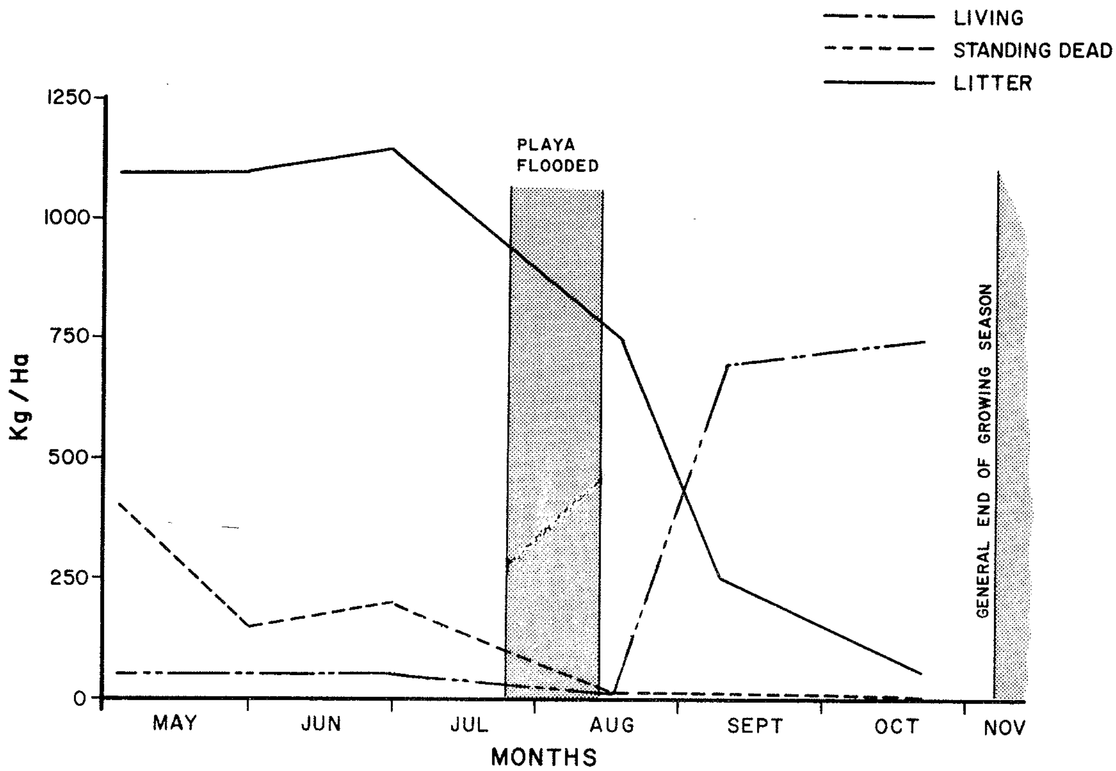

Figure 3. Seasonal changes in biomass of Panicum obtsusum on the Jornada playa 1970.

Playa Fringe Productivity Studies -- In order to study the interaction of the seasonally aquatic playa and the terrestrial area surrounding it, a 100m fringe around the playa was delimited. The vegetation around the playa, i.e. the fringe, varies from dense mesquite thickets to more open grassland-shrub communities. This variation was quantified into density, size class, and biomass estimates for the different directions around the playa by the sampling design described in the 1970 Desert Biome reports section 2.2.2.3.7. The findings for the entire fringe are shown in Table 3. Gutierrezia sarothrae (snakeweed) had the highest density (569 ind/ha) of all the shrubs measured. Prosopis juliflora (mesquite) was second in density and has by far the greatest canopy volume and will thus probably have the greatest biomass. As indicated previously and as shown in Table 4, the distribution of the shrubs around the frings is not uniform. For example, mesquite has a high density and volume on the North fringe compared to the East. The South fringe has the lowest density of mesquite but the second highest canopy volume, indicating this area is characterized by large individuals. Larrea divaricata (creosote-bush) occurs in low numbers on the N and S frings, but not at all on the E and W.

Table 3. Density, canopy volume and standing crop biomass for shrub species occurring in the 100m fringe around the Jornada Playa study site.

SPECIES	DENSITY Ind/ha	CANOPY VOLUME m^3/ha[1]	FORMULA	STANDING CROP BIOMASS kg/ha[2]
Prosopis juliflora	480	27,391	oblate spheroid	-
Ephedra torreyana	152	8.5	right cylinder	-
Ephedra trifurca	408	295	right cylinder	-
Gutierrezia sarothrae	569	190	prolate spheroid	-
Larrea divaricata	22	4.3	inverted cone	-
Yucca elata	153	1.3	cylinder (caudes)	-
			inv. cone (leaves)	-
Atriplex canescens	2	10.7	prolate spheroid	-

1. The formula used to calculate canopy volumes for each species was selected to best fit the general shape of the species on the study area. These formuli may not necessarily give the best relation of volume to biomass, thus may be changed.

2. The studies relating biomass to canopy volume for the above species are still in progress.

Table 4. Density (ind/ha) and canopy volume (m^3/ha) shrub species occurring in each directional quadrant around the 100m fringe of the Jornada Playa study site.

SPECIES	NORTH Ind/ha	NORTH m^3/ha	EAST Ind/ha	EAST m^3/ha	SOUTH Ind/ha	SOUTH m^3/ha	WEST Ind/ha	WEST m^3/ha
Prosopis juliflora	770	42,784	346	13,677	280	33,829	468	21,075
Ephedra torreyana	278	13.9	124	5.4	64	2.5	118	10.8
Ephedra trifurca	660	349	250	154	403	389	318	314
Gutierrezia sarothrae	1086	308	258	92	494	178	418	180
Larrea divaricata	10	5.7	0	0	97	14.4	0	0
Yucca elata	208	1.5	154	1.2	131	1.5	112	1.0
Atriplex canescens	0	0	8	40	0	0	0	0

In summary, this data will be important, as indicated in a later section on the distribution of the animals.

Literature Citations --

Williams, W. T. and J. M. Lambert. 1959. Multivariate methods in plant ecology. I. Association analysis in plant communities. J. Ecol. 47: 83-101.

Abiotic Studies

Abiotic parameters measured in 1970 included precipitation, air temperature, air relative humidity, incoming solar radiation, soil temperature, and soil moisture tensions. These measures were made at the southwest edge of the playa in an open area. Details on instrumentation used are given in the 1970 Desert Biome Reports - Section 2.2.2.3.9.10.

The precipitation pattern in 1970 followed the general pattern for the Las Cruces area where over %0% of the rainfall occurs in late summer (Taft & Overpeck, 1968). The 105 year average at Las Cruces is 8.33 inches. The total precipitation measured at the study site for March through December was slightly over 5 inches. This was about 2 inches more than that received at Las Cruces, 25 mi. to the south. Las Cruces had the driest year on record, with 3.4 inches. Almost 3 inches of the 5 inches received at the playa occurred the last two weeks in July (Figure 4). This amount of precipitation was sufficient to flood the playa for a period of about 3 weeks, which was long enough to trigger a multitude of biological activities from rapid rates of litter decomposition to successful spade-foot toad reproduction. There is little question that the flooding of the playa was the most significant event on the study site in 1970.

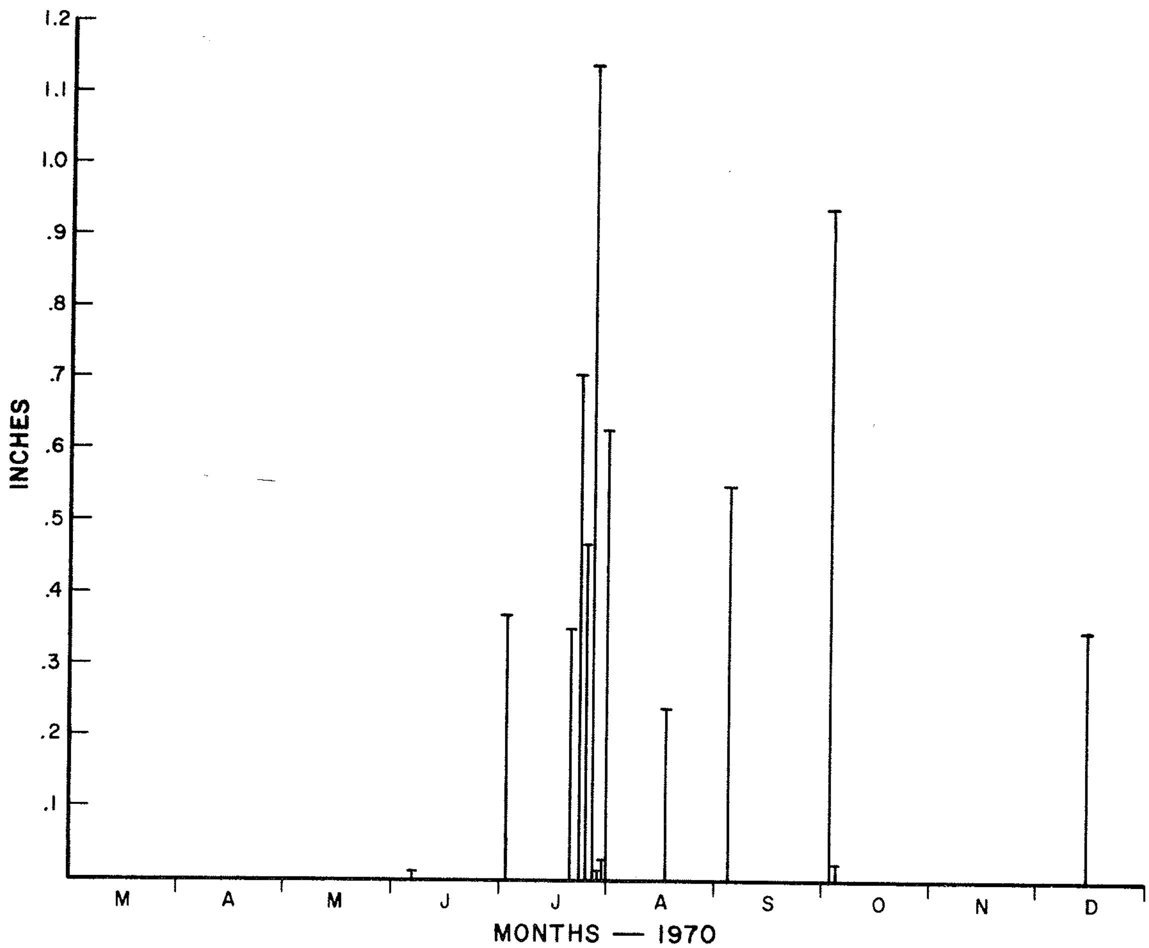

Figure 4. Precipitation at the Jornada playa weather station, 1970.

Air temperatures at the study site in 1970 were recorded continuously except for brief periods of hygrothermograph breakdown. This data has been summarized as weekly maximum and minimum temperatures for April through December (Figure 5). The general seasonal trends at the site follow what one might expect from past data from Las Cruces (Taft & Overpeck, 1968). A five week hot spell occurred from the second week in June to mid July, with maximum temperatures over 100° F for most days. Weekly minimums follow a fairly smooth seasonal curve. The last week with freezing temperatures was the 1st week in May. The first fall freeze occurred the 2nd week of October. Thus the freeze free period in 1970 was 22 weeks long or about 5 months.

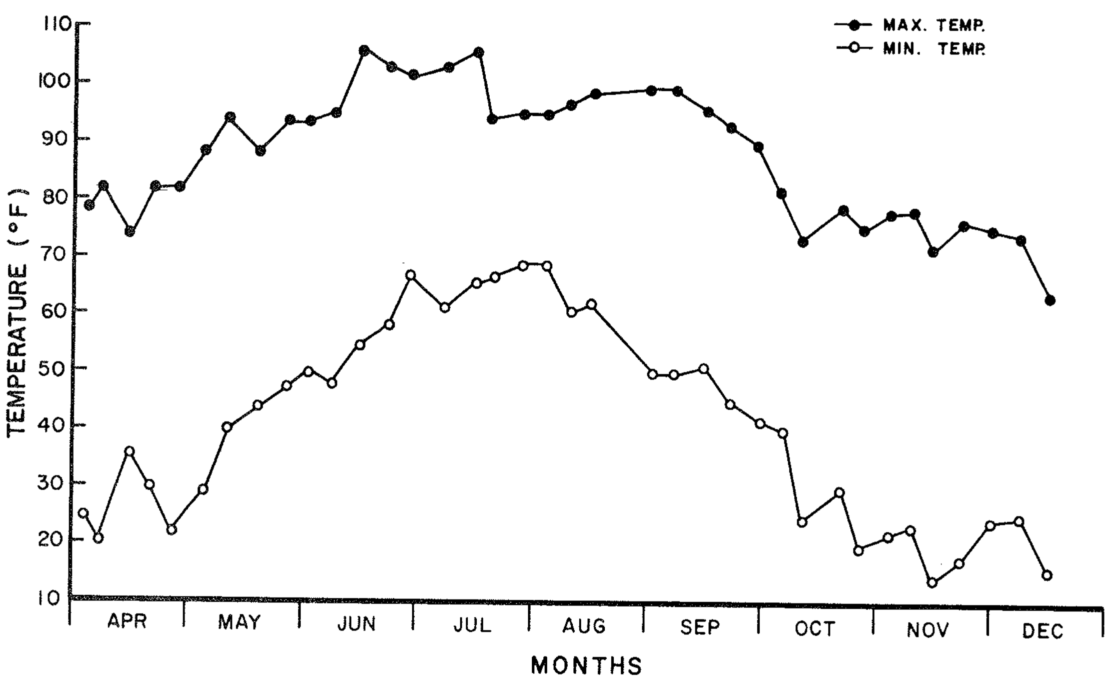

Figure 5. Seasonal changes in maximum and minimum ambient temperatures at the Jornada playa, 1970.

Air relative humidities at the study site in 1970 were also recorded continuously with the hygrothermograph. Weekly maximum and minimums are shown in Figure 6. Maximums were highly variable due to the unpredictability of the occurrence of precipitation or early morning cloudiness during any given week. The data does show that the humidity will probably climb above 60 per cent at least one day out of any week. As an indication of environmental stress, the weekly minimum humidities are probably more meaningful. In early April, the humidity dropped as low as 5 per-cent. Even during the rainy period of late July, there were days when the humidity dropped to nearly 20 per cent. In general, one can state that in this desert environment, one can expect low humidities any time of the year.

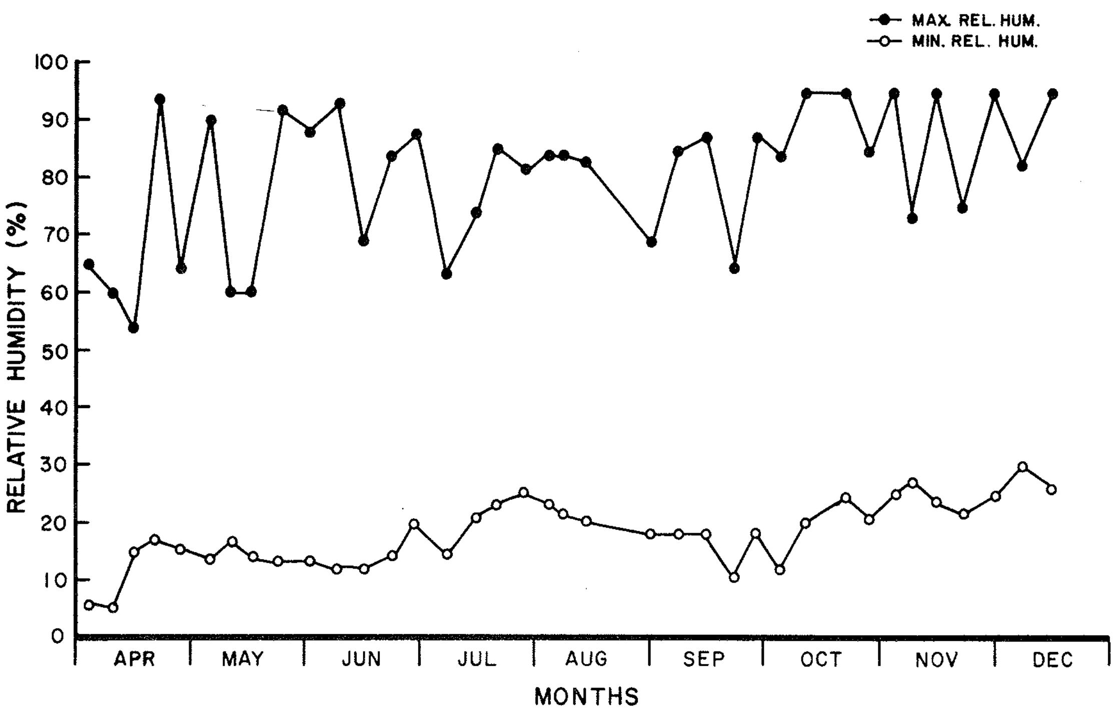

Figure 6. Seasonal changes in maximum and minimum relative humidity at the Jornada playa, 1970.

The Jornada Validation Site (Playa - NMSU Ranch)

Incoming solar radiation was weekly maximums in 1970 is shown in Fig. 7 for the study site from April to December. A maximum of about 800 Cal/cm^2/day occurred in May, with other high peaks in June and July. By December, the energy input had dropped to about 250 Cal/cm^2/day. These seasonal trends in solar radiation follow what one would expect for the latitute of the study site. During cloudy days, the total energy input had dropped to less than 100 Cal/cm^2/day.

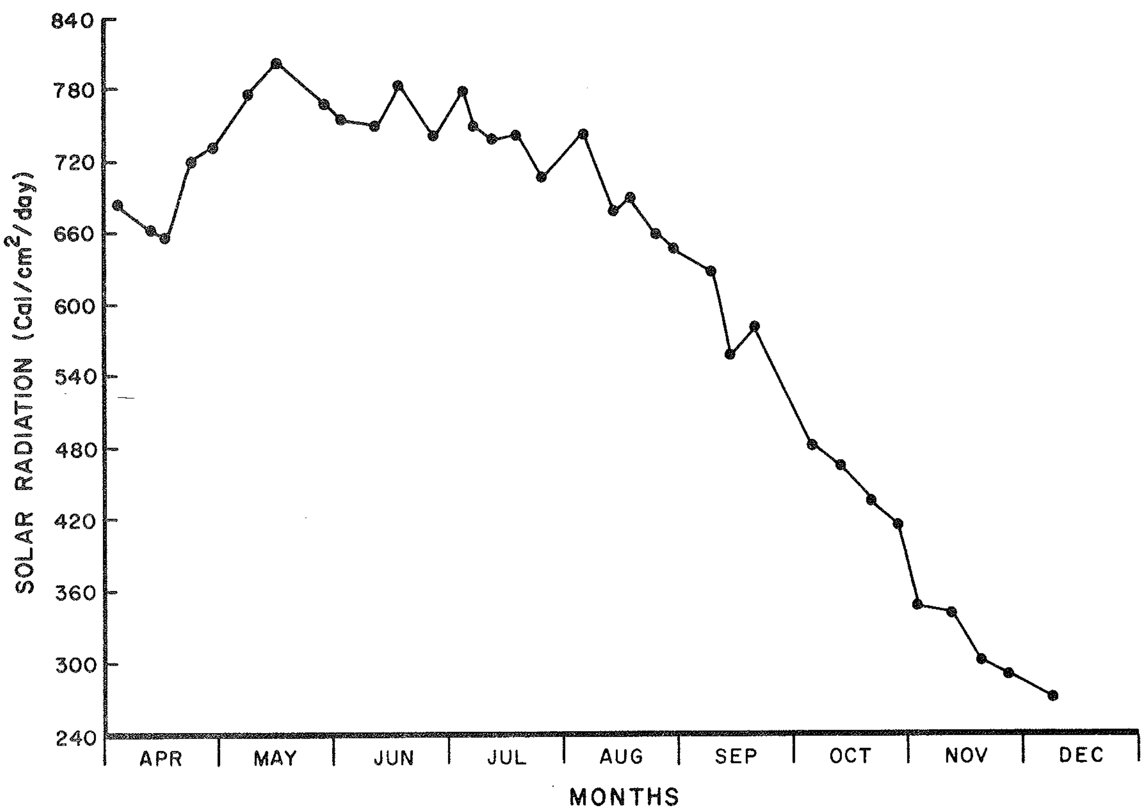

Figure 7. Seasonal changes in solar radiation at the Jornada playa, 1970.

Soil temperature and moisture tension data has not been completely summarized yet. Calibration curves for estimating soil water potentials from gypsum soil block resistances are nearing the final stages. In our desert soils where water tensions may exceed 1000 atm. in the dry surface layers, measurement of these kinds of tension presents a real challenge.

Wind speed and direction instrumentation will be placed at the study site in 1971.

Literature Cited --

Taft, P. H. and J. C. Overpeck. 1968. Climate Calendar, New Mexico State University, Las Cruces, New Mexico, 1851 to 1966. Research Report 138. Agr. Exp. Sta. NMSU.

Animal Studies

Lagamorph census -- Indices of abundance of the black-tailed jackrabbit, Lepus californicus and the cottontail, Sylvilagus auduboni are summarized in Table 5. Immatures of both species were seen from mid-August and undoubtedly contribute to the higher density estimates for September and early November. Quail hunting season began at the end of October and we saw hunters with recently killed cottontails and jackrabbits on areas near the study area. Hunting pressure could result in a reduced population base and a modification of flushing behavior which affect the density index.

Table 5. Indicies of densities of lagomorph populations in areas adjacent to the NMSU Ranch Playa. Density index based on a modification of the King method (Smithm 1966 and Hayne, 1949).

Date	Density Index (number/hectare) Lepus californicus	Sylvilagus auduboni
23 June 1970	0.40	0.06
10 July 1970	0.50	0.25
1 August 1970	0.50	0.19
22 September 1970	1.00	0.94
7 November 1970	1.21	0.71
21 November 1970	0.50	0.58
27 November 1970	0.51	0.10

Either or both lagamorphs exhibit pruning behavior. They clip branches from shrubs, often leaving large sections of the clipped branch uneaten. Creosotebush, Larrea divaricata, appears to be a favorite target for this kind of behavior. One species of mormon tea, Ephedra torreyana, is heavily pruned by lagamorphs while the other species, Ephedra trifurca, appears to be unpalatable to lagamorphs.

Rabbit droppings collected from $18m^2$ quadrats indicate lagamorph grazing activity on the playa bottom. It may be possible to estimate lagamorph activity on the playa bottom when these data are analyzed.

Rodents -- At the time that this report was being written, the vertebrate data had not been transferred to IBM cards. Consequently some analyses such as movements, growth of individual animals, etc. were not completed. Data readily compiled from the original sheets has been summarized in a series of tables and figures.

The trapping records clearly showed that there were two distinct small mammal communities. Deer mice, Peromyscus maniculatus, and silky pocket mice, Perognathus flavus, were essentially confined to the Panicum community on the playa bottom. Kangaroo rats, Dipodomys merriami were taken on the playa bottom only at trapping stations adjacent to mesquite clumps. Following flooding in late July, marked Peromyscus from the playa were taken at trap stations on the fringe. However, after the playa dried, Peromyscus returned to the playa bottom. All other species of small mammals can be assigned to playa fringe community except Reithrodontomys and Sigmadon which may be confined to the tabosa grass (Hilaria) community but we do not have sufficient records to verify this (Table 6).

Table 6. Small mammals taken on mammal trapping grids (Fig. 2). Species with sufficient recaptures for computation of Lincoln Index indicated by *. Other densities equal total number of animals trapped.

Species	North	Density Estimate South	East	West
Dipodomys ordii	5	4	6	2
Dipodomys spectabilis	3	2[Z]	2[Z]	0
Neotoma albigula	3	2	3	1
Onychomys leucogaster	1	1	0	0
Perognathus flavus	3	3	3	4
Perognathus penincillatus	15.3*	16*	11*	1
Peromyscus maniculatus	14.0*	34.0[2] (32.3)	6*	18.7[2] (12)*
Reithro donytomys megalotis	0	0	0	1
Sigmodon hispidus	0	0	0	2

The only species for which we had a sufficient number of recaptures to apply a continuous census population estimator was Dipodomys merriami. Density estimates for Dipodomys merriami are summarized in Table (7). The highest population densities in Dipodomys merriami were on the north and south grids. These grids had a greater density and canopy volume of Prosopis and Larrea than the other grids (Table 4). It appears that some of the relationships suggested by Rosenzweig and Winakus (1970) are not supported by our data. However, additional information is necessary to test their hypotheses.

Table 7. Densities of Dipodomys merriami on the 0.45 hectare sample areas on the fringe of the Jornada Playa during 1970 as estimated by the Schnabel Method (Smith 1966).

Date	Population Estimate Grid Identification[1]			
	North	South	East	West
March 1		48		
March 8		54.5		
April 3			12.0	
May 9, 16+	18	50.8	12.7+	10.6+
June 26, 27+	20	49.3	13.3+	9.8+
July 28		48.9	13.3	
August 23, 24+	22+	48.1	13.3	11.5+
September 19, 24+	26.8+	47.2	14.1	10.3+
October 27		48.7	14.3	

[1] refers to grid identification as shown in Figure
+ indicates trapping on date indicated by +

Since D. spectabilis has a very distinctive mound, we are confident that our data for this species represents an absolute number. Our density estimates for P. penincillatus are affected by the lack of success in trapping this species during the colder months of the year. Based on the density estimates and biomass data in Figures 7 and 8 and Table 8, it is apparent that the dominant and probably most important rodents in this ecosystem are D. merriami and P. maniclatus.

Some indication of the population structure and reproductive cycles in these species can be obtained by examination of Figs. 7 and 8 and Table 9. D. merriami probably produced two litters. The first probably being recruited into the trappable population in April or May and the second in September. Reproductive activity had ceased in D. merriami by October (Table 9). In our most recent trapping (mid-January) we observed that the testes were beginning to descend in approximately 50% of the D. merriami males. P. maniculatus probably had litters before and after the playa flooded. We noted a number of previously unmarked P. maniculatus in our August trapping that we classified as either pre or post breeding which could have been immatures of adult size.

Antelope -- A herd of antelope spend varying periods of time on the watershed that has been selected as the Jornada validation site. This herd has been studied for several years by the Wildlife Department at NMSU which will provide information on reproductive success, food habits, etc. Beginning in late October, this herd apparently spent considerable time around the playa using the water hole and the stem ripened Panicum. The grazing activity of the herd is visible but may be impossible to quantify since our cattle exclosures pose no barrier to these animals. The following notes summarize our chance counts of the herd and their location:

10 November	31 on playa
24 November	11 on playa
5 December	21 on playa
8 December	17 on playa
8 January 1971 (15-20 of these were immature)	54 1 mile NE of playa
11 January 1971	0.5 mi. east of playa

Birds -- The results of the avian census for the playa and fringe area are summarized below. additional field work was conducted on the bajada site in preparation for the 1971 validation studies. Accurate avian census for 1971 will require a gridded map of the area in order to properly locate breeding pairs and map nest sites.

Throughout the period during which the playa was flooded, numerous wadering birds and some ducks spent varying periods of time feeding on the playa. Any attempt to quantify the importance of these transients in the economy of the playa will require extended periods of observation. We had not anticipated this problem during the first year of our operation and consequently have only scattered sightings of these transients which are of limited value.

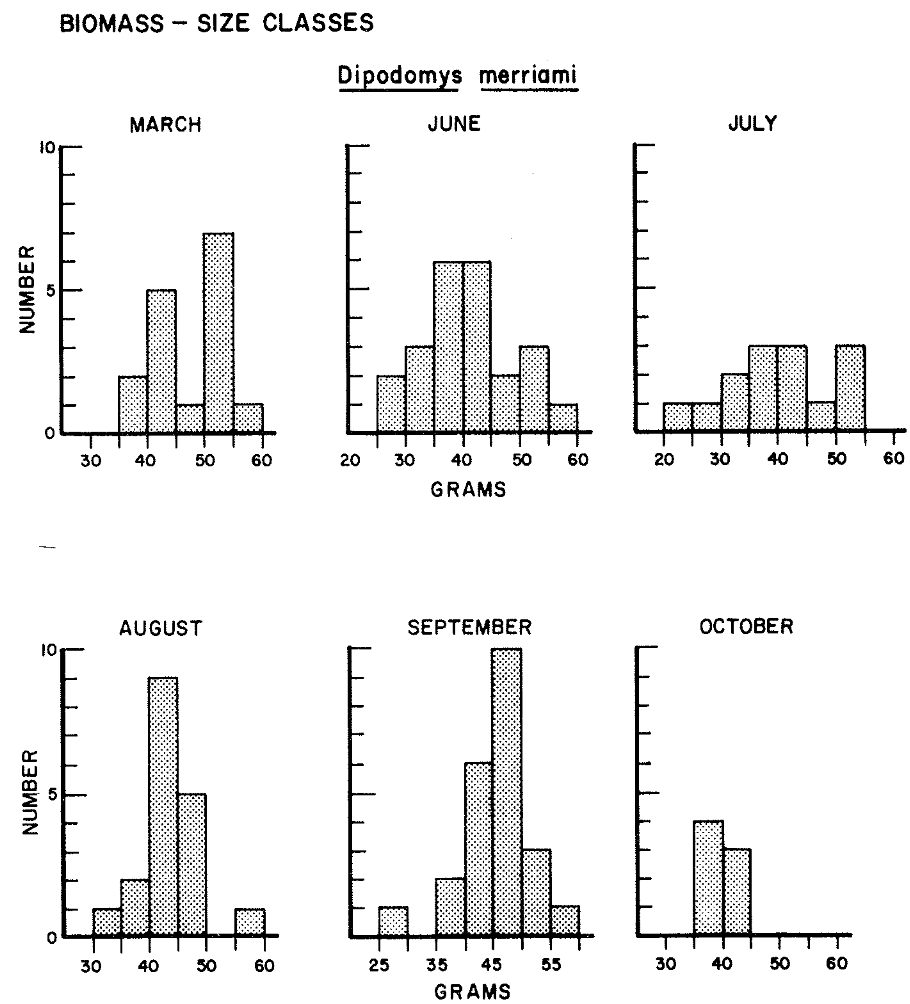

Figure 7. Size classes of Dipodomys merriami based on live weight on the various sampling dates at the Jornada playa study area during 1970.

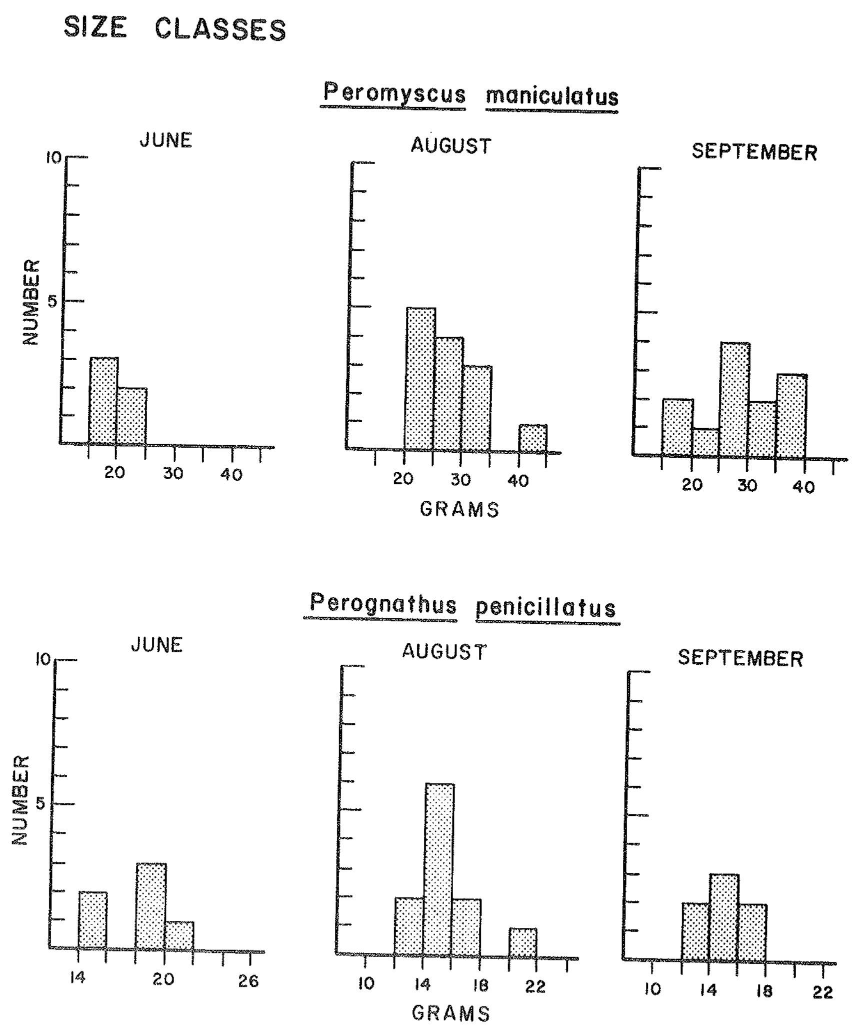

Figure 8. Size classes of Peromyscus maniculatus and Perognathus penincillatus based on live weight on the various sampling dates at the Jornada playa study area during 1970.

Table 8. Mean live weights for rodent species taken on the NMSU Ranch playa study area during the 1970 study period.

Species	Month	X	Biomass in gms range	N
Dipodomys merriami	March	45.02	37-59	11
	June	41.04	28-55	23
	July	39.07	23-53	14
	August	43.3	32-56	18
	September	45.4	26-57	23
	October	39.7	38-44	7
Dipodomys spectabilis	June	104.2	56-135	6
	August	155.6	136-179	5
	September	121	144-128	3
	October	137	---	2
Peromyscus maniculatus	March	30	25-35	3
	June	18	15-20	5
	August	27.1	21-40	13
	September	28.3	18-39	12
Perognathus penincillatus	June	17.5	15-20	6
	July	16.6	14-20	5
	August	14.9	12-20	11
	September	14.7	13-16	7
Neotoma albigulus[7]		147.8	94-204	10
Perognathus flavus[7]		8.7	5-13	10
Dipodomys ordii[7]		52	40-61	9

[7] data summarized for all trapping dates.

Table 9. Breeding status of Dipodomys merriami and Peromyscus maniculatus taken on the NMSU Ranch playa study area during 1970.

		Breeding Condition				
Species	Date	Immature	Pregnant	Testes Scrotal	Lactating	Post or Pre-breeding
Dipodomys merriami	May 16	1	1	5	4	2
	June 26/27	4	0	8	6	4
	July 28	3	1	3	1	2
	August 23	0	0	8	4	4
	September 23	1	0	4	5	14
	October 27	0	0	0	0	11
Peromyscus maniculatus	May 16	-	-	-	1	2
	June 26/27	-	-	2	4	2
	August 23	0	3	3	1	5
	September 23	1	1	2	4	2

Playa birds - July 1970

A. Definite breeding records:

Roadrunner - 1 active nest, S; produced at least 3 young
Cactus Wren - 1 active nest, N; 3 eggs on 6 July

B. Apparent breeding resident pairs (based upon repeated sightings and/or singing males)

Species	Quadrant N	E	S	W	Total	Remarks
Scaled Quail			1		1+	A pair with young; much calling in area indicates additional pair
Roadrunner			1		1	Nest, see above
Cactus Wren	1		1		2	1 active nest, see above; group of 3-5 in S, probably family
Loggerhead Shrike	1	1	1		3	Perhaps overestimated, very mobile
Mockingbird	1	1		1	3	Perhaps overestimated, very mobile
Crissal Thrasher	1				1	Based on singing and sightings of pair in both E and N sectors
Scott Oriole	1				1	A female and male at different times
Black-throated sparrow	2-3				2-3	Based on repeated sightings and singing males 4-5 (family?) seen once
Totals	7-8	2	4	1	14-15	

C. Others (all summer residents of general area, but actual nesting in study dubious or improbable).

Swainson Haek - 1 seen over area.
Lesser Nighthawk - seen several times over area
Mourning Dove - flushed from playa bottom a number of times
Ash-throated Flycatcher - individual seen in northern fringe 3 times; each time it flew out of area; possibly nesting on area
White-necked Raven - one seen on area; flew in, perched; flew out.

Summary

Field work - are visited on 3, 6, 7, 9, 13, 16, 20 and 21 July. Playa fringe searched systematically on 3, 6, 7, July using spot mapping technique and searching for nests (2 people worked area on 6 July).

Results - Findings summarized above. Many abandoned nests found but only 2 active ones. Height of nesting season was obviously past. Counts of breeding pairs are, therefore, less accurate than ones made within the principal breeding season.

Bajada Birds - July 1970

The upland, or bajada, portion of the Jornada desert study area was cruised in July 1970 in order to determine the species composition of the breeding avifauna and some idea of the density and habitat distribution of the species. The method was systematic cruising, usually by two observers (R. J. Raitt, R. L. Maze), with greatest concentration on the area in and adjacent to the principal arroyo of the watershed. This procedure was followed on 9, 13, 16 and 21 July.

The following is the list of species observed, with approximate numbers of pairs along one mile of arroyo in parentheses:

Scaled Quail (1)
Roadrunner (1)
Ladder-backed Woodpecker (1)
Ash-throated Flycatcher (2)
Verdin (4)
Cactus Wren (2-3)
Mockingbird (1)
Crissal Thrasher (1)
Black-tailed Gnatchatcher (4-5)
Loggerhead Shrike (1)
Scott Oriole (1)
Brown-headed Cowbird (1)
Pyrrhuloxia (1)
House Finch (1)
Black-throated Sparrow (more than 5, plus many others away from arroyo)

Arthropod census -- The invertebrate data had not been transfered to IBM cards before this report was written. Therefore a more refined presentation of data based on families and genera of insects cannot be made.

Figures 9, 10, 11, and 12 summarize the percent of the total sample by order for the arthropods sampled at different months on P. obtusum and H. mutica. The most numerous Hymenopteran on both H. mutica and P. obtusum was a small formicid (Prenolipis imparis - ref. Smith, 1947) which remained relatively important in the tabosa (H. mutica) on all sampling dates but was not active at all on P. obtusum following flooding of the playa and vegetative growth of P. obtusum. During the growth period of P. obtusum two species of Lygaeidae (Hemiptera) predominate. These species reach maximum importance with the setting of seed heads. Sweet (pers. comm.) indicated that many Lygaeidae are important as seed eaters. This supposition should be examined during the 1971 period.

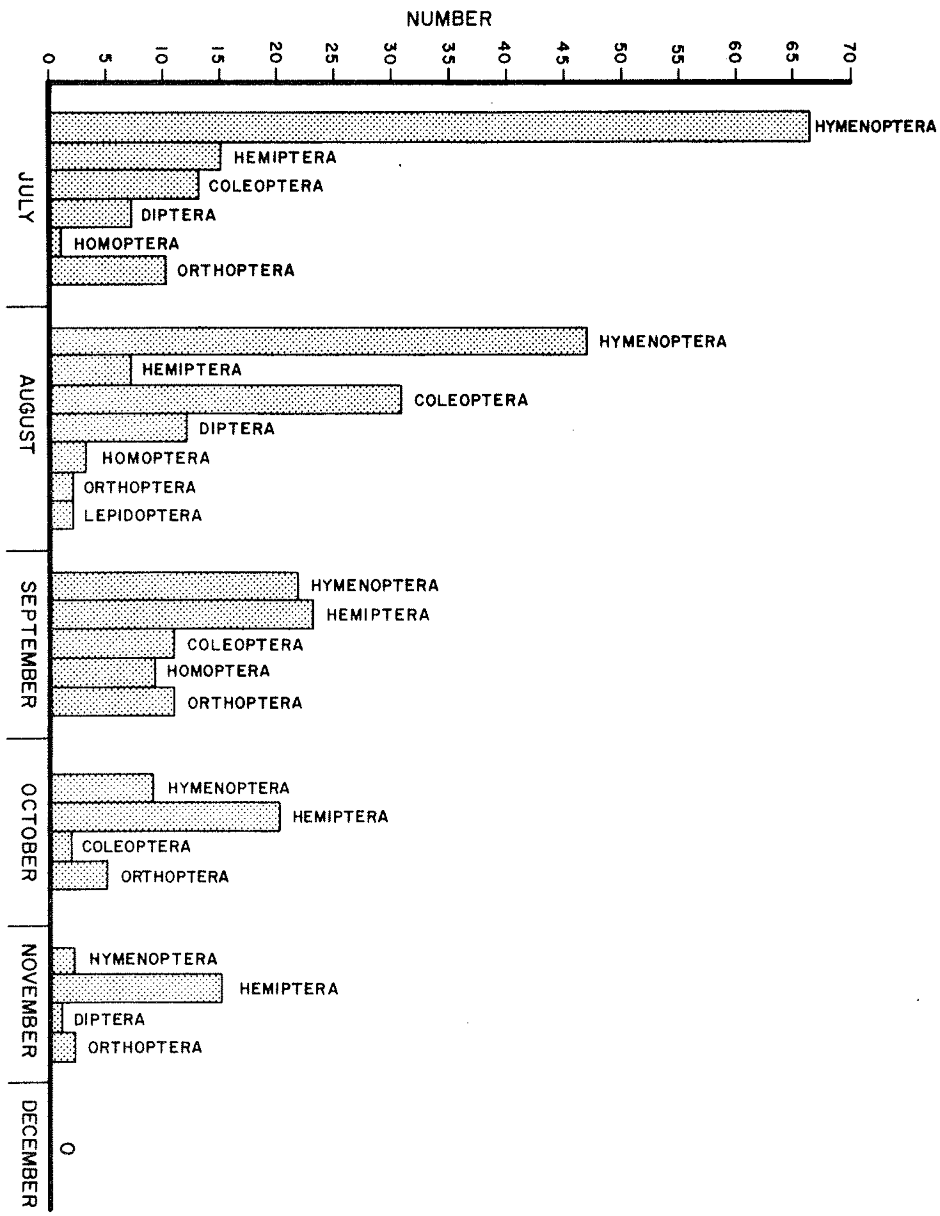

Figure 9. Numbers of arthropods of the important orders taken on Panicum obtusum by sweep netting during 1970.

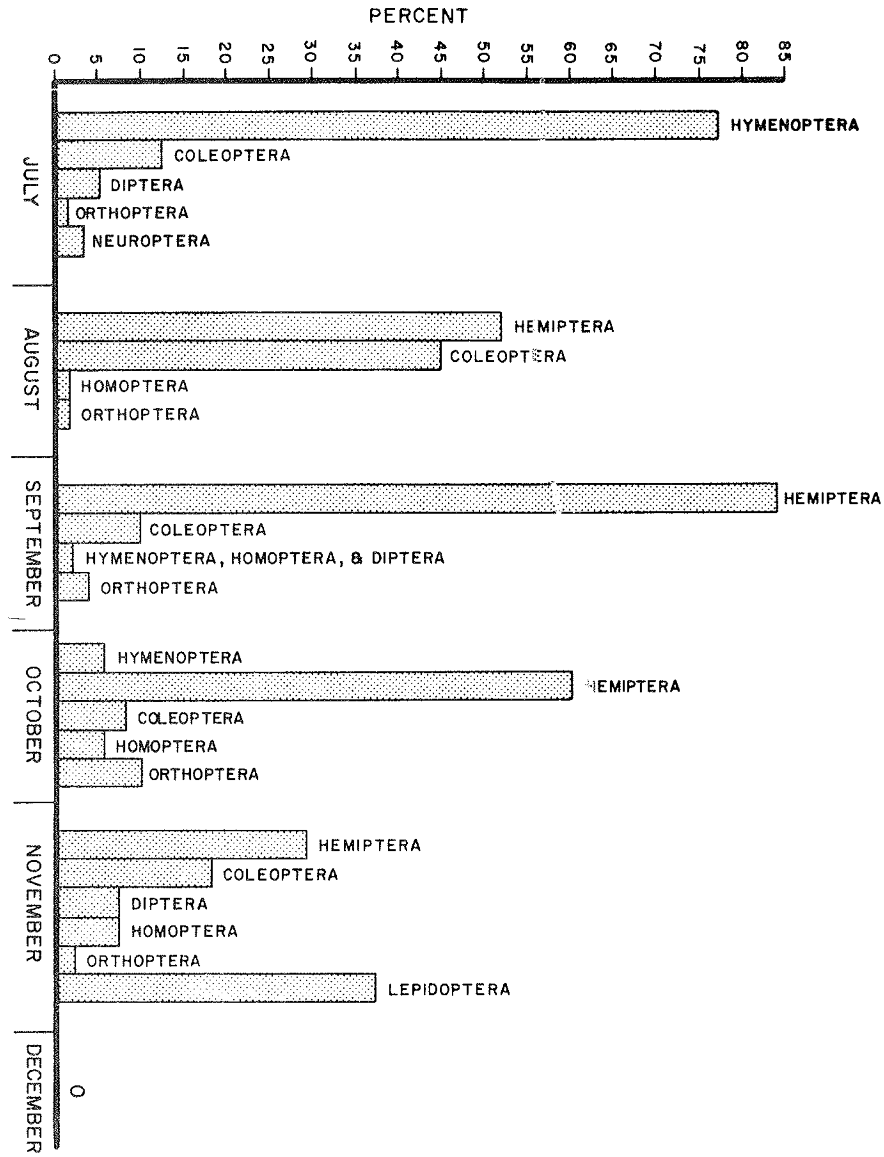

Figure 10. The percent of the total sample represented by arthropods of the indicated orders on *Panicum obtusum* during 1970.

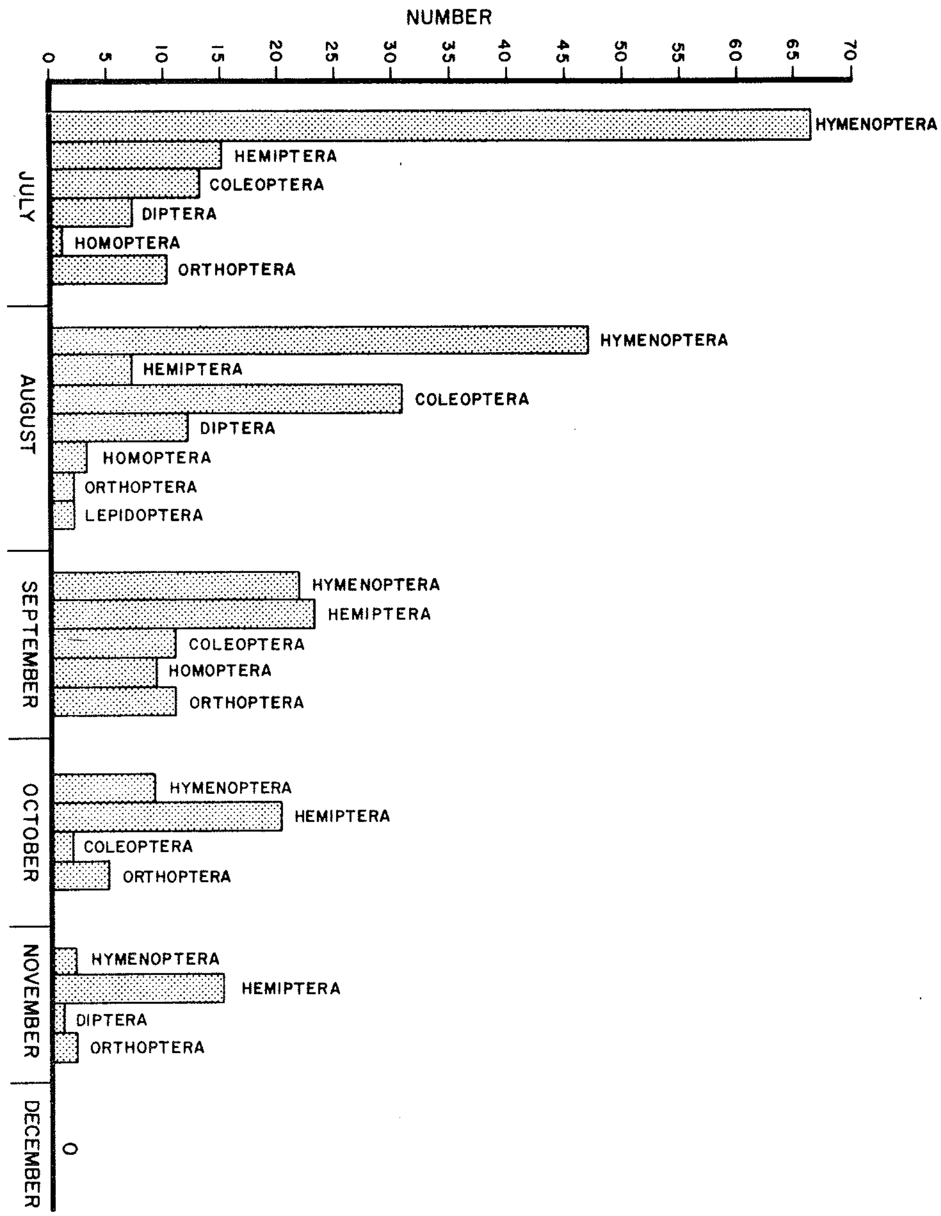

Figure 11. Numbers of arthropods of the important orders taken on Hilaria mutica by sweep netting during 1970.

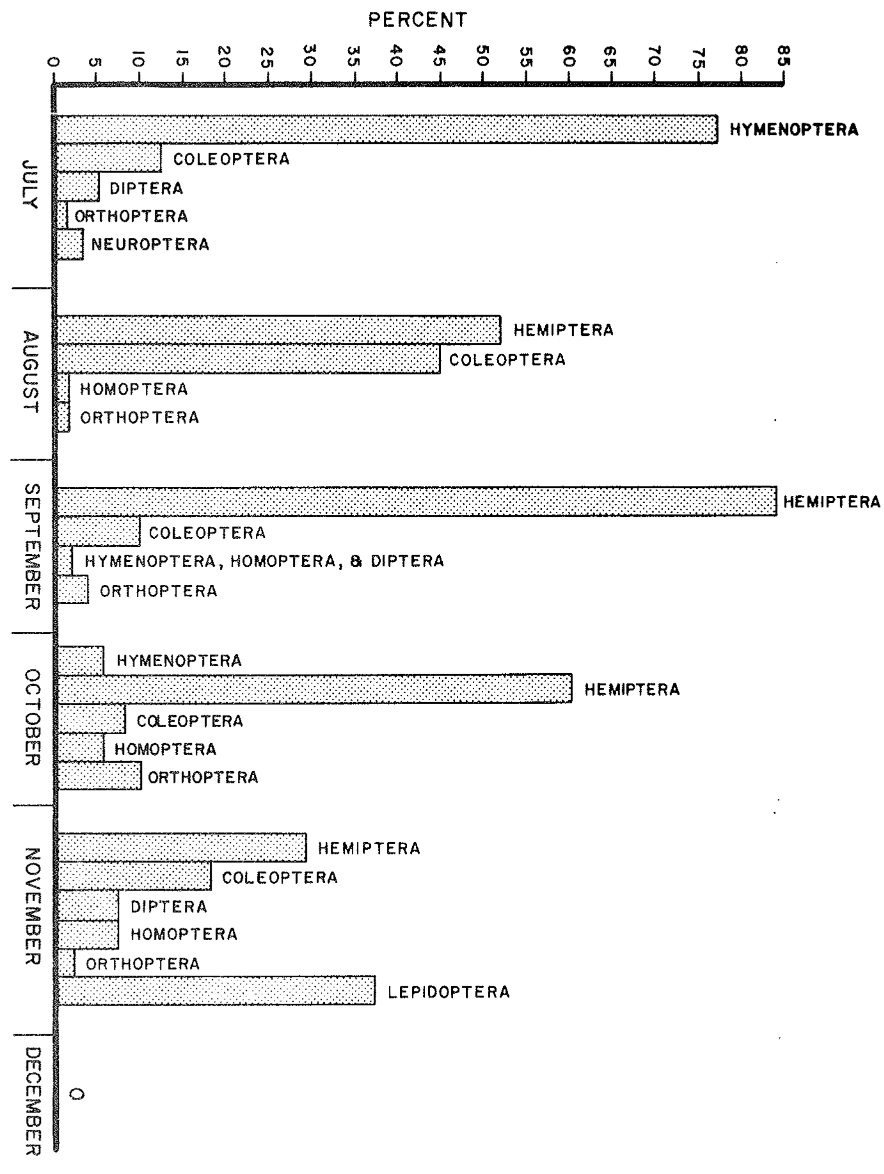

Figure 12. The percent of the total sample represented by arthropods of the indicated orders on Hilaria mutica during 1970.

The Jornada Validation Site (Playa - NMSU Ranch)

The Hemipteraus important in the H. mutica areas were Lygaeidae and Nabidae with Lygaeidae slightly more abundant . Coleoptera on H. mutica were mostly Malacliidae chewing carnivores, (Table 10). Their relative abundance appeared to be a function of productivity and probably of availability of prey species. The other orders found on Hilaria appear to be of less significance but this should be examined by the more quantitative D-Vac methods to be instituted in 1971.

Table 10. Taxa of arthropods collected on the dominant plant species of the Jornada playa and fringe during 1970.

Plant Species Sampled

Mesquite Prosopis juliflora

- Hemiptera
  - Reduviidae
  - Lygaeidae
  - Pentatomidae
    - Chlorochroa sp.
    - Dendrocoris sp.
    - Brochynema sp.
    - Thyanta sp.
- Homoptera
  - Cicadidae
  - Membracidae
  - Dictyopharidae
- Coleoptera
  - Meloidae
    - Epicauta pardalis
    - Epicauta arizonica
    - Epicauta sp.
    - Pyrrota sp.
  - Scarabaeidae
    - Euphoria sp.
    - Polyphaga sp.
  - Cerambycidae
    - Philonoma sp.
    - Stenaspis sp.
  - Buprestidae
    - Acmaeodera amabilis
    - Acmaeodera gibbula
    - Acmaeodera sp.
    - Chrysobothris sp.
    - Chrysobothris sp.
  - Anthicidae
    - Baulius sp.
    - Notoxus sp.
  - Malachiidae
    - Collops vittatus
    - Collops bipunctatus
  - Chrysomelidae
    - Euryscopa lecontei
  - Coccinellidae
    - Olla sp.
    - 3 other unidentified genera
- Diptera
  - Asilidae
    - 3 genera (Erax? + 2 more)
  - Muscidae
  - Sarcophagidae
  - Calliphoridae
    - Lucilia
  - Syrphidae
  - Bombyliidae
- Lepidoptera
  - Lycaenidae
- Hymenoptera
  - Halicitidae
    - Agapostemon
  - Megachilidae
    - Megachile
  - Sphecidae
    - Cerceris
    - Ammophila
    - Chlorion
    - Sceliphron
    - Stenodynerus
  - Pompilidae
    - Pepsis
  - Apidae
    - Xylocopis
    - Apis
  - Argidae
  - Ichneumonidae
  - Formicidae
    - Pogonomyrmex rugosus (winged reproductives)

Hilaria mutica

- Orthoptera
  - Gryllidae
    - Acheta
  - Phasmidae
  - Acrididae
    - Auclocera
    - 2 other genera
- Hemiptera
  - Nabidae
  - Lygaeidae
    - Ischnorpyncus
  - Tingidae
  - Pentatomidae
    - Thyanta
- Homoptera
  - Membracidae
  - Dictyopharidae
  - Fulgoridae
  - Cicadellidae
- Coleoptera
  - Malachiidae
    - Collops quadrimaculosus
    - Collops limbellus
  - Chrysomelidae
    - Altica
    - Euryscopa lecontei
  - Carabidae
  - Meloidae
    - Lytta
  - Curculionidae
  - Cleridae
  - Dermestidae
- Hymenoptera
  - Mutillidae
  - Formicidae
    - Prenolepis imparis
    - Novomessor
  - Chalcidae
  - Argidae
  - Sphecidae
    - Sceliphron
- Diptera
  - Bombyliidae
  - Sarcophagidae

Vine mesquite Panicum obtusum

- Orthoptera
  - Acrididae
    - Auclocera
    - 2 other genera
- Hemiptera
  - Reduviidae
  - Nabidae
  - Pentatomidae
    - Thyanta
  - Lygaeidae
    - Ischnorhyncus
- Homoptera
  - Cicadellidae
    - Oncometopia
    - 1 other genus
- Coleoptera
- Diptera
  - Bombyliidae
    - 2 genera
  - Asilidae
  - Syrphidae
- Neuroptera
  - Myrmeleontidae
- Hymenoptera
  - Argidae
  - Mutillidae
  - Vespidae
  - Sphecidae
  - Andrenidae
  - Formicidae
    - Prenolepis imparis
    - Pogonomyrmex
  - Apidae

Yucca Yucca elata

- Coleoptera
  - Cleridae
- Lepidoptera
  - Arctiidae
- Hymenoptera
  - Sphecidae
    - Sphex
  - Pompilidae
    - Pepsis

Ephedra trifurca

- Lepidoptera
  - 1 unidentified family (gall producer)
  - Arctiidae

Table 10. (Continued) Taxa of arthropods collected on the dominant plant species of the Jornada playa and fringe during 1970.

Plant Species Sampled

Vine mesquite *Panicum obtusum*	Yucca *Yucca elata*	*Ephedra trifurca*
Collops quadrimaculosus		
Collops limbellus		
Chrysomelidae		
Diabotrica tricincta		
Diabotrica duodecimpunctata		
Carabidae		
Calsoma		
Lebia grandis		
Tenebrionidae		
Eleodes longicollis		
Coccinellidae		
Hippodamia convergenus		
Cleridae		
Curculionidae		
Circindellidae		

Gutterezia sarothrae - Snake weed	*Hymenoxis odorata*	Ground Dwellers
Hymenoptera	Homoptera	Cleoptera
Pompilidae	Cicadellidae	Scarabaeidae
Sphecidae	Membracidae	*Canthon*
	Hemiptera	*Trox*
	Lygaeidae	Tenebrionidae
	Harmostes	*Eleodes longicollis*
	Corizus	*Eleodes* (caudifera?)
	Lygaeus	Carabidae
	Nysius	*Calsoma* sp.
	Geocoris	Cicindellidae
	Pentatomidae	Curculionidae
	Thyanta	
	Cleoptera	Orthoptera
	Buprestidae	Gryllidae
	Acmaeodera	
	Coccinellidae	Hymenoptera
	Anthicidae	Mutillidae
	Notoxus	
	Chrysomelidae	
	Altica	
	Bruchidae	
	Algarobius	
	Carabidae	
	Tenebrionidae	

Other important groups associated with the Panicum community included two families of Coleoptera and one species of unidentified moth. In August and September lady bird beetles *Hippodomia* sp. were abundant. An important component of the September Coleoptera was the Chrysomellid, Diabotrica, however, this genus was most numerous on the scattered coyote melon plants *Curcurbita foetidissum*. The presence of *Diabotrica* in *Panicum* may be the result of dispersion from the *dying Curcurbita*. This premise needs to be examined. We cannot explain the relatively large number of Lepitoptera in the November sample.

The can-trap survey of ground arthropods plus general observations indicate that two species of beetles were important on the study area. The Tenebrionid, *Eleodes* sp., was essentially limited to the playa fringe except in areas with very sparse grass cover. The Carabid *Calosoma* was limited to the *Panicum* covered playa bottom. Based on a mark-recapture study with 59 marked Eleodes and 57 marked Calosoma which was initiated 20 September, we estimated 319 *Eleodes*/hectare and 212 *Calosoma*/hectare. Based on qualitative observations, the *Calosoma* population had declined greatly by mid-September. We therefore suggest that these ground beetles are extremely important in the playa system and will increase our efforts to study these populations in subsequent years.

Although quantitative data were not available for insects associated with mesquite (*Prosopis juliflora*), mormon tea (*Ephedra trifurca*), and soaptree yucca (*Yucca elata*) we have qualitative sweep samples taken at several dates during the year. The attached lists indicate groups of insects collected from these plants. These insects have been sorted, identified to the level indicated, and placed in a reference collection. The appended lists summarize the groups collected to date. This reference collection will simplify the sorting and identification tasks in subsequent years. Tables 10 and 11 provide a summation of the arthropods collected on the study area and assignment of the groups found on *Hilaria* and *Panicum* feeding groups. These tables may provide guidelines for decisions on invertebrate process studies.

Table 11. Assignment of major insect groups important on the Jornada playa to feeding classes. Assignments made on the basis of information in Borror, D. J. and DeLong, 1964, and Manhinick, E. F., 1967.

Hilaria

- HERBIVORES
  - Herbivores-grazing
    - Orthoptera
      - Acrididae (*Auclocera* + 2 other genera)
      - Phasmidae
    - Coleoptera
      - Chrysomelidae (*Altica*, *Euryscopa*)
      - Meloidae (*Lytta*)
      - Curculionidae
- Herbivores-sucking
  - Hemiptera
    - Lygaeidae (*Ischnorhyncus?*)
    - Tingidae
    - Pentatomidae (*Thyanta*)
  - Homoptera
    - Cicadellidae
    - Membracidae
    - Fulgoridae
    - Dictyopharidae
  - Diptera
    - Sarcophagidae
    - Muscidae
- Nectivores
  - Diptera
    - Syrphidae
  - Hymenoptera
    - Apidae
- CARNIVORES
  - Carnivores-chewing
    - Orthoptera
      - Mantidae
  - Coleoptera
    - Malachiidae (*Collops*)
    - Carabidae
    - Cleridae (*Enoclerus?*)
  - Hymenoptera
    - Sphecidae (*Sceliphron*)
    - Mutillidae
  - Carnivores-sucking
    - Meniptera
      - Nabidae
- OMNIVORES
  - Hymenoptera
    - Formicidae (*Prenolepis*)
  - Orthoptera
    - Gryllidae (Acheta)
- DETRITUS
  - Coleoptera
    - Tenebrionidae (*Eleodes*)
    - Dermestidae

Panicum

- HERBIVORES
  - Herbivores-chewing
    - Orthoptera
      - Acrididae (*Auclocera*)
    - Coleoptera
      - Chrysomelidae (*Diabotrica*)
      - Curculionidae
    - Hymenoptera
      - Formicidae (*Pogonomyrmex*)
  - Herbivores-sucking
    - Hemiptera
      - Pentatomidae (*Thyanta*)
      - Lygaeidae (*Ischnorhyncus?*)
    - Homoptera
      - Cicadellidae
    - Nectivores
      - Lepidoptera
      - Diptera
        - Syrphidae
      - Hymenoptera
        - Apidae (Xylocopis)
        - Andrenidae
- CARNIVORES
  - Carnivores-chewing
    - Coleoptera
      - Cicindellidae
      - Malachiidae (*Collops*)
      - Carabidae (*Calosoma*, *Lebia*)
      - Coccinellidae (*Hippodamia*)
      - Cleridae
    - Neuroptera
      - Myrmeleontidae
    - Hymenoptera
      - Sphecidae
      - Vespidae
      - Mutillidae
  - Carnivores-sucking
    - Hemiptera
      - Reduviidae
      - Nabidae
    - Diptera
      - Asilidae
- OMNIVORES
  - Coleoptera
    - Tenebrionidae (*Eleodes*)
  - Diptera
    - Bombyliidae
  - Hymenoptera
    - Formicidae (*Formica*)

At the request of the site coordinator, Dr. Clifford Crawford visited with us during the heavy rains at the end of July to examine the millipedes which were believed to be important in the Chihuahuan system. The following is his report.

Report on Observations of Millipedes
(probably Spirostrepidae: Orthorporus)
at IBP Desert Biome Site, Jornada Experimental Range, N.M.

Clifford S. Crawford
Department of Biology
The University of New Mexico

Millipedes were observed in the vicinity of the IBP playa study area from July 28-30, 1970. Observations were made of general behavior, approximate density and size distribution, and topographic distribution. These categories are discussed below.

General behavior -- Millipedes had been seen in large numbers since about July 24 when heavy rains began to fall in the area. Reports in the literature of millipede "migrations" after rains led me to suspect that above-ground movement might be unidirectional. However, directional records of 60 animals seen on the road to the playa on July 30 indicate that movement was probably random. Fourteen were moving north, 13 south, 20 east, and 13 west.

Terrestrial locomotion on unshaded ground was seen only in the morning while the surface temperature was below 36^{o}. Many individuals were seen moving over open ground at surface temperatures between 25^{o} and 28^{o}. In the heat of the day the animals are often difficult to find; at that time they tend to stay in shade on the ground (dense shade under a shrub can result in a surface temperature of 28^{o} while the exposed soil is at 36^{o}) or climb into vegetation. I saw individuals resting in *Larrea*, *Prosopis*, *Yucca*, and *Ephedra*. Several were feeding on *Ephedra* bark. None were mating.

Millipedes did not move much on the open ground when surface temperatures dropped near the playa in the evenings. At 2130 hours on July 28 soil temperature was 28^{o} (air temperature was 27^{o}) and two individuals were finally seen after some searching. Heavy rains made further search impossible.

Besides feeding on bark, sticks, and miscellaneous debris, only one animal was seen (by Helen Hart) feeding on a leaf: the seed leaf of an emerging dicot. The millipedes feed readily on lettuce and carrots in the laboratory.

Approximate density and size distribution -- As searching in vegetation for millipedes probably results in overlooking numerous individuals, I attempted to gain an index of density by counting individuals on the road to the playa. Sixty animals were seen in about a 2 mile stretch of road on the morning of July 29. Sixty eight were seen on the same stretch the next day. This kind of approach, i.e., counting walking individuals on a known area of open ground, seems to be a feasible way of estimating density. It could be done simultaneously over a series of days by different observers in various parts of the study site.

I obtained weights of 20 animals and lengths of all 60 observed on July 29. A curvilinear relationship is evident when weights are plotted against lengths. From a line fitted by eye to the points, I obtained estimated weights for the remaining 40 millipedes. Table 12 of 1-gram weight classes amounts to what is probably a rough survivorship curve. If valid it indicates relatively high mortality in the early stages of life. The total estimated weight of the 60 animals was 89.7g.

Topographic distribution -- Millipedes on the ground and in desert shrubs ceased to be observed as soon as I entered the *Larrea* community to the south of the playa on the morning of July 30. The only specimen seen in an hour of walking through this area was beneath a rotting yucca at the side of an arroyo. Prevailing temperatures were certainly not the cause of the paucity of millipede in the *Larrea* community. It seems plausible that the well-drained *Larrea* slope offers insufficient organic debris (and perhaps insufficient succulent vegetation) for these millipedes. The lower ground near the road and the playa, however, supports varied vegetation and accumulates debris from runoff. The latter area ought, therefore, to be a better millipede habitat from a trophic standpoint.

For about a mile after one leaves the windmill at the turnoff to the playa there are relatively few millipedes. Perhaps this rather flat area is beyond the zone of extensive litter accumulation from upslope runoff, and cannot, therefore, support a large underground population of debris-feeding millipedes. Soil analyses for organic material in the areas discussed would be valuable in this context.

Table 12. Weight classes and biomass of Orthoporus millipedes from approximately 2 miles of road near the Jornada playa study area.

Weight call	Number	Biomass (gms)
0-1	31	12
1-2	16	19
2-3	3	6.5
3-4	0	0
4-5	2	9
5-6	2	11
6-7	2	12
7-8	2	16
8-9	0	0
9-10	0	0
10+	2	20

Repitles -- As indicated in the experimental design, we made no concentrated effort to systematically sample the reptile populations. Reptiles were captured, marked and released in conjunction with other programmed activities. Since the only can trap grid, a mammal trap grid and set of soil blocks and thermistors were located in the north quadrat, a disproportionate amount of time was spent in that sector. This probably accounts for some of the disparity in concentrations of lizards (Figs. 13 and 14). However it is also apparent that the north quadrat had a more diverse lizard fauna with two species of lizard Phrynosoma modestum and Uta stansburiana being essentially limited to this quadrat. The greater density and diversity of lizards in this area when compared to the other quadrats around the playa could be a function of greater shrub volume diversity (Pianka, 1967) and/or greater cover, productivity, and overall shrub volumes on this quadrat.

Figures 13 and 14 show that two species consistently used the playa; Holbrookia maculata is a playa bottom resident while Phrynosoma cornutum forged on the playa bottom prior to flooding. The activity of P. cornutum on the playa bottom was coincident with the activity of the ant, Prenolepis imparis, on the Panicum areas of the playa. P. cornutum may also have sought open areas for basking. The distribution of Sceloporus magister is a function of large mesquite clumps, Prosopis juliflora, that provided suitable habitat for this species. Individual Sceloporus were recorded in the same shrubon numerous occasions. The data in Table 4 on shrub volumes and numbers indicate that the greatest concentration of Prosopis is on the north quadrat. The south quadrat has more large Prosopis than either the west or east quadrat. However, we undoubtedly undersampled Sceloporus on these quadrats.

Since we know that the east and west quadrats were undersampled, the Enemidophorus and Phrynosoma density estimates can be essentially assigned to the north and south quadrats. Based on the population indices in Table 13 and the biomass estimates Figures 15 and 16, it is suggested that at least three species of lizards, P. coruntum cremidophorus tigris, and S. magister may be as important as small mammals in the economy of this playa ecosystem.

Table 13. Number captured or density estimates of lizard species on and adjacent to Jornada Playa during 1970. Population estimates by Lincoln Index are indicated by an asterisk.

Species	Population Index
Cnemidophorus tesselatus	27 2 *
Cnemidophorus tigris	119 2 *
Crotaphytus wislizenii	5
Holbrookia maculata	5
Phrynosoma cornutum	104 *
Phrynosoma modestum	20 *
Sceloporus magister	27
Uta stansburiana	22

2 based on car trap mark and recapture on 0.45 hectare area.

Figures 15 and 16 summarize data on size class activity and body temperatures for S. magister and P. cornutum. These data could be used in constructing a sub-model for these species. snout -vent length measurements indicate that we can distinguish three age classes in these species: young of the year, juveniles and adults. Since live weights vary with reproductive state, feeding, etc., these data are of limited use in separating age classes. Both species show activity peaks in the mid morning and late afternoon, with a greater activity in the A.M.

Hatchling P. cornutum began to appear in mid-September after the major portion of adult activity had apparently ceased. This apparent reduction in overlap of activity between juveniles and adults probably reduces intraspecific competition. It was noted that horned lizard activity was greatly curtailed after the summer rains. There are several possible explanations for this: (1) foraging time reduced due to greater availability of food. (2) deposition of eggs reduced energy requirements of (3) an annual cycle independent of temperature and other environmental factors which appeared to be most favorable for lizard activity.

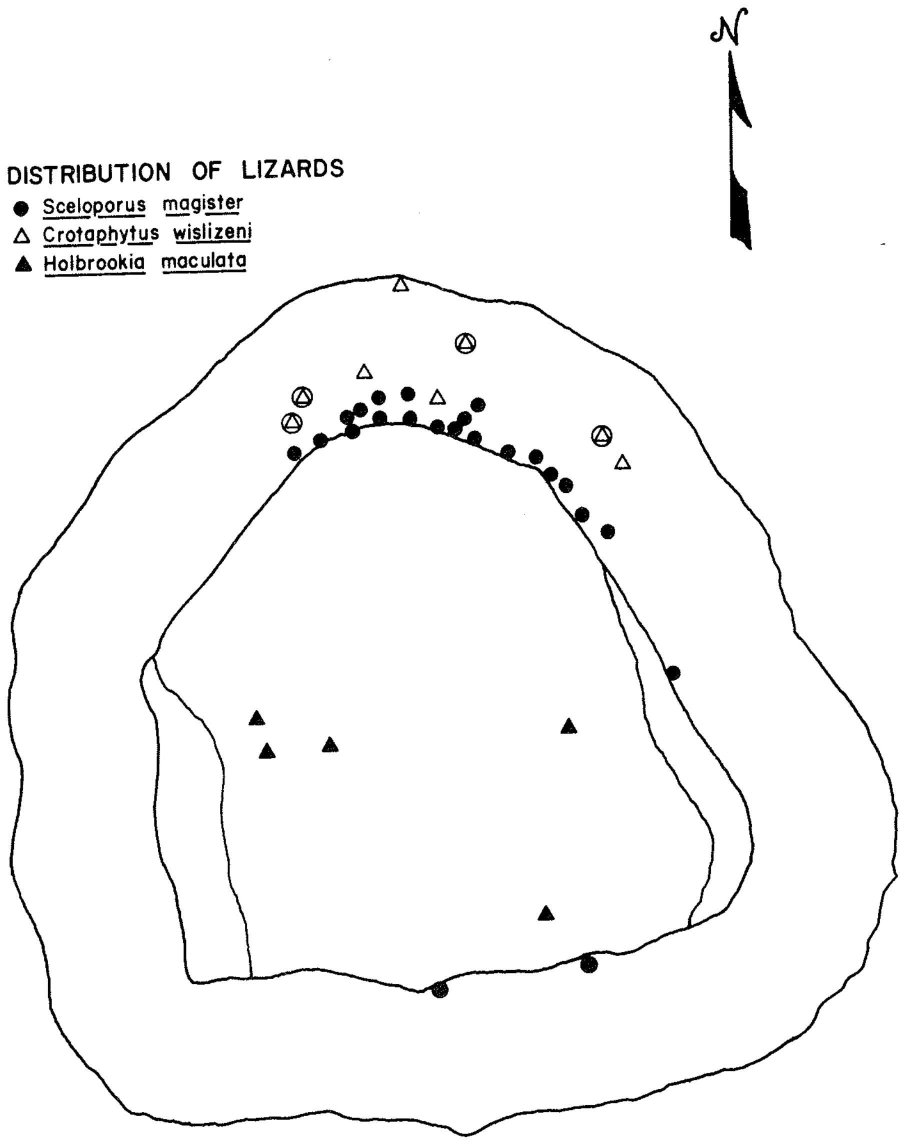

Figure 13. Distribution of captures of three lizard species on the Jornada playa study area during 1970. Open diamonds which are circled indicate recaptures of the same Crotaphytus wislizeni.

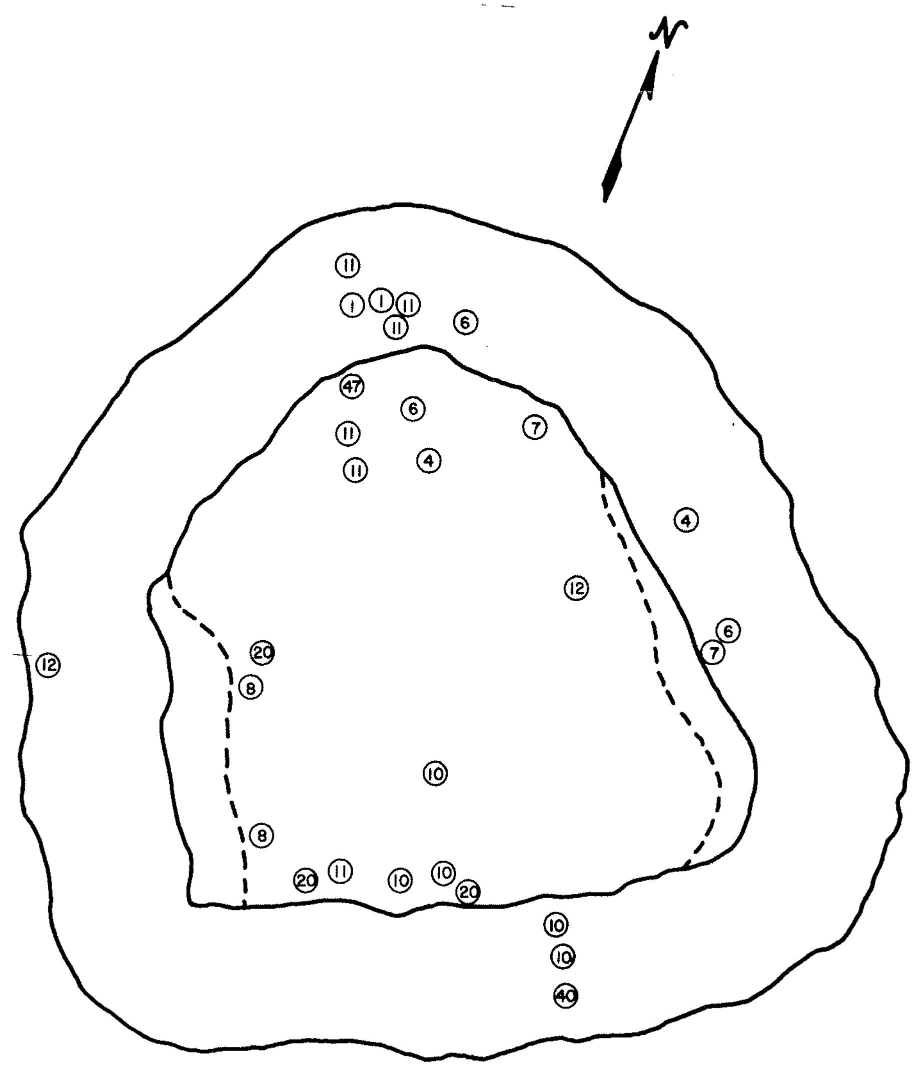

Figure 14. Distribution of captures of Phrynosoma cornutum which were captured more than a single time on the Jornada playa study area in 1970.

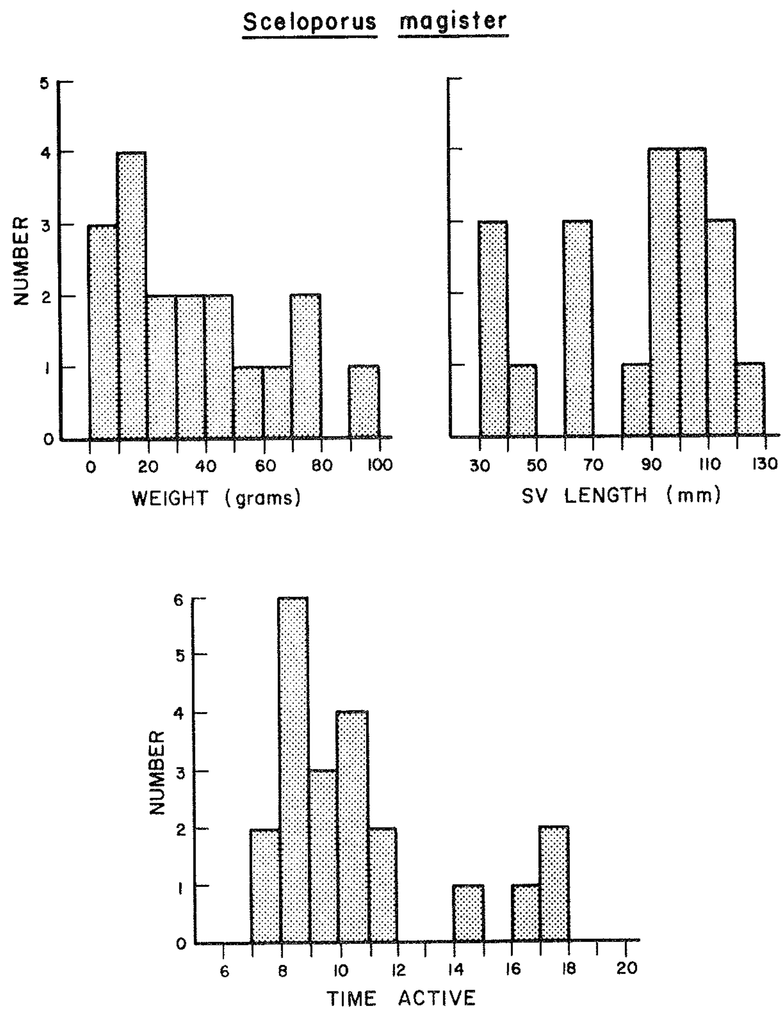

Figure 15. Live weight biomass, size classes based on snout-vent length, and activity of *Sceloporus magister* on the Jornada playa study area during 1970.

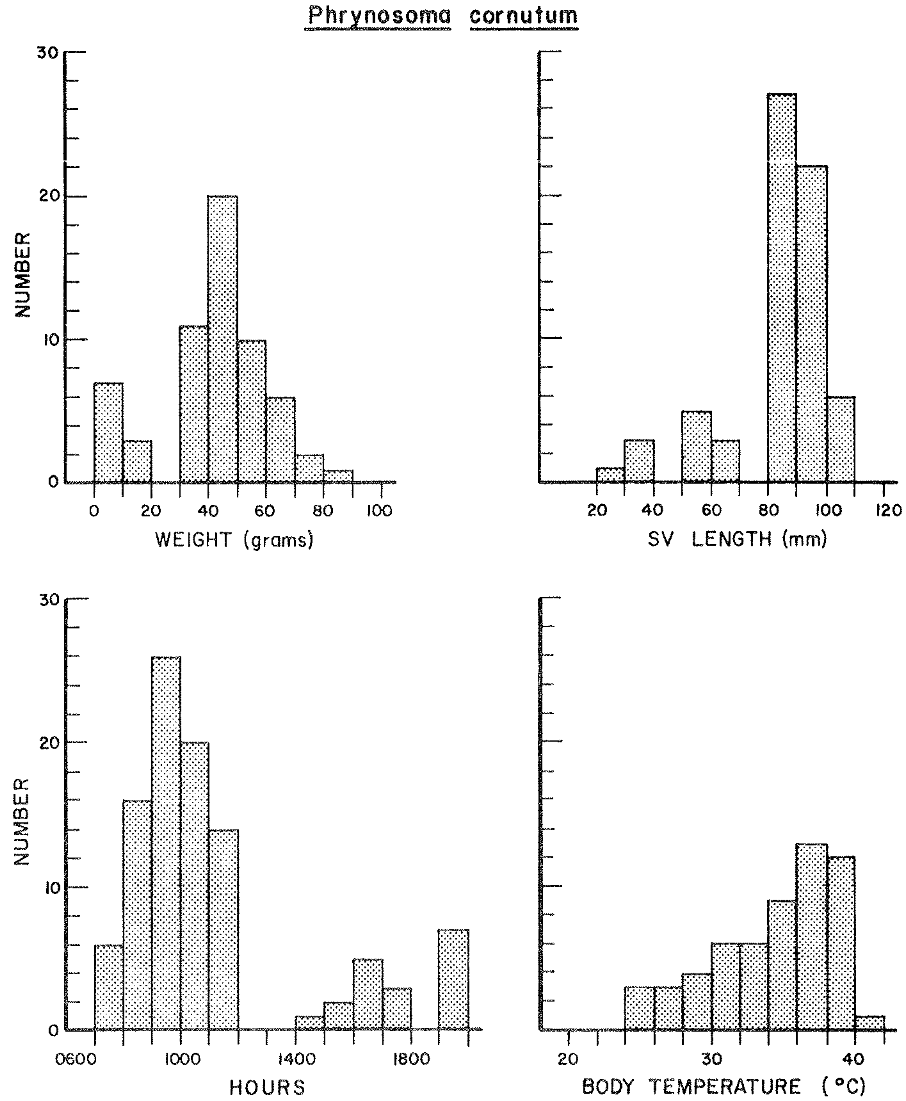

Figure 16. Liveweight biomass, size classes based on snout-vent length, activity and body temperatures of Phrynosoma cornutum on the Jornada playa study area during 1970.

Six species of snakes were captured on the playa itself or immediate fringe (Table 14). It is obvious from the numbers of individuals captured that the snake population in this area was undersampled. The greatest diversity and activity of snakes was noted in August as the flooded playa receded and the tremendous numbers of toadlets emerged. The coachwhips, hognosed snake and kingsnake were probably preying on these immature frogs. Additional snakes were seen during this period but were not captured and could not be accurately identified. Thus species of snakes which feed on frogs probably congregate in the playa area during the flood stages. The rattlesnakes and gopher snakes are mammal predators but probably do not have much of an impact on the rodent population. We found one dead marked Dipodomys merriami just inside the base of a mesquite clump that we attributed to a rattlesnake that had failed to locate the rat after it had died.

Table 14. Other reptiles captured on playa or fringe in 1970.

Genus Species	Common Name	Number Capture
Crotalus virdis	prairie rattlesnake	2
Crotalus atrox	western diamondback	1
Pituophis melanoleucus	gopher snake	4
Masticophis flagellum	coachwhip snake	2
Lampropeltus getulus	western kingsnake	1
Heterodon platyrhinos	hognose snake	1
Terrepene ornata	ornate box turtle	4

The ornate box turtles were active after the playa flood but their activity period was limited. Although these are large animals, they are herbivores with an abbreviated activity period and consequently probably have little impact on the system.

Anurans -- The playa flooded during the heavy rains the night of July 24-25. By mid-day July 25, we observed numerous egg masses along the edges of the cattle tank on the south edge of the playa. During the next two days we marked by toe clipping 190 Scaphiopus hammondi (average live weight, approximately 11 grams) 13 Scaphiopus bombrifrons (x live weight 17.6 gms), 2 S. couchi (mean weight 50 gms), 40 Bufo debilis and 30 Bufo cognatus. There was a sequence in the breeding of these anurans. S. couchi had essentially completed its breeding by mid-day the first day of playa flooding, S. bombifrons and S. hammondi within 36 hours, B. cognatus, B. debilis 48-72 hours after flooding. Anuran tadpoles were the most numerous and constant component of the flooded playa system.

In a survivorship experiment two cages with 100 tadpoles and 250 tadpoles respectively (cages 1m^2) were placed in the water on 31 July. On 15 August each cage had a population of eight (8) tadpoles or toadlets.

Anurans tadpoles were sampled by the Texas Tech personnel with the invertebrates. These samples have been sent to Ronald Altig who has agreed to separate and classify the animals in these samples.

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Aquatic Studies -- A Flooded Playa

Charles R. Ward and George F. Meenaghan, Texas Technological College and Walter G. Whitford, New Mexico State University.

Abiotic measurements -- The data on abiotic measurements are summarized in Figures 17 through 24. The pH remained relatively constant during the first week post-flooding but began to increase during the second week (August 5). Fig. 17. This increase in pH was associated with an algal bloom which was also associated with a marked drop in nitrate nitrogen Fig. 18. The relatively high K+ concentration and increase in K+ in the playa water (Fig. 19) probably results from K+ released by decomposition of plant materials and concentration by evaporation. The low sodium levels (Fig. 21) indicate that this ion is of minor importance in the playa. The increase in conductivity is in part due to the potassium and the remainder may be due to divalents such as magnesium sulfates, etc.

The diurnal measurements of oxygen and temperature Figs. 22-24 show the typical patterns of heating of shallow waters and increases in dissolved oxygen associated with photosynthesis.

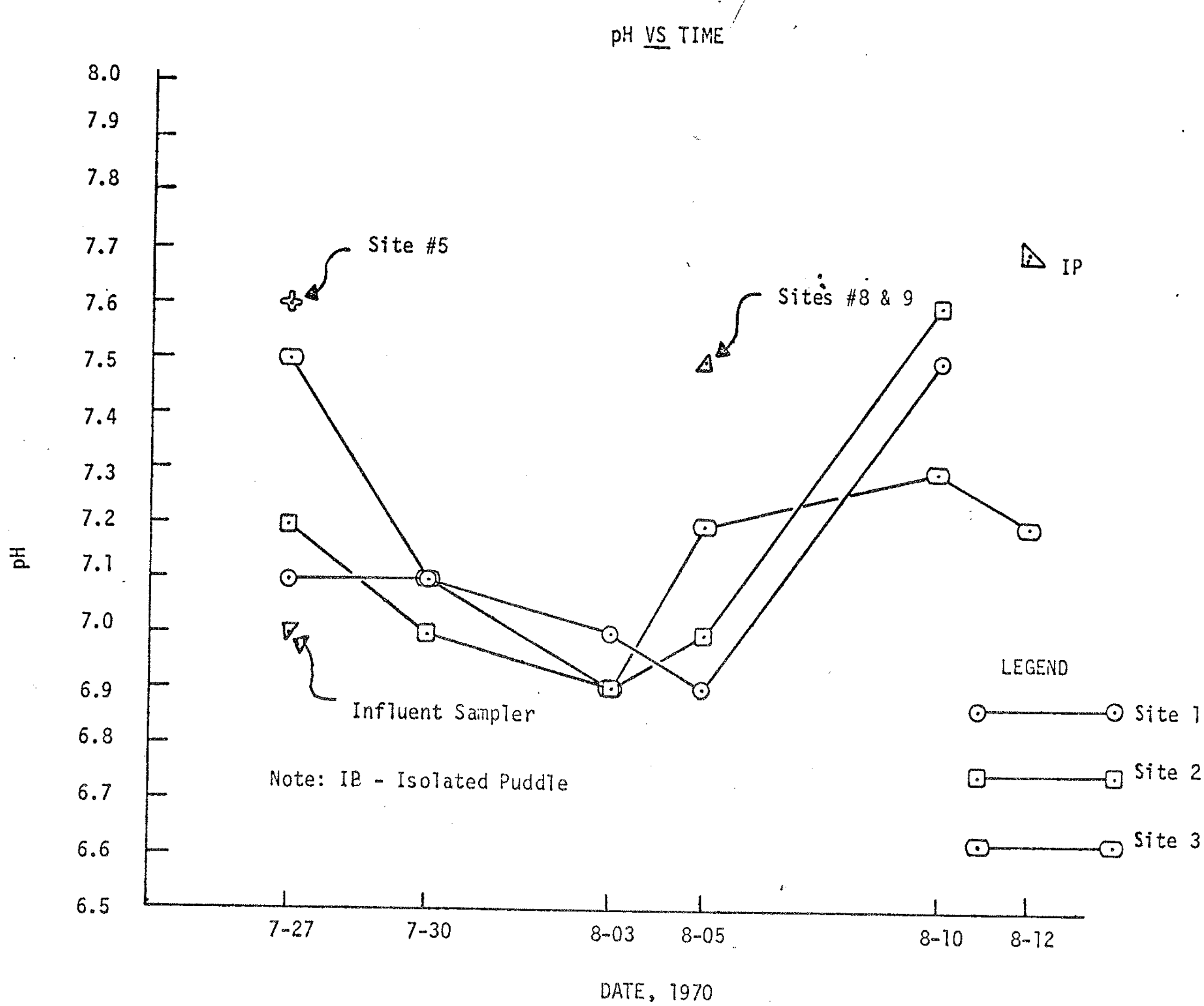

Figure 17. pH changes in Jornada playa water.

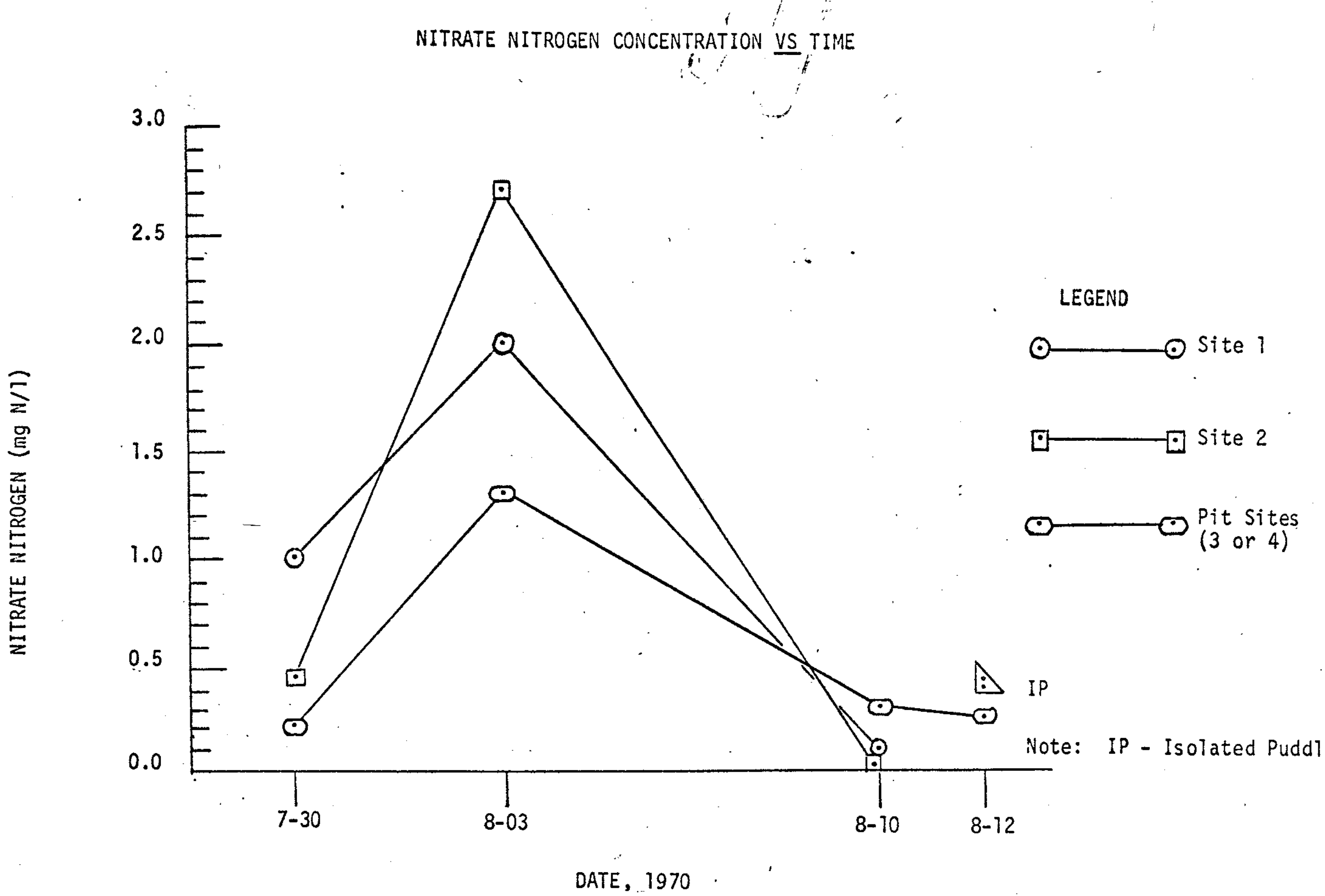

Figure 18. Changes in nitrate nitrogen in the Jornada playa water.

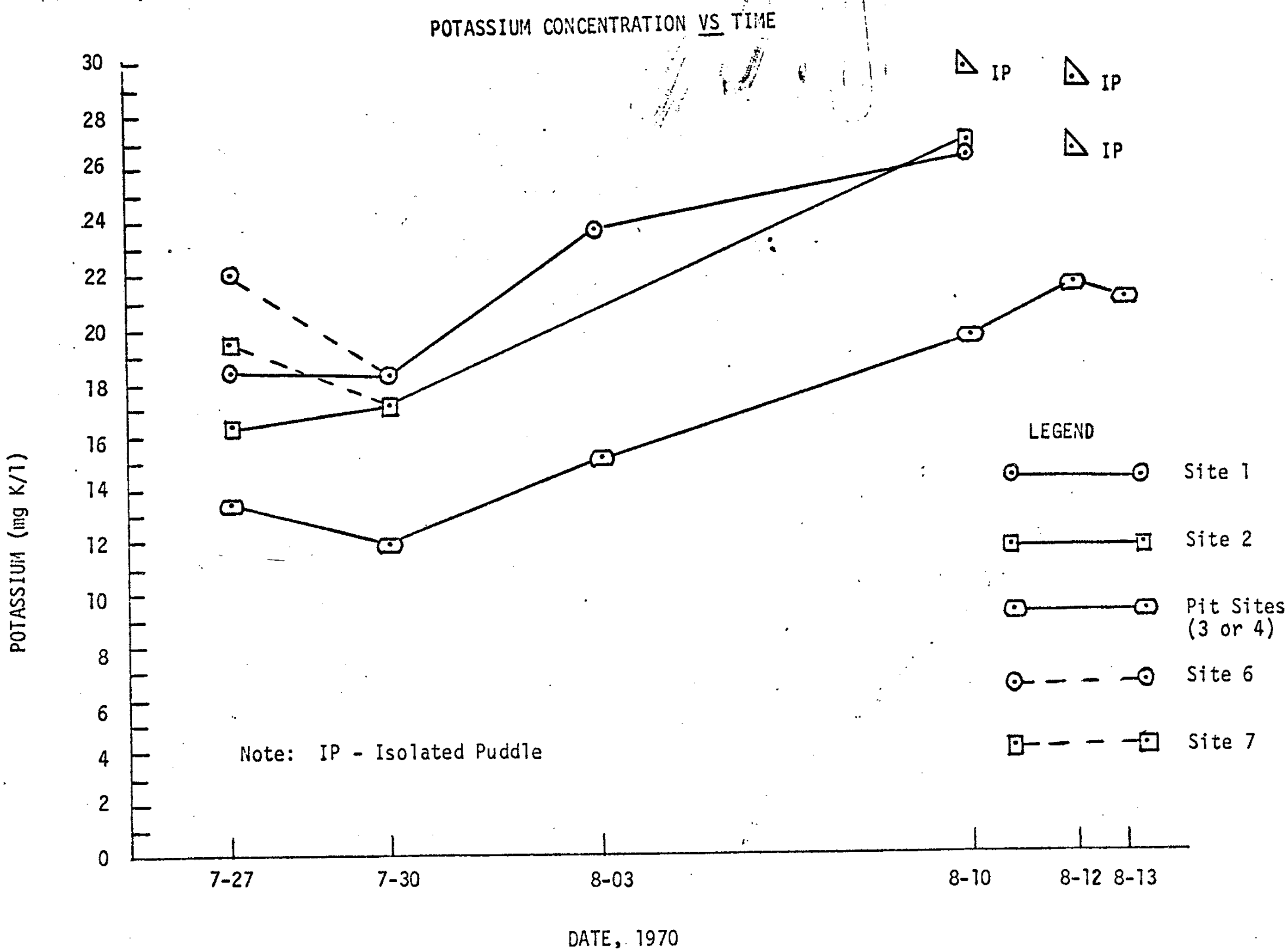

Figure 19. Changes in potassium levels in Jornada playa water.

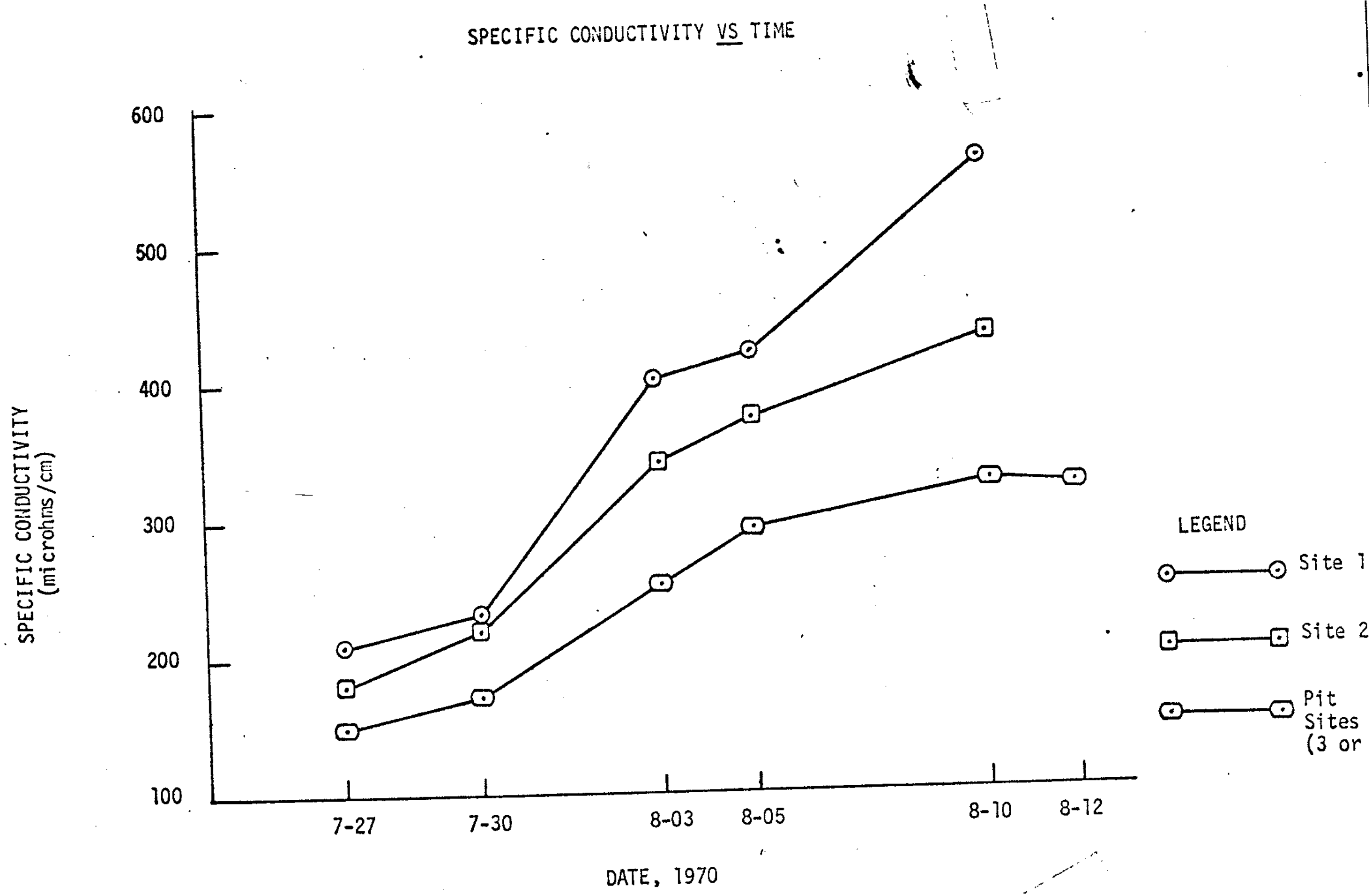

Figure 20. Changes in Specific conductivity in Jornada playa water.

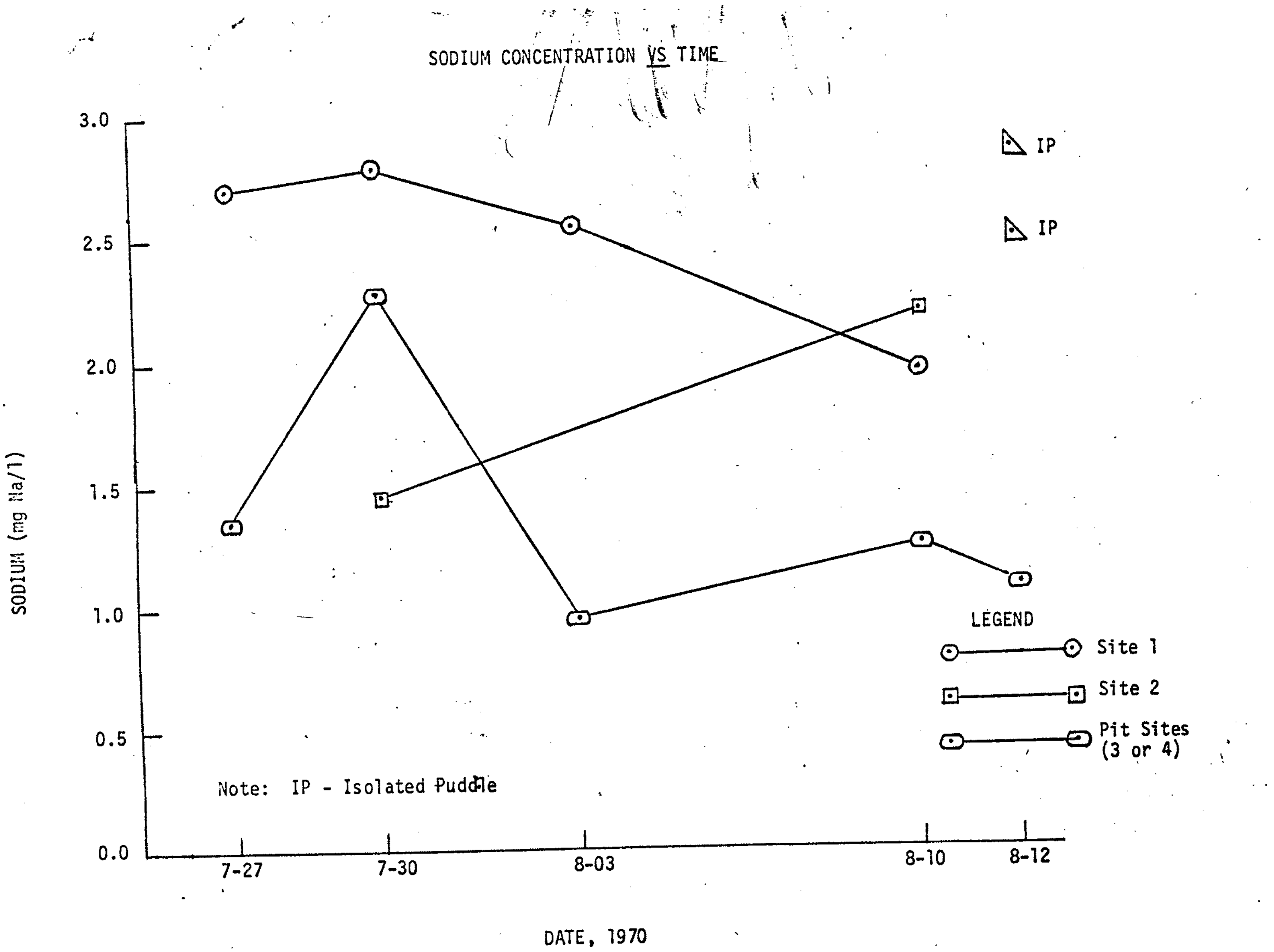

Figure 21. Changes in sodium concentration in Jornada playa water.

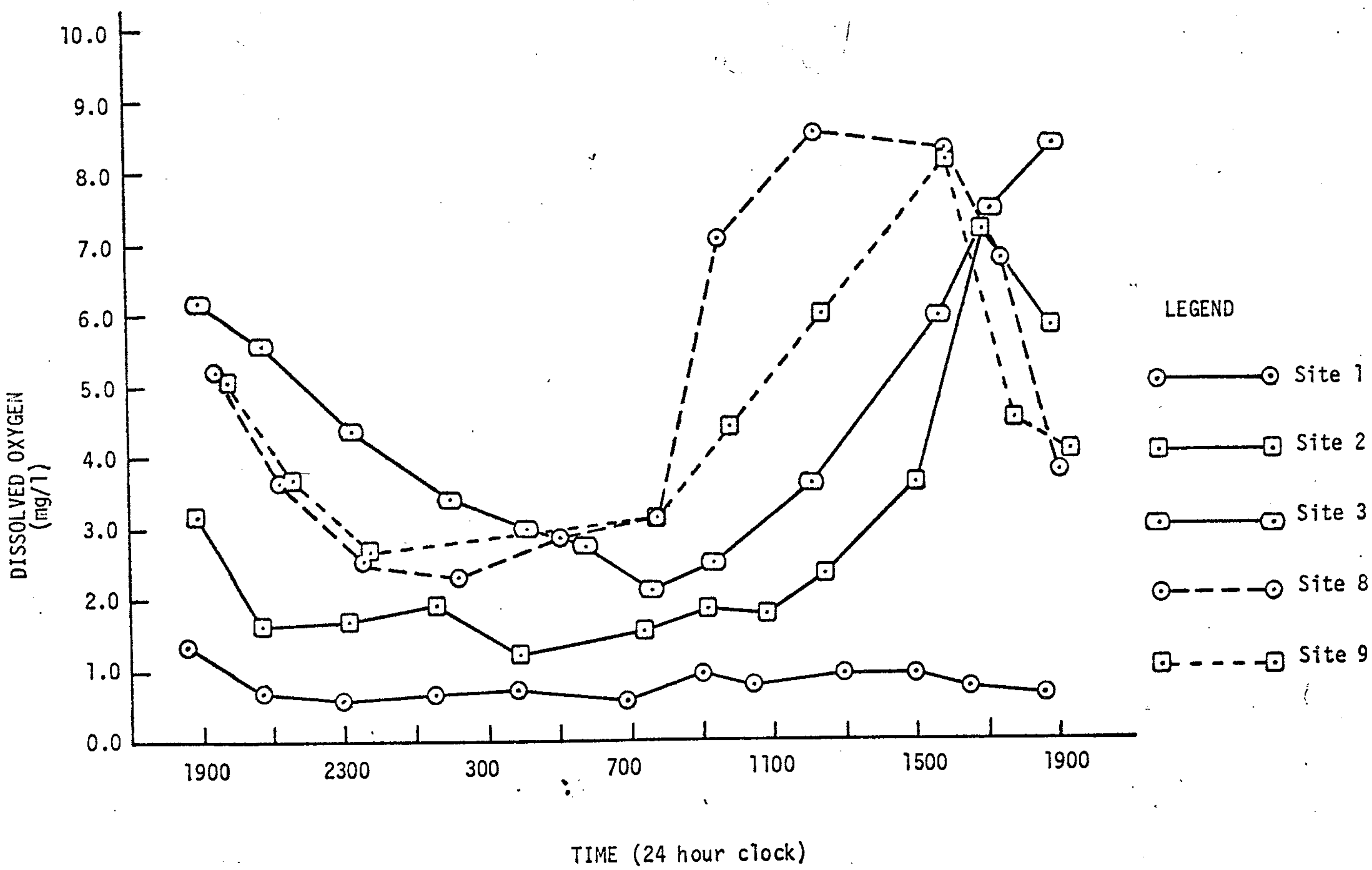

Figure 22. Diel fluctuations in dissolved oxygen in the Jornada playa water.

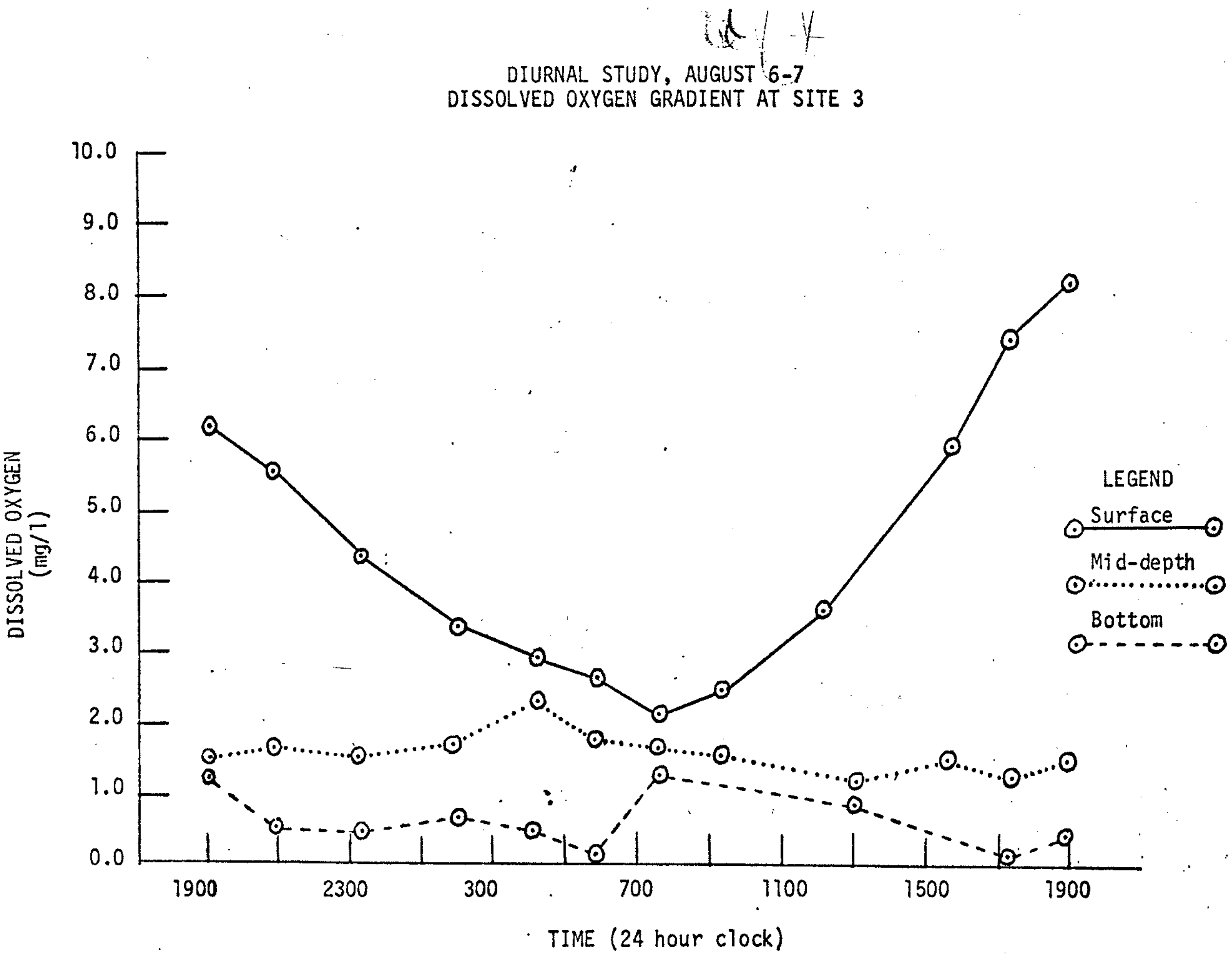

Figure 23. Diel fluctuations in dissolved oxygen in the Jornada playa water.

Figure 23. Diel fluctuations in dissolved oxygen in the Jornada playa water.

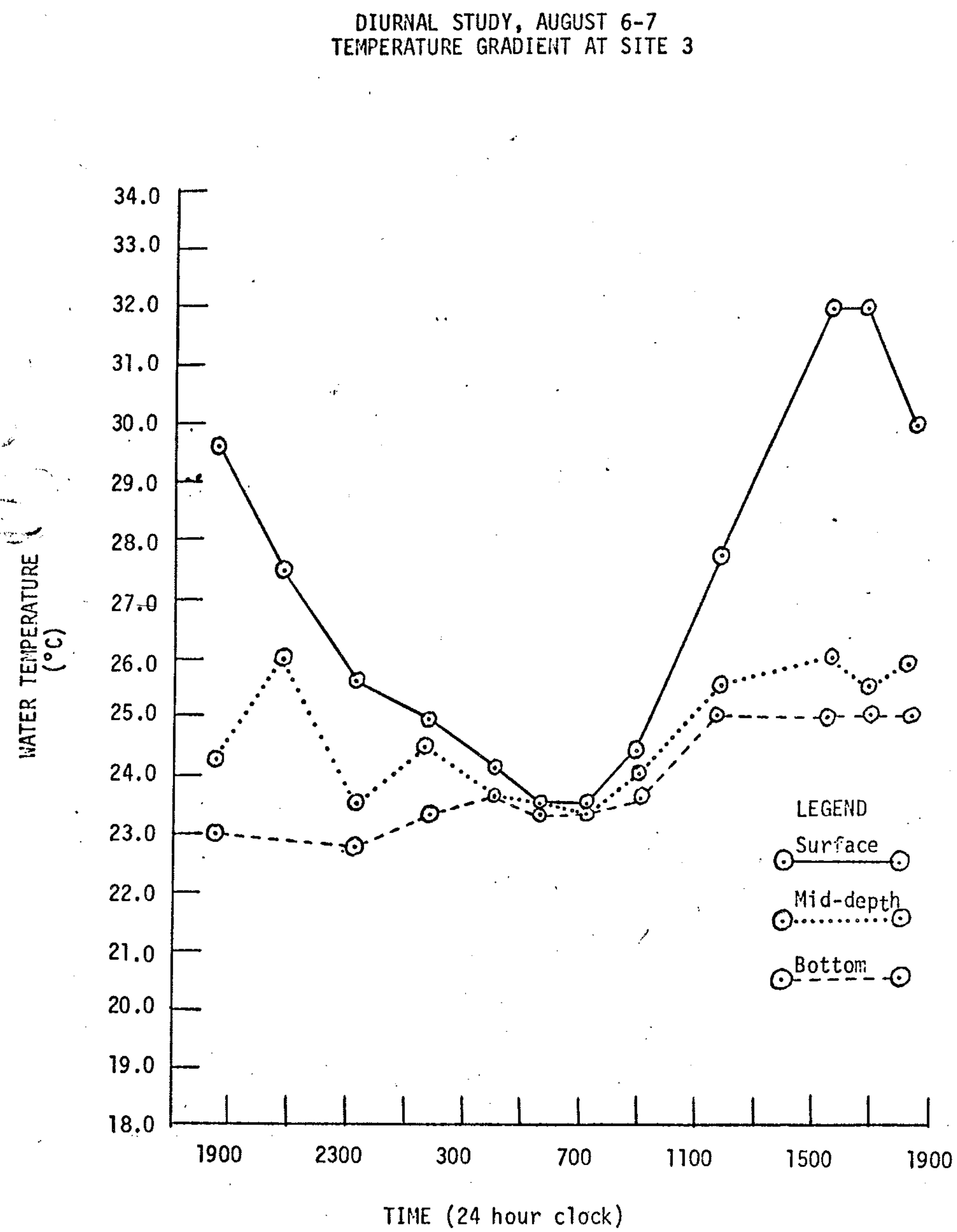

Figure 24. Diel fluctuations in water temperature in the Jornada playa.

The changes in water chemistry are undoubtedly a function of biological activity. For example the peak in population density of the Conchostroca (Fig. 26) immediately precedes the increase in dissolved nitrates. Conchostraca are detritus feeders which pass large quantities of material through their systems changing its forms, and increasing surface area both of which serve to facilitate microbial decomposition and aid in the release of nutrients into the water.

Invertebrate population trends. The Jornada Playa was first inundated on July 25, 1970, and received additional recharge on July 26 and July 28. The first invertebrate and plankton samples were taken on July 27, at which time a wide variety of organisms appeared. The lake had been invaded by a tremendous number of anurans the previous two nights and eggs were lain in great abundance. Tadpoles of at least one of the five species (Bufo cognatus Say, B. debilis Girard, Scaphiopus couchi Baird, S. hammondi Baird, and S. bombifrons Cope) were taken in 2 of the 10 samples taken on the 27th. Early instars of the tadpole shrimp (Apus (Triops) longicaudats LeConte), clam shrimp (Eulimnadia sp.?), and two species of fairy shrimp (Thamnocephalus platyurus Packard ? and Streptocephalus texanus Packard ?) were also taken, of which T. platyurus was the most abundant. In addition, 2nd and 3rd instar mosquito larvae (Aedes sp.) and chironomid larvae were encountered. A wide variety of terrestrial invertebrates that had been trapped by the water also appeared in the samples on the first few dates. Numerous dragonfly and damselfly adults (Odonata) were observed flying over the lake on this date.

The first adult aquatic beetles were noted swimming in the playa on the night of July 27; these were Hydrophilus triangularis (Say) (Coleoptera: Hydrophilidae), a large water scavenger beetle. The night of July 28 additional water was received from the watershed and raised the water level to its maximum depth of 0.85 feet. The following morning numerous predaceous diving beetle adults (Eretes sticticus (L.) and Thermonectus nigrofasciatus (Aube) (Coleoptera: Dytiscidae) were observed in the playa in addition to the Hydrophilus triangularis adults. The number of adult Odonata had increased and oviposition was observed, however, immatures were never taken from the playa or tank.

By August 3 a maximum of 328 clam shrimp, 108 tadpole shrimp, 24 T. platyurus and 236 S. texanus per square meter were found. Thus, there was a reversal in numbers of the anostrachans, and S. texanus replaced T. platyurus as the most numerous Eubranchipod. Greater numbers of the adult beetles already mentioned were observed and adults of most of the other species of water beetles appeared (Laccophilus spp.). Early instar larvae of some of these aquatic beetles also appeared in these samples. A maximum of 44 early instar Ephemeroptera nymphs were found per square meter on this date. Adult Corixidae and Notonectidae were also present.

The water level dropped from a maximum staff gauge reading of 0.85 ft. on July 29 to 0.51 on August 3, and this water drop coupled with the unevenness of the playa basin and the presence of potholes had a dramatic effect upon the invertebrate (and tadpole) populations. In those situations where there is a fairly uniform lake bed one would expect a dramatic concentration of these invertebrates into a smaller surface area (and volume) of water. However, due to the habits of the tadpole and clam shrimp feeding in the more tepid shoreline areas, a tremendous number of these were isolated each day as these potholes were separated from the main lake body; and the tadpole and clam shrimp perished as the potholes dried.

The effect of the drying potholes on the population numbers was shown in the trap samples taken on August 10. By this date a maximum of only 20 tadpole shrimp and 68 S. texanus fairy shrimp per square meter was taken in the samples. No clam shrimp were present in the trap samples taken on this date. However, there was a tremendous increase in the number of larval insects and the adults were being concentrated in the tank and playa areas that still contained water. As many as 260 corixid nymphs, 40 dytiscid larvae, 28 hydrophilid larvae and 104 Ephemeroptera nymphs per square meter were found in the trap samples taken on that date.

Further concentration of the insect adults had occurred by August 12, but a reduction in larval numbers was noted in the samples taken on that date. Many of the larval Coleoptera were in the last instar and had probably pupated prior to the few remaining puddles and potholes going dry by August 14 or August 15. However, attempts at recovering pupae in the soil in and surrounding a pothole were unsuccessful.

The temporal fluctuations of the major groups of invertebrates discussed above are shown in Figs. 32-37. The Anostraca and Conchostraca appeared to peak about July 31 (Figs. 26 and 27), while the Notostraca peaked a few days later, about Aug. 26 (Fig. 4).

The insects (Figs. 30, 31 and 32) had a much lower rate of increase, with populations peaking on the last day of full sampling, August 10. The drying of the potholes restricted sampling sites on August 12 to one large pothole near site 1 and the tank. This rise in populations indicates that, had the playa held water for a longer period of time, insects would have become increasingly important components of the invertebrate fauna, while the Eubranchipoda decreased in both numbers and importance, after peaking much earlier, about July 31.

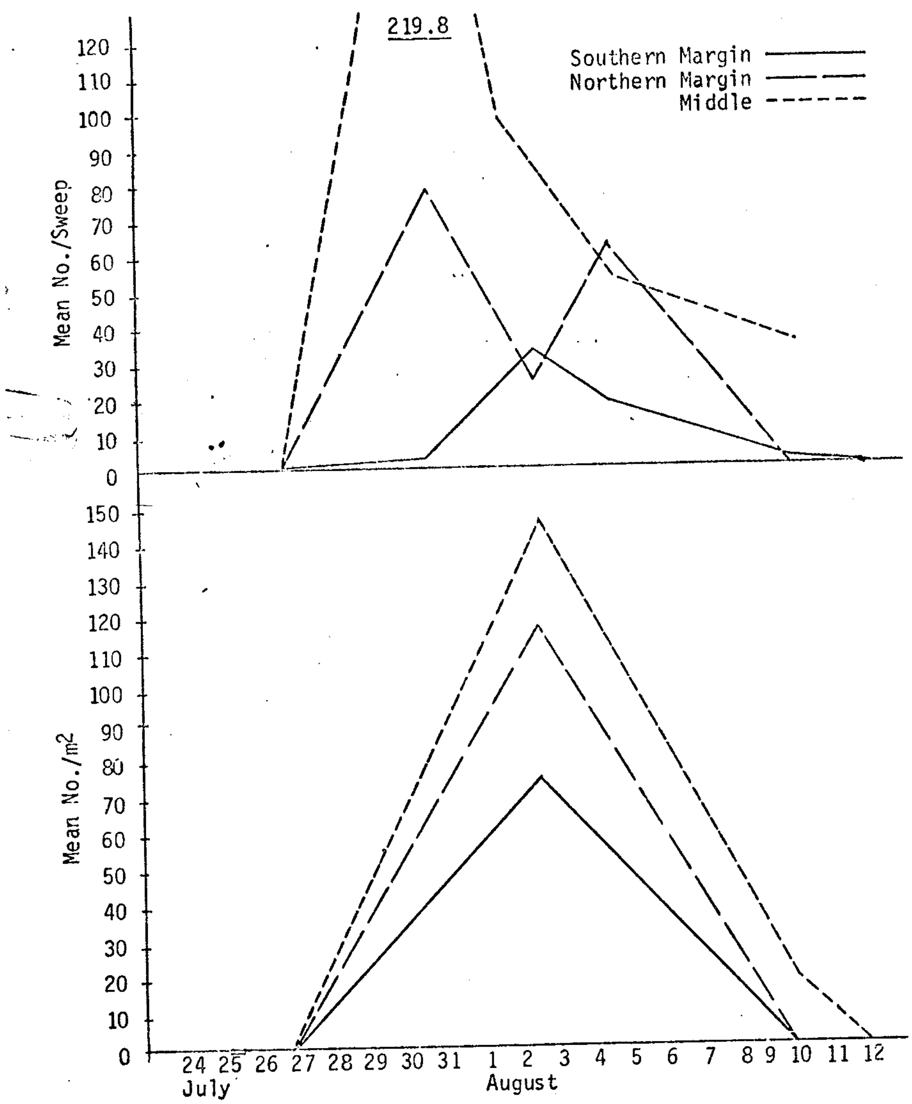

Figure 25. Population fluctuations of Streptocephalus (Anostraca) in the three major areas of the playa. Las Cruces, New Mexico, July-August, 1970.

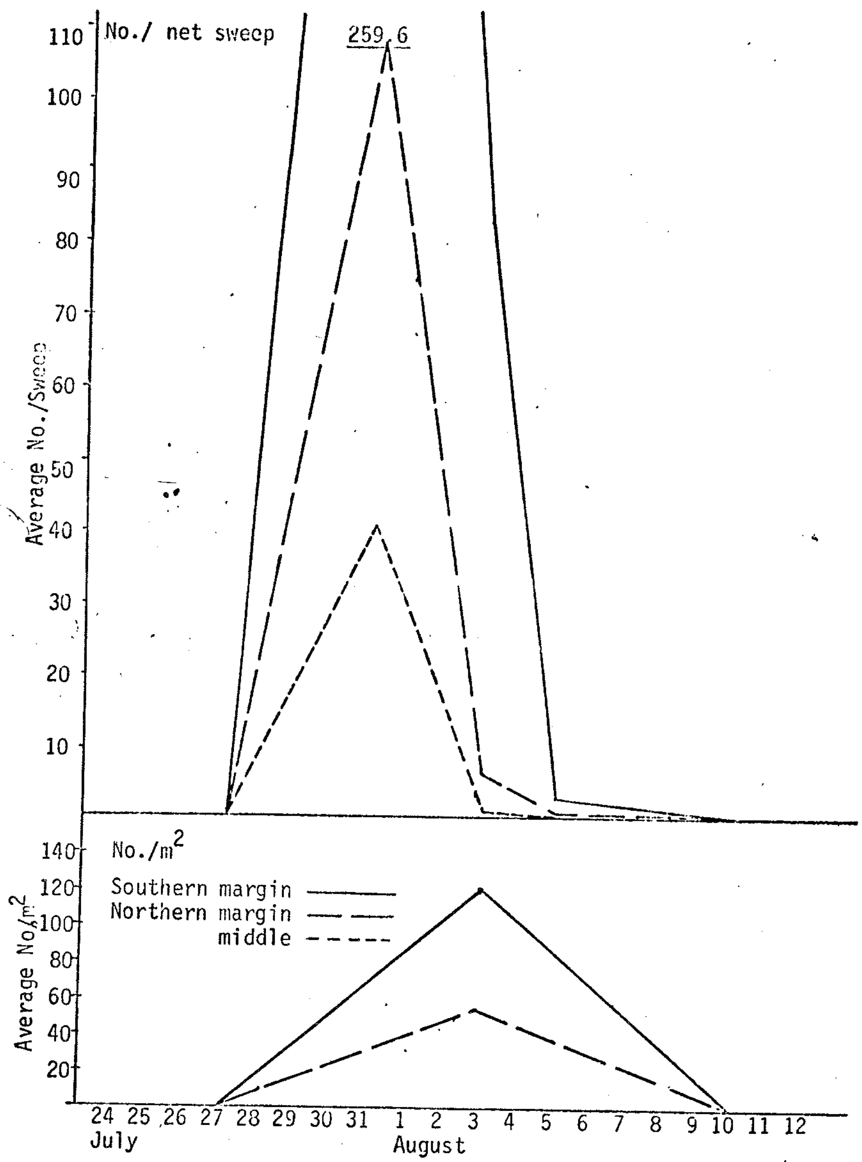

Figure 26. The population fluctuations of Conchostraca in the three major areas of the playa. Las Cruces, New Mexico, July-August, 1970.

24 Hour Study -- A 24 hour study was conducted on August 6-7. The first samples were taken at 6 p.m. on August 6 and were continued at two hour intervals. Each set of samples consisted of five 5m long D-frame net sweeps taken parallel to the shoreline. The first one was taken at the shoreline with the remainder being taken at intervals toward the bare center portion of the playa. Three trap samples were taken in conjunction with the net samples at stations 1, 3, and 5. The counts from these samples are summarized in Figs. 27-31.

Time of Sampling -- The most obvious conclusion to be drawn from the total catches from each sample (Figs. 37, 38, and 39) is that the time at which you are most likely to capture the greatest number of organisms is during the daylight hours. The average population estimates for aquatic invertebrates as calculated from trap samples, was 16/m^2 during the day and 11.2/m^2 for the night samples. The average total aquatic invertebrate catch per 5m sweep was 17.8 for the day samples and 11.7 for sweeps after dark. The total number of species captured in each sample was approximately the same for both day and night samples.

Spatial Distribution -- The five sampling stations used in the 24 hour study were arranged from the shoreline to the middle of the playa. Figures 40 and 41 show the lateral distribution of the major groups of invertebrates. It is interesting to note that the numbers of practically every taxon, as estimated by both sampling techniques, either increase or decrease from the shoreline to the center of the playa. The Eubranchipods show a very distinct increase toward the center of the playa, while the Coleoptera are most numerous at the shoreline and decrease toward the center of the playa. This distribution holds true for most insects with the notable exceptions of the Ephemeroptera and Corixidae.

In order to confirm these distribution patterns, the ten original samples were separated into southern margin samples (25, 26, and 29), northern margin samples (30, 31 and 32), and middle samples (33, 34, and 350. These patterns of distribution are illustrated in Figures 27-32. Figure 27 shows the distribution of Streptocephalus to be very similar to that indicated by the 24 hour study. In the trap samples the distribution of the Notostraca was also similar to the other Eubranchipoda, being most numerous in the more barren central portion (Fig. 29). The net samples were inconsistent but the total numbers were very low.

The Conchostraca show a very different distribution from that indicated by the 24 hour study. Instead of a slight increase toward the center of the playa, there is a very distinct concentration of the Conchostraca along the shoreline (Fig. 28). This figure also reveals that Aug. 6-7, the date of the 24 hour study, was some time after the peak conchostracan population. The extremely low numbers of individuals captured in the 24 hour study probably contributed to the conflicting indications.

The shoreline distribution of Thermonectus was clearly supported (Fig. 30), but the Ephemeroptera were also shown to be present in the greatest numbers along the shoreline (Fig. 30). The Corixids were even more concentrated in the central portion of the playa than the 24 hour study indicated (Fig. 31).

Population trends in the Tank -- The stock tank in the southwestern corner of the playa held water long after the playa had dried completely. Samples were taken from the tank at irregular intervals until mid-October.

The sampling data (Figs. 33-36) indicate some distinct differences among the populations in the tank and the remainder of the playa. The first samples, taken July 27, showed very low populations in both the playa and the tank. The tadpole population was much higher in the tank on the first sampling date (.4/m^2 in playa to 32/m^2 in tank).

By August 3, the second sampling date, the differences in invertebrate populations were pronounced. The estimated populations per square meter in the playa and the tank were:

	Playa	Tank
Anostraca	125	924
Conchostraca	62	4
Notostraca	51	4
Insecta	14	4

Fairy shrimp populations remained higher in the tank than in the playa proper, while Conchostraca and Notostraca appeared to be restricted almost exclusively to the playa. Only one Conchostraca and 4 Notostraca were noted in eleven trap samples in the tank, while as many as 33 Conchostraca and 27 Notostraca were collected in a single trap sample in the playa. The insect population remained high in the tank, with some increase following the drying of the playa. The population of Corixid nymphs was high, averaging approximately 40/m^2 for the three dates sampled following drying of the playa.

Figure 33 illustrates the population fluctuations of the major predators Hydrophilidae and Dytiscidae, and their most probable insect prey, Corixidae and Ephemeroptera. The populations of these two groups, as estimated by the trap samples, are graphed for both the playa and the tank. The same data are given in Figure 34, except the sampling method is the sweep net rather than the trap. The smaller number of prey organisms collected in these samples is probably due to the escape of many of the earlier instars through the coarse mesh of the net.

Figs. 40 and 41 illustrate the relation of the total insect population to the eubranchipod population in the playa and the tank, as estimated by the trap samples (10) and the net samples (11). The last peaks in the insect populations are due almost entirely to the large population of Ceratopogonidae, a small aquatic Diptera larva, which reached a maximum concentration of $912/m^2$ in the tank on August 30.

The tank was nearly dry in mid-October, when a late rain brought the water level back up to the maximum capacity of the tank. This drying and reflooding was probably responsible for the large number of early instar eubranchipods in the last samples, and the reduction in other organisms.

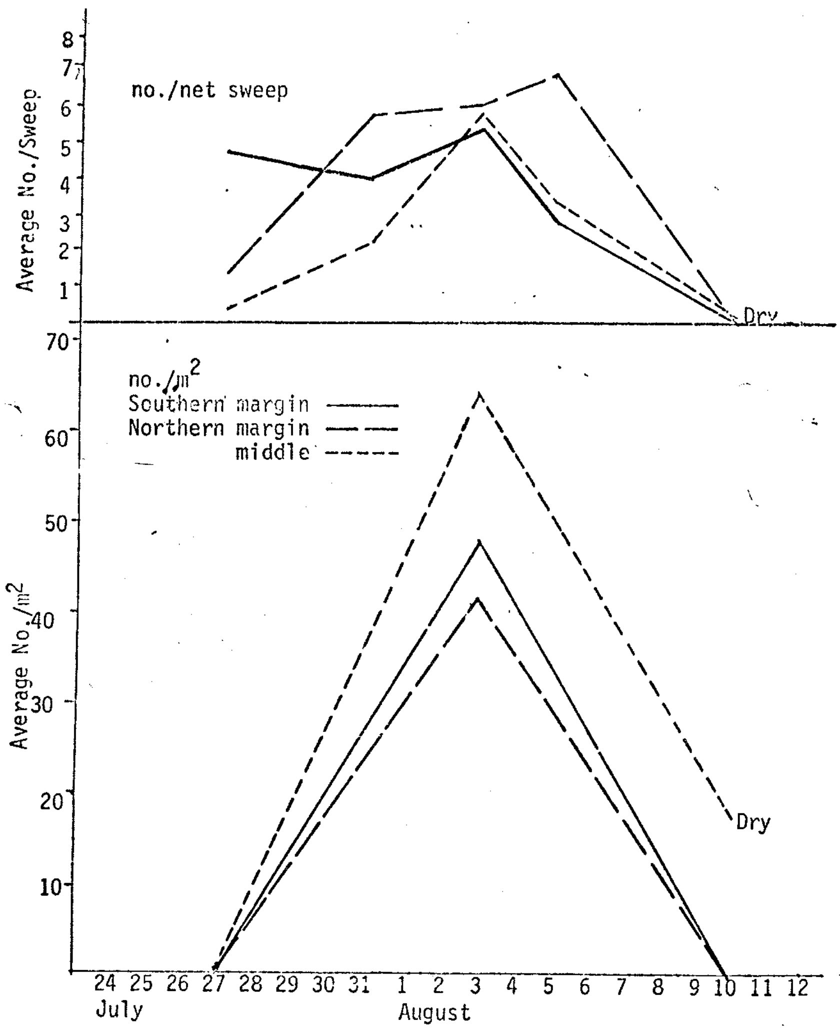

Figure 27. Population fluctuations of Apus longicaudatus in the three major areas of the lake. Las Cruces, New Mexico, July-August, 1970.

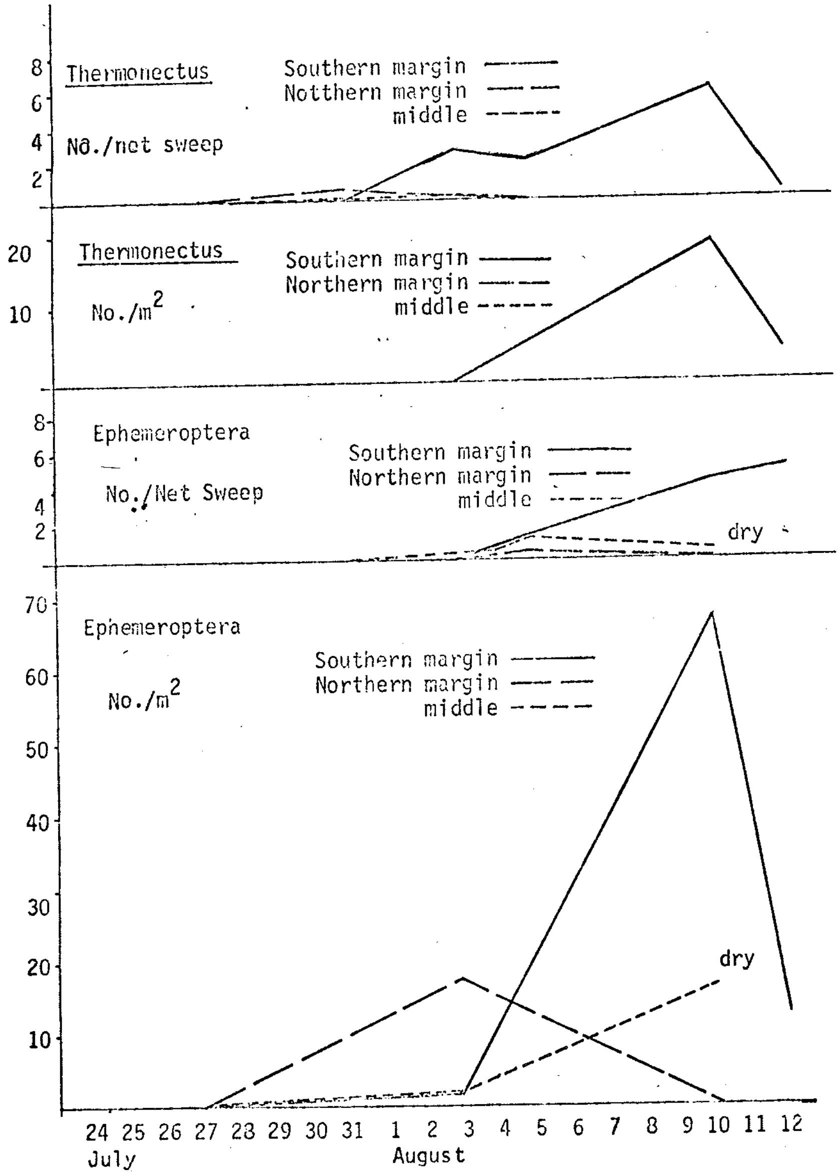

Figure 28. The population fluctuations of Thermonectus and Ephemeroptera in the three major areas of the playa. Las Cruces, New Mexico, July-August, 1970.

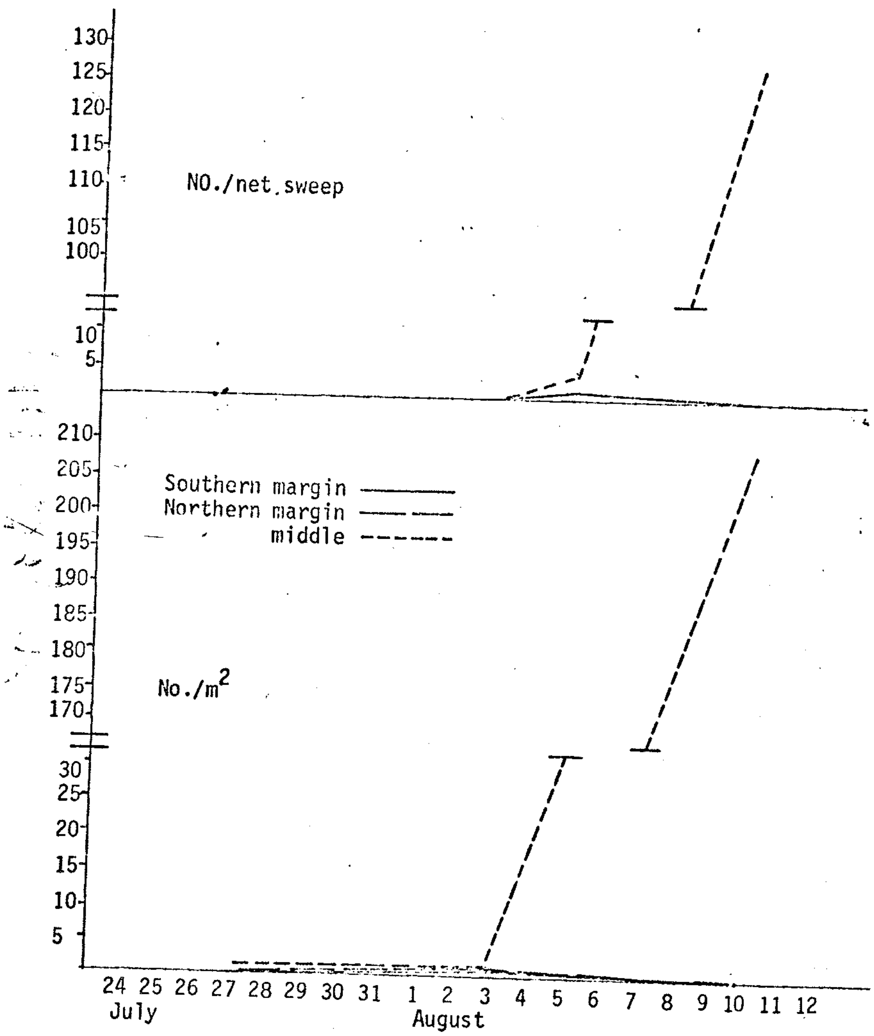

Figure 29. The population fluctuations of Corixidae in the three major areas of the playa. Las Cruces, New Mexico, July-August, 1970.

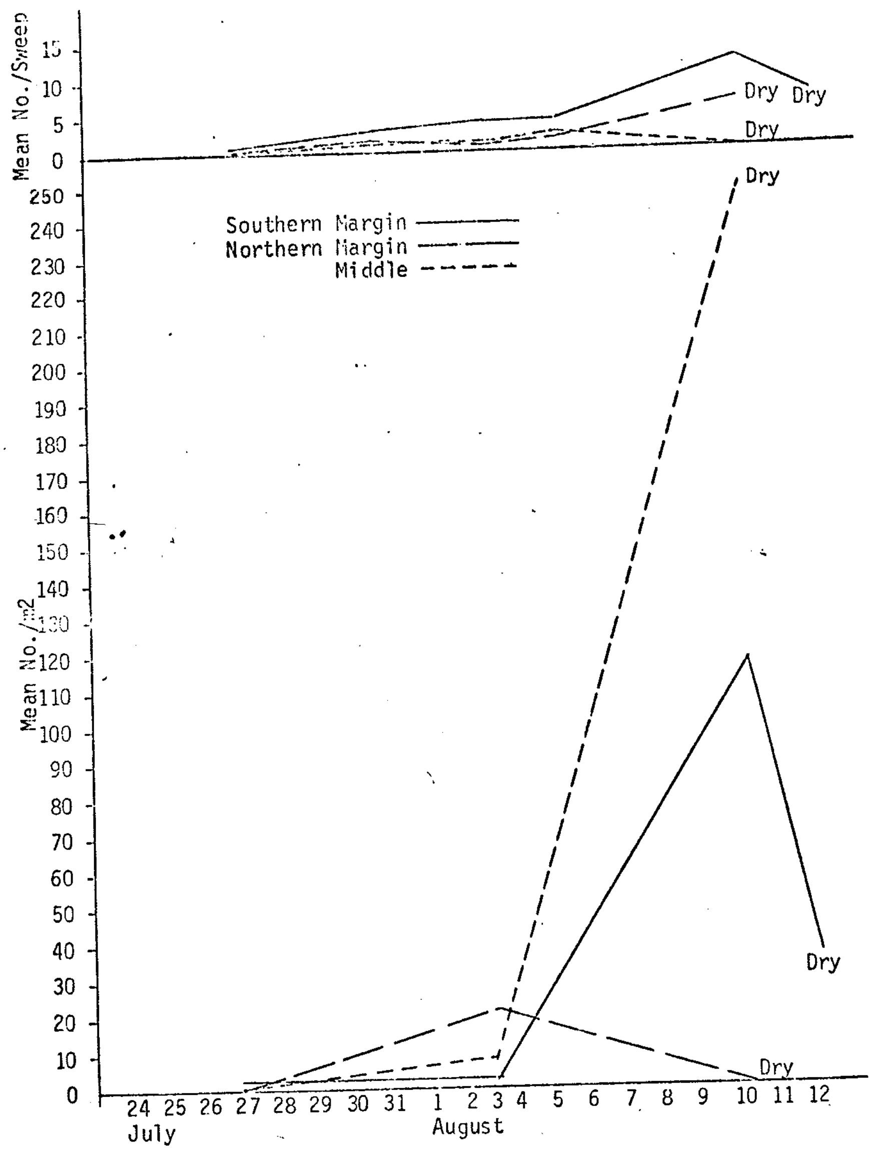

Figure 30. Population fluctuations of toal Insecta in the three major areas of the playa. Las Cruces, New Mexico, July-August, 1970.

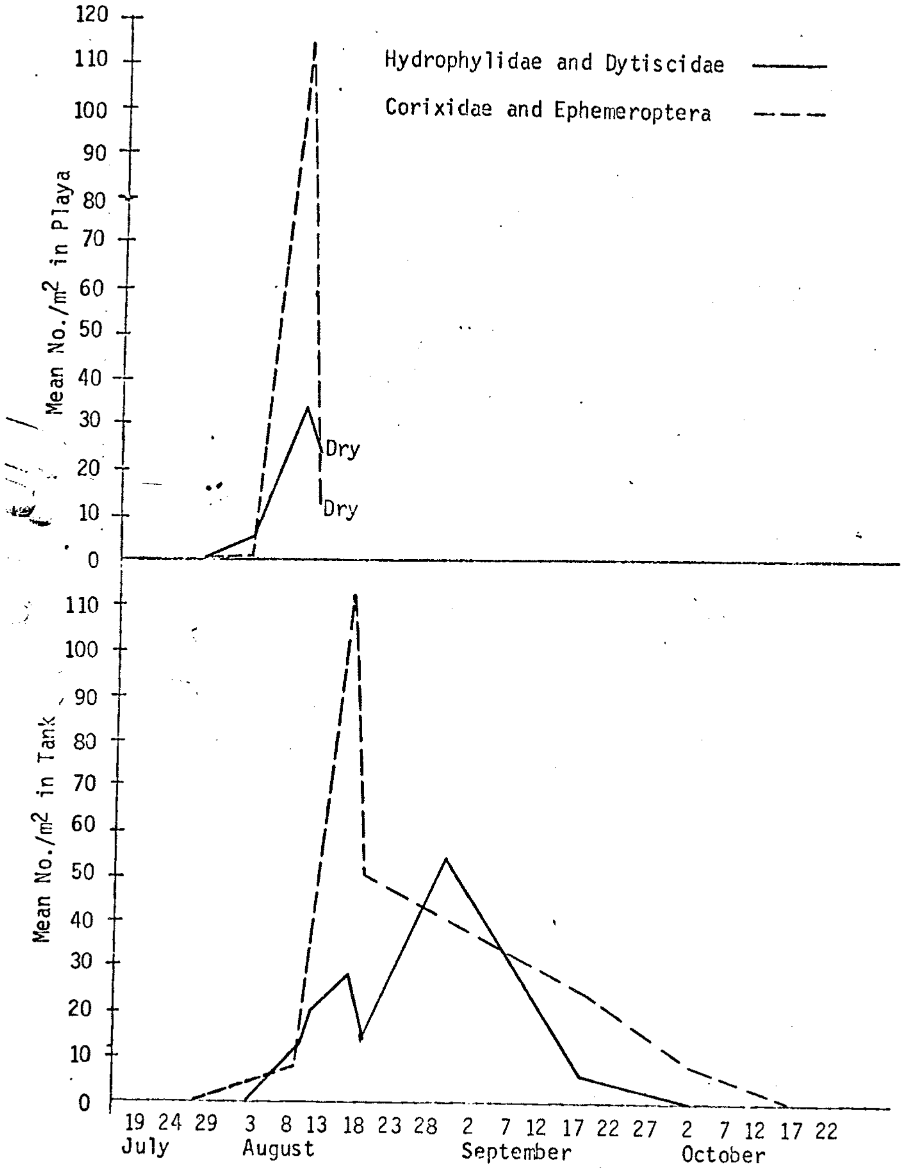

Figure 31. A comparison of the mean numbers of predaceous aquatic beetles (Dytiscidae and Hydrophylidae: Coleoptera) and two probable prey groups (Corixidae: Hemiptera and Baetidae: Ephemeroptera) per square meter in tank and playa samples. Las Cruces, New Mexico, July-Actober, 1970.

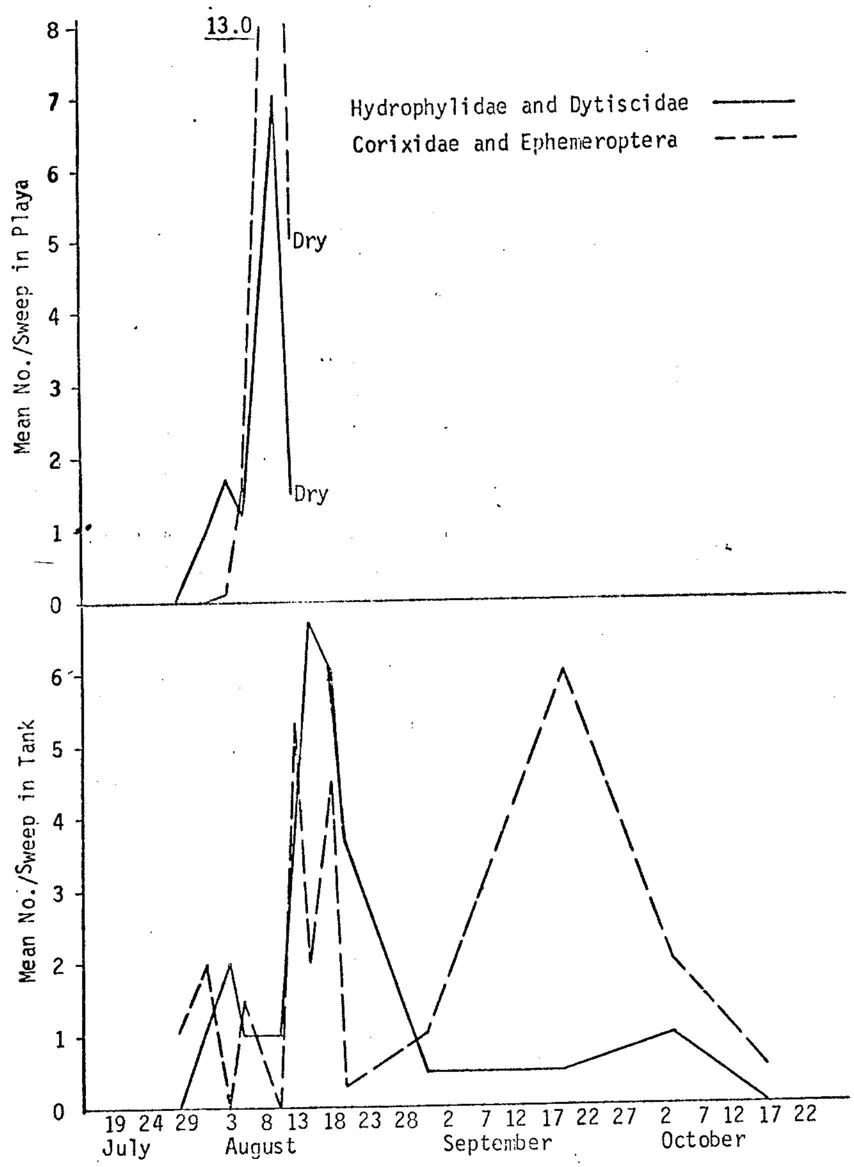

Figure 32. A comparison of the mean numbers of predaceous aquatic beetles (Hydrophylidae and Dytiscidae) and two probable prey groups (Corixidae; Hempitera and Baetidae: Ephemeroptera) per 5m net sweep in tank and playa samples. Las Cruces, New Mexico, July-October, 1970.

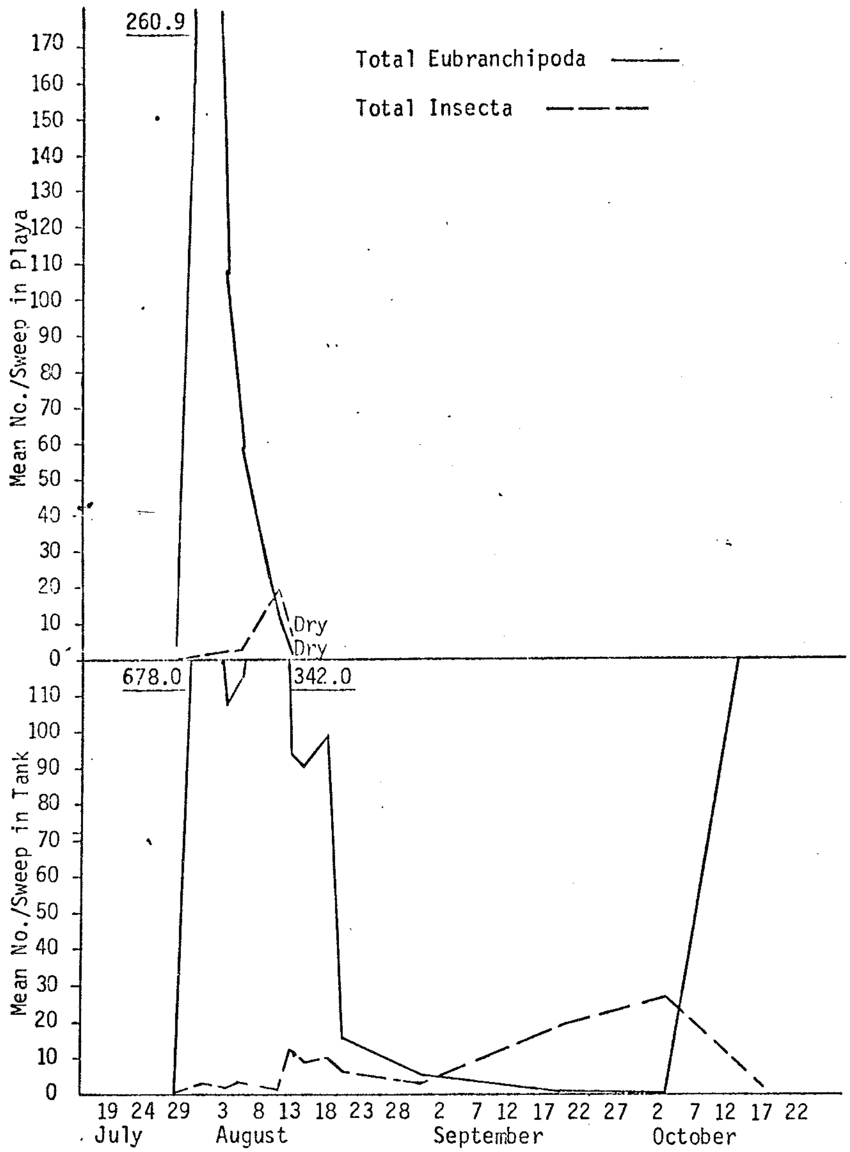

Figure 33. A comparison of the mean numbers of Eubranchipoda and Insecta per 5m sweep in the tank and playa samples. Las Cruces, New Mexico, July-August, 1970.

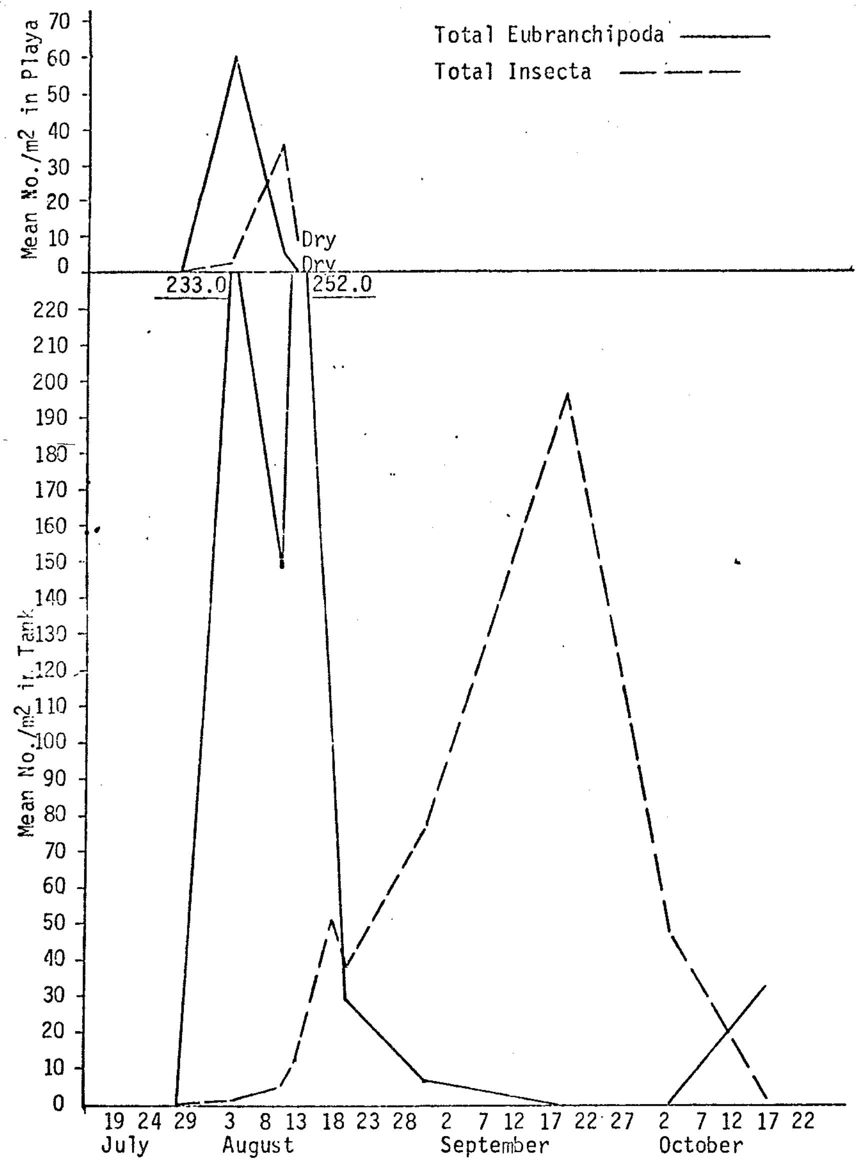

Figure 34. A comparison of the mean numbers of Eubranchipods and Insecta per square meter in tank and playa samples. Las Cruces, New Mexico, July-October, 1970.

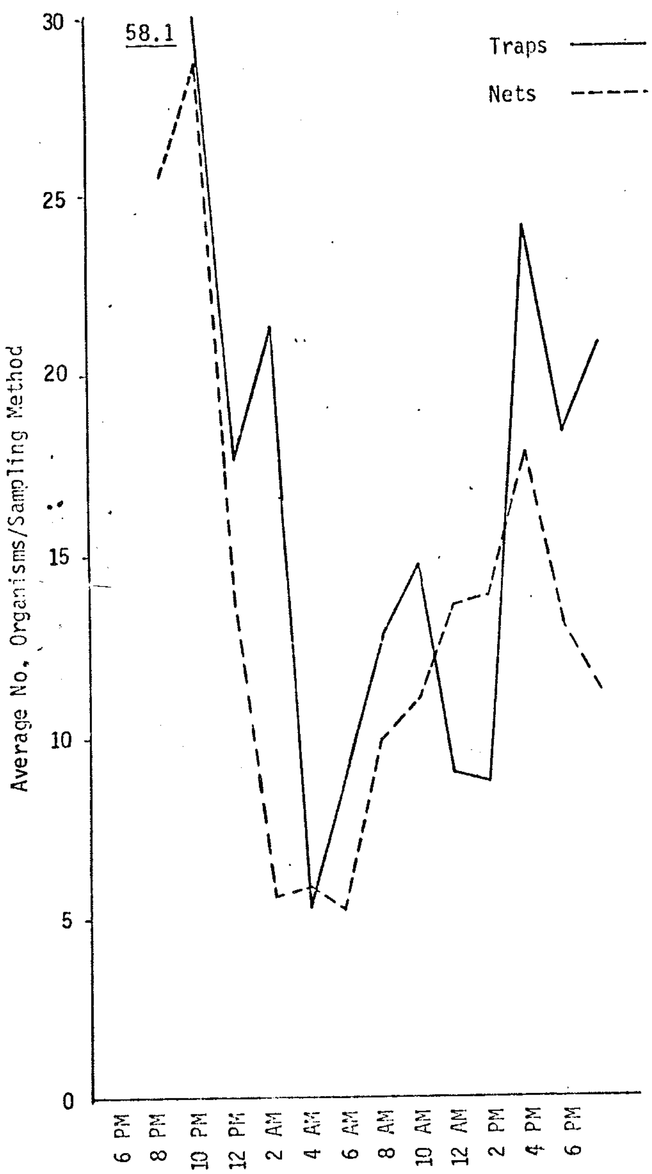

Figure 35. 24 hour study, average no. of aquatic invertebrate organisms captured by each sampling method. Las Cruces, New Mexico, August 6-7, 1970.

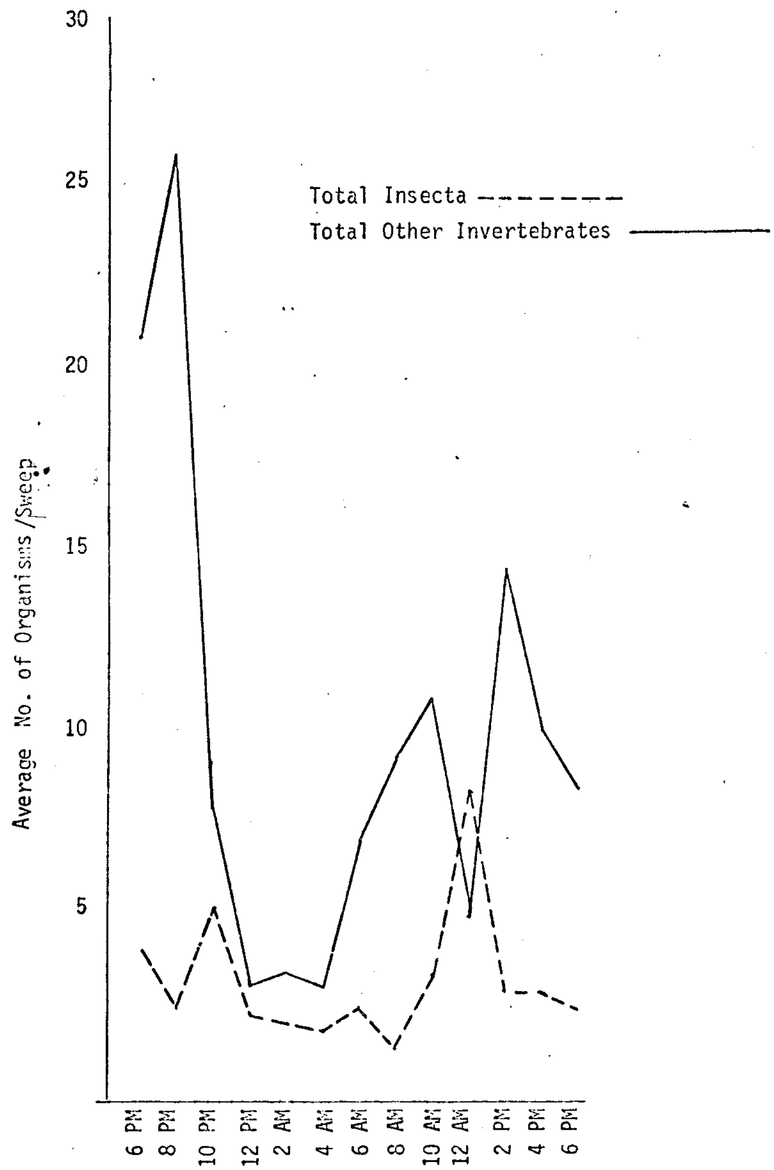

Figure 36. 24 hour study, average no. of insects and other invertebrates captured per 5m sweep. Las Cruces, New Mexico, August 6-7, 1970.

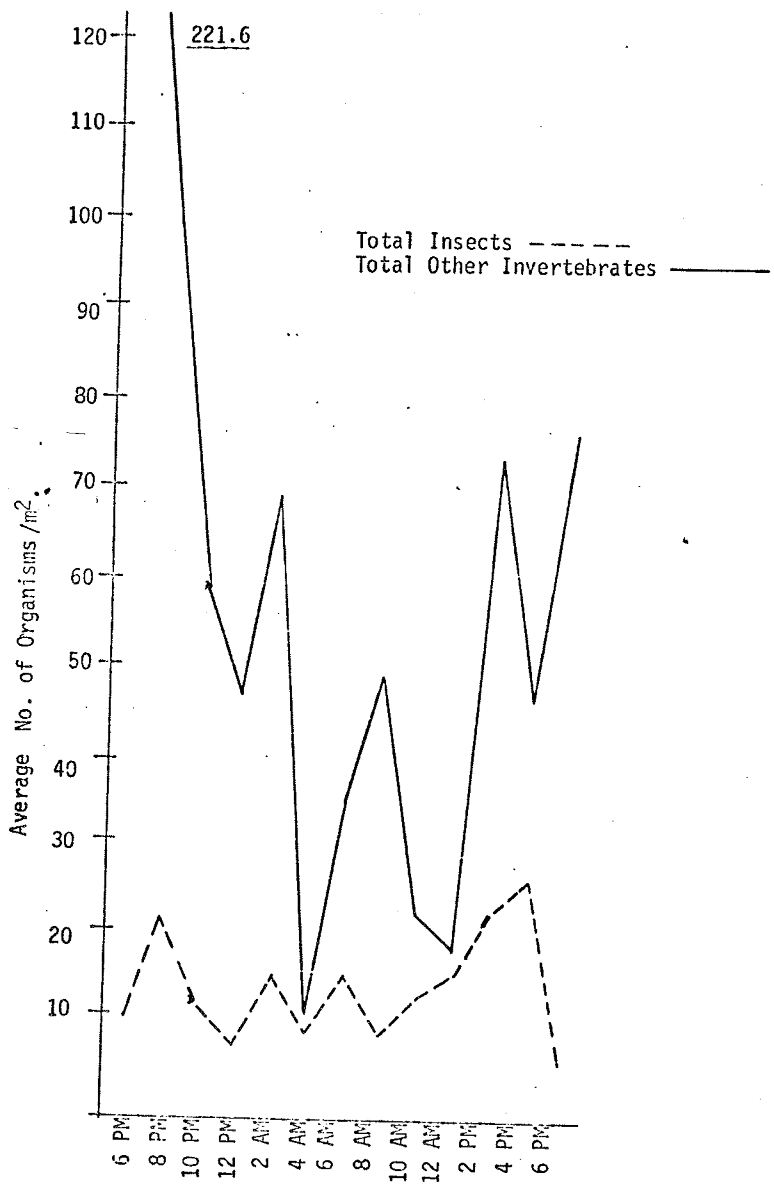

Figure 37. 24 hours study, number of insects and other aquatic organisms per m^2 as estimated by trap samples. Las Cruces, New Mexico, August 6-7, 1970.

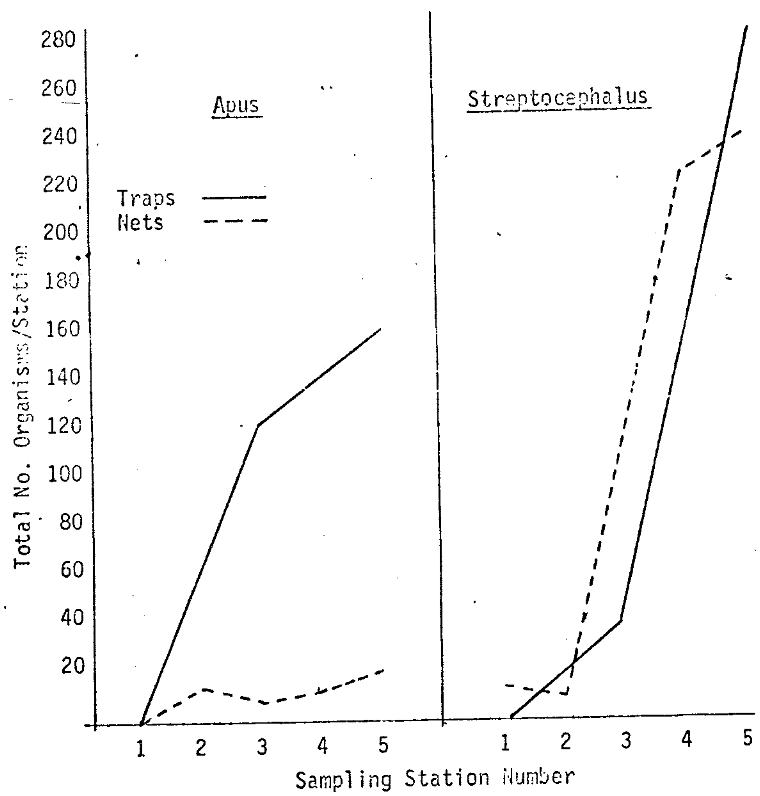

Figure 38. Spatial distribution of Apus and Streptocephalus; from 24 hour study. Las Cruce, New Mexico, August 6-7, 1970.

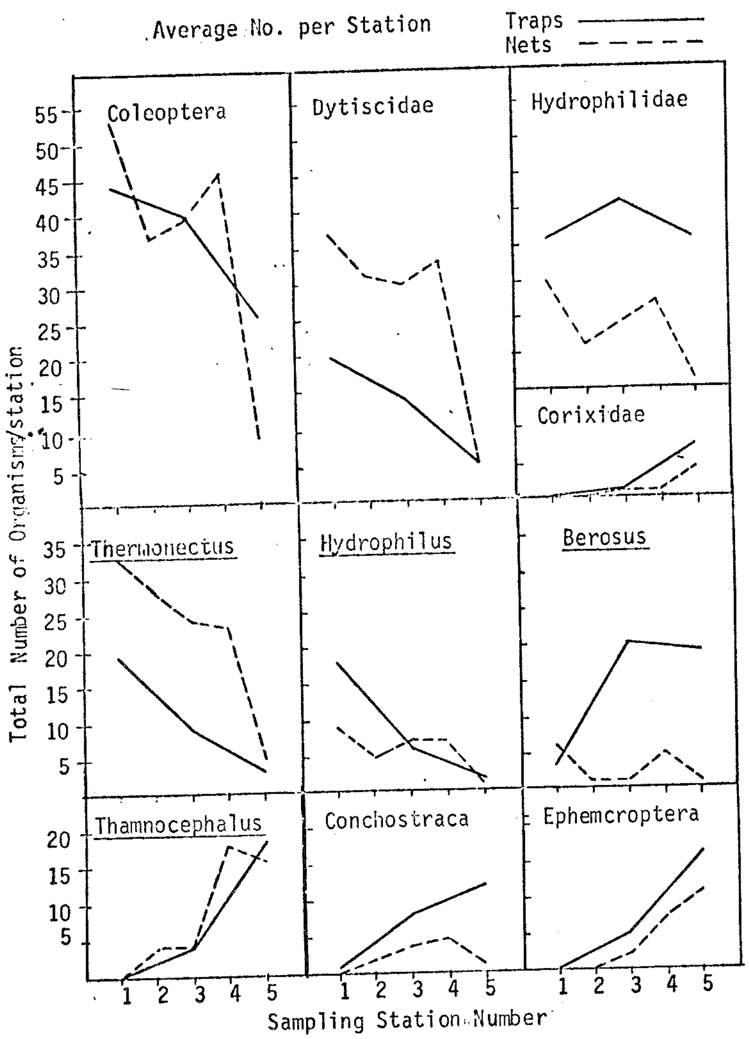

Figure 39. Spatial distribution of the major invertebrate taxa; from 24 hour study. Las Cruces, New Mexico, August 6-7, 1970.

Species Diversity -- Following is a list of the species of invertebrates collected at the Jornada study playa during the sampling period. Those specimens not positively identified are followed by a question mark. At least 35 species were collected and the most important ones are noted by an asterisk.

There appears to be few taxonomic specialists available to identify the specimens collected. Most identifications at this time have been made with available literature by the authors. We are presently awaiting the return of some of the collected materials from taxonomic specialists.

Biomass -- No biomass estimates have been made at this time because of the above stated difficulty in getting the specimens identified. Any specimens dried for biomass determinations would be almost impossible to identify at a later date. Once these estimates are made, a more complete evaluation of the importance of each species can be made.

Macroinvertebrate Checklist from the Jornada Playa

Class Eubranchipoda

Order Anostraca (Fairy Shrimp)

Family Streptocephalidae

*1. Streptocephalus texanus Packard ?

*2. Streptocephalus sp. ?

Family Thamnocephalidae

*3. Thamnocephalus platyurus Packard ?

Order Conchostraca (Clam Shrimp)

Family Lamnadiidae

*4. Eulimnadia sp. ?

Order Notostraca (Tadpole Shrimp)

Family Apodidae

*5. Apus (Triops) longicaudatus LeConte

Class Insecta

Order Ephemeroptera

Family Baetidae

*6. Callibaetis sp. ?

Order Hemiptera

Family Gerridae

7. Gerris sp. ?

Family Notonectidae

8. Buenoa margaritacea Bueno

9. Buenoa sp. #2 ?

*10. Notonecta undulata Say

Family Nepidae

11. Ranatra sp. ?

Family Belostomatidae

12. (One immature collected)

Family Corixidae

*13. Corisella edulis Champion

*14. Sigara (Vericorixa) alternata Say

*15. Sp. #3 ?

16. Sp. #4 ?

Order Coleoptera

Family Dytiscidae

*17. Eretes sticticus (L.)

*18. Thermonectus nigrofasciatus (Aube)

19. Laccophilus fasciatus Aube

20. Laccophilus vacaensis Young

21. Hygrotus nubilus (LeConte) ?

22. Hygrotus collatus (Fall) ?

Family Hydrophilidae

*23. Hydrophilus triangularis (Say)

*24. Tropisternus lateralis Herbst

25. Tropisternus sp. ?

*26. Berosus miles LeConte

*27. Berosus sp. #2 ?

*28. Berosus sp. #3 ?

Family Elmidae

29. Stenelmis sp. ?

Order Diptera

Family Culicidae

*30. Aedes sp.

*31. Psorophora signipennis (Coquillett)

*32. Culex tarsalis Coquillett)

*33. Culex sp. #2 ?

Family Chironomidae

34. Sp. #1 ?

Family Ceratopogonidae

Caloric Values - Plant Parts -- Caloric values of plant parts are presented in Table 15. As can be seen in Table 15, there was no sufficient difference in caloric values between sampling dates to warrant continued calorimetric determination for a species for each sampling date. We will do calorimetric determinations on samples taken at the end of the growing season to compare with values at the beginning of the growing season.

Table 15. Caloric values for plant parts sampled on the dates indicated. $\bar{X}$ is the mean, sd - standard deviation, N is number of samples.

Species	Sampling Date May 5, 1970	Sampling Date May 30, 1970
Panicum obtusum	Calories/gm	Calories/gm
1) living vegetative	$\bar{x}$ 4988.4NS5 sd 613.2 N = 5	$\bar{x}$ 4979.1NS6 sd 1053.8 N = 6
2) dead	$\bar{x}$ 4253.0 sd 400.2 N = 4	$\bar{x}$ 4271.5 sd 51.5 N = 4
3) litter	$\bar{x}$ 4304.4 sd 55.4 N = 3	$\bar{x}$ 4538.8 sd 152.6 N = 5
4) root	---	$\bar{x}$ 4436.6 sd 137.2 N = 22
Hilaria mutica		
1) living vegetative	$\bar{x}$ 4302.0 sd 631.5916 N = 3	$\bar{x}$ 4580.9 sd 130.7 N = 4
2) dead	$\bar{x}$ 4424.6 sd 279.0 N = 5	$\bar{x}$ 4662.5 sd 100.7 N = 4
3) litter	$\bar{x}$ 5385.8 sd 2817.7 N = 5	$\bar{x}$ 4488.8 sd 50.8 N = 3
Hymenoxys oderata		
1) living vegetative	---	$\bar{x}$ 4886.2 sd 88.9 N = 3
2) flowering	---	$\bar{x}$ 4479.0 sd 137.7 N = 3
Helianthus ciliaris		
1) standing dead	---	$\bar{x}$ 4242.2 sd 289.1 N = 3
Xanthium saccharatum		
1) litter	$\bar{x}$ 4713.7 sd 19.1 N = 4	$\bar{x}$ 4547.9 sd 111.0 N = 3
Descurainia pinnata		
	$\bar{x}$ 4460.3 sd 760.8	

Table 15 (Continued) Caloric values for plant parts sampled on the dates indicated. $\bar{x}$ is the mean, sd = standard deviation, N is number of samples.

Species	Sampling Date May 5, 1970	Sampling Date May 30, 1970
Lagomorph feces		
		CHN analysis[1]
	$\bar{x}$ 5872.8	40.24%C
	sd 1841.7	5.51%H
	N = 3	1.79%N
Cattle feces		
	$\bar{x}$ 4873.7	
	sd 567.9	
	N = 5	

1 Performed by Dr. George Meenaghan's Laboratory at Texas Tech University.

Microorganisms

The data on soil microorganisms are summarized in Tables 16 - 19. Obviously microbial activity in the soil is a function of soil moisture. Microbial counts increased markedly in the saturated soils sampled August 14 and October 20. However, this should not be construed to indicate that this increase in numbers in any way reflects the activity of these microorganisms. The plate count method provides data on the potential number of viable organisms, not numbers actually active at the sampling date.

These data do indicate that, based on numbers alone, fungi and aerobic bacteria are equally important decomposers in the playa soil. However, on the basis of biomass, fungi may be considered more important. We expect to resolve some of these questions during 1971 by comparing direct count methods with plate counts and possibly other techniques for assessing the relative importance and timing of activity of microorganisms.

A report on Microbial Ecology of Jornada Playa is included as an appendix to this report.

Table 16. Aerobic soil bacteria as determined by standard plate count methods for soil samples from the Jornada playa - 1970. Numbers in "Note" column refer to notes on page.

		April 30		May 15		August 14		October 20	
Sample Station	Sample Depth cm.	Organisms per gm. soil	Note	Organisms per gm. soil	Note	Organisms per gm. soil	Note	Organisms per gm. soil	Note
4	10	$3.8x10^6$	1,3	$5.2x10^6$	1,9	$5.4x10^7$	1,15	$6.2x10^7$	15
4	20	$3.5x10^6$	3	$4.5x10^9$	7,9	$2.3x10^7$	1,15	$2.2x10^7$	15
4	30	$2.7x10^6$	3	$5.1x10^9$	7,9	$2.2x10^7$	15	$4.4x10^7$	15
17	10	$3.5x10^6$	1,3	$3.0x10^6$	1,9	$1.6x10^8$	1,15	$2.6x10^7$	1,15
17	20	$4.6x10^6$	3	$3.7x10^6$	1,9	$2.4x10^8$	15	$8.8x10^6$	1,15
17	30	$2.8x10^6$	1,3	$2.7x10^6$	1,9	$2.4x10^8$	15	$8.8x10^6$	1,15
23	10	$5.1x10^6$	3	$4.2x10^6$	1,9	$2.4x10^8$	15	$3.0x10^7$	15
23	20	$3.2x10^6$	1,3	$3.1x10^6$	9	$1.5x10^8$	1,15	$1.5x10^7$	1,15
23	30	$1.7x10^6$	1,3	$2.6x10^6$	9	$2.0x10^6$	1,15	$1.4x10^7$	1,20
31	10	$2.6x10^6$	1,3	$2.4x10^6$	1,13	$3.4x10^9$	1,18	$5.1x10^7$	1,15
31	20	$3.4x10^6$	1,3,6	$2.8x10^6$	1,13	$5.4x10^8$	18	$19.5x10^6$	1,15
31	30	$2.2x10^6$	1,3,6	$2.2x10^6$	1,9	$3.7x10^8$	1,18	$7.7x10^9$	1,15

Table 17. Fungi as determined by standard plate count methods for soil samples from Jornada playa 1970. Numbers in the columns labeled "Note" refer to notes on page.

		April 30		May 15		August 15		October 20	
Sample Station	Sample Depth cm.	Organisms per gm. soil	Note	Organisms per gm. soil	Note	Organisms per gm. soil	Note	Organisms per gm. soil	Note
4	10	9.5×10^{5}	1,4	16.5×10^{5}	1,10	7×10^{5}	1,16	1.3×10^{7}	1,16
4	20	13.3×10^{5}	1,4	14.6×10^{5}	1,10	6.5×10^{5}	1,16	5.7×10^{6}	1,16
4	30	8.1×10^{5}	4	10.7×10^{5}	1,10	3.5×10^{5}	1,2,16	5.1×10^{6}	16
17	10	8.4×10^{5}	4	3.3×10^{6}	1,10	1.6×10^{8}	1,16	1.9×10^{7}	1,16
17	20	11.7×10^{5}	1,4	1.1×10^{6}	1,10	5.3×10^{7}	16	1.2×10^{7}	16
17	30	2.9×10^{5}	2,4	4.3×10^{5}	2,10	3.4×10^{6}	16	6.9×10^{6}	16
23	10	5.1×10^{6}	1,4	7.5×10^{5}	1,10	9.9×10^{7}	1,16	4.9×10^{8}	16
23	20	6.6×10^{5}	4	8.3×10^{5}	1,10	2.5×10^{7}	1,16	1.6×10^{7}	16
23	30	3.3×10^{5}	2,4	3.4×10^{5}	1,2,10	1.4×10^{7}	1,16	5.4×10^{6}	1,16
31	10	12.2×10^{5}	4	3.7×10^{5}	1,2,10	1.4×10^{8}	1,16	3.8×10^{8}	16
31	20	3.9×10^{6}	1,4	7.4×10^{5}	1,10	7.0×10^{7}	1,16	5.6×10^{6}	1,16
31	30	3.7×10^{5}	1,4	1.6×10^{5}	1,10	3.6×10^{7}	1,16	7.7×10^{6}	1,16

Table 18. Anaerobic soil bacteria as determined by standard plate count for soil samples from the Jornada playa - 1970. Numbers in the columns labeled "Note" refer to notes on page.

		April 30		May 15		August 14		October 20	
Sample Station	Sample Depth cm.	Organisms per gm. soil	Note	Organisms per gm. soil	Note	Organisms per gm. soil	Note	Organisms per gm. soil	Note
4	10	1.8×10^{5}	2,5	^{5}	8	7.9×10^{7}	17	4.0×10^{6}	17
4	20	3.9×10^{5}	2,5	6.9×10	11	11.0×10^{7}	17	1.9×10^{7}	17
4	30	7.9×10^{5}	5	7.5×10^{5}	11	12.3×10^{7}	17	5.2×10^{7}	17
17	10	6.4×10^{5}	5	4.0×10^{6}	11,12	9.6×10^{7}	17	2.6×10^{5}	2,17
17	20	6.5×10^{5}	5	9.5×10^{5}	11	2.7×10^{7}	17	17.8×10^{6}	17
17	30	5.6×10^{5}	5	9.8×10^{5}	11	1.2×10^{7}	17	19.4×10^{6}	17
23	10	3.0×10^{5}	2,5	4.3×10^{5}	2,11	4.6×10^{7}	17	8.2×10^{4}	2,17
23	20	7.9×10^{5}	5	14.6×10^{5}	11	3.4×10^{7}	17	3.6×10^{6}	17
23	30	4.5×10^{5}	5	7.5×10^{5}	11	10.1×10^{7}	17	14.7×10^{6}	17
31	10	3.9×10^{5}	2,5	4.7×10^{5}	2,11	8.3×10^{8}	17,18	1.8×10^{7}	17
31	20	9.7×10^{5}	5	6.1×10^{5}	11	1.6×10^{8}	17,18	2.9×10^{6}	17
31	30	1.2×10^{5}	2,5	6.2×10^{5}	11	$12/5 \times 10^{8}$	17,18	1.6×10^{6}	17

Table 19. Moisture status of playa soils on dates sub-samples were taken for plate counts.

Depth cm.	April 30	May 15	August 14	October 20
0-10	dry -less than 2% water by weight	dry -less than 2% water by weight	saturated	nearly saturated
10-20	dry -less than 2% water by weight	dry - less than 2% water by weight	saturated	saturated
20-30	moist-approx. 10% water by weight	moist - approx. 10% water by weight	saturated	saturated

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Explanatory Notes

Note #1. - Plate counts less than 7 of aerobes and fungi are not considered accurate due to the possibility of error introduced from contamination. This is not usually a major problem in anaerobic cultures.

Note #2. - Plate counts which are this low may or may not be representative of the soil population. Such low numbers may indicate or result from errors in sampling, dilution, plating, incubation, or any combination of these factors. Such low counts are also changed greatly if any contamination is present.

Note #3. - Aerobic bacteria cultured from soil samples taken 4/30/70 showed heterogeneity with respect to colonial morphology, distribution of motile and non-motile forms, distribution of pigmented and non-pigmented forms, and no abundance of any single, recognizable form was evident.

Note #4. - Fungi cultivated from soil samples taken 4/30/70 indicated Mucor sp. and Penicillium sp. as the predominating forms - with some Aspergillus sp. also noted - from gross observation and examination of plates.

Note #5. - Anaerobes cultivated from soil samples taken 4/30/70 showed uniform distribution of various colonial types - no unusual or predominant forms were evident.

Note #6. - Counts of this type (in which the dilutions do not follow the normal pattern) usually result from an error in dilution, contamination of plates, or colloidal material from the diluted sample being present in the plate. In any case, such a count is usually not representative.

Note #7. - These samples showed abnormally high counts. The predominant organism was a yellow pigmented, gram-positive coccus. The high counts indicate that the core was taken from decomposing substrate. These counts are not representative.

Note #8. - This data was apparently lost or misplaced.

Note #9. - Aerobic cultures of soil samples taken 5/15/70 showed heterogeniety with respect to numbers and types of forms. No abundance of any single, recognizable colonial type was evident. Some plates showed growth of a somewhat motile, gram positive rod which comprised a slightly dominant form. No single depth or location showed this phenomenon - distribution seemed to be random.

Note #10. - Fungi cultivated from soil samples taken 5/15/70 indicated Mucor sp. as the predominant form - Pennicilium sp. and Aspergillus sp. were also noted - from gross examination of plates.

Note #11. - Anaerobes cultured from soil samples taken 5/15/70 showed heterogeneity with respect to numbers and types of forms-- no unusual or predominant forms were noted.

Note #12. - This sample was recounted for anaerobes due to the unusually high count. The results of the second count were similar to the results of the first. The odor of H_2S was evident from this set of cultures in both cases.

Note #13. - These 2 samples showed abundant growth of a red pigmented, non-motile, gram-positive short rod.

Note #14. - Aerobes cultured from samples taken at this date showed uniform distribution of various colonial types - no unusual or predominant forms were noted.

Note #15. - Fungi cultured from samples taken at this date showed a heterogeneous mixture of forms-- no predominant form was noted.

Note #16. - Anaerobic plates cultured from samples taken at this date showed growth of a highly motile, gram negative, rod-shaped bacteria which tended to spread over the surface of the plate after 48 hrs.

Note #17. - The unusually high counts of these samples were rechecked and found to be correct.

Note #18. - These plates were accidentally contaminated.

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Helen Hart . . . . .general field assistance

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David Apodoca . . . . lagamorph census

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APPENDIX

Microbial Ecology of Desert Playas

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Abstract

Microbiological studies of the playa employed a variety of methods to determine the bacterial types and standing crop, the uptake of radioactive substrates and decomposition rates in the playa basin. Bacterial population are similar in type and number to those of previously studied lakes of the Lubbock region. These populations assimilated greater amounts of acetate than glucose, a finding contrary to previous studies. Caloric values of grass and cow chips from the basin were essentially the same. Approximately 25 species of bacteria were isolated from grass and soil of the basin.

Objectives

The objectives of this study were:

1. to conduct an inventory of numbers and types of aerobic, heterotrophic bacteria of the Jornada playa
2. To measure the uptake of selected radioactive substrates by these bacteria in order to estimate the heterotrophic potential of these functional types
3. to measure the uptake of radioactive substrates by the phytoplankton present in the playa as an estimate of the primary productivity of this component of the ecosystem
4. to measure the caloric content and decomposition rates of the grasses and cow manure of the system which serve as substrate for the microbial populations of the playa ecosystem
5. in addition, similar measurements made at selected subsites were designed to provide a comprehensive analysis of the system
6. correlation of bacterial population measurements with chemical and biological components were an associated goal of the study

Methods

Due to debris, detritus, and so on, there was too much sand and dirt in the playa. The methods for determining the uptake of radioactive substrates, glucose, acetate, and sodium bicarbonate in the light and in the dark are as follows:

Concentrations for glucose and sodium bicarbonate were approximately 2.5 μc per ml and for acetate, 0.25 μc per ml of uniformly labeled substances in each case. These known concentrations of radioactive substrates were suspended in 100 ml of basal salt solution of pH 7.1. 1 ml amounts were aseptically placed in screw-cap tubes and refrigerated until time of use. At sampling time, one ml of the lake sample was pipetted into 1 ml of radioactive solution and incubated in the lake for 1 hr. The incubation time for the sodium bicarbonate in the light and in the dark was the same. The dark tubes were wrapped in aluminum foil. Following the incubation period the organisms were inactivated by the addition of membrane filters using a membrane filter apparatus. The cells were washed with two 10 ml portions of distilled water. The filters were then air dried under a 100 watt bulb and placed in scintillation counting vials containing 15 ml of scintillation cocktail. Counts were made using a Beckman Scintillation Counter.

A known amount of leaf litter was added to litter bags with 3 different neck sizes. These were suspended in the water and removed weekly. The organism matter remaining was washed, weighed, and dried.

Caloric values using a power bomb calorimeter were taken. The bags did not survive the debris pounding against them, drying, and so forth, so we lost much of this. However, we did get the caloric values on these things.

Results and Discussion

Bacterial populations:

Approximately 25 types of aquatic bacteria were isolated on the basis of colony morphology. These organisms were present in water samples, soil samples, on grasses, and in decomposing cow manure. Pigmented, gram-negative bacilli were most commonly isolated. Taxomonic studies were not conducted. Actinomycetales-like forms were present. Types were similar to those described in an earlier review (Gooden, 1970).

Six originally selected sampling sites dried quickly and alternate sites were chosen to continue the study. In a few sites, samples were taken throughout the full study period. Variations between sites were due in part to localized effects of drying. Fluctuations at the same sites were due to diurnal changes and sampling error. In total, the populations were within a range of one order of magnitude which is the probable range of validity for the dilution plate method used.

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Measurements of uptake of radioactive substrates by bacteria indicate that acetate-utilizing functional types were more abundant than were glucose-using types. Alternatively, fewer numbers of organisms may have been assimilating acetate at a higher rate than those using glucose; either case being true, more acetate than glucose was assimilated. The method used does not entirely eliminate the possibility that acetate was preferentially absorbed to soil and organic particles present. However, using similar and identical concentrations in Texas playa lakes we found that, in most instances more glucose than acetate was assimilated (Hill, 1971).

Dark and light uptake of radioactive CO_2 was approximately equal and insignificant. All evidence points to the fact that the method used was not suitable for the system studied. We suggest that a more careful handling of the stock solution and samples will result in increased accuracy in the measurement of phytoplankton productivity.

Bacterial populations fluctuate on a 24-hour basis as indicated by a series of diurnal samplings made at selected sites. The changes in numbers of bacteria suggest that the usual midmorning sampling time was suitable for securing the greatest number of bacteria at the water surface. Highest bacterial numbers per ml of lake water were counted on August 12. Later counts at alternate sample sites 14, 15, 16 and 17 showed that relatively low numbers of bacterial cells remained even though the lake water was diminishing. These data are in agreement with studies conducted on Texas playa lakes.

The turbidity of the lake water prevented the use of the fluorescent-acridine orange direct counting method for bacterial enumeration. The soil particles and debris present were greater than that of most aquatic systems. In general the plate counts of these bacteria populations were in line with previous studies. No observations were made regarding changes in dominant bacterial types.

Uptake of Radioactive Substrates:

Uptake of ^{14}C-Acetate was greater than that of ^{14}C-U-Glucose in practically every instance and at every site. Exceptions to this were observed only in a specific study near a concentration of cow manure. In this case the uptake of both glucose and acetate were quite low and comparable. ^{14}C-Acetate was utilized at site #1 in amounts which varied by the day and time of day at which the sample was taken. At site #1 significant amounts of glucose were assimilated on only two occasions. Our data show that the uptake of glucose fluctuated little except for the site #3 on 8-7 (1:35 AM) at 37.6 cmp, site: enclosure on 8-3 (AM) at 27.6 cpm and at site #10 on 8-7 (1:55 AM) at 21.0 cpm.

Caloric values:

Vascular plant samples harvested from the playa basin were dried, weighed and the caloric value of 8 samples was determined using a Parr Bomb Calorimeter. An average caloric value of 4280 calories per gram dry weight was obtained. Approximately 100 "litter bags" of 3 different mesh sizes were filled with a measured amount of dried plant biomass (approximately 1.75 gm). The bags were suspended by string to wooden poles at random sites in the lake. Unfortunately, only 9 samples were recovered, washed, weighed, and the caloric value measured. These samples averaged 31.7% decomposition and 4142 cal/gm dry weight. Wide variety is seen between samples, however. These figures are practically worthless since the data concerning exposure time and location and size of mesh bag are not available. Cow manure samples varied little in caloric value regardless of age, and values were essentially the same for grass as for the manure 4280 vs. 4281/cal/gm.

Decomposition Studies:

Tubosa grass taken from the playa during the spring was dried, cut up, and placed in carefully prepared bags of 4 different mesh sizes. Four replications of the 4 bags were placed at each of the 6 selected locations. These bags were to be retrieved at intervals, the grass washed, dried, and weighed in an attempt to measure decomposition rates. Mesh sizes were designed to allow access to decreasing size and numbers of animal decomposers.

The bags were in place prior to filling and were quickly covered with debris and dirt from the playa water. Apparently due to debris and wind-wave action, the bags did not withstand the decomposition tests as well as the grasses. With the exception of the bags made from an army-surplus parachute, many of the mesh bags tore or disintegrated under stress (such was not the case in our previous work). Part of the bags recovered were destroyed after I left TTU. These could have been used for caloric value measurements.

In vitro decomposition studies were initiated to determine degradation of the grasses in microcosm developed from grass and soil from the Jornada playa. These studies had been in progress for 6 weeks to 2 months prior to the filling of the playa. Each week remaining grasses from duplicate flasks was dried, weighed, and prepared for caloric measurements. This work was to be continued and completed by a graduate assistant. Apparently, the data has been lost or destroyed since I can get no information by phone or mail regarding this phase of the work.

Microscopic observations of bacteria and phytoplankton were attempted, but proved to be unsuitable in this lake. The high turbidity and debris content prevent microscopic examination and direct counting of bacterial and algal populations.

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