BIOLOGICAL RESOURCES ENVIRONMENTAL PLANNING TECHNICAL REPORT FOCUSED SENSITIVITY SPECIES SURVEYS

DECEMBER 1993

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BIOLOGICAL RESOURCES ENVIRONMENTAL PLANNING TECHNICAL REPORT FOCUSED SENSITIVE SPECIES SURVEY

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Abstract: Surveys were conducted in 1992 and 1993 to determine baseline biological resource conditions for environmental documentation for the Installation Restoration Program at Edwards Air Force Base. Focused surveys were conducted for three sensitive plant species, eubranchiopods (freshwater shrimp), the desert tortoise, and Mohave ground squirrel. Sensitive plant surveys focused on known populations of desert cymopterus, Barstow woolly sunflower, and alkali mariposa lily. These surveys determined the approximate boundaries and numbers of individuals associated with each population. Eubranchiopod surveys identified four major types of eubranchiopod habitat on the base: playas, edge playas, claypans, and road pools, which differ from each other in size, physical properties, and chemical properties. Three species of fairy shrimp were identified at Edwards AFB: *Branchinecta gigas, B. mackini,* and *B. lindahli*; one species of tadpole shrimp, *Lepiduras lemmoni*; and one species of clam shrimp, *Eocyzicus digueti*. Desert tortoise surveys revealed a trend of increasing relative density from west to east across the base. Creosote bush scrub and arid phase saltbush habitats appeared to provided the best habitats for the desert tortoise with halophytic phase saltbush scrub habitats in the southwest portion of the base apparently providing the poorest habitat for the species. Trapping studies for the Mohave ground squirrel confirmed the presence of several breeding populations in the eastern portion of Complex One Charlie and the Gravity Wave area northeast of Rogers Dry Lake. Sensitive species were also detected incidental to all surveys conducted in 1992 and 1993 on Edwards AFB. Desert cymopterus was observed in two areas on the east side of the base and alkali mariposa lily was observed in low numbers in many areas of the base. Desert tortoise sign was found throughout the base during other surveys in roughly equal proportions to the relative densities recorded in focused surveys for this species. The Mohave ground squirrel was observed incidentally in native habitats in all but the most southwestern portions of the base.

Purpose and Need for Surveys

On August 30, 1990, Edwards Air Force Base (AFB) was placed on the National Priorities List, making it subject to the federal facilities provisions of Section 120 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). This action required the Air Force to enter into a Federal Facilities Agreement (FFA) with the U.S. Environmental Protection Agency (EPA) for the implementation of environmental restoration efforts under the Installation Restoration Program (IRP). The FFA was signed by the Air Force, EPA, and California Department of Health Services (now referred to as CalEPA-DTSC) on October 16, 1990. The FFA requires compliance with many federal and state laws, and also requires the establishment and implementation of appropriate procedures for the remediation of hazardous materials releases. In compliance with this agreement, any ground disturbance activities

associated with testing and remediation may not occur until environmental resources inventories, including sensitive species surveys, are completed.

Edwards AFB contains 10 Operable Units (OUs), which include 408 IRP sites and Potential Release Locations (PRLs) where hazardous waste or toxic materials may have been intentionally or inadvertently released. Although many of these sites and PRLs are concentrated in developed areas, several are also scattered throughout the base. Site investigations to determine types and sources of contamination may include installing soil borings, groundwater monitoring wells, and performing seismic and electromagnetic surveys. Remediation technologies may require substantial ground disturbance resulting in impacts to biological resources, including species considered sensitive by the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (CDFG), and/or the California Native Plant Society (CNPS) (Table 1).

Focused surveys were conducted for desert cymopterus, Barstow woolly sunflower, alkali mariposa lily, eubranchiopods (freshwater shrimp), desert tortoise, and Mohave ground squirrel. These surveys provide important resource management information, a baseline for assessment of potential impacts to sensitive species resulting from the implementation of the IRP, and a basis for the development of mitigation and impact reduction measures. Protecting the habitats on the base supplements mitigation measures directed at specific sensitive species.

Surveys have been conducted in the past for the three plant species chosen for focused surveys (desert cymopterus, Barstow woolly sunflower, and alkali mariposa lily), but more intensive surveys were required to further characterize the extent of these populations. These species were chosen because at the time of the survey in 1993, these were the only three species that existed on Edwards AFB that were given federal protection as candidate species by the USFWS. Since that time, the candidate listing has been revised by USFWS and the species have been given new status as federal species of concern. Desert cymopterus (*Cymopterus deserticola*) is a perennial herb of the family Apiacae that is known mostly from its occurrences on Edwards AFB. This species is generally found along sandy swales and washes, most often in Joshua tree woodlands (Charlton 1993). The Barstow woolly sunflower (*Eriophyllum mohavense*) is an annual herb of the family Asteracae that occurs in the Mojave Desert and is threatened by road construction, off-road vehicles and grazing. This species generally grows on small rises between bare sinks in arid phase saltbush scrub (Charlton 1993), but has also been found in similar areas within

Table 1

Endangered, Threatened, and Sensitive Species Detected on Edwards AFB

Scientific Name	Common Name	Federal Status[1]	State Status[2]	CNPS Status[3]
Plants				
Astragalus preussii var. *laxiflorus*	Lancaster milkvetch	none	none	1B
Calochortus striatus	alkali mariposa lily	SC	none	1B
Canbya candida	pygmy poppy	none	none	1B
Chorizanthe spinosa	Mojave spineflower	none	none	4
Cymopterus deserticola	desert cymopterus	none	none	1B
Eriophyllum mohavense	Barstow woolly sunflower	SC	none	1B
Goodmania luteola	yellow spiny cape	none	none	4
Loeflingia squarrosa var. *artemisiarum*	sage-like loeflingia	none	none	1B
Muilla coronata	crowned onion	none	none	4
Reptiles				
Gopherus agassizii	Desert tortoise	T	T	none
Sauromalus obesus	Chuckwalla	SC	none	none
Uma scoparia	Mojave fringe-toed lizard	none	CSC	none
Birds				
Accipiter cooperi	Cooper's hawk	none	CSC	none
Aquila chrysaetos	Golden eagle	none	CSC	none
Asio flammeus	Short-eared owl	none	CSC	none
Asio otus	Long-eared owl	none	CSC	none
Athene cunicularia	Burrowing owl	none	CSC	none
Buteo regalis	Ferruginous hawk	SC	CSC	none
Buteo swainsoni	Swainson's hawk	none	T	none
Chaetura vauxi	Vaux's swift	none	CSC	none
Circus cyaneus	Northern harrier	none	CSC	none
Falco mexicanus	Prairie falcon	none	CSC	none
Lanius ludovicianus	Loggerhead shrike	SC	none	none
Toxostoma lecontei	Le Conte's thrasher	SC	CSC	none
Mammals				
Spermophilus mohavensis	Mohave ground squirrel	SC	T	none
Taxidea taxus	American badger	none	CSC	none

Notes: [1]Federal Status: T = Threatened; SC = Special concern species
[2]State Status: T = Threatened; CSC = California species of special concern
[3]California Native Plant Society (CNPS) Status: 1B = Plants rare, threatened, or endangered in California; 4 = Plants of limited distribution

creosote bush scrub communities within the study area. The alkali mariposa lily (*Calochortus striatus*) is a perennial herb of the Liliacae family that occurs in the Mojave Desert in California and Nevada and is threatened by construction, off-road vehicles and grazing.

Eubranchiopod surveys were conducted to inventory those species present on Edwards AFB and to determine whether any freshwater shrimp within the study area are sensitive species so that appropriate protective measures could be implemented.

The desert tortoise is known to inhabit Edwards AFB and these surveys were designed to determine the relative density of this species basewide so that impacts from IRP activities could be assessed. The desert tortoise (*Gopherus agassizii*) is a large herbivorous reptile of the family Testudinae whose range includes the Sonoran and Mojave Deserts of southern California, southern Nevada, Arizona, extreme southwestern Utah, and the Sonoran and northern Sinaloan areas of Mexico.

The Mohave ground squirrel is known to inhabit Edwards AFB and these surveys were designed to determine the range of known populations. The Mohave ground squirrel (*Spermophilus mohavensis*) is a ground squirrel of the family Sciuridae and occupies a restricted range in the northeast Mojave Desert in parts of San Bernardino, Los Angeles, Kern, and Inyo counties in California. This diurnal species is active above ground only in spring and early summer before entering aestivation.

Study Area

The study area for these surveys coincides with the boundaries of Edwards AFB (Figure 1). Some areas of the base were excluded from focused surveys because recent survey data existed or appropriate habitat for the target species was absent. For example, desert tortoise surveys were not conducted in areas of dry lake beds or in the Complex One Charlie area where recent surveys had been completed.

Five zonal habitats and one major azonal habitat are present on the base (Figure 2). Creosote bush scrub is the most common community, comprising approximately 40 percent of the study area. This community is dominated by creosote bush (*Larrea tridentata*) and often appears similar to Joshua tree woodland (approximately 20% of the study area), except for the lack or scarcity of Joshua trees (*Yucca brevifolia*). Common associates in both communities include winterfat (*Eurotia lanata*), cheesebush (*Hymenoclea salsola*), and Nevada tea (*Ephedra nevadensis*). Halophytic phase saltbush scrub comprises approximately 20 percent of the study area and is dominated by four species of saltbush: spinescale (*Atriplex spinifera*), shadscale (*A. confertifolia*), four-wing saltbush (*A. canescens*), and quailbush (*A. lentiformes*). Arid phase saltbush scrub (approximately 18% of the study area) is dominated by allscale (*Atriplex polycarpa*) with burrobush (*Ambrosia dumosa*), goldenhead (*Acamptopappus sphaerocephalus*), and cheesebush among

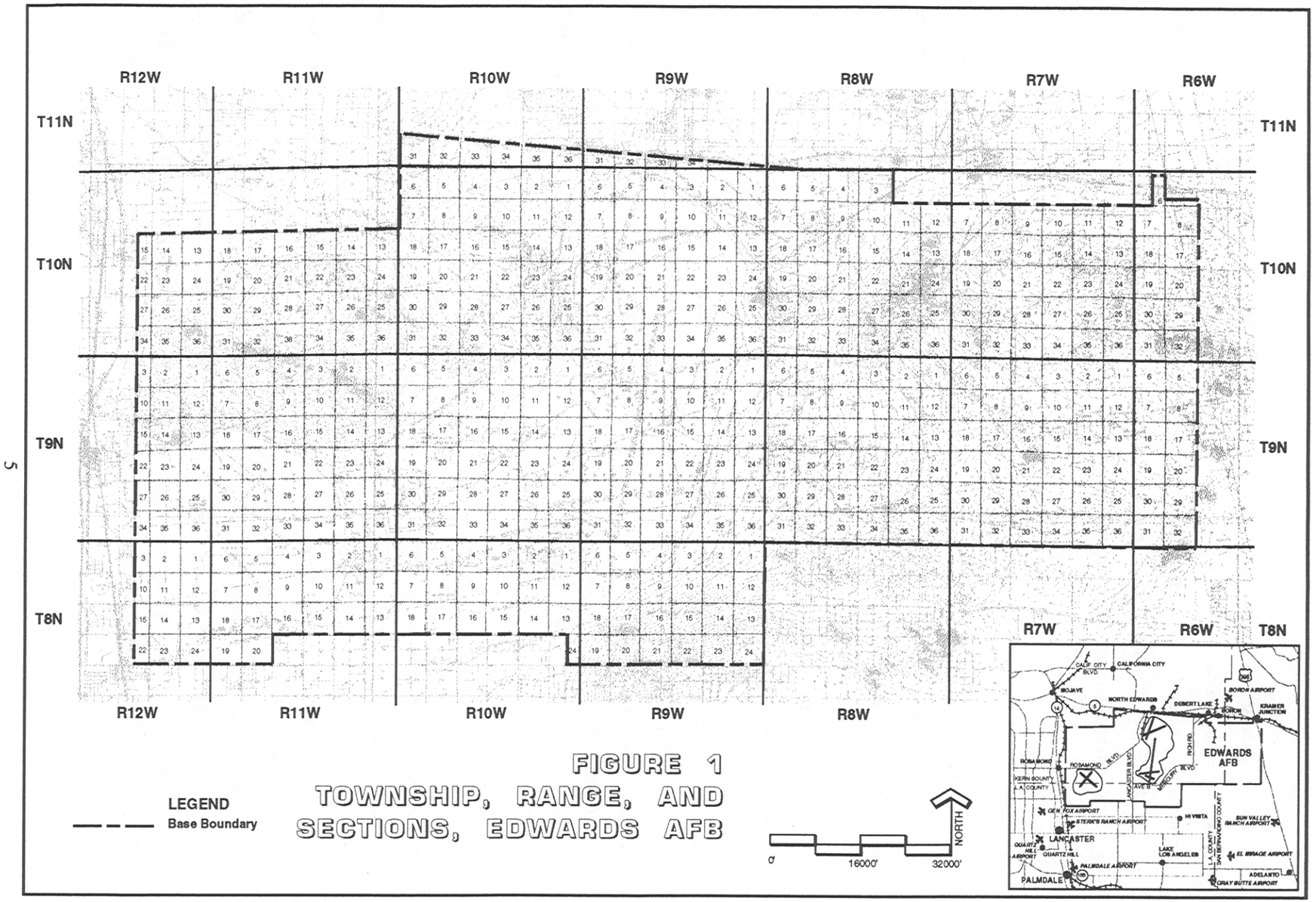

FIGURE 1
TOWNSHIP, RANGE, AND SECTIONS, EDWARDS AFB

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the common associates. Saltgrass (*Distichlis spicata*) is abundant in the understory of halophytic phase saltbush scrub but is uncommon in arid phase saltbush scrub. Mesquite woodland is an azonal habitat limited to desert washes in the south-central part of the base, comprises only about 1 percent of the study area, and is dominated by honey mesquite (*Prosopsis glandulosa* ssp. *torreyana*) with Parish's great basin sagebrush (*Artemesia tridentata* ssp. *parishii*) and inkweed as common associates.

METHODS

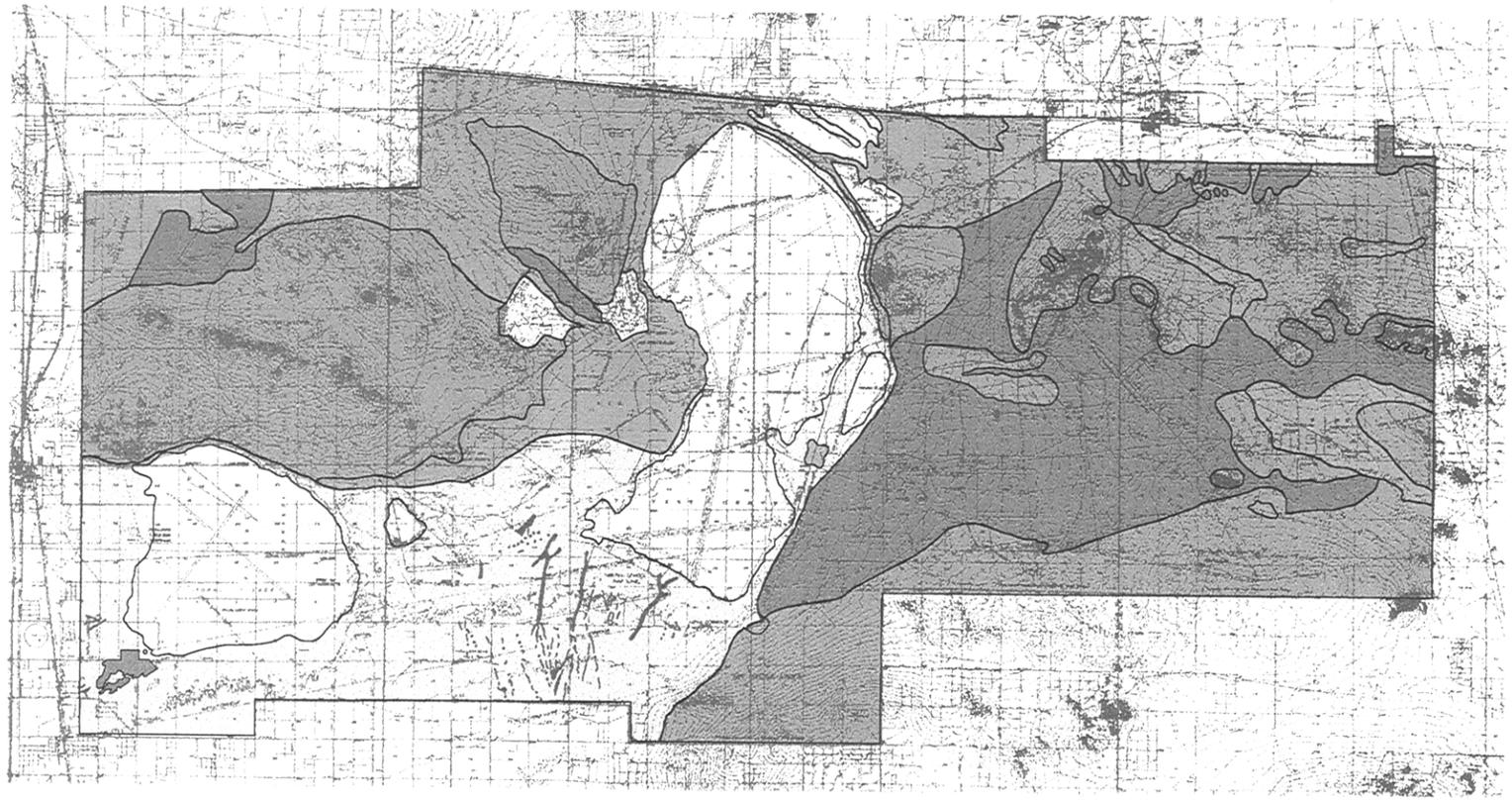
Sensitive Plants

Selected known populations of Barstow woolly sunflower (*Eriophyllum mohavensis*), desert cymopterus (*Cymopterus deserticola*), and alkali mariposa lily (*Calochortus striatus*) were surveyed in spring 1993 to confirm the presence of these species and determine the boundaries of specific populations. Populations to be studied were chosen by the base biologist and located in the field with the assistance of Mr. David Charlton.

A series of transects spaced approximately 5 meters apart, were walked within the area known to support the target species. If plants occurred outside of the known area, the survey continued until no individuals of the target species had been identified within approximately 15 meters. Individual plants were marked and counted by placing a pin flag near the specimen and/or flagging the perimeter of the plant populations using surveyors flagging tape. Phenology of the individuals (e.g., vegetative, in flower, in fruit), conditions of disturbance (e.g., evidence of herbivory, digging or trampling by animals), and associated plant species were recorded.

Eubranchiopods (Freshwater Shrimp)

A representative sampling of eubranchiopods (freshwater shrimp) within a variety of ephemeral aquatic habitats present on the base was conducted by the Branchiopod Research Group from the University of San Diego. Dry soil samples from each pool or playa survey site were taken using a shovel or trowel to lift off chunks or flakes of soil to a depth of 5 to 8 centimeters. Between one-half and three one-gallon storage bags of soil were removed, depending on the size of the site. Subsamples of the soil from each site were washed through a series of sieves, and eubranchiopod eggs remaining were identified when possible. Samples containing eggs were hydrated in deionized-dechlorinated water at a variety of temperatures, depending on the types of eggs present. Unsieved soil from the sample was added to



LEGEND

- Halophytic Phase Saltbush Scrub
- Arid Phase Saltbush Scrub
- Creosote Bush Scrub
- Joshua Tree Woodland
- Mesquite Woodland
- Lake Bed/Urban Landscape (Within Base Boundaries)
- Piute Ponds

Source: Modified from D. Charlton, 1991

FIGURE 2
ZONAL HABITATS AND OTHER MAJOR FEATURES OF EDWARDS AFB

0' 16000' 32000' NORTH

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provide necessary minerals, ions, and further inoculum. Hatched larvae were raised to maturity, identified, and vouchered.

Samples of live organisms were collected when standing water was present at a survey site by wading or canoeing using dip nets or aquarium nets. If few freshwater shrimp were captured, they were identified, measured, and returned to the site. Collected specimens were anaesthetized in soda water and preserved in 70 percent ethanol. Some specimens were taken to the laboratory at the University of San Diego for physiology, behavior, and locomotion studies and then fixed for future electron microscopy studies. Physical and chemical properties of each survey site were also measured including pH, temperature, alkalinity, salinity, total dissolved solids, dissolved oxygen; and sodium, potassium, magnesium, and calcium ion concentrations.

Desert Tortoise

All field surveys for desert tortoise were conducted in 1992 and 1993 by Mark Allaback, Randall Arnold, and David Laabs. Five permanent U.S. Bureau of Land Management (BLM) desert tortoise population trend plots were surveyed by each observer for calibration purposes. The trend plots included the Desert Tortoise Natural Area (Interior), Fremont Peak, Fremont Valley, Kramer Hills, and Lucerne Valley. All of these sites are similar in habitat and geomorphologic characteristics to habitats within the study area. The first calibration session was performed from November 30 to December 06 and from December 29 to 30, 1992. An additional calibration session was performed between October 14 and 17, 1993 at three BLM trend plots (Lucerne Valley, Kramer Hills, and Fremont Peak) because surveys at Edwards AFB were ongoing and the BLM had reevaluated one of the trend plots during the course of the surveys. Each observer performed six transects at each of the five trend plots. Absolute densities of desert tortoise at these trend plots were obtained from the BLM (Berry, personal communication) and from previous study results (CSC 1991).

Sampling locations at Edwards AFB were chosen by random computer generation from all sections within the study area (Figure 3). To have been selected, a section must be more than half within the base boundaries and more than half vegetated. Twenty-four sections were surveyed between November 18 and December 7, 1992. One hundred additional sections on the east side of the base and 50 on the west side were surveyed between March 1 and July 16, 1993. Another 50 section on the west side of the base were surveyed between October 4 and October 16, 1993, a total of 224 sections. In each square-mile

section three transects were surveyed, one by each observer. The center point of each section was used as the starting point and transect orientation was offset slightly for each observer so that all transects were unique and did not overlap except to avoid buildings and PRLs (Figure 3).

Relative density strip transects were used to sample each section (Berry and Nicholson 1984 and CSC 1991). This methodology, developed by the BLM, is particularly suited to sampling large areas of tortoise habitat. The results are based on an index of abundance and do not measure absolute density. Each transect consisted of an equilateral triangle, with each leg 0.8 kilometer long. All desert tortoise sign within 10 meters of the transect centerline was recorded. Multiple pieces of sign that appeared to indicate the presence of a single tortoise, such as multiple scats in a burrow or scats of similar size and age in proximity, were counted as a single "corrected sign." Data were recorded on forms developed by the BLM and Gilbert O. Goodlett. Parameters recorded by these surveys included:

- live tortoises;
- tortoise burrows;
- tortoise scat;
- tortoise carcasses;
- general site description;
- locational data;
- human-related disturbances (CSC 1991); and
- incidental sightings of other sensitive species.

Relative densities were derived by relating counts of tortoise scat, cover sites, and live desert tortoises in each survey site to sign counts at the BLM trend plots where absolute densities have been previously measured. Regression analysis of the average total corrected sign observed plotted against absolute density at the BLM trend plots was performed for each observer. These regression equations were then used to calibrate sign counts at transects within the study area. Relative density for each section was calculated by averaging the relative densities for each observer for that section.

Mohave Ground Squirrel

Trapping surveys for the Mohave ground squirrel were conducted in accordance with CDFG trapping guidelines. A total of five trapping grids were monitored, each for two periods of five consecutive days.

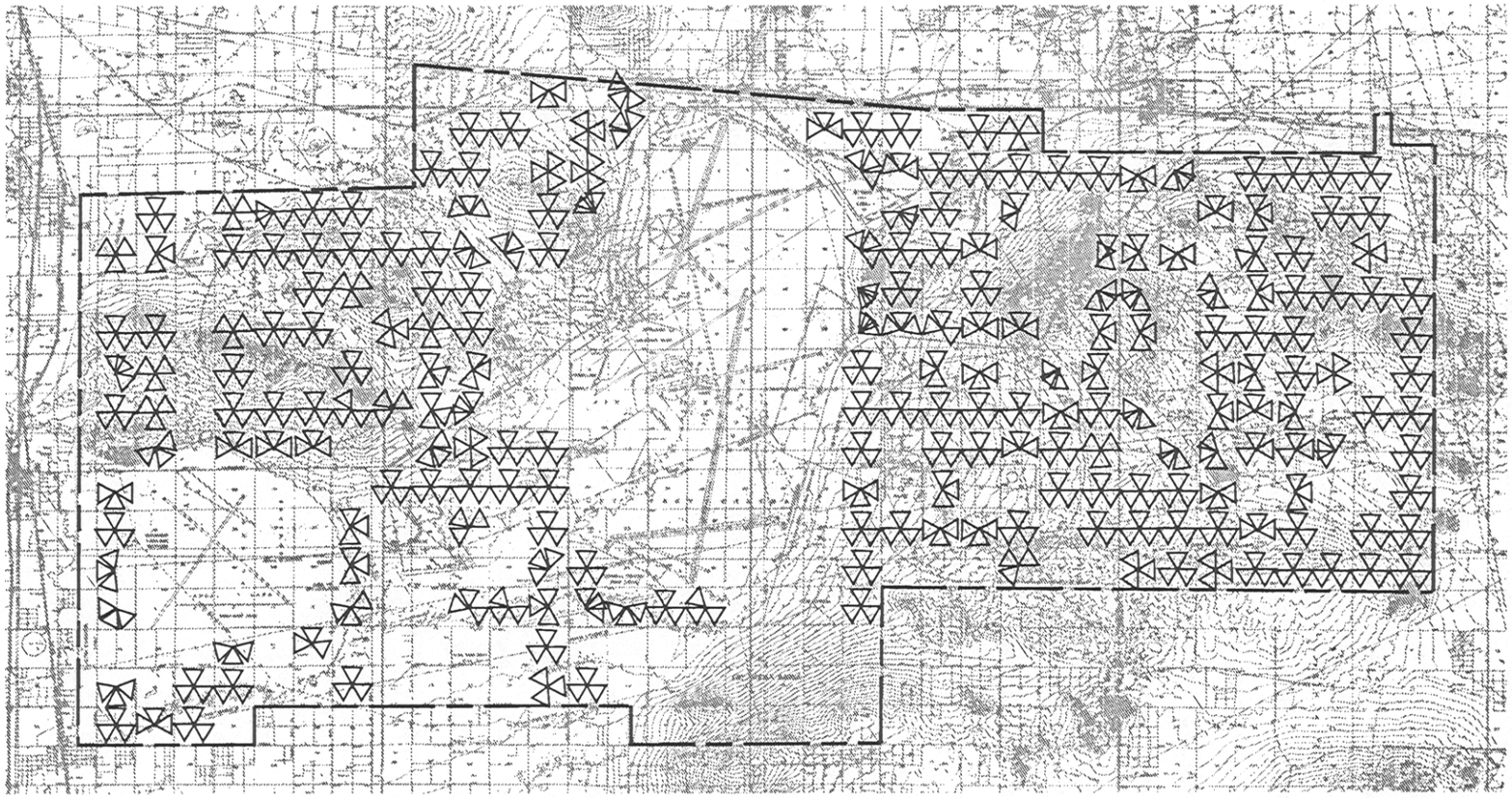
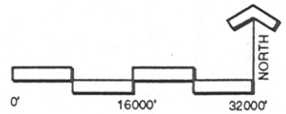


FIGURE 3
LOCATION OF
DESERT TORTOISE TRANSECTS
EDWARDS AFB



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Grid #1 was located in Complex One Charlie and consisted of 500 traps arranged in a 20- by 25-trap configuration (Figure 4). The other grids were located in various locations in the Gravity Wave area northeast of Rogers Dry Lake west of Rich Road (Figure 5). Grid #2 was comprised of 200 traps in an 8- by 25-trap configuration. Grids #3, 4, and 5 contained 100 traps each in a 4- by 25-trap grid. Two sizes of folding Sherman™ live traps were used (3 inches by 3.5 inches by 12 inches and 3 inches by 3.5 inches by 9 inches). All traps were shaded and each trap location was uniquely lettered and numbered. Shades used included folded cardboard shades, screen shades, and five-gallon buckets cut in half lengthwise. Commercial horse feed ("sweet feed") was used as bait, and contained molasses, rolled corn, rolled barley, and crimped oats. This bait was periodically supplemented with fresh fruit.

Each Mohave ground squirrel trapped was marked by fur clipping, with a unique pattern using a binary numbering system to allow for rapid identification of recaptured animals. Sex, age, and weight were recorded for each Mohave ground squirrel trapped. Antelope ground squirrels (*Ammospermophilus leucurus*) trapped were also marked using ink in the same numbering system.

Incidental Sensitive Species Detections

Incidental detections of species that are considered sensitive by the USFWS, CDFG, and/or CNPS were recorded on field maps during all surveys. These were compiled by each square mile section across the study area.

Global Positioning System

Magellan System Corporation Nav 5000 Pro™ navigation units were used to navigate to the center of each section to be surveyed for desert tortoise to aid in relocating transects in the future. Positional data were also recorded at points along the perimeter of sensitive plant populations, the sampling sites for eubranchiopods, the corners of desert tortoise transect triangles and the corners of Mohave ground squirrel trapping grids.

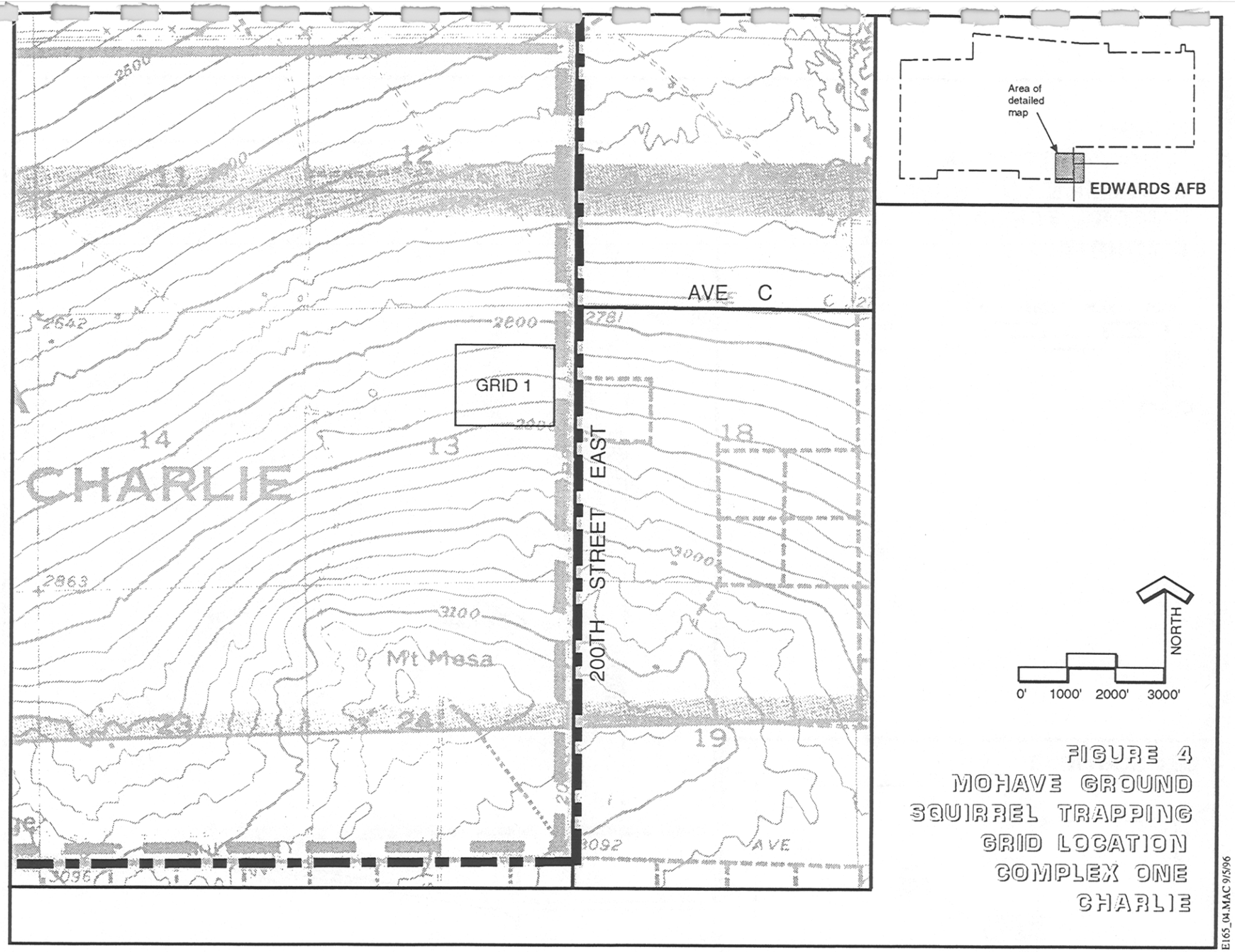

FIGURE 4
MOHAVE GROUND SQUIRREL TRAPPING GRID LOCATION COMPLEX ONE CHARLIE

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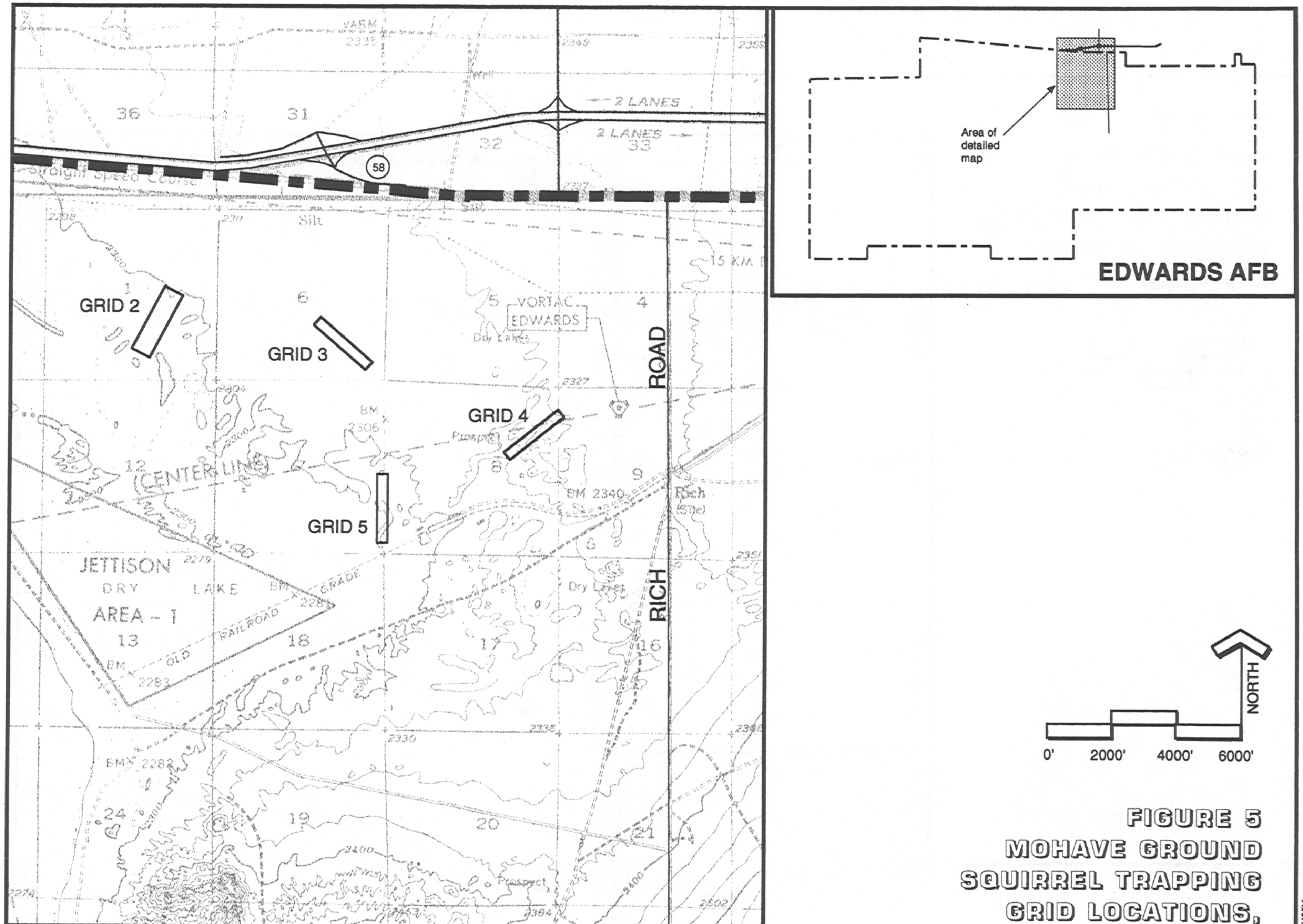

FIGURE 5
MOHAVE GROUND SQUIRREL TRAPPING GRID LOCATIONS, NORTH

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RESULTS

Sensitive Plants

One population of Barstow woolly sunflower was surveyed, located approximately 2.5 kilometers northwest of Leuhman Ridge (Figure 6). Two concentrations of plants were identified with 26 individuals observed in an area of 28 square meters and 42 individuals observed in a 42 square meter area. At the time of the survey, the Barstow woolly sunflower was just past peak flowering (i.e., most individual were beginning to produce seeds).

Three populations of desert cymopterus were surveyed. A total of 141 individuals were identified in a population encompassing approximately 0.16 square kilometers located 2.5 kilometers southwest of Haystack Butte (#1 on Figure 6). Thirty-nine individuals were in late flowering/early fruiting stages, 95 were in vegetative condition, and 7 individuals were seedlings. Another population, located along Mars Boulevard approximately 4.0 kilometers southeast of Leuhman Ridge contained 33 individuals in a 0.1 square kilometer area (#2 on Figure 6). Fifteen individuals were in late flowering/early fruiting stages, and 18 were in the vegetative state. One individual in fruit was encountered 0.4 km northwest of Haystack Butte along Mars Boulevard (#3 on Figure 6).

One alkali mariposa lily population was surveyed just southeast of the intersection of 140th Street East and Avenue B. This population (Figure 6) covered approximately 0.06 square kilometers scattered along a shallow drainage running in a north/south direction. Thirty individuals were located in this area, six of which were in flower and 24 in fruit.

Eubranchiopods (Freshwater Shrimp)

Four common types of aquatic habitats were identified during surveys for eubranchiopods (freshwater shrimp) on Edwards AFB: playas, edge playas, claypans, and road pools. Playas are expansive, ancient dry lakes and include Rogers, Rosamond, and Buckhorn within the study area. Once filled from seasonal rain, they retain water for several months and are characterized by high levels of solute, alkalinity, salinity, sodium, total dissolved solids (TDS), and basic pH. Edge playas are generally large areas that were once part of larger playas but have been cut off from the main portion by road construction. While the edge playas are similar in pH to the larger playas, they have lower alkalinity, salinity, and TDS levels. Claypans include the numerous natural low-lying areas outside the playas that contain

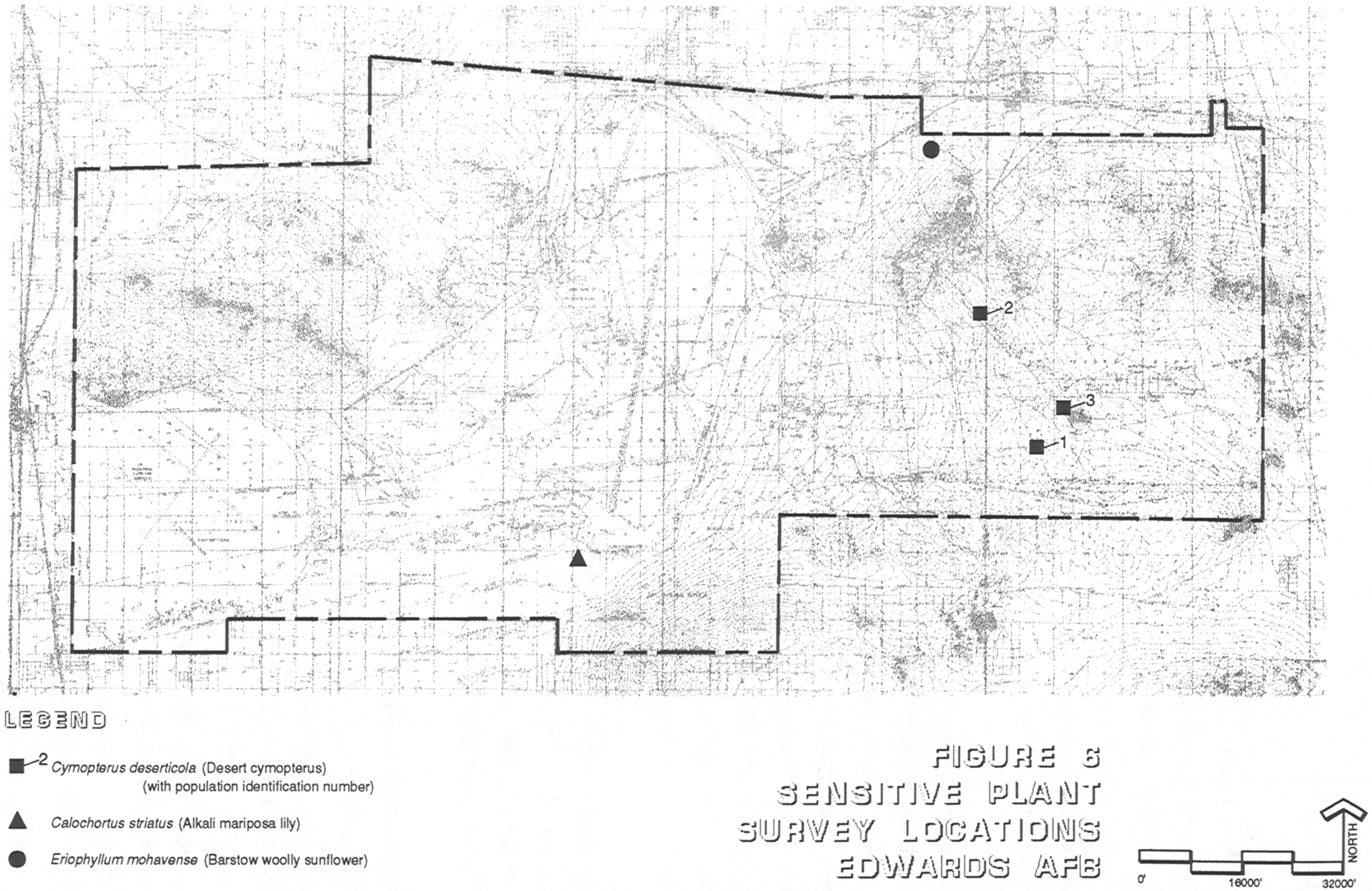

FIGURE 6
SENSITIVE PLANT
SURVEY LOCATIONS
EDWARDS AFB

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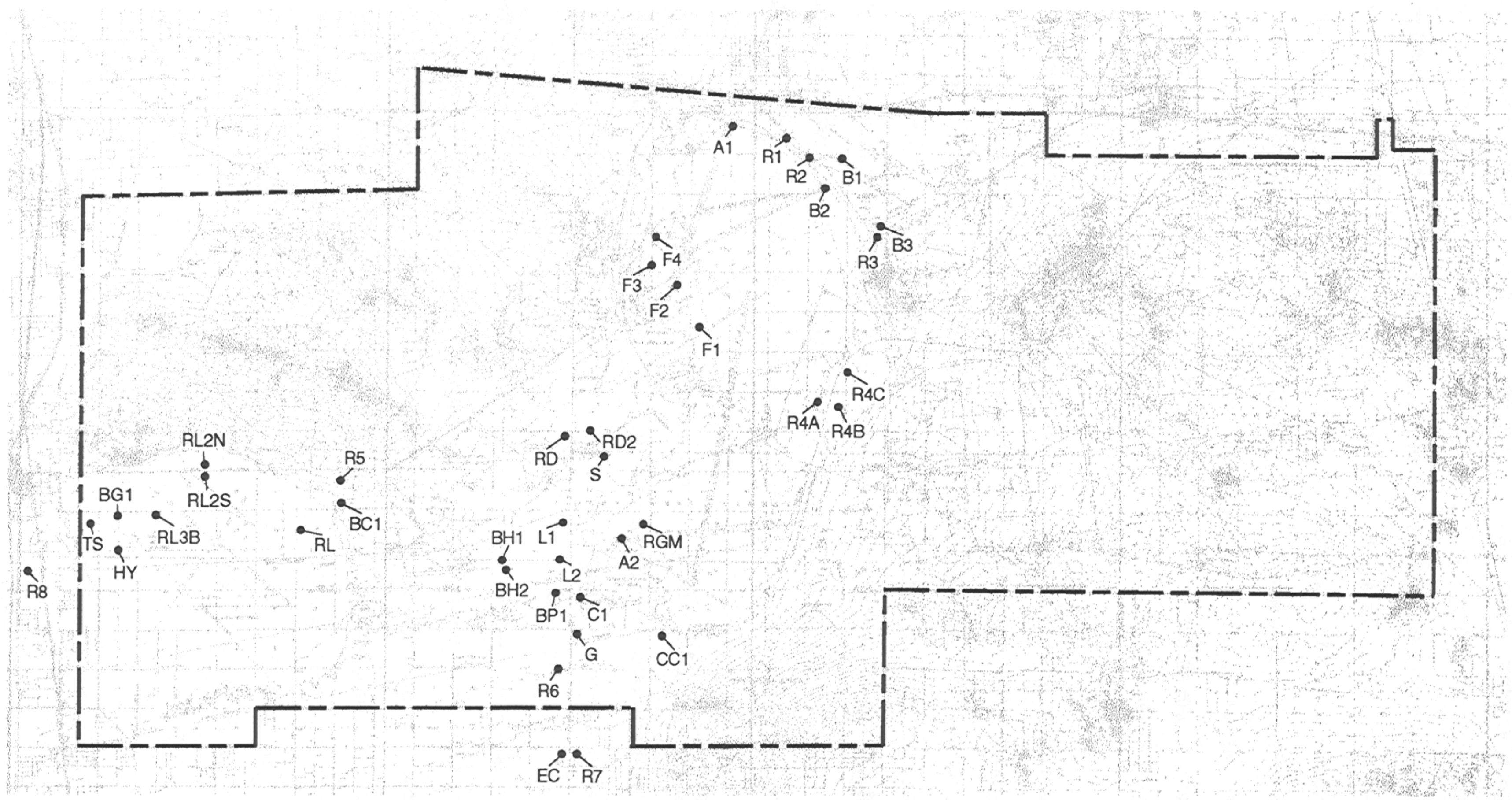
impermeable soils and also retain water. These are present throughout the base and vary in size, length of water retention, and water chemistry. At Edwards AFB, they do not reach the alkalinity, salinity, or TDS levels of the playas, but they exceed the levels of pH and sodium. Road pools are small pools along or in some way affected by roads. This group includes roadside ditches, artifacts of road construction, and cattle tanks associated with old homestead sites. The characteristics of this group are widely varying pH levels and levels of the other parameters with particularly low levels of alkalinity. One pool (BG1 on Figure 7) is unique among the aquatic habitats identified. This area, comprising approximately 1 acre, had standing water among the shrubs (i.e., there was no obvious pool) in January 1993. The pH of the water at this site was near neutral (7.4) and solute levels were relatively low (Appendix A-3).

This variety of aquatic environments provides habitats for five species of eubranchiopods on Edwards AFB, including one species of tadpole shrimp, *Lepidurus lemmoni*; one species of clam shrimp, *Eocyzicus digueti*; and three species of fairy shrimp, *Branchinecta mackini, B. gigas*, and *B. lindahli*. A total of 37 sites were surveyed on the three large dry lake beds (Rogers, Rosamond, and Buckhorn), a number of other pools and playas within the study area, and three sites within two kilometers of the base (Figure 7). A total of five sampling trips were made during 1992 and 1993. Table 2 presents a summary of species occurrence and co-occurence on Edwards AFB. Appendix A lists species that were detected in each pool during each sampling period; shows ranges and means by habitat type of pH, alkalinity, sodium ion concentration, salinity, and TDS for the live samples; and shows the changes in pH, sodium ion concentration, and alkalinity over time for three of the pool sampling locations. There was a general increase over time of sodium ion concentration and alkalinity while pH remained relatively equal.

Lepidurus lemmoni was found in 48 percent of the sites sampled, occurring in most playa collections, half the claypans, and two road pools. This species appeared in January after heavy winter rains and was present in some of the sites retaining water into the summer, covering a temperature range from 6° to 28°C. *Lepidurus lemmoni* was present at high pH and at the highest levels of alkalinity, salinity, and TDS measured. Of the sites in which it occurred, 87 percent also contained *B. mackini*, 67 percent contained *B. gigas*, and only 27 percent contained *B. lindahli*. *Lepidurus lemmoni* occurred alone at only survey site, a borrow pit in which only one individual was present.



LEGEND

• Sample Locations

FIGURE 7
EUBRANCHIOPOD
(FRESHWATER SHRIMP)
SAMPLE LOCATIONS

0' 16000' 32000'
NORTH

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Table 2

Species Occurrence and Co-Occurrence in Live Samples*

	L. lemmoni	*B. gigas*	*B. mackini*	*B. lindahli*	*E. digueti*
L. lemmoni	--	91%	56%	27%	50%
B. gigas	67%	--	48%	13%	0%
B. mackini	87%	100%	--	53%	100%
B. lindahli	27%	18%	35%	--	100%
E. digueti	7%	0%	9%	13%	--

Notes: Co-occurrence of *L. lemmoni, B. gigas*, and *B. mackini* equal 35%.
*Before trip 4 - Not calculated for pools sampled on trip 4 or after because species may have been present earlier in those sites.

Eocyzicus digueti was only found at two sites, in which it was abundant and present until June, although those individuals found later were smaller than those in earlier samples. It was present at moderate TDS, salinity, and sodium levels with high temperatures and low alkalinity.

Branchinecta mackini was present in 74 percent of the sites sampled and it occurred in all types of habitats. Early in the year it was observed swimming under ice at 2°C and was also present at the highest temperatures measured, 34°C, a slightly higher temperature than reported from earlier collections (32°C, Eng *et al* 1990). The highest densities of this species were measured in smaller pools near mid-season. *B. mackini* was still present in moderate numbers at the north end of Rosamond Dry Lake in July. Of the sites at which it was found, 48 percent also contained *B. gigas*, 56 percent contained *L. lemmoni*, 35 percent contained *B. lindahli*, and it was found alone in 17 percent of the sites. Along with *L. lemmoni*, *B. mackini* was found at the highest levels of alkalinity, salinity, and TDS. *B. mackini* was also found at the highest sodium levels.

Branchinecta gigas was found in 35 percent of the sites sampled. Of these sites, 100 percent contained *B. mackini*, 91 percent contained *L. lemmoni,* and only 18 percent contained *B. lindahli*. *B. gigas* was found at the highest alkalinities, but at much lower sodium and TDS levels and slightly lower pH than *B. mackini* or *L. lemmoni*. This species was present in the pools surveyed in November 1992 but was not found after the March 1993 sampling period. *B. gigas* was present in playas but not present late in

the season when alkalinities, sodium levels, and temperatures were high. It was also present in claypans, but only in one road pool which was along the edge of Rogers Dry Lake.

Branchinecta lindahli was present in 48 percent of the sites sampled from November 1992 through March 1993. Of the sites at which it occurred, 53 percent contained *B. mackini,* 27 percent contained *B. lindahli* and 13 percent *B. gigas*. Although present at the widest range of pH values, the temperature, alkalinity, and salinity values were quite low, while sodium and TDS levels were comparable to those of *B. gigas*. As with *B. gigas*, *B. lindahli* was not present late in the season when temperatures and solute levels were high. It was not found in most pools by March and from all pools by June 1993. Unlike *B. gigas*, it was not found early in the season at playa sites. *B. lindahli* was also the only freshwater shrimp species found in the unusual site west of Rosamond Dry Lake (BG1 on Figure 7).

Desert Tortoise

Data for each observer from BLM trend plots are shown in Table 3. Following the first series of transects, correlation coefficients (and r^2, coefficient of determination) were low for all observers (r^2 = 0.327, 0.236, and 0.358). All were less than 0.8, which is considered the minimum acceptable level for this value (Goodlett 1992). When data from Fremont Valley were deleted, correlation coefficients were significantly higher for all observers (r^2 = 0.862, 0.844, and 0.842). Regression lines for all observers crossed the y-axis near 6 (Figure 8). These regression equations were used to calibrate sign counts at Edwards AFB for transects conducted in fall 1992 and spring 1993. Data collected from the second calibration session by each observer are presented on Table 4. Correlation coefficients and coefficients of determination were high for all observers (r^2 = 0.989, 0.994, and 0.990). Regression lines for all observers crossed the y-axis at 3 (Figure 9). These second regression lines were used to calculate relative densities for the 50 transects performed in October 1993. The slopes of the regression equations for each individual observer were greater in the first calibration session than the second.

Appendix B-1 presents the results by transect and relative densities of desert tortoise calculated for each section. Relative densities ranged from three to 68 tortoises per 2.6 Km^2 at Edwards AFB. The mean relative density of all sections surveyed was 17.3 tortoises per 2.6 Km^2 with a standard deviation of 11.3. A total of 3,866 tortoises were estimated to be present in the 224 sections surveyed. Figure 10 presents the density distribution across the study area and includes relative density estimates from 1991 tortoise surveys using the same methodology in the Complex One Charlie area.

Table 3

1992 Results of Transects on BLM Trend Plots

Calibration Site	Transect Orientation	Mark Allaback Total Corrected Sign	Randy Arnold Total Corrected Sign	David Laabs Total Corrected Sign	Estimated Tortoise Density (individuals per 2.6 Km^2)
DTNA* (Interior)	N	13	9	11	
DTNA (Interior)	W	10	7	7	
DTNA (Interior)	S	7	6	6	
DTNA (Interior)	E	13	10	10	
DTNA (Interior)	NE	9	7	8	
DTNA (Interior)	SW	8	10	9	
Mean		**10.00**	**8.17**	**8.50**	**47**
Fremont Peak	N	8	6	6	
Fremont Peak	W	4	8	6	
Fremont Peak	S	7	3	3	
Fremont Peak	E	7	4	3	
Fremont Peak	NE	6	3	4	
Fremont Peak	SW	3	6	7	
Mean		**5.83**	**5.00**	**4.83**	**32**
Kramer Hills	N	6	1	2	
Kramer Hills	W	8	8	9	
Kramer Hills	S	6	7	5	
Kramer Hills	E	7	8	6	
Kramer Hills	NE	5	2	5	
Kramer Hills	SW	9	6	6	
Mean		**6.83**	**5.33**	**5.50**	**60**
Fremont Valley	N	7	5	7	
Fremont Valley	W	10	3	5	
Fremont Valley	S	2	2	3	
Fremont Valley	E	4	3	7	
Fremont Valley	NE	3	4	3	
Fremont Valley	SW	5	2	4	
Mean		**5.17**	**3.17**	**4.83**	**101**
Lucerne Valley	N	17	11	15	
Lucerne Valley	W	7	13	12	
Lucerne Valley	S	23	12	14	
Lucerne Valley	E	19	14	19	
Lucerne Valley	NE	17	15	11	
Lucerne Valley	SW	10	8	10	
Mean		**15.50**	**12.17**	**13.50**	**82**

Note: *Desert Tortoise Natural Area (Interior).

Table 4

1993 Results of Transects on BLM Trend Plots

Calibration Site	Transect Orientation	Mark Allaback Total Corrected Sign	Randall Arnold Total Corrected Sign	David Laabs Total Corrected Sign	Estimated Tortoise Density (individuals per 2.6 Km ^{2})
Fremont Peak	N	10	8	6	
Fremont Peak	W	6	6	9	
Fremont Peak	S	10	9	10	
Fremont Peak	E	6	9	5	
Fremont Peak	NE	12	5	7	
Fremont Peak	SW	7	7	8	
Mean		**8.5**	**7.3**	**7.5**	**32**
Kramer Hills	N	17	20	19	
Kramer Hills	W	16	14	17	
Kramer Hills	S	21	20	11	
Kramer Hills	E	13	13	15	
Kramer Hills	NE	19	12	16	
Kramer Hills	SW	16	22	17	
Mean		17.0	16.8	15.8	60
Lucerne Valley	N	25	40	30	
Lucerne Valley	W	29	22	18	
Lucerne Valley	S	26	26	26	
Lucerne Valley	E	34	18	18	
Lucerne Valley	NE	33	19	32	
Lucerne Valley	SW	11	10	21	
Mean		**26.3**	**22.5**	**24.0**	**82**

Relative densities were considerably higher on the east side of the base than the west side. The mean relative density of the 124 sections surveyed on the east side of the base was 22.0 (standard deviation = 11.0), while the mean of the 100 sections surveyed on the west side of the base was 11.4 (standard deviation = 8.5). The number of sections in which no tortoise sign was detected was much lower on the east side. Only two sections lacked sign on the east, while no desert tortoise sign was detected in 31 sections on the west side. The sections containing highest relative densities were concentrated along the southern boundary of the base between Haystack Butte and Red Buttes. The section with the highest relative density (68 tortoises per 2.6 Km^2), was in this area. Other areas supporting high tortoise relative densities included the portion of the base northwest of Leuhman Ridge and the Kramer Hills area. In addition, small patches of above average relative densities were located in the Rosamond Hills on the west side of the base.

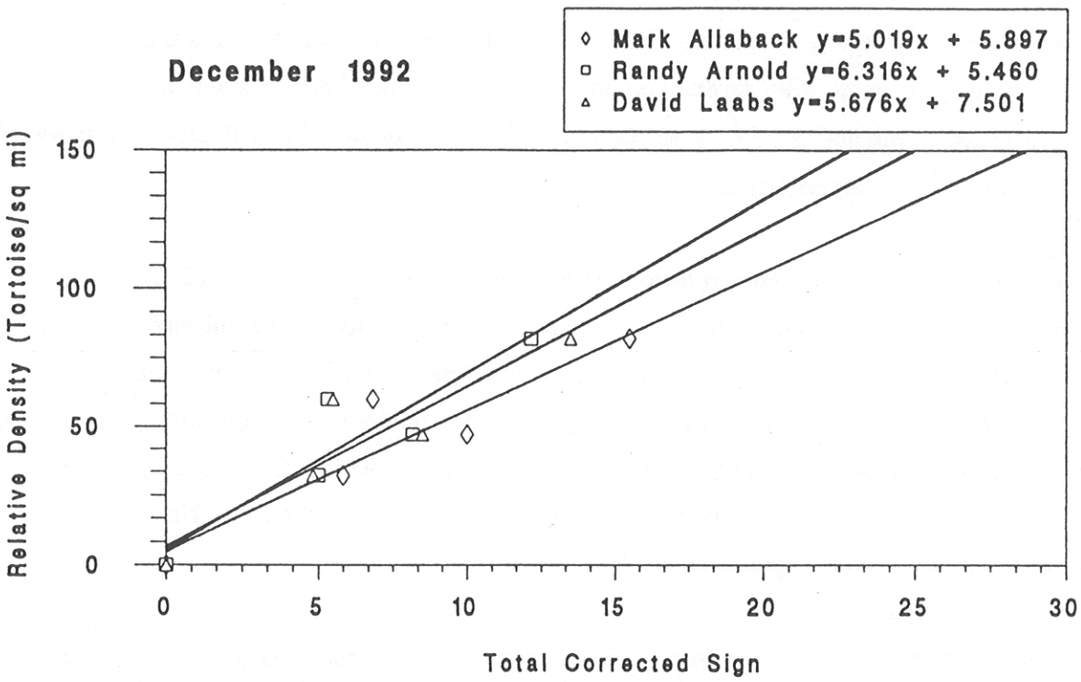


Figure 8: Simple Linear Regression of Total Corrected Sign

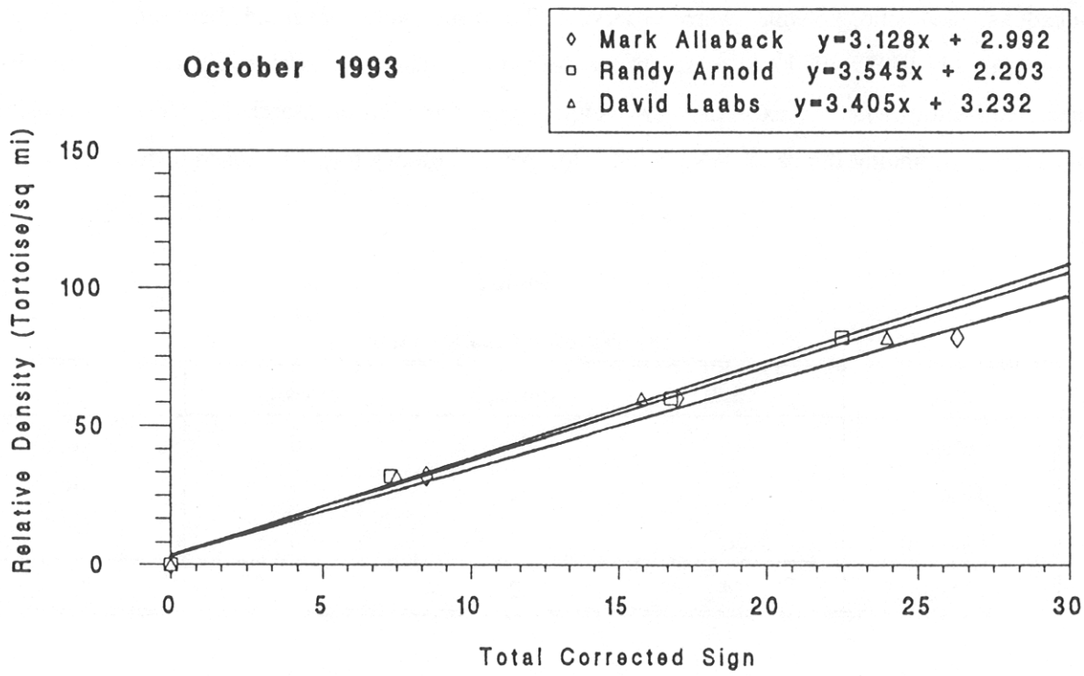


Figure 9: Simple Linear Regression of Total Corrected SignVersus Density at BLM Trend Plots

Relative densities were low in the southwest corner of the base. Much of this area is covered by dry lake beds and playa systems, with several sections showing evidence of previous agricultural use. No sign was detected in the majority of the sections surveyed south of Rosamond Boulevard and west of the southwest shore of Rogers Dry Lake.

Appendix B-2 presents mean desert tortoise relative density by dominant zonal habitat. Figure 11 shows relative densities overlaid on the vegetation map of the base. Creosote bush scrub and arid phase saltbush scrub habitats supported the highest relative densities of desert tortoise with 21 as a mean density. Within creosote bush scrub, the relative density was highest in the southeastern part of the base with a mean of 40. Joshua tree woodlands had a mean tortoise density of 15 per 2.6 Km^2; halophytic phase saltbush scrub communities showed the lowest mean tortoise density with 7 per 2.6 Km^2. No sections in the study area are dominated by mesquite woodlands.

Twenty-seven live tortoises were observed over the course of the study. Data for these observations are summarized in Table 5 and presented in detail in Appendix B-3. Sixteen males and ten females were identified. One tortoise could not be reliably sexed because it was in a burrow. Twenty-four adults, two subadults, and one juvenile were observed. Tortoises were observed between March 16 and November 11, 1993 with 17 of these observations (63%) made in March. All live tortoises observed appeared healthy with one exception. An adult female observed on March 12, 1993 had considerable moisture surrounding the nares, a symptom of upper respiratory tract disease in tortoises.

Table 5

Live Tortoise Data Summary

Sex	Adult	Subadult	Juvenile	Total
Male	16	0	0	16
Female	7	2	1	10
Unknown	1	0	0	1
Total	24	2	1	**27**

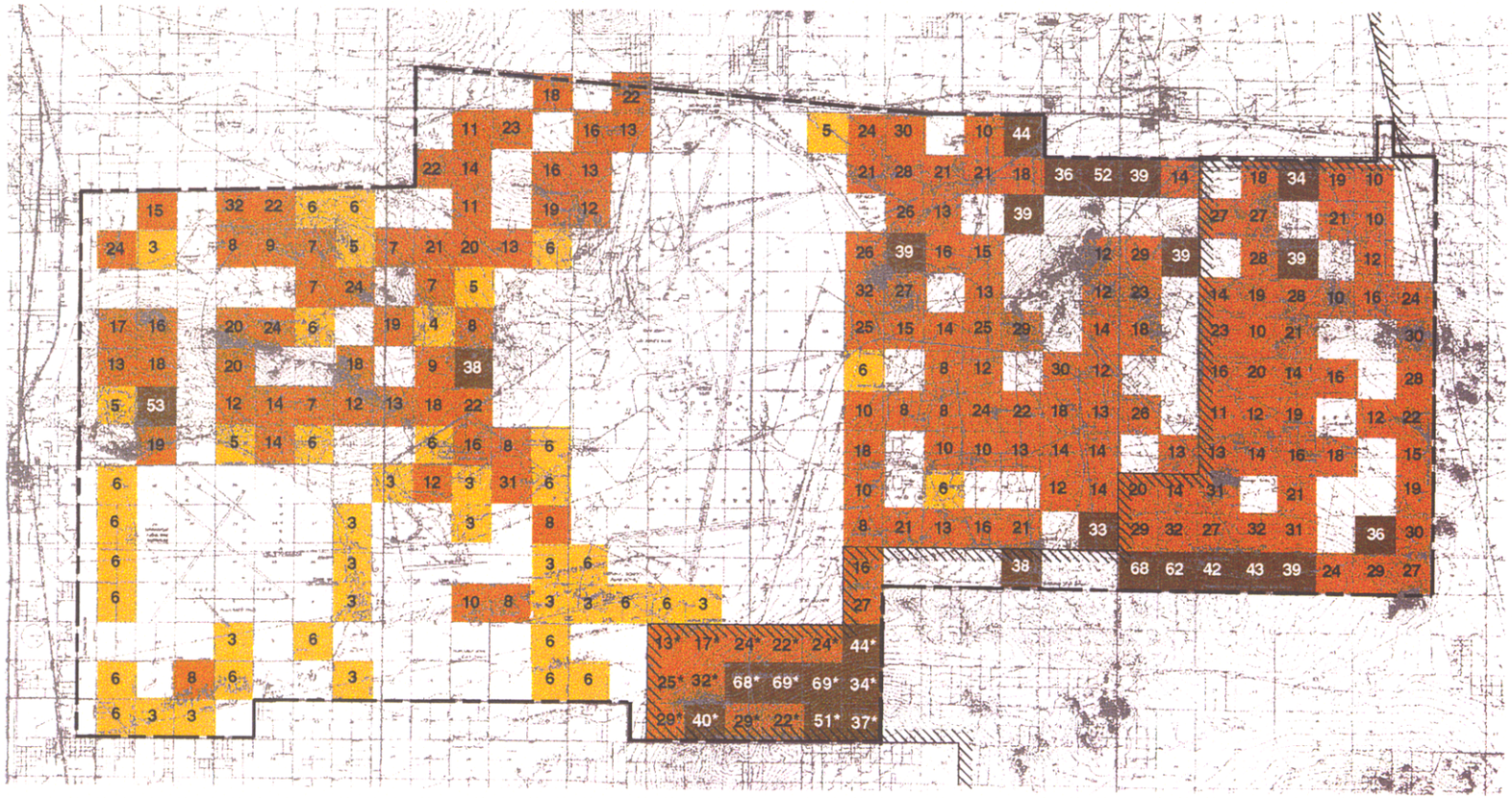
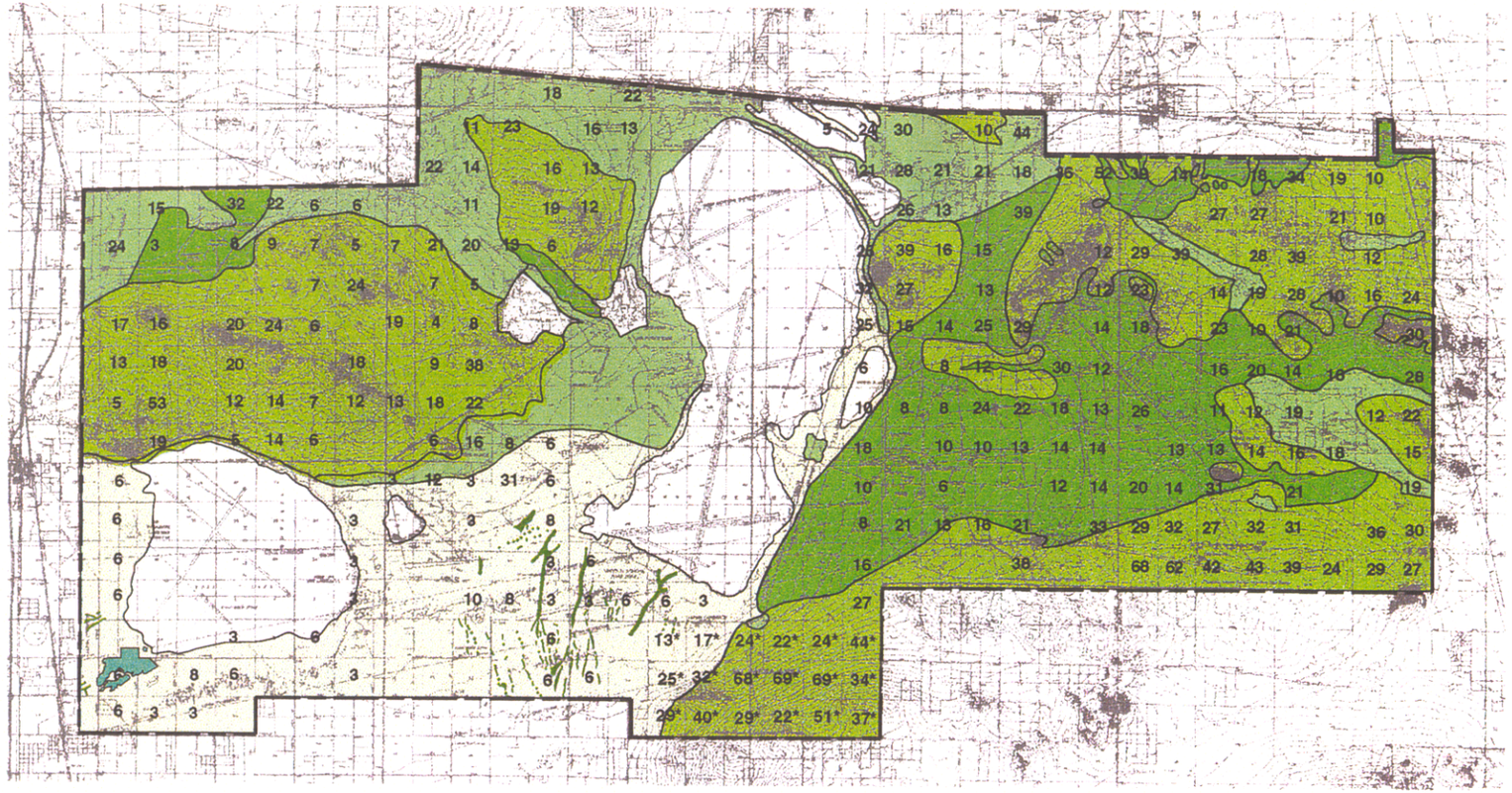


FIGURE 10
DESERT TORTOISE RELATIVE DENSITIES
IN SURVEYED AREAS ON EDWARDS AFB



LEGEND

- Halophytic Phase Saltbush Scrub
- Arid Phase Saltbush Scrub
- Creosote Bush Scrub
- Joshua Tree Woodland
- Mesquite Woodland
- Lake Bed/Urban Landscape (Within Base Boundaries)
- Piute Ponds
- * From CSC, 1991

Source: Modified from D. Charlton, 1991

FIGURE 11

DESERT TORTOISE RELATIVE DENSITIES (INDIVIDUALS/2.6KM²) BY ZONAL HABITATS, EDWARDS AFB

NORTH

0' 16000' 32000'

E165-09-MAC 2/92

A total of 166 desert tortoise carcasses were observed during transects. Data for these observations are summarized in Table 6 and presented in detail in Appendix B-4. Data are divided into four categories: less than 1 year, 1 to 4 years, greater than 4 years, and unknown. About one-third of the carcasses which could be aged had died within the past 4 years (34%). The distribution of carcasses on the east and west sides of the base parallels relative density estimates for these areas. A total of 71.7 percent of the carcasses were found on the east side of the base, while 28.3 percent were on the west side.

At least one human-related disturbance type was recorded in every section and as many as 11 different types were recorded in one section. The mean number of disturbance types per section was 6.4 with a standard deviation = 2.1 (Appendix B-5). Paved roads occurred in 27 sections (12.1%) and maintained dirt roads were present in 142 (63.4%) sections. In addition, non-maintained roads and tracks resulting from off-road vehicle use were very common across the study area. Non-maintained dirt roads were recorded in 190 sections (84.8%), while tracks were observed in 188 sections (83.9%).

Evidence of domestic animals (sheep, cattle, and burros) was widespread. Old (>40 years) evidence of cattle grazing was detected on 81 sections (36.2%). Evidence of recent sheep grazing was recorded in 89 sections (39.7%). Evidence of feral burros was observed on 91 sections (40.6%). Most of the burro sign was old, although occasionally fairly recent (5 to 10 years old) sign was encountered in Joshua tree woodland on the east side of the base with the highest concentrations of recent sign along the southeastern boundary of Rogers Dry Lake.

Table 6

Time Since Death of Carcasses Located in the Study Area, Edwards AFB

Sex	<1 Year	1-4 Years	>4 Years	Unknown	Totals
Male	6	15	9	2	32
Female	2	13	13	2	30
Unknown	1	14	77[1]	12[2]	104
Total	9	42	99	16	166

Notes: [1]Older carcasses were often so disarticulated that sex could not be positively determined.
[2]Usually single scutes or pieces of bone.

Garbage was recorded in nearly every section (217 sections or 96.9%). The majority was not recent except in the southwest and northeast areas of the base. Spent shell casings, most dating from before 1960, were widespread and numerous, occurring on 184 of 200 sections (82.1%). Shooting targets were found in 32 sections (14.29%). Craters resulting from explosions of larger shells were recorded on 21 sections (9.4%). Fences and utility lines were recorded in 44 (19.6%) and 53 (23.7%) sections, respectively. All other disturbance types were recorded on less than 10 percent of sections surveyed.

Mohave Ground Squirrel

Focused trapping surveys for the Mohave ground squirrel in spring 1993 confirmed the presence of populations of the species in Complex One Charlie and in the Gravity Wave area. Trapping was conducted between April 27 and May 7 and between May 18 and May 28, 1993. Mohave ground squirrels were captured on four of the five grids (Table 7). A total of 6 adults and 24 juveniles were captured during these surveys. At grid #1 in the Complex One Charlie area, two Mohave ground squirrels were captured, one adult male and one adult female, with no juveniles trapped. At grid #2, none were trapped throughout the survey. At grid #3, no Mohave ground squirrels were trapped in the first 5 days of the survey but two juveniles were trapped in the second survey period. At grid #4, none were trapped in the first survey period but two juvenile Mohave ground squirrels were captured during the second. At grid #5, 4 adults were trapped and 18 juveniles were captured in the second survey period.

Relative abundance of the sympatric antelope ground squirrel (*Ammospermophilus leucurus*) was much higher but the study confirms the presence of populations of the Mohave ground squirrel at Edwards AFB. At grid #1, the average number of adults trapped over the entire survey was 6.3 while in the same period it was 0.3 for Mohave ground squirrels. Results were similar for the other grids.

Incidental Sensitive Species Detections

During surveys conducted on Edwards AFB in 1992 and 1993, sightings and sign of sensitive species were recorded by section. Detailed data are presented in tables and figures in Appendix C.

Two isolated populations of desert cymopterus were incidentally observed on the east side of the base. Four individuals were observed within Joshua tree woodland, and a single specimen was seen in an area of arid phase saltbush scrub. Several sightings of alkali mariposa lily (usually 2-3 individuals) were noted in areas of halophytic phase saltbush scrub and in mesquite woodlands in the southwest area of the base.

Table 7

Mohave Ground Squirrel Trapping Results

			Mohave Ground Squirrel						Antelope Ground Squirrel					
Grid #	# Traps	Trapping Period 1993	Adult Males	Adult Females	Juveniles	Total	Adults per 500 trap days	Juveniles per 500 trap days	Adult Males	Adult Females	Juveniles	Total	Adults per 500 trap days	Juveniles per 500 trap days
1	500	4/27 to 5/1	1	1	0	2	0.4	0	19	19	0	38	7.6	0
2	200	5/3 to 5/7	0	0	0	0	0	0	10	6	0	16	8	0
3	100	5/3 to 5/7	0	0	0	0	0	0	4	1	1	6	5	1
4	100	5/3 to 5/7	0	0	0	0	0	0	10	6	0	16	16	0
5	100	5/3 to 5/7	1	2	0	3	3	0	9	4	0	13	13	0
1	500	5/18 to 5/22	0	1	2	3	0.2	0.4	13	12	7	32	5	1.4
2	200	5/24 to 5/28	0	0	0	0	0	0	9	4	0	13	6.5	0
3	100	5/24 to 5/28	0	0	2	2	0	2	5	5	3	13	10	3
4	100	5/24 to 5/28	0	2	18	20	2	18	6	4	2	12	10	2
5	100	5/24 to 5/28	0	0	2	2	1	2	7	6	1	14	13	1
Total			**2**	**6**	**24**	**32**			**92**	**67**	**14**	**173**		

Three reptiles considered sensitive were observed or detected by sign during surveys at Edwards AFB in 1992 and 1993. Twenty-five live desert tortoises were seen incidental to other surveys on the base (not including those observed during desert tortoise surveys). These incidental observations were concentrated in the area east of Rogers Dry Lake and north and east of the housing area. Mojave fringed-toed lizards (*Uma scoparia*) were observed in the northeastern part of the base. Chuckwalla scat was found in the rocks east of Rogers Dry Lake and west of Rich Road. The presence of this species was not confirmed through observation.

The following ten sensitive bird species were sighted during these surveys:

- loggerhead shrike (*Lanius ludovicianus*), in 42 percent of surveyed sections;
- Le Conte's thrasher (*Toxostoma lecontei*), in 31 percent of surveyed sections;
- golden eagle (*Aquila chrysaetos*), seen in two sections (1%);
- ferruginous hawk (*Buteo regalis*), seen in two sections (1%);
- northern harrier (*Circus cyaneus*), sighted in 20 sections (9%);
- prairie falcon (*Falco mexicanus*), observed in six sections (3%) near the cliffs just north of Rosamond. A prairie falcon nest was also identified in this area;
- Cooper's hawk (*Accipiter cooperi*), seen in one section (<1%);
- short-eared owl (*Asio flammeus*), observed in four sections (2%) in the southwestern part of the base;
- long-eared owl (*A. otus*), seen in two sections (1%) in the southwestern part of the base; and
- burrowing owl (*Athene cunicularia*), observed in 25 sections (11%) throughout the study area, except in the southwest.

Two sensitive mammal species were identified on Edwards AFB during these surveys. The Mohave ground squirrel was seen incidentally in 15 sections, nine of which were east of Rogers Dry Lake. The American badger (*Taxidea taxus*) was detected incidentally in 34% of the surveyed sections.

DISCUSSION

Sensitive Plants

Factors contributing to the low number of individuals detected during the spring 1993 surveys may have included the climate, domestic animal grazing, and foraging by lagomorphs (hares and rabbits). Climate can affect the germination process of plant populations. In the 1992-1993 season, rains occurred in the fall, but there was little precipitation in the late winter and early spring. This lack of precipitation could have affected the number of individuals that germinated and reduced the size of populations surveyed.

Numbers of the Barstow woolly sunflower may fluctuate more than the alkali mariposa lily and desert cymopterus because it is an annual species and the other two species are perennials. The population of Barstow woolly sunflower that was surveyed in arid phase saltbush scrub was relatively small (68 individuals). There was evidence of domestic sheep grazing in this area and it appeared that the effects of trampling were more destructive to the populations than the animals actually eating the plants. Damage caused by sheep may have negatively affected the viability of plants and the number of seeds produced.

The alkali mariposa lily population that was surveyed in the study area was in halophytic phase saltbush scrub near the margins of small claypans. The population appeared healthy based on observations of fruit production and maturation. Many fruits had been eaten by black-tailed jackrabbits and desert cottontails as noted by the angular tooth cut on the stem. This foraging of the fruit capsules may limit seed production in this species. Since the lily is a perennial species, established individuals will most likely survive from year to year despite these impacts but the establishment of new individuals from seed could be affected. Several incidental observations of the lily were made in halophytic phase saltbush scrub and mesquite woodland habitats with similar impacts by foraging animals noted. Many of the individuals found with mature fruits were growing in or near a saltbush which may have obscured the fruit somewhat from hares and rabbits.

The populations of desert cymopterus southwest of Haystack Butte along Mars Boulevard southeast of Leuhman Ridge appeared to be healthy based on observations of flower and fruit production. In the two

larger populations of desert cymopterus studied, the number and distribution of the species appeared to be positively influenced by small mammals of the family Heteromyidae which eat the leaves and seeds of cymopterus, aiding in its establishment. The observation of numerous small mammal burrows with seeds of cymopterus present in them, and the number of older burrows with small, live leaves of very young specimens in them may indicate that these small mammals occupy an important role in the growth and distribution of new desert cymopterus individuals.

Eubranchiopods (Freshwater Shrimp)

Due the large size of the study area, the limited duration of the survey, and the presence of hundreds of claypans and pools across the study area, this survey must be considered preliminary. Edwards AFB supports a variety of ephemeral aquatic environments. Playas offered habitats with longer saturation periods and high solute levels. Although claypans provided habitats with shorter saturation periods and somewhat less extreme habitats, they had high solute levels compared to many other types of ephemeral habitats. The group of road pools showed variable characteristics but generally were the most dilute in terms of solutes.

Disturbances seemed to favor the generalist, *Branchinecta lindahli*, while undisturbed habitats favored the alkaline-tolerant species *B. mackini, B. gigas,* and *Lepidurus lemmoni*. Flightline areas and areas where petroleum products were used to line the runways had low densities of branchiopods. In the few cases where eggs were present in soil samples from these areas the eggs were very sparse. At Edwards AFB, *L. lemmoni* appears tolerant of a wide range of solute levels and temperatures. At mid-season, multiple sizes of this species were present possibly due to some eggs hatching directly or to a second or prolonged hatching.

B. mackini were found at slightly higher temperature (34° C) than reported from previous collections (32° C, Eng et al., 1990). Eriksen & Brown (1980) reported a 12-hour LD/50 of 34.5° C for the species but it was field collected at 34° C in this study. Alkalinity values for *B. gigas* (2,120 mg/L) were well above the highest reported previously (1,003 mg/L in Eng *et al.* 1990). *B. gigas* was found mainly in playas and claypans, but in only one long-lived road pool adjacent to Rogers Dry Lake. As expected, it was always found with its prey species *B. mackini*. The species was not present in May samples when

temperatures were high. *B. gigas* may have a short life cycle, or decreasing densities of *B. mackini* may cause *B. gigas* to be unable to find food and subsequently die out.

B. lindahli was found at higher pH levels (10.6) then previously reported (10.3 in Eng *et al.* 1990), but all other values for alkalinity, TDS, and temperature were within the normal ranges for this species. The early disappearance of this species is presumably due to its short life span, although increased temperatures may have had an effect. It is unlikely that high solute levels are responsible for either its disappearance or its absence from playas because the alkalinities measured in May were within its reported range (Eng *et al.* 1990). If there is some geographic variability within the species, the higher alkalinities of the playas may preclude it from establishing large populations. *B. lindahli* was often found with *B. mackini* and seemed to be more common in disturbed areas than other species and was found by itself more often than any other species. This was the only species found in the anomalous, low solute/pH BG1 site (Appendix A). In some pools, where *B. lindahli* eggs were found the species was not evident in live samples. It is possible that eggs did not hatch or that densities were too low to be detected in small live samples. Playas receive runoff that has traveled over large areas and perhaps eggs wash in but hatched animals do not survive.

Almost nothing has been reported about the biology of *Eocyzicus digueti*, but it appears to be found in desert playas (Sublette and Sublette 1967, Kubly 1982) including those at Edwards AFB. This study supplies the first water chemistry data for this species and findings indicate that it does not appear to be tolerant of high alkalinity but is tolerant of high salt concentrations.

Desert Tortoise

The methodology employed in this study is designed to give desert tortoise relative density figures based on sign resulting from the presence of the species. The technique provides relative density only, and results should not be interpreted as absolute density. No attempt was made to extrapolate relative density figures for unsurveyed sections. Other survey limitations included the small percentage of each section sampled (individual transects sample 0.9% of a square mile or 2.8% of each section) and the wide margin of error of absolute density figures from the BLM trend plots which can affect the accuracy of calibration efforts. In spite of these qualifications, this methodology is extremely useful for revealing trends in desert tortoise populations over large areas.

Results are based on the relationship which exists between tortoise presence and the accumulation of tortoise scat and cover sites. This relationship is dynamic on both temporal and spatial scales. Sign counts can be reduced by significant rains (Goodlett 1991; Berry, personal communication). Surveys conducted in late fall and early winter 1992 were clearly affected by rainstorms. Some deterioration of sign is expected as a result and total sign counts from sections surveyed in fall 1992 are probably lower than they would have been prior to rainfall. These lowered counts may be corrected by the first series of calibration transects which were also performed at the same time of year, after fall storms. However, these same regression equations may then overestimate tortoise densities for surveys conducted in summer 1993 after a spring with little precipitation when tortoise sign may have accumulated. Decreases in the ability to detect sign are exaggerated by rainstorms for juvenile and hatchling tortoise, which are difficult to detect under ideal conditions. The relationship between sign counts and density was notably skewed at Fremont Valley. Signs of widespread flooding were obvious at this site, where the rocky substrate appeared to be wiped clean of debris over large areas. In addition, the proportion of the population composed of juvenile and hatchling tortoise at Fremont Valley is 67 percent (Berry, in preparation). Regression lines were recalculated to estimate densities at a time of year when tortoise sign had built up over the entire season, but winter rains had not yet begun.

Regression analysis of average total corrected sign observed against population density at BLM trend plots was performed for each observer. The point 0,0 was used in regression analysis, but the line was not forced through this point. As a result, the lines cross the y-axis at a number greater than zero, meaning that a total sign count of zero may indicate a positive tortoise density. At low densities, the lack of sign observed in such a small sample does not necessarily indicate that there are no tortoise present.

If these results reflect actual population structure, the population in the study area may be unhealthy with low reproductive success. However, it is more likely that the results are indicative of the difficulties in detecting sign of juvenile tortoises. Time since death data can be valuable in determining mortality rates and can provide indirect evidence of the prevalence of upper respiratory tract disease in recent years. Use of fine-grained distinctions from a key prepared by Berry and Woodman (1984) for determining time since death were not possible because of time and handling restrictions. High mortality in recent years has been noted for populations throughout the western Mojave Desert, due in part to the upper respiratory tract disease which has been reported from Edwards AFB (Hagan, personal communication). Time since

death data did not indicate a proportional difference in mortality on one side of the base when compared to the other.

Disturbances of different types were not tallied together because the overall effect of disturbance types on tortoises is not equally weighted. Roads, both paved and dirt, are probably the most significant disturbance type in terms of direct threats to desert tortoise in the study area. Not only do they represent a source of mortality from vehicles, but also lead to other sources of disturbance resulting from access by humans. Evidence of domestic animals in the northwestern part of the base was recent. In some areas the effects of grazing appreared to have had a negative effect on both annual and perennial plant growth. Garbage was present throughout the study area. Most garbage was historic and not recent except in areas easily accessible to urban areas, like the southwestern corner of the base near Lancaster, near the town of Boron, and along public access roads. Disturbances that were ubiquitous like military-related shells were not counted individually because this would have detracted from the surveyor's ability to detect tortoise sign.

Approximately 176.8 square kilometers of the east side of the study area and the 46.8 square kilometers of Complex One Charlie are within the Fremont-Kramer unit of critical habitat designated by the USFWS for the desert tortoise (Figure 10). Activities that are considered by the USFWS to be adverse modifications of critical habitat may be evaluated on a case by case basis between base personnel and the USFWS. Activities that could produce adverse modifications may be determined by whether the project will affect the rehabilitation of the entire Fremont-Kramer recovery unit. Of the 176.8 square kilometers on the east side of the base, 52 (76%) were surveyed during these studies. Relative density transects for desert tortoise during 1992-1993 combined with results from the Complex 1 Charlie study (CSC, 1991) indicate that desert tortoise density had a mean of over 27 tortoises per 2.6 Km^2 within the area of critical habitat on the base.

Mohave Ground Squirrel

This survey provides relative abundance estimates of Mohave ground squirrels and does not determine absolute densities. Such surveys would require large trapping grids monitored in early spring when all adults are typically above the ground (usually late March and early April). Grid #1 was large enough to accommodate studies of this sort but low trap success limited the analysis possible.

Two of the trapping grids (Grids #3 and #5) confirmed the presence of the Mohave ground squirrel at new locations within the study area. A combination of trapping and ground surveys could determine the presence of this species across large areas. Trapping helps determine when juveniles are emerging because the Mohave ground squirrel is especially vocal at this time, emitting diagnostic contact and alarm calls. Future studies could be useful for determining presence of the Mohave ground squirrel in other areas of the base and defining the current occupied western range of the species. From these surveys, incidental sightings, and accidental trappings, it appears that the Mohave ground squirrel is present throughout much of the base. A large number of visual and auditory detections recorded incidentally substantially increased the amount of known occupied habitat on the base.

Incidental Sensitive Species Detections

Data that were compiled for incidental sightings of sensitive species provides the most comprehensive description of the presence and distribution of sensitive species across the study area. The methods that were used recorded species presence per square-mile section to avoid duplication of data.

Global Positioning System

Global positioning systems (GPS) technology provided a greater accuracy of locational data than methods used previously in the study area. The nature of the topography within the study area (large expanses between notable relief areas) makes other methods such as triangulation with a compass, less effective and accurate.

The majority of data attempted to be recorded by GPS was successful although several problems limited complete effectiveness. This technology was relatively new during the time of these surveys and a learning curve existed for surveyors in the field, the base station operators, and the post-processors. Because of this, traditional field mapping was performed to supplement the GPS data.

Uncertainties encountered in the field included lack of satellites needed to get accurate readings and the inability to get accurate reading when topography limited the number of satellites that could be detected. Areas with deep washes on the east side of the base, and areas near areas of relief such as Leuhman

Ridge on the east side of the study area and the Rosamond Hills on the west side of the study area, were sufficient to limit the number of satellites that could be accessed.

The base station used to collect data needed to correct field readings was located in the main base area of Edwards AFB. It was discovered during post-processing efforts that there were several occasions when the base station was not operating at the same time data was being taken in the field. If possible, these readings were retaken to provide more accurate data. There were also several points of data that could not be post-processed for unexplained reasons. However, all data taken using the GPS are likely to be more accurate than those that would have been taken by surveyors using field maps. In all, of over 1,700 locational fixes attempted, over 80 percent were successfully recorded and post processed.

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LIST OF ACRONYMS

AFB	Air Force Base
BLM	U.S. Bureau of Land Management
CDFG	California Department of Fish and Game
CERCLA	Comprehensive Environmental Restoration, Compensation, and Liability Act
CNPS	California Native Plant Society
EPA	U.S. Environmental Protection Agency
FFA	Federal Facilities Agreement
GPS	Global Positioning System
IRP	Installation Restoration Program
OU	Operable Unit
PRL	Potential Release Location
TDS	Total Dissolved Solids
USFWS	U.S. Fish and Wildlife Service

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APPENDIX A

Eubranchiopod (Freshwater Shrimp) Survey Results

Table A-1
Branchiopod Species Distribution By Sampling Site

Pool	Type of Pool	Live Sample	Soil Sample	Location	SPECIES L. lemmoni	B. gigas	B. mackini	B. lindahli	E. digueti	INT
A2	P	Y	Y	Rogers S	3 4	2 3	2 3			X
F1	P	Y	N	Flight Path			2			
RGM	P	Y	N	Rogers Middle			2			
RL	P	Y	Y	Rosamond E	3		2 3	e		
RL2S	P	Y	N	Rosamond N	3 6 7	2	2 3 4 6 7 8 9	e		
RL2N	P	Y	Y	Rosamond N	3	2	2 3			X
RL3B	P	Y	Y	Rosamond W	e	e	2	e		X
A1	P	N	Y	Rogers N			e			X
F2	P	N	Y	Flight Path				e'		
F3	P	N	Y	Flight Path			e			
F4	P	N	Y	Flight Path		e	e			
B1	EP	Y	Y	Rogers N Jettison	3	2	1 2 3			
B3	EP	Y	Y	Triangle)	3	2 3	2 3			X
R3	EP	Y	Y	Rogers N (Triangle)	2 3		1 2 3	?		
S	C/P	Y	Y	Sage Street	3 4 6		1 2 3 4	1	3 4 6	
BC1	C	Y	Y	Buckhorn N	2 3	2	2 3			X
BG1	C	Y	Y	Before Rosamond W				2		X
BH1	C	Y	Y	Buckhorn S	2			2		X
BH2	C	Y	Y	Buckhorn S			2	e		X
BP1	C	Y	Y	Branch Park	2	2 3	2 3 6	e		X
EC	C	Y	Y	Ave E (Excellent)		1 2 3	1 2 3			
G	C	Y	N	South Gate Pool	3	3	3			
R4B	C	Y	Y	Mercury Blvd. (Toxics)			3	2		
R6	C	Y	Y	120th St. Mesquite				1 2		X
R7	C	Y	Y	Ave E.			6	e		X
TS	C	Y	Y	Before Rosamond W	2 3	2	2 3	2		
L2	C	Y	Y	Lancaster Blvd.			6	e		
R4C	C	Y	N	Just N. of R4	4		4			
L1	C	N	Y	Lancaster Blvd.		e	e	?		X
CC1	RP/C	Y	Y	Complex Charlie			e	2		X
B2	RP	Y	Y	Rogers N Barrow Pit	2	e	e	e		X
C1	RP	Y	Y	120th St. Cattle Tank			e	2		X
HY	RP	Y	N	Rosamond W (Hybrid)			1	1		
R1	RP	Y	Y	Rogers N			e	2		X
R2	RP	Y	Y	Rogers N	2 3 4	1 2	1 4	1 2 3		X
R4A	RP	Y	Y	Track)			1 2 3	1 2 3		X
R8	RP	Y	N	Sierra Hwy.			1	1		
RD	RP	Y	N	Round Pool			2 3	1 3	2 3	
RD2	RP	Y	N	E of Round Pool		e		1		
R5	RP	N	Y	Into Buckhorn N			e	e		X
TOTALS				40	15	11	26	15	2	
LIVE SAMPLES				34						

Sampling Trips

1 Trip 1 November 1992
2 Trip 2 January 1993
3 Trip 3 March 1993 (<20% of pools sampled)
4 Trip 4 May 1993
5 Trip 5 (NOT A SURVEY TRIP)
6 Trip 6 June 1993
7 thru 9 Trip 7 July 1993 (NOT SURVEY TRIPS)
indicate live animals sampled
e indicates eggs found in soil samples
' indicates only one egg found
INT eggs intermediate

Type of Pool

P = Playa
EP = Edge Playa
C = Claypan
RP = Road Pool

BioEPTR/19

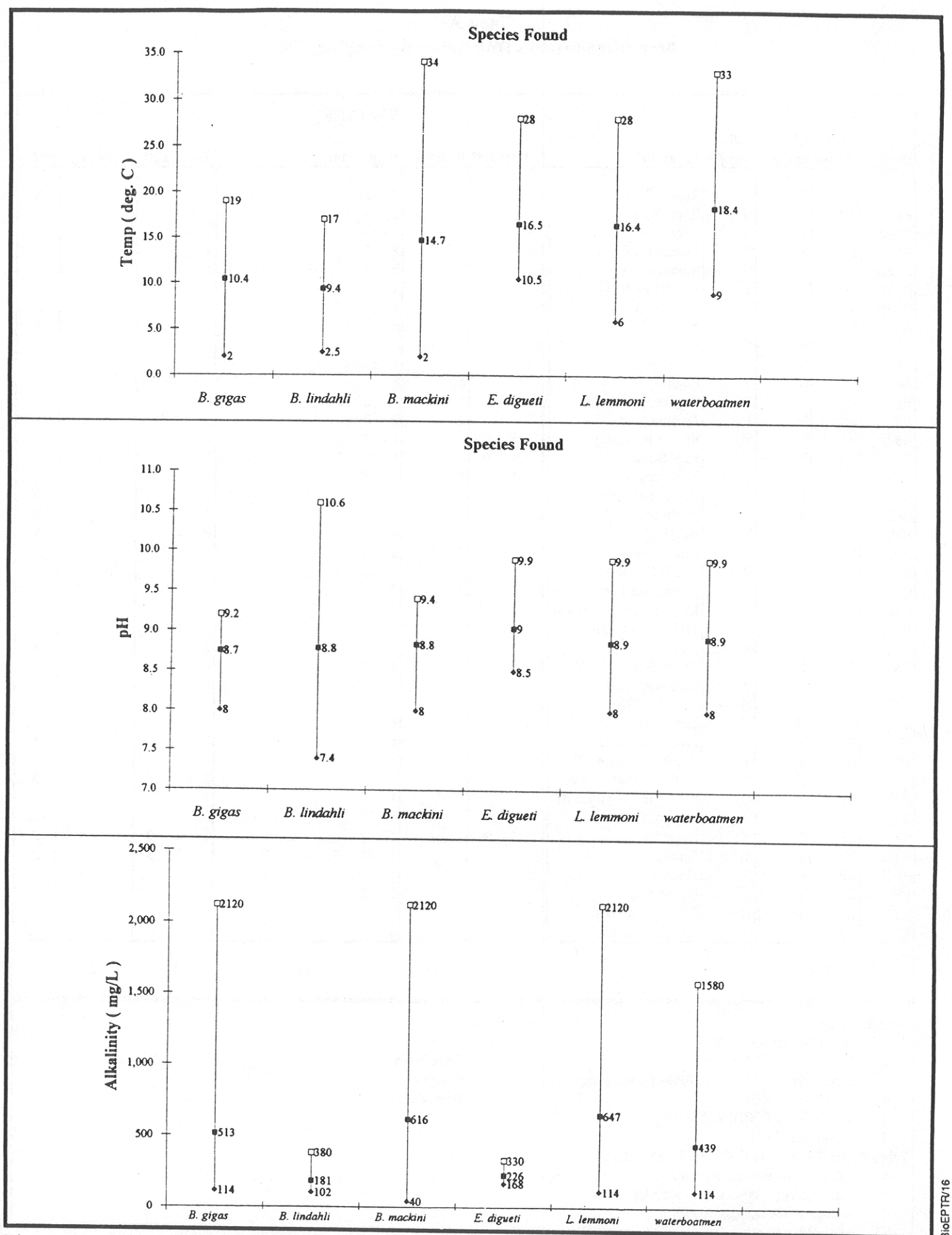

Figure A-2 Water Chemistry Ranges and Means By Species In Live Samples (Page 1 of 2)

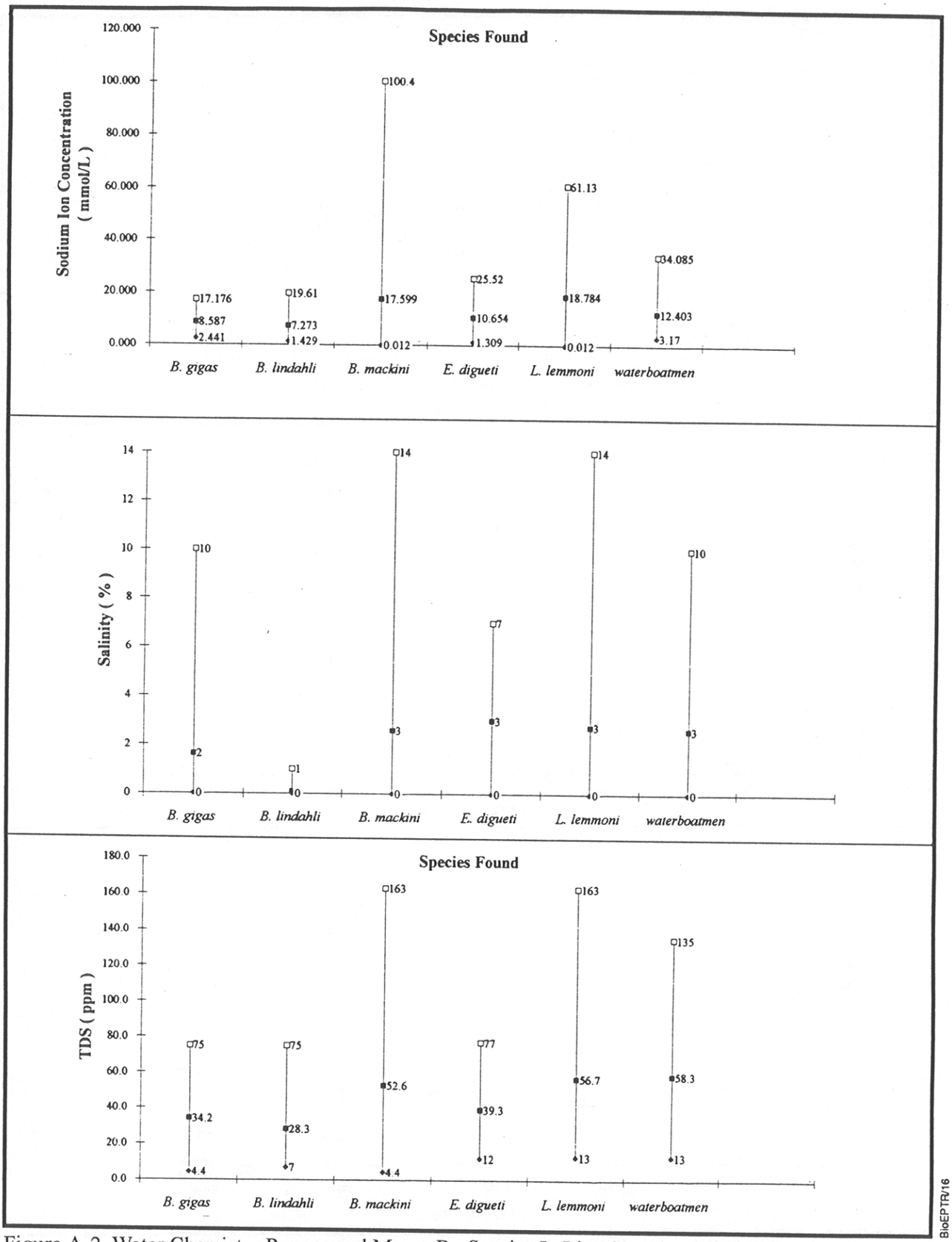

Figure A-2 Water Chemistry Ranges and Means By Species In Live Samples (Page 2 of 2)

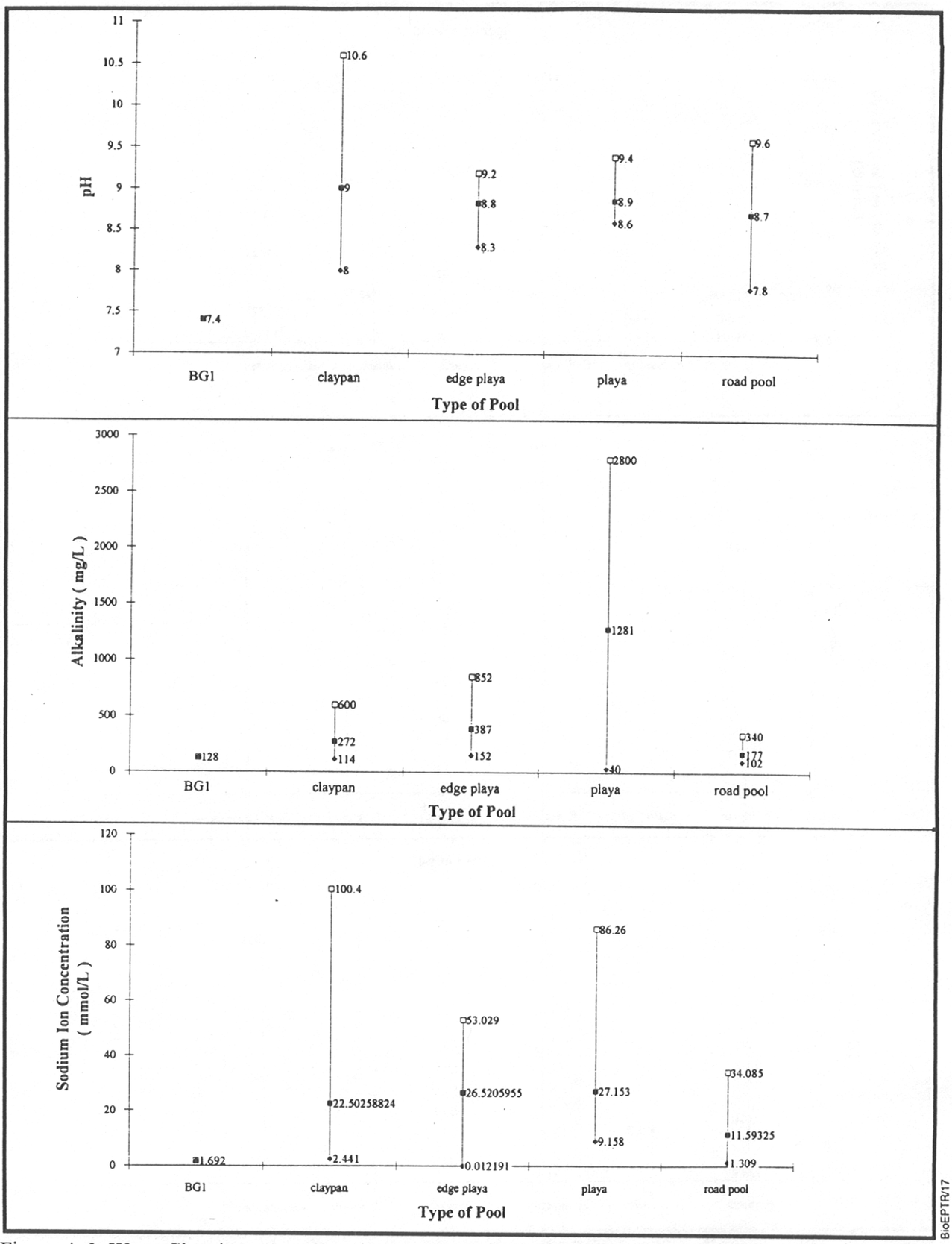

Figure A-3 Water Chemistry Ranges and Means By Habitat Type In Live Samples (Page 1 of 2)

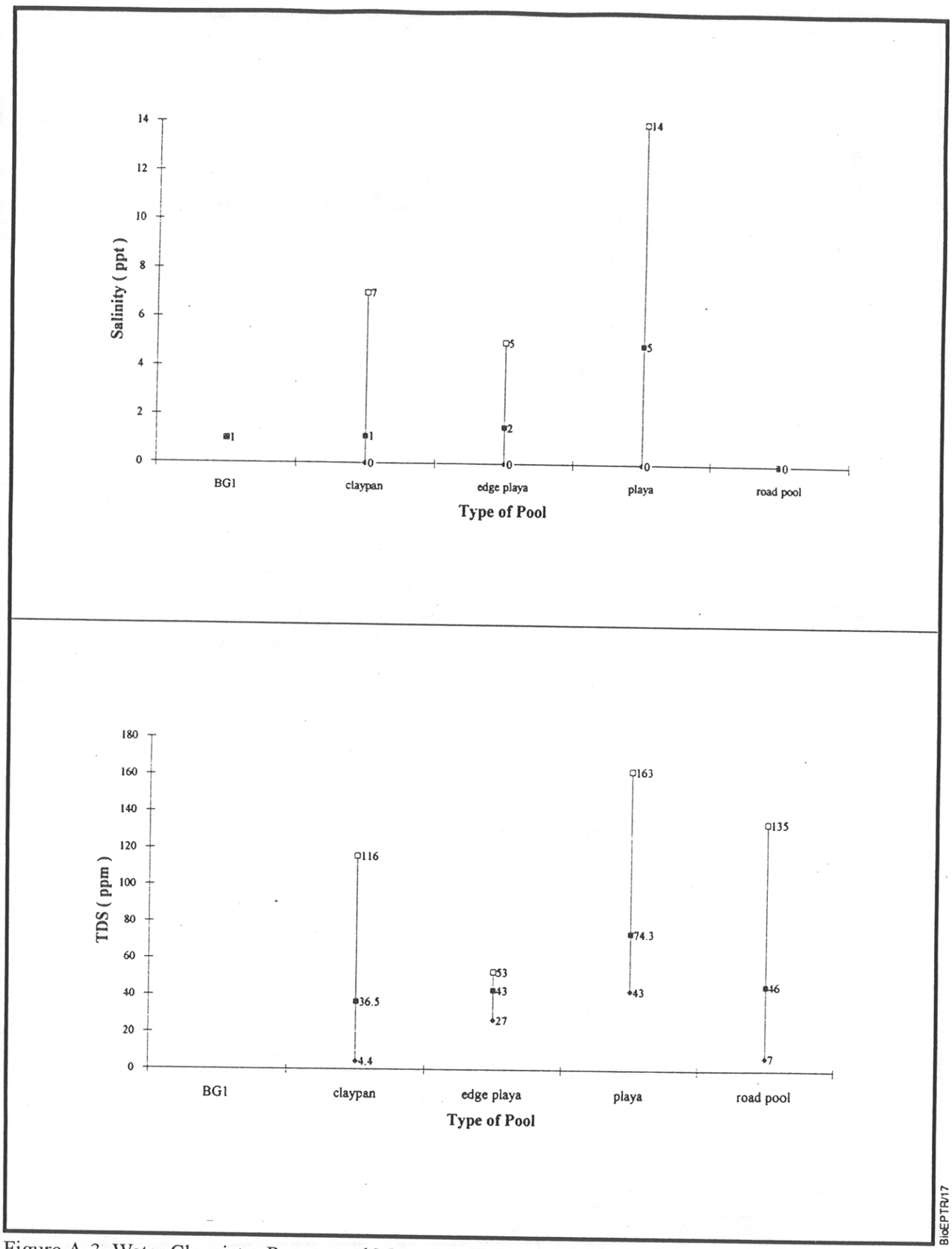

Figure A-3 Water Chemistry Ranges and Means By Habitat Type In Live Samples (Page 2 of 2)

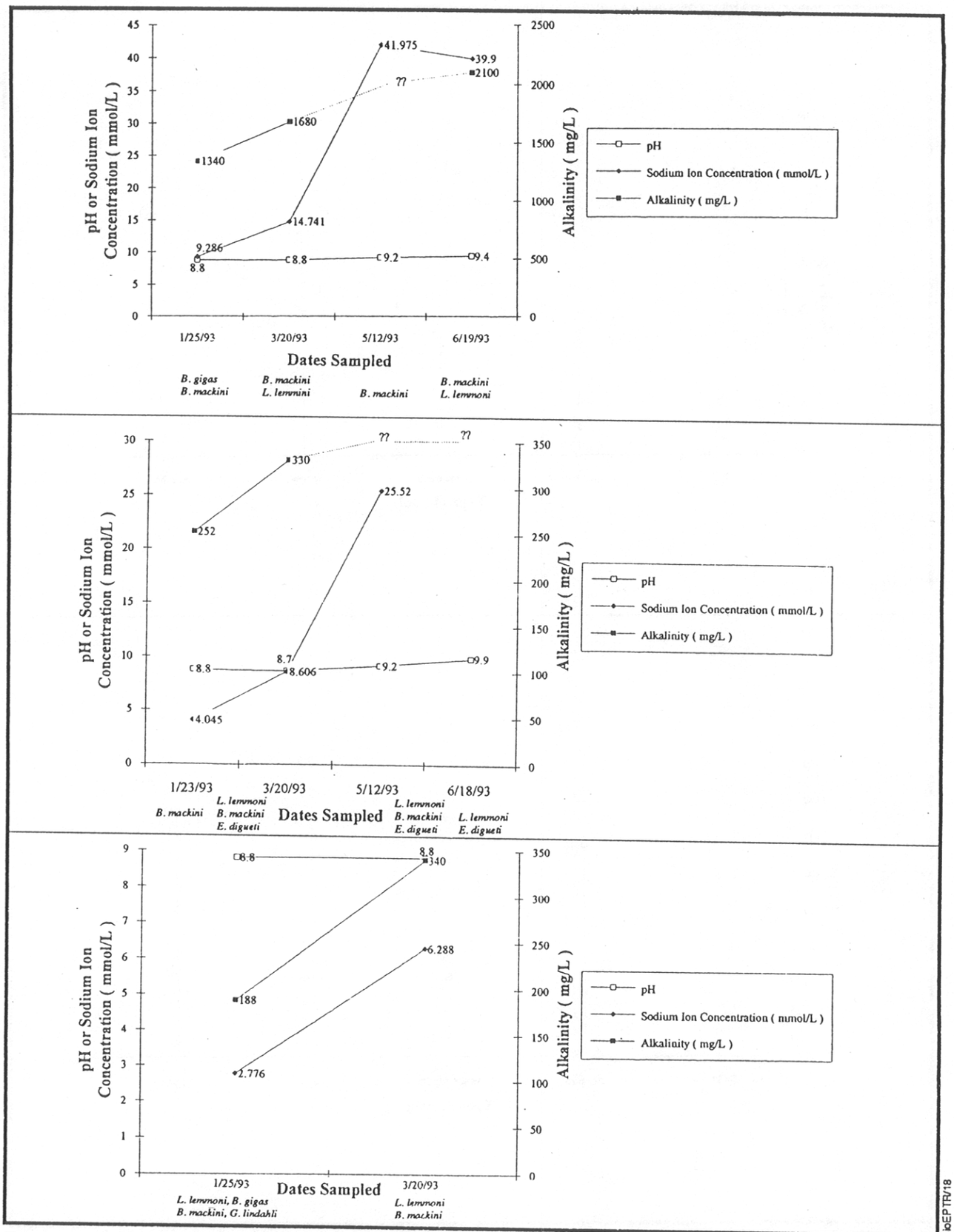

Figure A-4 Change in pH, Sodium Ion Concentration, Alkalinity, and Species Composition

APPENDIX B

Desert Tortoise Survey Results

Table B-1

Desert Tortoise Transect Results

Location			Triangle Orientation from Section Center	Surveyor	Date	Total Sign	Total Corrected Sign	Estimated Relative Density	Mean for Section
T	R	Sec							
11N	10W	34	W	MA	10/5/93	3	3	12	**18**
			E	RA	10/5/93	5	5	20	
			S	DL	10/5/93	9	5	20	
11N	10W	36	S	MA	10/5/93	7	6	22	**22**
			W	RA	10/5/93	3	3	13	
			SW	DL	10/5/93	9	8	30	
10N	10W	5	SW	MA	10/6/93	1	1	6	**11**
			N	RA	10/6/93	0	0	2	
			SE	DL	10/6/93	12	6	24	
10N	10W	4	SE	MA	10/6/93	7	6	22	**23**
			SW	RA	10/6/93	8	8	31	
			N	DL	10/6/93	5	4	17	
10N	10W	2	NW	MA	6/24/93	1	1	11	**16**
			SW	RA	6/28/93	3	3	24	
			E	DL	6/24/93	1	1	13	
10N	10W	1	W	MA	10/5/93	16	5	19	**13**
			N	RA	10/5/93	3	2	9	
			NW	DL	10/5/93	2	2	10	
10N	9W	2	E	MA	10/5/93	0	0	3	**5**
			N	RA	10/5/93	2	2	9	
			W	DL	10/5/93	0	0	3	
10N	10W	7	SE	MA	10/7/93	4	4	16	**22**
			N	RA	10/7/93	10	10	38	
			SW	DL	10/7/93	3	3	13	
10N	10W	8	SW	MA	10/7/93	0	0	3	**14**
			SE	RA	10/7/93	3	3	13	
			N	DL	10/7/93	11	7	27	
10N	10W	10	NW	MA	10/11/93	5	4	16	**16**
			SE	RA	10/11/93	4	4	16	
			NE	DL	10/11/93	5	4	17	
10N	10W	11	NE	MA	10/10/93	6	3	12	**13**
			W	RA	10/5/93	5	4	16	
			SE	DL	10/10/93	2	2	10	
10N	12W	13	SE	MA	7/9/93	8	5	31	**15**
			N	RA	7/16/93	0	0	5	
			SW	DL	7/9/93	0	0	8	
10N	11W	17	S	MA	7/7/93	2	2	16	**32**
			NW	RA	7/12/93	6	6	43	
			NE	DL	7/7/93	6	5	36	

Table B-1, Page 2 of 16

Location			Triangle Orientation from Section Center	Surveyor	Date	Total Sign	Total Corrected Sign	Estimated Relative Density	Mean for Section
T	R	Sec							
			NW	MA	7/8/93	3	3	21	
10N	11W	16	W	RA	7/14/93	4	4	31	**22**
			SE	DL	7/8/93	1	1	13	
			SW	MA	10/11/93	2	2	9	
10N	11W	15	SE	RA	10/11/93	0	0	2	**6**
			N	DL	10/11/93	1	1	7	
			SE	MA	10/11/93	0	0	3	
10N	11W	14	N	RA	10/11/93	2	2	9	**6**
			SW	DL	10/11/93	1	1	7	
			N	MA	10/7/93	4	3	12	
10N	10W	17	NE	RA	10/7/93	3	3	13	**11**
			NW	DL	10/7/93	1	1	7	
			SE	MA	6/24/93	6	5	31	
10N	10W	15	N	RA	6/28/93	2	2	18	**19**
			SW	DL	6/24/93	0	0	8	
			NW	MA	7/15/93	0	0	6	
10N	10W	14	N	RA	7/19/93	1	1	12	**12**
			NNW	DL	7/15/93	2	2	19	
			NW	MA	7/8/93	12	7	41	
10N	12W	23	S	RA	7/14/93	2	2	18	**24**
			NE	DL	7/8/93	1	1	13	
			E	MA	10/12/93	0	0	3	
10N	12W	24	N	RA	10/12/93	0	0	2	**3**
			S	DL	10/12/93	0	0	3	
			N	MA	6/13/93	0	0	6	
10N	11W	20	SW	RA	6/13/93	0	0	5	**8**
			SE	DL	6/13/93	1	1	13	
			SW	MA	10/9/93	3	3	12	
10N	11W	21	SE	RA	10/9/93	1	1	6	**9**
			N	DL	10/9/93	3	2	10	
			SE	MA	10/9/93	1	1	6	
10N	11W	22	N	RA	10/9/93	2	2	9	**7**
			SW	DL	10/9/93	1	1	7	
			SW	MA	10/11/93	1	1	6	
10N	11W	23	N	RA	10/11/93	1	1	6	**5**
			SE	DL	10/11/93	0	0	3	
			SE	MA	10/11/93	1	1	6	
10N	11W	24	SW	RA	10/11/93	3	3	13	**7**
			N	DL	10/11/93	0	0	3	
			N	MA	7/9/93	4	4	26	
10N	10W	19	SW	RA	7/16/93	2	2	18	**21**
			SE	DL	7/9/93	2	2	19	

Location			Triangle Orientation from Section Center	Surveyor	Date	Total Sign	Total Corrected Sign	Estimated Relative Density	Mean for Section
T	R	Sec							
10N	10W	20	SW	MA	6/21/93	1	1	11	**20**
			S	RA	6/25/93	2	2	18	
			W	DL	6/21/93	7	4	30	
10N	10W	21	NE	MA	10/6/93	21	6	22	**13**
			N	RA	10/6/93	1	1	6	
			E	DL	10/6/93	2	2	10	
10N	10W	22	N	MA	10/5/93	1	1	6	**6**
			SE	RA	10/6/93	2	2	9	
			SW	DL	10/5/93	0	0	3	
10N	11W	27	N	MA	10/9/93	1	1	6	**7**
			SW	RA	10/9/93	3	3	13	
			SE	DL	10/9/93	0	0	3	
10N	11W	26	NW	MA	6/29/93	4	2	16	**24**
			NE	RA	7/6/93	3	3	24	
			S	DL	6/29/93	6	4	30	
10N	10N	30	SW	MA	10/10/93	1	1	6	**7**
			SE	RA	10/9/93	2	2	9	
			N	DL	10/10/93	1	1	7	
10N	10W	29	SE	MA	10/10/93	0	0	3	**5**
			N	RA	10/6/93	1	1	6	
			SW	DL	10/10/93	1	1	7	
10N	12W	35	SE	MA	6/10/93	0	0	6	**17**
			N	RA	6/10/93	5	5	37	
			SW	DL	6/10/93	0	0	8	
10N	12W	36	SW	MA	6/28/93	2	2	16	**16**
			SE	RA	7/6/93	3	3	24	
			N	DL	6/28/93	0	0	8	
10N	11W	32	S	MA	6/29/93	2	2	16	**20**
			NW	RA	7/6/93	4	4	31	
			NE	DL	6/29/93	1	1	13	
10N	11W	33	SE	MA	6/13/93	2	2	16	**24**
			N	RA	6/13/93	5	5	37	
			SW	DL	6/13/93	3	2	19	
10N	11W	34	SW	MA	10/9/93	0	0	3	**6**
			SE	RA	10/9/93	2	2	9	
			N	DL	10/9/93	1	1	7	
10N	11W	36	E	MA	6/10/93	10	5	31	**19**
			NW	RA	6/10/93	2	2	18	
			SSW	DL	6/10/93	0	0	8	
10N	10W	31	NW	MA	10/10/93	0	0	3	**4**
			S	RA	10/7/93	1	1	6	
			NE	DL	10/10/93	0	0	3	

Table B-1, Page 4 of 16

Location			Triangle Orientation from Section Center	Surveyor	Date	Total Sign	Total Corrected Sign	Estimated Relative Density	Mean for Section
T	R	Sec							
10N	10W	32	N	MA	7/14/93	0	0	6	**8**
			SW	RA	7/19/93	1	1	12	
			SE	DL	7/14/93	0	0	8	
9N	12W	2	N	MA	6/10/93	0	0	6	**13**
			SE	RA	6/10/93	3	3	24	
			NE	DL	6/10/93	0	0	8	
9N	12W	1	S	MA	6/12/93	1	1	11	**18**
			NE	RA	6/12/93	4	4	31	
			NW	DL	6/12/93	1	1	13	
9N	11W	5	N	MA	10/13/93	15	12	41	**20**
			SW	RA	10/13/93	2	2	9	
			SE	DL	10/13/93	2	2	10	
9N	11W	2	SW	MA	10/12/93	14	7	25	**18**
			SE	RA	10/12/93	4	4	16	
			N	DL	10/12/93	4	3	13	
9N	10W	6	N	MA	10/7/93	7	4	16	**9**
			S	RA	10/7/93	1	1	6	
			SE	DL	10/7/93	1	1	7	
9N	10W	5	E	MA	6/11/93	8	7	41	**38**
			NNE	RA	6/11/93	4	4	31	
			SSW	DL	6/11/93	8	6	42	
9N	12W	11	SE	MA	10/13/93	0	0	3	**5**
			N	RA	10/13/93	1	1	6	
			SW	DL	10/13/93	1	1	7	
9N	12W	12	NW	MA	6/12/93	14	11	61	**53**
			S	RA	6/12/93	9	9	62	
			NE	DL	6/12/93	5	5	36	
9N	11W	8	SE	MA	6/9/93	0	0	6	**12**
			SE	RA	6/13/93	2	2	18	
			SW	DL	6/9/93	2	1	13	
9N	11W	9	SW	MA	6/9/93	2	2	16	**14**
			SE	RA	6/13/93	2	2	18	
			N	DL	6/9/93	0	0	8	
9N	11W	10	N	MA	10/12/93	1	1	6	**7**
			SW	RA	10/12/93	3	3	13	
			SE	DL	10/12/93	0	0	3	
9N	11W	11	SE	MA	10/12/93	3	3	12	**12**
			NW	RA	10/12/93	3	3	13	
			SW	DL	10/12/93	3	2	10	
9N	11W	36	SW	MA	7/14/93	0	0	6	**13**
			NE	RA	7/14/93	3	3	24	
			NW	DL	7/14/93	0	0	8	

Location			Triangle Orientation from Section Center	Surveyor	Date	Total Sign	Total Corrected Sign	Estimated Relative Density	Mean for Section
T	R	Sec							
9N	10W	7	S	MA	6/14/93	2	2	16	**20**
			SE	RA	6/10/93	2	2	18	
			N	DL	6/14/93	4	3	25	
9N	10N	8	NW	MA	10/10/93	17	11	37	**22**
			N	RA	10/8/93	4	4	16	
			W	DL	10/10/93	3	3	13	
9N	12W	13	SW	MA	6/14/93	7	4	26	**19**
			SE	RA	6/14/93	0	0	5	
			E	DL	6/14/93	4	3	25	
9N	11W	17	W	MA	10/13/93	1	1	6	**5**
			E	RA	10/13/93	1	1	6	
			N	DL	10/13/93	0	0	3	
9N	11W	16	N	MA	6/9/93	0	0	6	**14**
			W	RA	6/14/93	1	1	12	
			E	DL	6/9/93	4	3	25	
9N	11W	15	W	MA	10/12/93	2	2	9	**6**
			E	RA	10/12/93	0	0	2	
			N	DL	10/12/93	1	1	7	
9N	10W	18	E	MA	10/8/93	2	2	9	**6**
			S	RA	10/8/93	1	1	6	
			SE	DL	10/8/93	0	0	3	
9N	10W	17	W	MA	5/28/93	3	3	21	**16**
			SE	RA	5/28/93	2	2	18	
			NE	DL	5/28/93	0	0	8	
9N	10W	16	SW	MA	5/28/93	0	0	6	**8**
			SE	RA	5/28/93	0	0	5	
			N	DL	5/28/93	1	1	13	
9N	10W	15	SW	MA	7/11/93	0	0	6	**6**
			SW	RA	7/14/93	0	0	5	
			N	DL	7/11/93	0	0	8	
9N	12W	23	E	MA	6/13/93	0	0	6	**6**
			W	RA	6/13/93	0	0	5	
			S	DL	6/13/93	0	0	8	
9N	11W	24	SE	MA	10/8/93	0	0	3	**3**
			N	RA	10/8/93	0	0	2	
			SW	DL	10/8/93	0	0	3	
9N	10W	19	N	MA	5/28/93	0	0	6	**12**
			SW	RA	5/28/93	1	1	12	
			SE	DL	5/28/93	2	2	19	
9N	10N	20	N	MA	10/8/93	0	0	3	**3**
			SW	RA	10/8/93	0	0	2	
			SE	DL	10/8/93	0	0	3	

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Location			Triangle Orientation from Section Center	Surveyor	Date	Total Sign	Total Corrected Sign	Estimated Relative Density	Mean for Section
T	R	Sec							
9N	10W	21	SE	MA	5/28/93	14	9	51	**31**
			N	RA	5/28/93	2	2	18	
			SW	DL	5/28/93	3	3	25	
9N	10W	22	SW	MA	6/11/93	0	0	6	**6**
			SE	RA	6/11/93	0	0	5	
			N	DL	6/11/93	0	0	8	
9N	12W	26	N	MA	6/11/93	0	0	6	**6**
			SW	RA	6/11/93	0	0	5	
			SE	DL	6/11/93	0	0	8	
9N	11W	26	E	MA	10/13/93	0	0	3	**3**
			N	RA	10/13/93	0	0	2	
			S	DL	10/13/93	0	0	3	
9N	10N	29	NW	MA	10/8/93	0	0	3	**3**
			NE	RA	10/8/93	0	0	2	
			SW	DL	10/8/93	0	0	3	
9N	10W	27	SW	MA	6/8/93	0	0	6	**8**
			SE	RA	6/12/93	1	1	12	
			N	DL	6/18/93	0	0	8	
9N	12W	35	SW	MA	6/25/93	0	0	6	**6**
			NW	RA	6/30/93	0	0	5	
			W	DL	6/25/93	0	0	8	
9N	11W	35	E	MA	10/14/93	0	0	3	**3**
			N	RA	10/14/93	0	0	2	
			S	DL	10/14/93	0	0	3	
9N	10N	34	N	MA	10/4/93	0	0	3	**3**
			W	RA	10/4/93	0	0	2	
			NW	DL	10/4/93	0	0	3	
9N	10W	35	N	MA	6/9/93	0	0	6	**6**
			SW	RA	6/12/93	0	0	5	
			SE	DL	6/9/93	0	0	8	
8N	12W	2	W	MA	6/25/93	0	0	6	**6**
			SSW	RA	6/30/93	0	0	5	
			SE	DL	6/25/93	0	0	8	
8N	11W	2	NE	MA	10/14/93	0	0	3	**3**
			S	RA	10/14/93	0	0	2	
			SW	DL	10/14/93	0	0	3	
8N	10W	5	SE	MA	7/11/93	0	0	6	**10**
			N	RA	7/18/93	0	0	5	
			NW	DL	7/11/93	2	2	19	
8N	10W	4	NW	MA	5/21/93	0	0	6	**8**
			SW	RA	5/24/93	0	0	5	
			SE	DL	5/28/93	1	1	13	

Location			Triangle Orientation from Section Center	Surveyor	Date	Total Sign	Total Corrected Sign	Estimated Relative Density	Mean for Section
T	R	Sec							
8N	10W	3	S	MA	10/4/93	0	0	3	**3**
			N	RA	10/4/93	0	0	2	
			W	DL	10/4/93	0	0	3	
8N	10W	2	E	MA	10/4/93	0	0	3	**3**
			N	RA	10/4/93	0	0	2	
			NE	DL	10/4/93	0	0	3	
8N	10W	1	SE	MA	4/28/93	0	0	6	**6**
			S	RA	5/4/93	0	0	5	
			SW	DL	4/28/93	0	0	8	
8N	9W	3	N	MA	6/8/93	0	0	6	**6**
			SW	RA	6/11/93	0	0	5	
			SE	DL	6/8/93	0	0	8	
8N	9W	5	SW	MA	10/4/93	0	0	3	**3**
			NW	RA	10/4/93	0	0	2	
			SE	DL	10/4/93	0	0	3	
8N	11W	8	S	MA	10/14/93	0	0	3	**3**
			SE	RA	10/14/93	0	0	2	
			SW	DL	10/14/93	0	0	3	
8N	11W	10	SE	MA	6/28/93	0	0	6	**6**
			N	RA	7/6/93	0	0	5	
			W	DL	6/28/93	0	0	8	
8N	10W	10	SE	MA	5/18/93	0	0	6	**6**
			N	RA	5/24/93	0	0	5	
			SW	DL	5/18/93	0	0	8	
8N	12W	14	SW	MA	7/10/93	0	0	6	**6**
			S	RA	7/16/93	0	0	5	
			ESE	DL	7/10/93	0	0	8	
8N	11W	18	N	MA	6/14/93	1	1	11	**8**
			SW	RA	6/14/93	0	0	5	
			N	DL	6/14/93	0	0	8	
8N	11W	17	SE	MA	6/26/93	0	0	6	**6**
			N	RA	6/30/93	0	0	5	
			SW	DL	6/26/93	0	0	8	
8N	11W	14	SE	MA	10/14/93	0	0	3	**3**
			SW	RA	10/14/93	0	0	2	
			N	DL	10/14/93	0	0	3	
8N	10W	15	SW	MA	4/29/93	0	0	6	**6**
			E	RA	5/4/93	0	0	5	
			NW	DL	4/29/93	0	0	8	
8N	10W	14	N	MA	4/30/93	0	0	6	**6**
			SW	RA	5/4/93	0	0	5	
			N	DL	4/30/93	0	0	8	

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Location			Triangle Orientation from Section Center	Surveyor	Date	Total Sign	Total Corrected Sign	Estimated Relative Density	Mean for Section
T	R	Sec							
8N	12W	23	SE	MA	6/14/93	0	0	6	**6**
			N	RA	6/14/93	0	0	5	
			SW	DL	6/14/93	0	0	8	
8N	12W	24	N	MA	10/13/93	0	0	3	**3**
			W	RA	10/13/93	0	0	2	
			E	DL	10/13/93	0	0	3	
8N	11W	19	SW	MA	10/14/93	0	0	3	**3**
			N	RA	10/14/93	0	0	2	
			SE	DL	10/14/93	0	0	3	
9N	8W	1	N	MA	3/11/93	1	1	11	**12**
			W	RA	3/11/93	1	1	12	
			S	DL	3/11/93	1	1	13	
9N	8W	12	SE	MA	3/14/93	0	0	6	**13**
			N	RA	3/12/93	3	3	24	
			SW	DL	3/14/93	0	0	8	
9N	8W	13	NE	MA	3/26/93	1	1	11	**14**
			S	RA	3/26/93	3	3	24	
			NW	DL	3/26/93	0	0	8	
9N	7W	7	W	MA	3/16/93	1	1	11	**26**
			S	RA	3/16/93	6	6	43	
			SW	DL	3/16/93	4	3	25	
9N	8W	2	W	MA	3/11/93	3	2	16	**30**
			S	RA	3/11/93	6	5	37	
			SW	DL	3/11/93	5	5	36	
9N	8W	10	SW	MA	3/26/93	3	2	16	**22**
			N	RA	3/26/93	4	4	31	
			SE	DL	3/26/93	2	2	19	
9N	8W	9	N	MA	3/10/93	2	2	16	**24**
			SW	RA	3/10/93	6	6	43	
			SE	DL	3/10/93	1	1	13	
9N	8W	8	N	MA	3/9/93	0	0	6	**8**
			SW	RA	3/10/93	1	1	12	
			SE	DL	3/9/93	0	0	8	
9N	8W	7	SW	MA	3/9/93	0	0	6	**8**
			SE	RA	3/11/93	0	0	5	
			N	DL	3/9/93	1	1	13	
9N	9W	12	SW	MA	4/1/93	0	0	6	**10**
			SE	RA	4/1/93	2	2	18	
			N	DL	4/1/93	0	0	8	
9N	8W	4	S	MA	3/29/93	2	2	16	**12**
			W	RA	3/29/93	1	1	12	
			E	DL	3/29/93	0	0	8	

Location			Triangle Orientation from Section Center	Surveyor	Date	Total Sign	Total Corrected Sign	Estimated Relative Density	Mean for Section
T	R	Sec							
9N	8W	5	N	MA	3/29/93	0	0	6	**8**
			S	RA	3/29/93	0	0	5	
			W	DL	3/29/93	1	1	13	
9N	9W	1	N	MA	4/1/93	0	0	6	**6**
			SW	RA	4/1/93	0	0	5	
			SE	DL	4/1/93	0	0	8	
9N	9W	13	SE	MA	3/10/93	2	2	16	**18**
			N	RA	3/10/93	3	3	24	
			SW	DL	3/9/93	1	1	13	
9N	9W	24	E	MA	3/30/93	0	0	6	**10**
			W	RA	3/30/93	1	1	12	
			S	DL	3/30/93	1	1	13	
9N	9W	36	N	MA	3/26/93	1	1	11	**16**
			SE	RA	3/26/93	2	2	18	
			SW	DL	3/26/93	2	2	19	
8N	9W	1	SE	MA	4/1/93	3	3	21	**27**
			N	RA	4/1/93	3	3	24	
			SW	DL	4/1/93	6	5	36	
9N	8W	34	NW	MA	3/12/93	8	8	46	**38**
			NE	RA	3/14/93	4	4	31	
			SW	DL	3/12/93	6	5	36	
9N	7W	25	SE	MA	3/12/93	15	10	56	**33**
			SW	RA	3/11/93	2	2	18	
			N	DL	3/12/93	3	3	25	
9N	7W	31	NW	MA	3/13/93	12	6	36	**68**
			E	RA	3/17/93	14	12	81	
			SW	DL	3/13/93	17	14	87	
9N	8W	15	E	MA	3/29/93	3	3	21	**13**
			N	RA	3/29/93	1	1	12	
			W	DL	3/29/93	0	0	8	
9N	8W	16	SW	MA	3/30/93	1	1	11	**10**
			SE	RA	3/30/93	1	1	12	
			N	DL	3/30/93	0	0	8	
9N	8W	17	N	MA	3/30/93	0	0	6	**10**
			SE	RA	3/30/93	1	1	12	
			SW	DL	3/30/93	1	1	13	
9N	8W	20	S	MA	4/15/93	0	0	6	**6**
			E	RA	4/15/93	0	0	5	
			N	DL	4/15/93	0	0	8	
9N	8W	29	W	MA	4/15/93	0	0	6	**13**
			S	RA	4/14/93	3	3	24	
			E	DL	4/15/93	0	0	8	

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Location			Triangle Orientation from Section Center	Surveyor	Date	Total Sign	Total Corrected Sign	Estimated Relative Density	Mean for Section
T	R	Sec							
9N	8W	30	N	MA	4/15/93	3	3	21	**21**
			SW	RA	4/15/93	1	1	12	
			SE	DL	4/15/93	4	4	30	
9N	9W	25	N	MA	3/30/93	0	0	6	**8**
			SW	RA	3/30/93	0	0	5	
			SE	DL	3/30/93	0	1	13	
9N	8W	28	W	MA	3/29/93	1	1	11	**16**
			S	RA	3/29/93	3	3	24	
			E	DL	3/29/93	1	1	13	
9N	8W	27	SE	MA	3/29/93	4	3	21	**21**
			N	RA	3/29/93	2	2	18	
			SW	DL	3/29/93	4	3	25	
9N	8W	23	SE	MA	4/15/93	0	0	6	**12**
			N	RA	4/15/93	2	2	18	
			SW	DL	4/15/93	1	1	13	
9N	8W	14	SW	MA	4/14/93	1	1	11	**14**
			SE	RA	4/14/93	3	3	24	
			N	DL	4/14/93	0	0	8	
9N	7W	32	SW	MA	3/13/93	11	10	56	**62**
			N	RA	3/17/93	5	5	37	
			SE	DL	3/13/93	17	15	93	
9N	7W	19	SW	MA	3/17/93	2	2	16	**20**
			N	RA	3/18/93	2	2	18	
			SE	DL	3/17/93	3	3	25	
9N	7W	20	SW	MA	3/10/93	2	2	16	**14**
			N	RA	3/10/93	2	2	18	
			SE	DL	3/10/93	0	0	8	
9N	7W	29	SW	MA	3/17/93	11	6	36	**32**
			N	RA	3/18/93	4	4	31	
			SE	DL	3/17/93	4	4	30	
9N	7W	17	S	MA	4/1/93	4	3	21	**13**
			W	RA	4/1/93	1	1	12	
			SW	DL	4/1/93	0	0	8	
9N	7W	21	E	MA	3/17/93	7	6	36	**31**
			S	RA	3/18/93	6	6	43	
			W	DL	3/17/93	1	1	13	
9N	7W	28	SE	MA	3/26/93	6	4	26	**27**
			SW	RA	3/26/93	6	5	37	
			N	DL	3/26/93	2	2	19	
9N	7W	33	SW	MA	3/13/93	17	13	71	**42**
			NW	RA	3/17/93	3	3	24	
			E	DL	3/13/93	4	4	30	

Location			Triangle Orientation from Section Center	Surveyor	Date	Total Sign	Total Corrected Sign	Estimated Relative Density	Mean for Section
T	R	Sec							
9N	7W	34	N	MA	3/28/93	6	5	31	**43**
			SE	RA	3/28/93	7	7	50	
			SW	DL	3/28/93	9	7	47	
9N	7W	35	SW	MA	3/28/93	16	10	56	**39**
			N	RA	3/28/93	5	4	31	
			SE	DL	3/28/93	4	4	30	
9N	7W	26	N	MA	3/28/93	3	3	21	**31**
			SE	RA	3/28/93	4	4	31	
			SW	DL	3/28/93	6	6	42	
9N	7W	27	E	MA	3/28/93	3	3	21	**32**
			W	RA	3/28/93	9	9	62	
			N	DL	3/28/93	1	1	13	
9N	7W	13	N	MA	3/16/93	2	2	16	**18**
			W	RA	3/16/93	3	3	24	
			SW	DL	3/16/93	2	1	13	
9N	7W	14	E	MA	3/16/93	2	2	16	**16**
			N	RA	3/16/93	1	1	12	
			SW	DL	3/16/93	2	2	19	
9N	7W	15	SW	MA	3/28/93	1	1	11	**14**
			N	RA	3/28/93	2	1	12	
			E	DL	3/28/93	3	2	19	
9N	6W	30	SE	MA	3/27/93	8	8	46	**36**
			SW	RA	3/27/93	4	4	31	
			N	DL	3/27/93	5	4	30	
9N	6W	29	N	MA	3/27/93	1	1	11	**30**
			SE	RA	3/27/93	5	5	37	
			SW	DL	3/27/93	7	6	42	
9N	6W	32	SW	MA	3/27/93	5	4	26	**27**
			N	RA	3/27/93	5	5	37	
			SE	DL	3/27/93	2	2	19	
9N	6W	31	N	MA	3/27/93	11	5	31	**29**
			SW	RA	3/27/93	6	6	43	
			SE	DL	3/27/93	1	1	13	
9N	7W	36	SE	MA	3/27/93	3	3	21	**24**
			SW	RA	3/27/93	4	4	31	
			N	DL	3/27/93	2	2	19	
9N	6W	20	N	MA	3/30/93	3	3	21	**19**
			SW	RA	3/30/93	0	0	5	
			SE	DL	3/30/93	5	4	30	
9N	6W	17	SE	MA	4/14/93	0	0	6	**15**
			N	RA	4/14/93	4	4	31	
			SW	DL	4/14/93	0	0	8	

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Location			Triangle Orientation from Section Center	Surveyor	Date	Total Sign	Total Corrected Sign	Estimated Relative Density	Mean for Section
T	R	Sec							
			N	MA	4/14/93	0	0	6	
9N	6W	7	SW	RA	4/14/93	2	2	18	**12**
			SE	DL	4/14/93	1	1	13	
			SE	MA	4/14/93	3	3	21	
9N	6W	8	N	RA	4/13/93	4	4	31	**22**
			SW	DL	4/14/93	1	1	13	
			SE	MA	3/14/93	1	1	11	
9N	7W	1	NE	RA	3/18/93	3	3	24	**16**
			W	DL	3/14/93	1	1	13	
			SE	MA	3/15/93	1	1	11	
9N	7W	2	SW	RA	3/18/93	3	3	24	**14**
			N	DL	3/15/93	0	0	8	
			SW	MA	4/13/93	2	2	16	
9N	6W	5	SE	RA	4/13/93	6	6	43	**28**
			N	DL	4/13/93	3	3	25	
			N	MA	3/15/93	0	0	6	
9N	7W	4	E	RA	3/17/93	3	3	24	**16**
			SW	DL	3/15/93	3	2	19	
			SW	MA	3/15/93	4	4	26	
10N	7W	33	N	RA	3/18/93	4	4	31	**23**
			SE	DL	3/15/93	1	1	13	
			NW	MA	4/17/93	0	0	6	
10N	7W	28	S	RA	4/15/93	0	0	5	**14**
			SW	DL	4/17/93	4	4	30	
			N	MA	4/17/93	6	4	26	
10N	7W	27	E	RA	4/15/93	1	1	12	**19**
			S	DL	4/17/93	2	2	19	
			SW	MA	3/31/93	1	1	11	
10N	7W	34	SE	RA	3/31/93	0	0	5	**10**
			N	DL	3/31/93	1	1	13	
			N	MA	3/31/93	12	5	31	
10N	7W	35	SW	RA	3/31/93	2	2	18	**21**
			SE	DL	3/31/93	1	1	13	
			SE	MA	3/31/93	3	3	21	
10N	7W	26	N	RA	3/31/93	6	5	37	**28**
			SW	DL	3/31/93	3	3	25	
			SW	MA	4/17/93	0	0	6	
10N	7W	25	SE	RA	4/16/93	0	0	5	**10**
			N	DL	4/17/93	2	2	19	
			SE	MA	4/13/93	3	3	21	
10N	6W	30	N	RA	4/13/93	2	2	18	**16**
			SW	DL	4/13/93	0	0	8	

Location			Triangle Orientation from Section Center	Surveyor	Date	Total Sign	Total Corrected Sign	Estimated Relative Density	Mean for Section
T	R	Sec							
10N	6W	29	SE	MA	4/17/93	9	7	41	**24**
			N	RA	4/15/93	2	2	18	
			SE	DL	4/17/93	1	1	13	
10N	6W	32	N	MA	4/13/93	9	8	46	**30**
			SW	RA	4/13/93	4	3	24	
			SE	DL	4/13/93	2	2	19	
10N	7W	23	N	MA	4/17/93	12	10	56	**39**
			SW	RA	4/16/93	5	4	31	
			SE	DL	4/17/93	4	4	30	
10N	7W	13	SW	MA	4/13/93	6	5	31	**21**
			SE	RA	4/13/93	2	2	18	
			N	DL	4/13/93	1	1	13	
10N	6W	18	SE	MA	4/16/93	0	0	6	**10**
			N	RA	4/16/93	0	0	5	
			SW	DL	4/16/93	2	2	19	
10N	6W	19	SW	MA	4/16/93	2	2	16	**12**
			E	RA	4/16/93	1	1	12	
			NW	DL	4/16/93	0	0	8	
10N	6W	7	N	MA	4/16/93	1	1	11	**10**
			SW	RA	4/13/93	1	1	12	
			SE	DL	4/16/93	0	0	8	
10N	7W	12	SW	MA	3/31/93	4	4	26	**19**
			SE	RA	3/31/93	3	2	18	
			N	DL	3/31/93	9	1	13	
10N	7W	11	SE	MA	4/13/93	7	5	31	**34**
			NE	RA	4/12/93	4	4	31	
			W	DL	4/12/93	6	6	42	
10N	7W	10	N	MA	4/12/93	1	1	11	**18**
			SW	RA	4/12/93	2	2	18	
			SE	DL	4/12/93	4	3	25	
10N	7W	8	E	MA	4/16/93	1	1	11	**14**
			S	RA	4/16/93	3	3	24	
			SE	DL	4/16/93	0	0	8	
10N	8W	28	SW	MA	5/7/93	0	0	6	**13**
			SE	RA	5/11/93	3	3	24	
			N	DL	5/7/93	0	0	8	
10N	10W	20	SE	MA	5/5/93	1	1	11	**16**
			N	RA	5/11/93	2	2	18	
			SW	DL	5/5/93	2	2	19	
10N	10W	19	SW	MA	5/6/93	8	7	41	**39**
			N	RA	5/11/93	3	3	24	
			SE	DL	5/6/93	15	8	53	

Table B-1, Page 14 of 16

Location			Triangle Orientation from Section Center	Surveyor	Date	Total Sign	Total Corrected Sign	Estimated Relative Density	Mean for Section
T	R	Sec							
10N	10W	32	NW	MA	5/20/93	1	1	11	**14**
			SE	RA	5/24/93	1	1	12	
			N	DL	5/20/93	2	2	19	
10N	10W	9	SE	MA	5/1/93	13	4	26	**21**
			N	RA	5/4/93	3	3	24	
			SW	DL	5/1/93	1	1	13	
10N	10W	10	N	MA	4/27/93	1	1	11	**18**
			SW	RA	5/4/93	2	2	18	
			SE	DL	4/27/93	3	3	25	
10N	10W	11	SE	MA	5/22/93	2	2	16	**36**
			N	RA	5/24/93	7	7	50	
			SW	DL	5/22/93	6	6	42	
10N	10W	12	SW	MA	5/24/93	17	14	76	**52**
			N	RA	6/2/93	6	6	43	
			SE	DL	5/24/93	6	5	36	
10N	10W	3	NW	MA	5/3/93	7	6	36	**44**
			S	RA	5/4/93	7	7	50	
			NE	DL	5/3/93	9	7	47	
10N	10W	4	SE	MA	7/13/93	1	1	11	**10**
			N	RA	7/18/93	0	0	5	
			SW	DL	7/13/93	1	1	13	
10N	10W	6	SW	MA	5/26/93	7	6	36	**30**
			SE	RA	6/2/93	3	3	24	
			N	DL	5/26/93	4	4	30	
10N	10W	7	N	MA	6/23/93	2	2	16	**28**
			NW	RA	6/25/93	9	8	56	
			E	DL	6/23/93	1	1	13	
10N	10W	30	SE	MA	6/23/93	7	5	31	**27**
			N	RA	6/28/93	4	4	31	
			SW	DL	6/23/93	2	2	19	
10N	10W	31	N	MA	5/19/93	4	3	21	**15**
			NW	RA	5/24/93	1	1	12	
			NE	DL	5/19/93	1	1	13	
10N	9W	36	NE	MA	5/27/93	11	9	51	**25**
			NE	RA	6/2/93	0	0	5	
			NE	DL	5/27/93	4	2	19	
10N	9W	25	SE	MA	7/12/93	7	7	41	**32**
			SE	RA	7/12/93	5	5	37	
			SE	DL	7/12/93	2	2	19	
10N	9W	24	E	MA	7/12/93	9	6	36	**26**
			N	RA	7/12/93	0	0	5	
			NE	DL	7/12/93	7	5	36	

Location			Triangle Orientation from Section Center	Surveyor	Date	Total Sign	Total Corrected Sign	Estimated Relative Density	Mean for Section
T	R	Sec							
10N	9W	12	N	MA	6/22/93	5	4	26	**21**
			E	RA	6/25/93	0	0	5	
			NE	DL	6/22/93	4	4	30	
10N	9W	1	SE	MA	6/22/93	8	7	41	**24**
			N	RA	6/25/93	4	3	24	
			SW	DL	6/22/93	0	0	8	
10N	8W	8	SW	MA	5/4/93	3	2	16	**21**
			SE	RA	5/11/93	2	2	18	
			N	DL	5/4/93	5	4	30	
10N	8W	18	SW	MA	6/23/93	1	1	11	**26**
			SE	RA	6/28/93	4	4	31	
			SE	DL	6/23/93	7	5	36	
10N	8W	17	SW	MA	7/13/93	0	0	6	**13**
			SE	RA	7/19/93	3	3	24	
			N	DL	7/13/93	0	0	8	
10N	7W	20	S	MA	11/18/92	3	3	21	**39**
			E	RA	11/18/92	7	6	43	
			W	DL	11/18/92	9	8	53	
10N	7W	19	S	MA	11/18/92	4	4	26	**29**
			E	RA	11/18/92	4	3	24	
			N	DL	11/18/92	5	5	36	
10N	7W	30	W	MA	11/19/92	4	3	21	**23**
			S	RA	11/19/92	3	3	24	
			SW	DL	11/19/92	18	3	25	
10N	7W	31	N	MA	11/19/92	3	2	16	**18**
			S	RA	11/19/92	2	2	18	
			W	DL	11/19/92	2	2	19	
10N	8W	36	E	MA	11/19/92	0	0	6	**14**
			N	RA	11/19/92	2	2	18	
			S	DL	11/19/92	2	2	19	
10N	8W	24	**	MA	11/20/92	1	1	11	**12**
				RA	11/20/92	2	2	18	
				DL	11/20/92	0	0	8	
10N	8W	25	E	MA	11/20/92	2	2	16	**12**
			S	RA	11/20/92	0	0	5	
			SE	DL	11/20/92	1	1	13	
10N	8W	34	W	MA	11/20/92	5	4	26	**29**
			N	RA	11/20/92	7	4	31	
			E	DL	11/20/92	6	4	30	
10N	8W	33	N	MA	11/21/92	3	3	21	**25**
			E	RA	11/21/92	4	4	31	
			W	DL	11/21/92	3	3	25	
10N	8W	21	N	MA	11/21/92	3	3	21	**15**
			W	RA	11/21/92	1	1	12	
			E	DL	11/21/92	2	1	13	
10N	8W	15	W	MA	11/21/92	4	3	21	**39**
			N	RA	11/21/92	9	8	56	
			SW	DL	11/21/92	7	6	42	

Location			Triangle Orientation from Section Center	Surveyor	Date	Total Sign	Total Corrected Sign	Estimated Relative Density	Mean for Section
T	R	Sec							
			W	MA	11/21/92	15	10	56	
10N	7W	7	E	RA	11/21/92	4	3	24	**39**
			S	DL	11/21/92	8	5	36	
			S	MA	11/23/92	2	2	16	
9N	8W	11	E	RA	11/23/92	3	2	18	**18**
			W	DL	11/23/92	2	2	19	
			N	MA	11/23/92	1	1	11	
9N	8W	24	S	RA	11/23/92	2	2	18	**14**
			W	DL	11/23/92	1	1	13	
			S	MA	11/23/92	4	4	26	
9N	7W	30	E	RA	11/23/92	4	4	31	**29**
			W	DL	11/23/92	6	4	30	
			S	MA	11/24/93	2	2	16	
9N	7W	16	W	RA	11/24/93	0	0	5	**13**
			NW	DL	11/24/93	3	2	19	
			N	MA	12/1/92	2	2	16	
9N	7W	3	S	RA	12/1/92	2	2	18	**20**
			W	DL	12/1/92	3	3	25	
			E	MA	12/1/92	0	0	6	
9N	7W	10	W	RA	12/1/92	2	2	18	**12**
			N	DL	12/1/92	1	1	13	
			S	MA	12/3/92	5	3	21	
9N	7W	11	N	RA	12/3/92	0	0	5	**19**
			W	DL	12/3/92	8	4	30	
			N	MA	12/3/92	3	3	21	
9N	7W	9	S	RA	12/3/92	0	0	5	**11**
			E	DL	12/3/92	0	0	8	
			E	MA	12/3/92	5	4	26	
9N	7W	23	N	RA	12/3/92	3	2	18	**21**
			S	DL	12/3/92	2	2	19	
			N	MA	12/4/92	10	7	41	
10N	7W	22	S	RA	12/4/92	3	3	24	**28**
			SW	DL	12/4/92	3	2	19	
			E	MA	12/4/92	13	4	26	
10N	7W	16	W	RA	12/4/92	3	3	24	**27**
			N	DL	12/4/92	5	4	30	
			S	MA	12/4/92	5	3	21	
10N	7W	15	N	RA	12/4/92	1	1	12	**27**
			E	DL	12/4/92	10	7	47	

Notes: Surveyors: MA = Mark Allaback, RA = Randy Arnold, DL = David Laabs
** These transects were not surveyed from the center of the section.

Table B-2
Mean Tortoise Relative Density by Habitat

Location			Habitat	Mean Desert Tortoise Density
T	R	Sec		
10N	7W	20	CB/AS	39
10N	7W	19	CB	29
10N	7W	30	JT/CB	23
10N	7W	31	JT	18
10N	8W	36	JT	14
10N	8W	24	CB	12
10N	8W	25	JT/CB	12
10N	8W	34	JT/CB	29
10N	8W	33	JT	25
10N	8W	21	JT	15
10N	8W	15	JT	39
10N	7W	7	JT/CB	39
10N	8W	11	JT	18
10N	8W	24	JT	14
10N	7W	30	CB/JT	29
10N	7W	16	JT	13
10N	7W	3	JT/AS	20
10N	7W	10	CB/AS	12
10N	7W	11	AS	19
10N	7W	9	JT/CB	11
10N	7W	23	JT	21
10N	7W	22	CB	28
10N	7W	16	CB	27
10N	7W	15	CB	27
9N	8W	1	JT	12
9N	8W	12	JT	13
9N	8W	13	JT	14
9N	7W	7	JT	26
9N	8W	2	JT	30
9N	8W	10	JT	22
9N	8W	9	JT	24
9N	8W	8	JT	8
9N	8W	7	JT	8
9N	9W	12	JT/HS	10
9N	8W	4	CB/JT	12
9N	8W	5	CB/JT	8
9N	9W	1	HS	6
9N	9W	13	JT	18
9N	9W	24	JT	10
9N	9W	36	JT/CB	16
9N	9W	1	CB	17
9N	8W	34	CB	38
9N	7W	25	JT/CB	33
9N	7W	31	CB	68
9N	8W	15	JT	13
9N	8W	16	JT	10
9N	8W	17	JT	10
9N	8W	20	JT	6
9N	8W	29	JT/CB	13
9N	8W	30	JT	21
9N	9W	25	JT	8
9N	8W	28	CB/JT	16
9N	8W	27	JT/CB	21
9N	8W	23	JT	12
9N	8W	14	JT	14
9N	7W	32	CB	62
9N	7W	19	JT	20

Table B-2
Mean Tortoise Relative Density by Habitat

Location			Habitat	Mean Desert Tortoise Density
T	R	Sec		
9N	7W	20	JT	14
9N	7W	29	CB	32
9N	7W	17	JT	13
9N	7W	21	CB/JT	31
9N	7W	28	CB	27
9N	7W	33	CB	42
9N	7W	34	CB	43
9N	7W	35	CB	39
9N	7W	26	CB	31
9N	7W	27	CB	32
9N	7W	13	AS/CB	18
9N	7W	14	CB/AS	16
9N	7W	15	CB	14
9N	6W	30	CB	36
9N	6W	29	CB	30
9N	6W	32	CB	27
9N	6W	31	CB	29
9N	7W	36	CB	24
9N	6W	20	CB/AS	19
9N	6W	17	CB/AS	15
9N	6W	7	CB	12
9N	6W	8	CB	22
9N	7W	1	JT/AS	16
9N	7W	2	JT/AS	14
9N	6W	5	JT/AS	28
9N	7W	4	JT	16
10N	7W	33	JT/CB	23
10N	7W	28	CB/AS	14
10N	7W	27	CB/AS	19
10N	7W	34	JT/CB	10
10N	7W	35	JT/CB	21
10N	7W	26	CB	28
10N	7W	25	CB/JT	10
10N	6W	30	CB	16
10N	6W	29	CB	24
10N	6W	32	CB/JT	30
10N	7W	23	CB	39
10N	7W	13	CB	21
10N	6W	18	CB	10
10N	6W	19	CB	12
10N	6W	7	CB	10
10N	7W	12	CB	19
10N	7W	11	CB/JT	34
10N	7W	10	JT/CB	18
10N	7W	8	JT/CB	14
10N	8W	28	JT	13
10N	10W	20	CB	16
10N	10W	19	CB	39
10N	10W	32	JT	14
10N	10W	9	AS	21
10N	10W	10	AS	18
10N	10W	11	CB/AS	36
10N	10W	12	CB/JT	52
10N	10W	3	AS	44
10N	10W	4	CB/AS	10
10N	10W	6	AS	30
10N	10W	7	AS	28
10N	10W	30	CB	27
10N	10W	31	CB/JT	15
10N	9W	36	HS	25

Table B-2

Mean Tortoise Relative Density by Habitat

Location			Habitat	Mean Desert Tortoise Density
T	R	Sec		
10N	9W	25	HS/CB	32
10N	9W	24	CB/AS	26
10N	9W	12	AS	21
10N	9W	1	AS/HS	24
10N	8W	8	AS	21
10N	8W	18	AS/CB	26
10N	8W	17	AS/CB	13
11N	10W	34	AS	18
11N	10W	36	AS	22
10N	10W	5	AS/CB	11
10N	10W	4	CB/AS	23
10N	10W	2	AS	16
10N	10W	1	AS	13
10N	9W	2	HS	5
10N	10W	7	AS	22
10N	10W	8	AS	14
10N	10W	10	CB	16
10N	10W	11	CB/AS	13
10N	12W	13	AS/JT	15
10N	11W	17	JT/AS	32
10N	11W	16	AS/JT	22
10N	11W	15	AS/CB	6
10N	11W	14	AS/CB	6
10N	10W	17	AS	11
10N	10W	15	CB	19
10N	10W	14	CB	12
10N	12W	23	AS	24
10N	12W	24	JT	3
10N	11W	20	JT	8
10N	11W	21	CB	9
10N	11W	22	CB	7
10N	11W	23	CB	5
10N	11W	24	CB	7
10N	10W	19	CB/AS	21
10N	10W	20	AS	20
10N	10W	21	AS/CB	13
10N	10W	22	CB/JT	6
10N	11W	27	CB	7
10N	11W	26	CB	24
10N	10W	30	CB	7
10N	10W	29	CB/AS	5
10N	12W	35	CB	17
10N	12W	36	CB	16
10N	11W	32	CB	20
10N	11W	33	CB	24
10N	11W	34	CB	6
10N	11W	36	CB	19
10N	10W	31	CB	4
10N	10W	32	CB	8
9N	12W	2	CB	13
9N	12W	1	CB	18
9N	11W	5	CB	20
9N	11W	2	CB	18
9N	10W	6	CB	9
9N	10W	5	CB	38
9N	12W	11	CB	5
9N	12W	12	CB	53
9N	11W	8	CB	12
9N	11W	9	CB	14
9N	11W	10	CB	7

Table B-2
Mean Tortoise Relative Density by Habitat

Location			Habitat	Mean Desert Tortoise Density
T	R	Sec		
9N	11W	11	CB	12
9N	11W	36	CB	13
9N	10W	7	CB	18
9N	10W	8	CB	22
9N	12W	13	CB/HS	19
9N	11W	17	CB/HS	5
9N	11W	16	CB	14
9N	11W	15	CB	6
9N	10W	18	CB	6
9N	10W	17	AS/CB	16
9N	10W	16	AS/HS	8
9N	10W	15	HS/AS	6
9N	12W	23	HS	6
9N	11W	24	HS/AS	3
9N	10W	19	HS/AS	12
9N	10W	20	HS/AS	3
9N	10W	21	HS	31
9N	10W	22	HS	6
9N	12W	26	HS	6
9N	11W	26	HS	3
9N	10W	29	HS	3
9N	10W	27	HS/MW	8
9N	12W	35	HS	6
9N	11W	35	HS	3
9N	10W	34	HS/MW	3
9N	10W	35	HS/MW	6
8N	12W	2	HS	6
8N	11W	2	HS	3
8N	10W	5	HS	10
8N	10W	4	HS	8
8N	10W	3	HS/MW	3
8N	10W	2	HS/MW	3
8N	10W	1	HS/MW	6
8N	9W	3	HS/MW	6
8N	9W	5	HS	3
8N	11W	8	HS	3
8N	11W	10	HS	6
8N	10W	10	HS/MW	6
8N	12W	14	HS	6
8N	11W	18	HS	8
8N	11W	17	HS	6
8N	11W	14	HS	3
8N	10W	15	HS/MW	6
8N	10W	14	HS/MW	6
8N	12W	23	HS	6
8N	12W	24	HS	3
8N	11W	19	HS	3

Notes:

CB	Creosote bush scrub
AS	Arid phase saltbush scrub
JT	Joshua tree woodland
HS	Halophytic phase saltbush scrub
MW	Mesquite woodland

Table B-3

Live Desert Tortoise Data

Location							
T	R	Sec	Date	Sex	Size	Notes	Observer
10N	7W	19	11-Nov-92	UN	AD	Inside burrow	RA
9N	7W	7	16-Mar-93	M	AD	Near burrow, healthy	RA; DL
9N	7W	7	16-Mar-93	F	AD	Near burrow, healthy	RA; DL
9N	7W	25	12-Mar-93	M	AD	On burrow ramp; dirty nares	MA
9N	7W	31	17-Mar-93	M	AD	None	RA
9N	7W	31	17-Mar-93	M	AD	Healthy	DL
9N	7W	32	17-Mar-93	M	AD	None	RA
9N	7W	20	10-Mar-93	M	AD	Healthy	MA
9N	7W	34	28-Mar-93	M	AD	Healthy	MA
9N	7W	35	28-Mar-93	M	AD	Two feet from burrow, healthy	MA
9N	7W	35	28-Mar-93	M	AD	Under creosote	RA
9N	7W	35	28-Mar-93	F	SA	Healthy	DL
9N	7W	15	28-Mar-93	M	AD	Inside burrow	RA
9N	6W	32	27-Mar-93	F	AD	None	RA
9N	6W	8	14-Apr-93	F	SA	Foraging, healthy	MA
10N	7W	26	31-Mar-93	M	AD	Under creosote	RA
10N	6W	29	17-Apr-93	F	AD	Foraging, healthy	MA
10N	7W	12	31-Mar-93	M	AD	None	RA
10N	7W	12	31-Mar-93	F	JUV	Healthy	DL
10N	7W	11	12-Apr-93	M	AD	Foraging	RA
10N	7W	10	12-Apr-93	F	AD	Near burrow, healthy	DL
10N	10W	11	22-Mar-93	F	AD	None	DL
10N	10W	12	24-May-93	F	AD	Healthy	DL
10N	11W	33	13-Jun-93	M	AD	Foraging	RA
9N	12W	12	12-Jun-93	M	AD	In burrow, healthy	MA
9N	11W	11	12-Oct-93	M	AD	Under creosote	RA
9N	12W	13	14-Jun-93	F	AD	Foraging, healthy	MA

Notes:

Sex:
UN = unknown
M = male
F = female

Size:
AD = adult
SA = subadult
JUV = juvenile

Observer:
RA = Randall Arnold
DL = David Laabs
MA = Mark Allaback

Table B-4

Desert Tortoise Carcass Locational Data

Location															
T	R	Sec	<1 yr Male	<1 yr Female	<1 yr Unk	1-4 yrs Male	1-4 yrs Female	1-4 yrs Unk	>4 yrs Male	>4 yrs Female	>4 yrs Unk	Unk Male	Unk Female	Unk Unk	Total
10N	7W	20	1												1
10N	8W	24	1												1
10N	8W	25								1					1
10N	7W	7												1	1
10N	8W	24									2	1			3
10N	7W	30						1							1
10N	7W	16						1							1
10N	7W	11												1	1
10N	7W	9							1		2			1	4
10N	7W	23									2				2
10N	7W	22				1	1			1					3
10N	7W	16					1								1
10N	7W	15	1		1	1					1			1	5
9N	8W	2				1				1					2
9N	7W	31							1		1	1	1		4
9N	8W	27					1				1				2
9N	8W	23									1				1
9N	7W	32						1			2				3
9N	7W	20												1	1
9N	7W	21									2				2
9N	7W	28									1			1	2
9N	7W	33							1		1			1	3
9N	7W	34	1								1				2
9N	7W	35						2	1		2				5
9N	7W	26					1								1
9N	7W	27				1			2		2				5
9N	7W	13									2				2
9N	6W	30								1					1
9N	6W	29									2				2
9N	6W	32		1							1				2
9N	6W	31							1		1				2
9N	7W	36					1		1						2
9N	6W	20								1					1
9N	6W	17									1				1
9N	6W	8				1					3				4
9N	7W	1									1				1
9N	7W	2									1				1
10N	7W	28									1				1
10N	7W	27									2				2
10N	7W	34						1							1

Table B-4, Page 2 of 2

Location			<1 yr	<1 yr	<1 yr	1-4 yrs	1-4 yrs	1-4 yrs	>4 yrs	>4 yrs	>4 yrs	Unk	Unk	Unk	
T	R	Sec	Male	Female	Unk	Male	Female	Unk	Male	Female	Unk	Male	Female	Unk	Total
10N	7W	35						1							1
10N	7W	26									2			1	3
10N	7W	25				1					2				3
10N	6W	30						2			1				3
10N	6W	29									1				1
10N	6W	32				1				2	1				4
10N	7W	23					1			1	7		1		10
10N	7W	13									1				1
10N	6W	18									3				3
10N	7W	12					1							1	2
10N	7W	11									1			2	3
10N	7W	10								1					1
10N	7W	8				1				1					2
10N	10W	19									1				1
11N	10W	34	1					1			2				4
10N	10W	5						2		1	1				4
10N	10W	4				1	1	1	1		3				7
10N	10W	2				1					1				2
10N	10W	1							1						1
10N	9W	2				1									1
10N	10W	7				1									1
10N	10W	8					1			1	1				3
10N	10W	10		1		1	2			1	2				7
10N	10W	11									2				2
10N	12W	13					1								1
10N	10W	14									1				1
10N	11W	24									2				2
10N	10W	21				1		1			1				3
10N	10W	22					1				1				2
10N	11W	27												1	1
9N	11W	2				1									1
9N	10W	7									1				1
9N	10W	8	1												1
9N	11W	15									1				1
8N	10W	5									1				1
Total			6	2	1	15	13	14	10	13	76	2	2	12	166

Table B-5

Human Disturbances on Desert Tortoise Transects

Location			Paved Roads	Dirt Roads	Dirt Trails	Dirt Tracks	Garbage	Shooting Targets	Shells	Test Pits	Camp Sites	Sheep	Cattle	Burros	Dogs	Fences	Utility Lines	Habitat Denuded	Partially Denuded	Old Buildings	Bomb Craters	Railroad Tracks
T	R	Sec																				
10N	7W	19	4	5		5	6		*					4		3	1					
10N	7W	30		5			2		*			1										
10N	7W	31	2	1	3	1	5		*					11			2	1				
10N	8W	36	2	5	1	2			*			2					1	1				
10N	8W	24	3	2	1	2	6		*							8	5		3			
10N	8W	25		7		1	1		*			1		6								
10N	8W	34		3	2	1	6		*					2		1						
10N	8W	33	2		4		13		*				2									
10N	8W	21	4	1	2	2	7		*		1	4	1				4					
10N	8W	15			2		4		*			18										
10N	7W	7		2	4	3	5		*			5	1	2		3						
9N	8W	11		8	6	4	6		*				13	4								
9N	8W	24		5	2	12	1		*				4									
9N	7W	30		2	6	16			*					1			2					
9N	7W	16	6	9	3		5		*				1	5				1				
9N	7W	3		4	4		6		*				6	6								
9N	7W	10		2	1	1	4	1	*				3	4				1				
9N	7W	11		12	5	6	16	1	*			1	4	12				2	3			
9N	7W	9		3	4		1		*					28								
9N	7W	23		3	8	2	6		*				2	5								
10N	7W	22		4	1		6		*		1	1										
10N	7W	16				3			*			1										
10N	7W	15			2	5	1		*			1										
9N	8W	1	1	8	12	8	13	2					4	8			1					
9N	8W	12		6	4	5	6						1	12			4					
9N	8W	13		4	2	17	3	2					6	1			2					
9N	7W	7		8	1	3	2	1		1			3	8			2					
9N	8W	2		6	1	8	7					4	1	35			4		1			
9N	8W	10		4	6	4	6	1	*				4	23							6	
9N	8W	9		3	7	7	13	6	*			1		12					1	2	12	
9N	8W	8		8	6	1	23	25					3	65				1	1		17	
9N	8W	7	2	8	2	1	9	28	*				1	12							37	
9N	9W	12			6		19						1	262		4		7			2	
9N	8W	4		4	6	5	9		*				2	36			4					
9N	8W	5		7	1	6	18		*				13	136			2					
9N	9W	1			4	2	6	5					6	273		4		13			1	
9N	9W	13		2	14	4	4	6						78							1	
9N	9W	24		3	8	6	29	164	*			1	2	38		6					3	

Location			Paved	Dirt	Dirt	Dirt		Shooting		Test	Camp						Utility	Habitat	Partially	Old	Bomb	Railroad
T	R	Sec	Roads	Roads	Trails	Tracks	Garbage	Targets	Shells	Pits	Sites	Sheep	Cattle	Burros	Dogs	Fences	Lines	Denuded	Denuded	Buildings	Craters	Tracks
9N	9W	36		4		1	12	1					9	16								
8N	9W	1		4	2	3	19	1							4	2						
9N	8W	34		2	4	9	8		*				1		1	2			1			
9N	7W	25		8	3	7	7	5					1				1					
9N	7W	31		1	3	4	4	38	*					3			2					
9N	8W	15		1	4	17	6	2					5	1				1				
9N	8W	16		5	2	15	4	1					1	8								
9N	8W	17		7	11	11	18	37					4	12						2	1	
9N	8W	20		6	7	22	17	49	*				3								27	
9N	8W	29		6	7	1	13	1		1		3		1			1					
9N	8W	30	1	5	7	3	19	5					3				2	1				
9N	8W	25			3	2	7	1						2								
9N	8W	28		3	5	6	19					1	7		1	1				1		
9N	8W	27		12	4	9	15	1	*		1	1	3	1			2					
9N	8W	23			1	26	4	7	*			1		1							5	
9N	8W	14		2	1	5		11					5	2								
9N	7W	32		1	5	1		42	*					1		2						
9N	7W	19			2	8	3	17	*			1	7	1							2	
9N	7W	20		6	6	1	3	18				2		2								
9N	7W	29		3	2	14	7	37	*				1									
9N	7W	17		5	7	5	2	5					3	1								
9N	7W	21		6	12	3	11	12	*				1	3								
9N	7W	28			4	6	2	16	*													
9N	7W	33		3	12	7	5	4									2					
9N	7W	34		5	4	3	13	79									2			1	2	
9N	7W	35		2	5	3	6	5								2	2				1	
9N	7W	26				4	9	3													1	
9N	7W	27		4	3	1	22	36					1	6						1	2	
9N	7W	13		5	8	7	7	166					7	4			2				2	
9N	7W	14		11	1		3	3					2	9								
9N	7W	15		2	2	1	1	16					1									
9N	6W	30		8	1	4	3										4					
9N	6W	29		1	6	1	52			1		1					2					
9N	6W	32			2	1	3			1		1										
9N	6W	31				7	4															
9N	7W	36		2	2	4	2									2	2					
9N	6W	20		3	1		3	17				3	4	3								
9N	6W	17		4	2		3	46	*			63	1			2						
9N	6W	7			1		2	3		2		4	4	1								

Location			Paved	Dirt	Dirt	Dirt		Shooting		Test	Camp											
T	R	Sec	Roads	Roads	Trails	Tracks	Garbage	Targets	Shells	Pits	Sites	Sheep	Cattle	Burros	Dogs	Fences	Utility Lines	Habitat Denuded	Partially Denuded	Old Buildings	Bomb Craters	Railroad Tracks
9N	6W	8		2	3	2	5	1				156	1	1		2			2			
9N	7W	1		2	2	8	4	1				26	21	3								
9N	7W	2		3	7	3	5	2	*				2	1			2					
9N	6W	5		4	3	3	54					175	8	2								
9N	7W	4		2	1	1	7	4						27			2		1			
10N	7W	33			5	1		7	*				4	1								
10N	7W	28		2	5	6	7	17						3			2					
10N	7W	27			2	1	16	67	*			1	1	2							1	
10N	7W	34			5		2	1					1									
10N	7W	35		2	2	1	5						3	1								
10N	7W	26		2	4	4	5	3	*			1										
10N	7W	25			2	1	4	5				25		2								
10N	6W	30			2	5	7	5	*		1	3										
10N	6W	29		4	1	7	3	5														
10N	6W	32		4	3	5	6	2				28	1	8			1					
10N	7W	23		4	3	1	12	14	*													
10N	7W	13		2		3	8	44	*			22		3								
10N	6W	18			3	2	8	65	*			37		1								
10N	6W	19		2		2	1	32	*			4										
10N	6W	7					2	11	*			2					1					
10N	7W	12			2		4	15	*			2										
10N	7W	11			4	2	5	2				85		2								
10N	7W	10			2	1	2	4				44	2	4								
10N	7W	8		2	2	3	4	5				42	1	2								
10N	8W	28	4	4	4	2	33	3	*			61	3				2		1			
10N	10W	20		5	2	6	1	1		5		2	1						1			
10N	10W	19		2	1	1	6	21														
10N	10W	32			2		1						2									
10N	10W	9	4	9	5	3	31					8	2					1	2			1
10N	10W	10		2	7	1	18	1				245										1
10N	10W	11		7	5		8	4				934		1								3
10N	10W	12		2	11		15	55				924		1								2
10N	10W	3		1	4	1	7	2				293	1				4	2				3
10N	10W	4	4	7	2	1	14	1				7	2				3					
10N	10W	6		2	1	2	9	8				251					4					
10N	10W	7				5	8	2				2	3	1		2						
10N	10W	30		7	1	2	29	5	*	2			1				3			1		
10N	10W	31		14	3		13	5	*							2						
10N	9W	36	5	7	4	3	142		*							2				2		

Location			Paved	Dirt	Dirt	Dirt		Shooting		Test	Camp						Utility	Habitat	Partially	Old	Bomb	Railroad
T	R	Sec	Roads	Roads	Trails	Tracks	Garbage	Targets	Shells	Pits	Sites	Sheep	Cattle	Burros	Dogs	Fences	Lines	Denuded	Denuded	Buildings	Craters	Tracks
10N	9W	25				1	144	114	*		1											
10N	9W	24			6	16	12	36	*	1									1			
10N	9W	12		2	11	4	78	15		1											2	
10N	9W	1		3	6	12	77	1				52				1	4					
10N	8W	8		1	4	5	8	2				65	2	1		2	6					
10N	8W	18				7	13	1					1									
10N	8W	17			4	8	4					3										
11N	10W	34				2	7	3				24										
11N	10W	36		3	2		9					1	1									1
10N	10W	5			2		4					15										
10N	10W	4				3	2					525										
10N	10W	2			3	4	6	2				9										
10N	10W	1		9	8	8	5	2									5					2
10N	9W	2				5	9	2	*				2									
10N	10W	7				4	2	3				165										
10N	10W	8			2		1															
10N	10W	10				11	5						1									
10N	10W	11		2	2	3	1	1														
10N	12W	13					6	1				34		2								
10N	11W	17			3		8	3	*			15										
10N	11W	16				1	3	2				365										
10N	11W	15		2		1	5	3				31		2			2					
10N	11W	14			2	1	5	2				165										
10N	10W	17		2	3	6	1					1										
10N	10W	15		3	8		18							1			5					
10N	10W	14		2	14	9	11										6		2	1		
10N	12W	23			2	11	12	5				415		3								
10N	12W	24		2	2		15	4	*			8										
10N	11W	20			7	2	1	1				725	1									
10N	11W	21			4	1	3	2														
10N	11W	22			4	9	1					25										
10N	11W	23		3		9	2					51										
10N	11W	24		2	4	14	4	1				1										
10N	10W	19		2	13	26	7	1				265		1								
10N	10W	20		4	6	23	11	1				1	1	4								
10N	10W	21		3	13	14	6	1				1										
10N	10W	22		3	1	12	35					1					2					
10N	11W	27		2	4	1	3	2				12										
10N	11W	26		1	8	2	8	3	*			1	2									

Table B-5, Page 5 of 6

Location			Paved	Dirt	Dirt	Dirt		Shooting		Test	Camp											
T	R	Sec	Roads	Roads	Trails	Tracks	Garbage	Targets	Shells	Pits	Sites	Sheep	Cattle	Burros	Dogs	Fences	Utility Lines	Habitat Denuded	Partially Denuded	Old Buildings	Bomb Craters	Railroad Tracks
10N	10W	30			11	24	4					11		2								
10N	10W	29		4	9	91	32	2	*					3	1		1					
10N	12W	35			6	18	1	5				132										
10N	12W	36		1	22	5	8	13	*			8										
10N	11W	32			7	8	2					35										
10N	11W	33		1	2	5	1					25										
10N	11W	34			5	3	12	3	*			11	1									
10N	11W	36			4	4	4	1														
10N	10W	31			27	25	12	4	*			25										
10N	10W	32		4	28	51	21	1						1	1		1					
9N	12W	2			16	12	1	5		1	1	9										
9N	12W	1				22	3	3				5										
9N	11W	5			8	28	6	3			1	1										
9N	11W	2		2	11	12	8	1	*			36										
9N	10W	6		5	5	19	7	2	*													
9N	10W	5		1	2	19	6															
9N	12W	11			11	25	8	11				3										
9N	12W	12			9	2	3	8														
9N	11W	8		4	5	35	11	1														
9N	11W	9		3	5	18	2	2														
9N	11W	10		4	6	23	4															
9N	11W	11			5	18	4		*													
9N	11W	36	2	5	9	7	6	1									6					
9N	10W	7		2	11	12	9	86		2			1									
9N	10W	8		2		42	1	1														
9N	12W	13	3	3	9	1	13	16	*				3									
9N	11W	17	4		6	22	18	6	*													
9N	11W	16				17	1							1								
9N	11W	15		4	3	18	8	1														
9N	10W	18	1	2	8	19	17	25														
9N	10W	17		14	1	8	28	55	*				1	4				1			3	
9N	10W	16		13	16	7	26	5	*					1		2			3			
9N	10W	15		4	5	4	4							2			3					
9N	12W	23			2		12	1								1						
9N	11W	24		7	2	1	7	2					2	2								
9N	10W	19			5	1	12	3					4									
9N	10W	20		3	7	7	24	4	*					1		7		2	2		2	
9N	10W	21			1	4	21	3					3	6								
9N	10W	22		2	6	3	28	11														

Table B-5, Page 6 of 6

Location			Paved	Dirt	Dirt	Dirt		Shooting		Test	Camp						Utility	Habitat	Partially	Old	Bomb	Railroad
T	R	Sec	Roads	Roads	Trails	Tracks	Garbage	Targets	Shells	Pits	Sites	Sheep	Cattle	Burros	Dogs	Fences	Lines	Denuded	Denuded	Buildings	Craters	Tracks
9N	12W	26			5	2	19	5	*						1	8						
9N	11W	26			1	6	5	1					1									
9N	10W	29		2	1		3						1									
9N	10W	27			1		12															
9N	12W	35			4		12	5								2						
9N	11W	35				2	3	1														
9N	10W	34		3	17	3	17	9						1		6	1			1		
9N	10W	35			3		4	4														
8N	12W	2	2	2	8	9	33	13								12	2			1		
8N	11W	2				3	5															
8N	10W	5		2	2	3	11	3						1								
8N	10W	4	3			1	41	1								2			1			
8N	10W	3	6	2		5	15	4								3						
8N	10W	2	11	3	7	8	76	2									6		3	2		
8N	10W	1	7		2		25							1		1	2	7				
8N	9W	3	6		5	1	15	2								3			1	1		
8N	9W	5	2	2	1	1	7	6						1		2	2					
8N	11W	8			3	29	25	7	*							1						
8N	11W	10			2	1	61	16								1						
8N	10W	10	2		1	4	3	7						1		5	2	1		4		
8N	12W	14		3	5	5	16	5	*							4						
8N	11W	18					7	1						1		2						
8N	11W	17														1						
8N	11W	14				2	8	2	*	1						6			2			
8N	10W	15			3	7	6	3	*						1	2		7				
8N	10W	14				3	6								1	4						
8N	12W	23	5	2	1	1	66	2									2					
8N	12W	24		1	1		4	1							1	9						
8N	11W	19				4	16	4								2						
TOTALS			98	560	924	1429	2591	1950	0	19	7	6779	246	1276	12	139	140	50	32	20	130	13

* Shells were not counted individually

APPENDIX C

Incidental Detections of Sensitive Species

Table C-1

Locations of Incidental Sensitive Species Detections

Location														
T	R	Sec	MGS	AB	BO	NH	GE	LT	LS	FH	PF	LO	SO	CH	DT
10N	7W	20						O	O						O
10N	7W	19													
10N	7W	30							O						
10N	7W	31				O			O						
10N	8W	36													
10N	8W	24						O							
10N	8W	25													
10N	8W	34													
10N	8W	33		S					O						
10N	8W	21							O						
10N	8W	15													
10N	7W	7													O
10N	8W	11		S				O	O						
10N	8W	24		S			O		O						
10N	7W	30			O				O						
10N	7W	16						O	O						
10N	7W	3		S											
10N	7W	10		S											
10N	7W	11		S					O						O
10N	7W	9		S					O						
10N	7W	23						O							
10N	7W	22			O										
10N	7W	16			O				O						
10N	7W	15							O						
9N	8W	1													
9N	8W	12		S						O					
9N	8W	13		S					O						
9N	7W	7		S				O	O						
9N	8W	2													
9N	8W	10		S					O						
9N	8W	9													
9N	8W	8	O						O						
9N	8W	7	O	S											
9N	9W	12		S		O			O						
9N	8W	4							O						
9N	8W	5							O						
9N	9W	1													
9N	9W	13						O	O						
9N	9W	24						O							
9N	9W	36						O	O						
9N	9W	1													O
9N	8W	34							O						O

Notes:

MGS	Mohave ground squirrel	*(Spermophilus mohavensis)*	S = Sign
AB	American badger	*(Taxidea taxus)*	O = Observation
BO	Burrowing owl	*(Athene cunicularia)*	
NH	Northern harrier	*(Circus cyaneus)*	
GE	Golden eagle	*(Aquila chryseatos)*	
LT	LeConte's thrasher	*(Toxostoma lecontei)*	
LS	Loggerhead shrike	*(Lanius ludovicianus)*	
FH	Ferruginous hawk	*(Buteo regalis)*	
PF	Prairie falcon	*(Falco mexicanus)*	
LO	Long-eared owl	*(Asio otus)*	
SO	Short-eared owl	*(Asio flammeus)*	
CH	Cooper's hawk	*(Accipiter cooperi)*	
DT	Desert tortoise	*(Gopherus agassizii)*	

Location														
T	R	Sec	MGS	AB	BO	NH	GE	LT	LS	FH	PF	LO	SO	CH	DT
9N	7W	25										O			O
9N	7W	31		S											O
9N	8W	15		S											
9N	8W	16		S					O						
9N	8W	17		S					O						
9N	8W	20													
9N	8W	20													
9N	8W	20													
9N	8W	20													
9N	8W	28							O						
9N	8W	27		S											
9N	8W	23													
9N	8W	14		S											
9N	7W	32		S				O							
9N	7W	19		S				O							
9N	7W	20													
9N	7W	29		S		O									
9N	7W	17							O						
9N	7W	21			O				O						
9N	7W	28													O
9N	7W	33		S											
9N	7W	34							O						O
9N	7W	35													
9N	7W	26													
9N	7W	27													O
9N	7W	13		S											
9N	7W	14						O							
9N	7W	15							O						
9N	6W	30													
9N	6W	29						O							
9N	6W	32													
9N	6W	31		S					O						
9N	7W	36													
9N	6W	20													
9N	6W	17		S											
9N	6W	7		S				O							
9N	6W	8		S				O							
9N	7W	1	O	S					O						O
9N	7W	2		S					O						
9N	6W	5		S											
9N	7W	4		S				O	O						
10N	7W	33							O						O
10N	7W	28													
10N	7W	27		S											

Notes:

MGS	Mohave ground squirrel	*(Spermophilus mohavensis)*	S = Sign
AB	American badger	*(Taxidea taxus)*	O = Observation
BO	Burrowing owl	*(Athene cunicularia)*	
NH	Northern harrier	*(Circus cyaneus)*	
GE	Golden eagle	*(Aquila chryseatos)*	
LT	LeConte's thrasher	*(Toxostoma lecontei)*	
LS	Loggerhead shrike	*(Lanius ludovicianus)*	
FH	Ferruginous hawk	*(Buteo regalis)*	
PF	Prairie falcon	*(Falco mexicanus)*	
LO	Long-eared owl	*(Asio otus)*	
SO	Short-eared owl	*(Asio flammeus)*	
CH	Cooper's hawk	*(Accipiter cooperi)*	
DT	Desert tortoise	*(Gopherus agassizii)*	

Location														
T	R	Sec	MGS	AB	BO	NH	GE	LT	LS	FH	PF	LO	SO	CH	DT
10N	7W	34		S					O		O				
10N	7W	35		S					O						
10N	7W	26		S	S										
10N	7W	25		S											
10N	6W	30		S											
10N	6W	29													
10N	6W	32							O						
10N	7W	23			S										
10N	7W	13							O						O
10N	6W	18						O							
10N	6W	19			S										
10N	6W	7													
10N	7W	12							O						O
10N	7W	11						O							O
10N	7W	10													O
10N	7W	8		S					O						O
10N	8W	28	O					O	O	O					
10N	10W	20	O					O	O						
10N	10W	19													
10N	10W	32	O												
10N	10W	9	O												O
10N	10W	10						O	O						
10N	10W	11	O					O	O						
10N	10W	12	O					O	O						
10N	10W	3													O
10N	10W	4													
10N	10W	6	O					O	O						
10N	10W	7						O							
10N	10W	30						O	O						
10N	10W	31	O												
10N	9W	36	O												
10N	9W	25							O						
10N	9W	24							O						
10N	9W	12						O							
10N	9W	1						O	O						
10N	8W	8						O							O
10N	8W	18						O							
10N	8W	17													
11N	10W	34			S										
11N	10W	36			O			O			O				
10N	10W	5		S	O	O		O							
10N	10W	4			O										O
10N	10W	2	O	S				O							

Notes:

MGS	Mohave ground squirrel	*(Spermophilus mohavensis)*
AB	American badger	*(Taxidea taxus)*
BO	Burrowing owl	*(Athene cunicularia)*
NH	Northern harrier	*(Circus cyaneus)*
GE	Golden eagle	*(Aquila chryseatos)*
LT	LeConte's thrasher	*(Toxostoma lecontei)*
LS	Loggerhead shrike	*(Lanius ludovicianus)*
FH	Ferruginous hawk	*(Buteo regalis)*
PF	Prairie falcon	*(Falco mexicanus)*
LO	Long-eared owl	*(Asio otus)*
SO	Short-eared owl	*(Asio flammeus)*
CH	Cooper's hawk	*(Accipiter cooperi)*
DT	Desert tortoise	*(Gopherus agassizii)*

S = Sign
O = Observation

Location														
T	R	Sec	MGS	AB	BO	NH	GE	LT	LS	FH	PF	LO	SO	CH	DT
10N	10W	1		S	O			O							
10N	9W	2													
10N	10W	7						O							
10N	10W	8			O	O							O		
10N	10W	10		S	O			O	O						O
10N	10W	11			O	O		O	O						
10N	12W	13						O	O						
10N	11W	17		S				O	O						O
10N	11W	16						O	O						
10N	11W	15		O				O							
10N	11W	14		S	O	O									
10N	10W	17					O	O							
10N	10W	15							O						
10N	10W	14													
10N	12W	23						O	O						
10N	12W	24		S		O		O							
10N	11W	20		S				O	O						
10N	11W	21						O							
10N	11W	22													O
10N	11W	23			O										
10N	11W	24							O						
10N	10W	19							O						
10N	10W	20						O							
10N	10W	21			O										
10N	10W	22													
10N	11W	27													
10N	11W	26		S				O	O						
10N	10W	30			O										
10N	10W	29				O								O	
10N	12W	35		S											
10N	12W	36							O						
10N	11W	32						O							
10N	11W	33			O			O	O						
10N	11W	34		S		O									
10N	11W	36						O							
10N	10W	31		S											
10N	10W	32													
9N	12W	2													
9N	12W	1		S				O	O						
9N	11W	5													
9N	11W	2													O
9N	10W	6			O										
9N	10W	5	O	S				O							

Notes:

MGS	Mohave ground squirrel	*(Spermophilus mohavensis)*	S = Sign
AB	American badger	*(Taxidea taxus)*	O = Observation
BO	Burrowing owl	*(Athene cunicularia)*	
NH	Northern harrier	*(Circus cyaneus)*	
GE	Golden eagle	*(Aquila chryseatos)*	
LT	LeConte's thrasher	*(Toxostoma lecontei)*	
LS	Loggerhead shrike	*(Lanius ludovicianus)*	
FH	Ferruginous hawk	*(Buteo regalis)*	
PF	Prairie falcon	*(Falco mexicanus)*	
LO	Long-eared owl	*(Asio otus)*	
SO	Short-eared owl	*(Asio flammeus)*	
CH	Cooper's hawk	*(Accipiter cooperi)*	
DT	Desert tortoise	*(Gopherus agassizii)*	

Location														
T	R	Sec	MGS	AB	BO	NH	GE	LT	LS	FH	PF	LO	SO	CH	DT
9N	12W	11		S					O						
9N	12W	12						O	O						
9N	11W	8		S				O							
9N	11W	9		S											
9N	11W	10			O										
9N	11W	11		S					O						
9N	11W	36							O						
9N	10W	7													
9N	10W	8			O				O						
9N	12W	13						O	O		O				
9N	11W	17				O			O		O				
9N	11W	16						O							
9N	11W	15		S	O										
9N	10W	18			O										
9N	10W	17						O	O						
9N	10W	16													
9N	10W	15		S											
9N	12W	23							O				O		
9N	11W	24						O			O				
9N	10W	19		S				O							
9N	10W	20													
9N	10W	21		S				O	O						
9N	10W	22		S				O	O						
9N	12W	26						O					O		
9N	11W	26				O									
9N	10W	29		S					O						
9N	10W	27		S					O						
9N	12W	35		S											
9N	11W	35													
9N	10W	34		S				O	O						
9N	10W	35	O					O	O						
8N	12W	2		S		O		O	O		O				
8N	11W	2				O									
8N	10W	5		S					O						
8N	10W	4		S					O						
8N	10W	3		S		O			O						
8N	10W	2													
8N	10W	1		S					O						
8N	9W	3		S					O						
8N	9W	5													
8N	11W	8							O			O	O		
8N	11W	10		S				O	O						
8N	10W	10		S		O			O						

Notes:

MGS	Mohave ground squirrel	*(Spermophilus mohavensis)*
AB	American badger	*(Taxidea taxus)*
BO	Burrowing owl	*(Athene cunicularia)*
NH	Northern harrier	*(Circus cyaneus)*
GE	Golden eagle	*(Aquila chryseatos)*
LT	LeConte's thrasher	*(Toxostoma lecontei)*
LS	Loggerhead shrike	*(Lanius ludovicianus)*
FH	Ferruginous hawk	*(Buteo regalis)*
PF	Prairie falcon	*(Falco mexicanus)*
LO	Long-eared owl	*(Asio otus)*
SO	Short-eared owl	*(Asio flammeus)*
CH	Cooper's hawk	*(Accipiter cooperi)*
DT	Desert tortoise	*(Gopherus agassizii)*

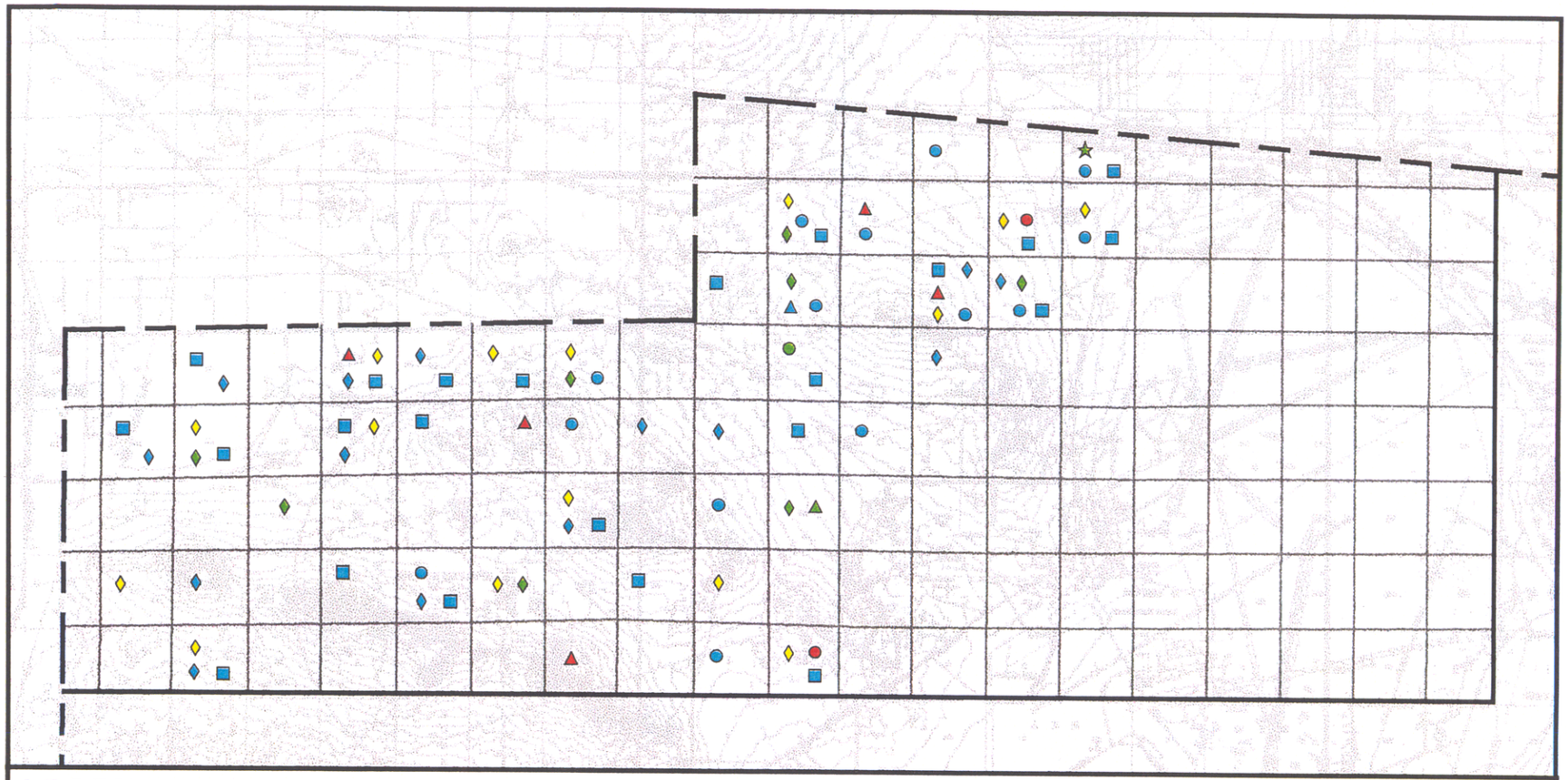
S = Sign
O = Observation

Table C-1, Page 6 of 6

Location														
T	R	Sec	MGS	AB	BO	NH	GE	LT	LS	FH	PF	LO	SO	CH	DT
8N	12W	14				O			O						
8N	11W	18		S		O		O							
8N	11W	17							O						
8N	11W	14				O		O							
8N	10W	15							O						
8N	10W	14						O							
8N	12W	23							O						
8N	12W	24				O									
8N	11W	19													
Totals			**15**	**76**	**25**	**20**	**2**	**70**	**93**	**2**	**6**	**2**	**4**	**1**	**25**

Notes:

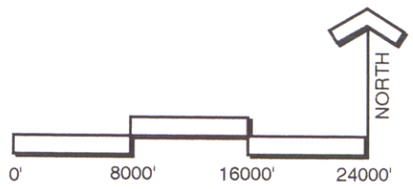
MGS	Mohave ground squirrel	*(Spermophilus mohavensis)*	S = Sign
AB	American badger	*(Taxidea taxus)*	O = Observation
BO	Burrowing owl	*(Athene cunicularia)*	
NH	Northern harrier	*(Circus cyaneus)*	
GE	Golden eagle	*(Aquila chryseatos)*	
LT	LeConte's thrasher	*(Toxostoma lecontei)*	
LS	Loggerhead shrike	*(Lanius ludovicianus)*	
FH	Ferruginous hawk	*(Buteo regalis)*	
PF	Prairie falcon	*(Falco mexicanus)*	
LO	Long-eared owl	*(Asio otus)*	
SO	Short-eared owl	*(Asio flammeus)*	
CH	Cooper's hawk	*(Accipiter cooperi)*	
DT	Desert tortoise	*(Gopherus agassizii)*	

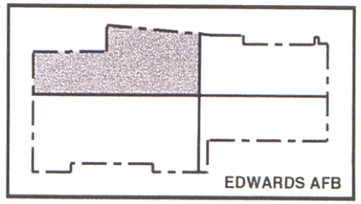


LEGEND

- Base Boundary
- Desert tortoise *(Gopherus agassizii)*
- Mohave ground squirrel *(Spermophilus mohavensis)*
- American badger *(Taxidea taxus)*
- Cooper's hawk *(Accipiter cooperi)*
- Golden eagle *(Aquila chrysaetos)*
- Ferruginous hawk *(Buteo regalis)*
- Northern harrier *(Circus cyaneus)*
- Prairie falcon *(Falco mexicanus)*
- Short-eared owl *(Asio flammeus)*
- Burrowing owl *(Athene cunicularia)*
- Le Conte's thrasher *(Toxostoma lecontei)*
- Loggerhead shrike *(Lanius ludovicianus)*
- Long-eared owl *(Asio otus)*

FIGURE C-2A
APPROXIMATE LOCATIONS OF INCIDENTAL SENSITIVE SPECIES DETECTIONS





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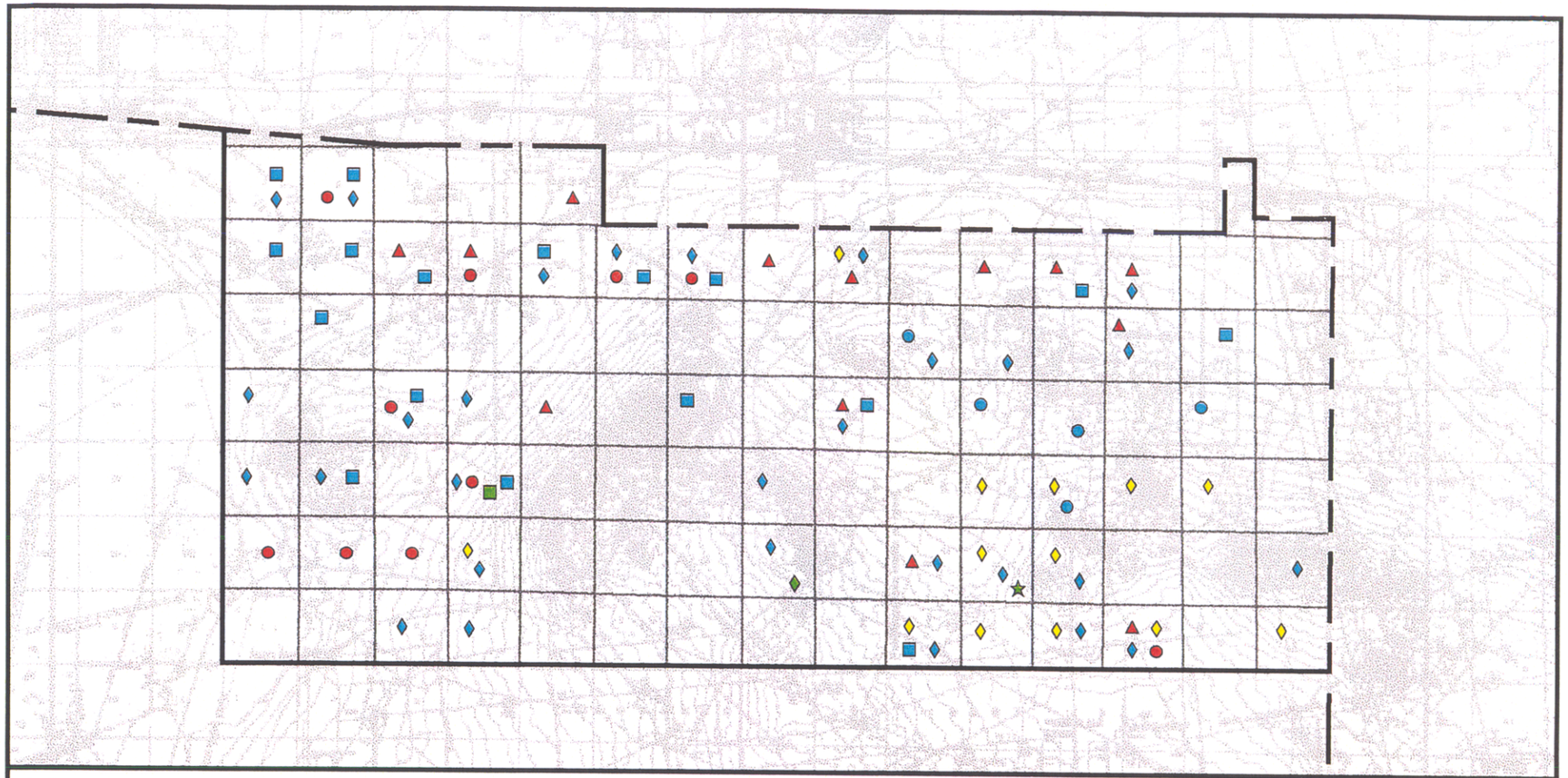
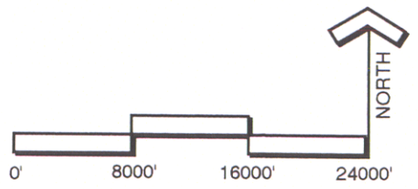
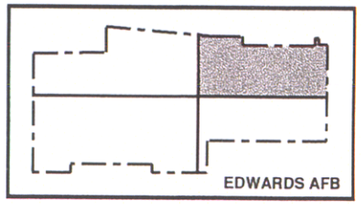


LEGEND

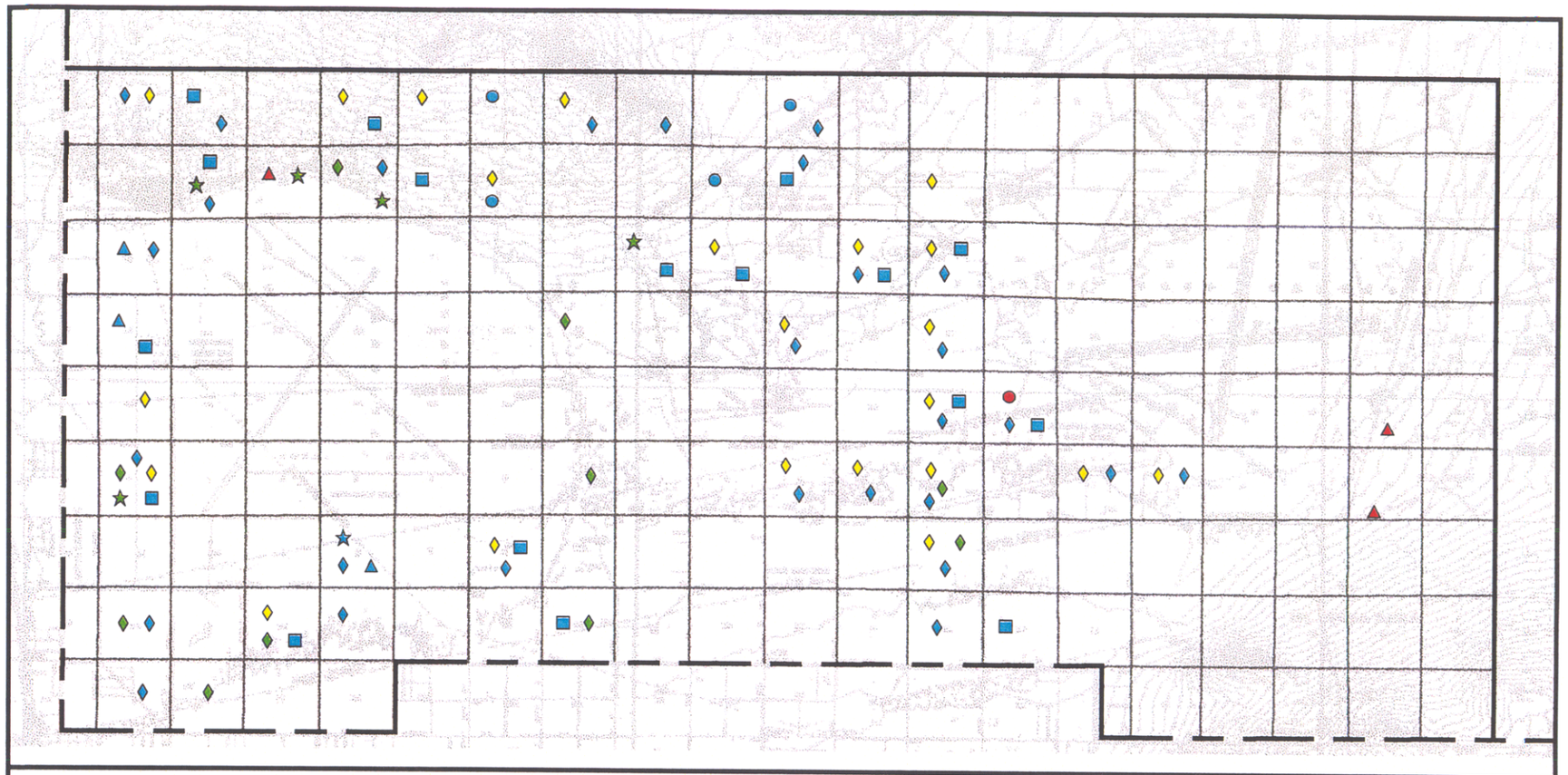
- Base Boundary
- Desert tortoise *(Gopherus agassizii)*
- Mohave ground squirrel *(Spermophilus mohavensis)*
- American badger *(Taxidea taxus)*
- Cooper's hawk *(Accipiter cooperi)*
- Golden eagle *(Aquila chrysaetos)*
- Ferruginous hawk *(Buteo regalis)*
- Northern harrier *(Circus cyaneus)*
- Prairie falcon *(Falco mexicanus)*
- Short-eared owl *(Asio flammeus)*
- Burrowing owl *(Athene cunicularia)*
- Le Conte's thrasher *(Toxostoma lecontei)*
- Loggerhead shrike *(Lanius ludovicianus)*
- Long-eared owl *(Asio otus)*

FIGURE C-2B
APPROXIMATE LOCATIONS OF INCIDENTAL SENSITIVE SPECIES DETECTIONS





E165_11.MAC 9/10/96



LEGEND

- Base Boundary
- Desert tortoise *(Gopherus agassizii)*
- Mohave ground squirrel *(Spermophilus mohavensis)*
- American badger *(Taxidea taxus)*
- Cooper's hawk *(Accipiter cooperi)*
- Golden eagle *(Aquila chrysaetos)*
- Ferruginous hawk *(Buteo regalis)*
- Northern harrier *(Circus cyaneus)*
- Prairie falcon *(Falco mexicanus)*
- Short-eared owl *(Asio flammeus)*
- Burrowing owl *(Athene cunicularia)*
- Le Conte's thrasher *(Toxostoma lecontei)*
- Loggerhead shrike *(Lanius ludovicianus)*
- Long-eared owl *(Asio otus)*

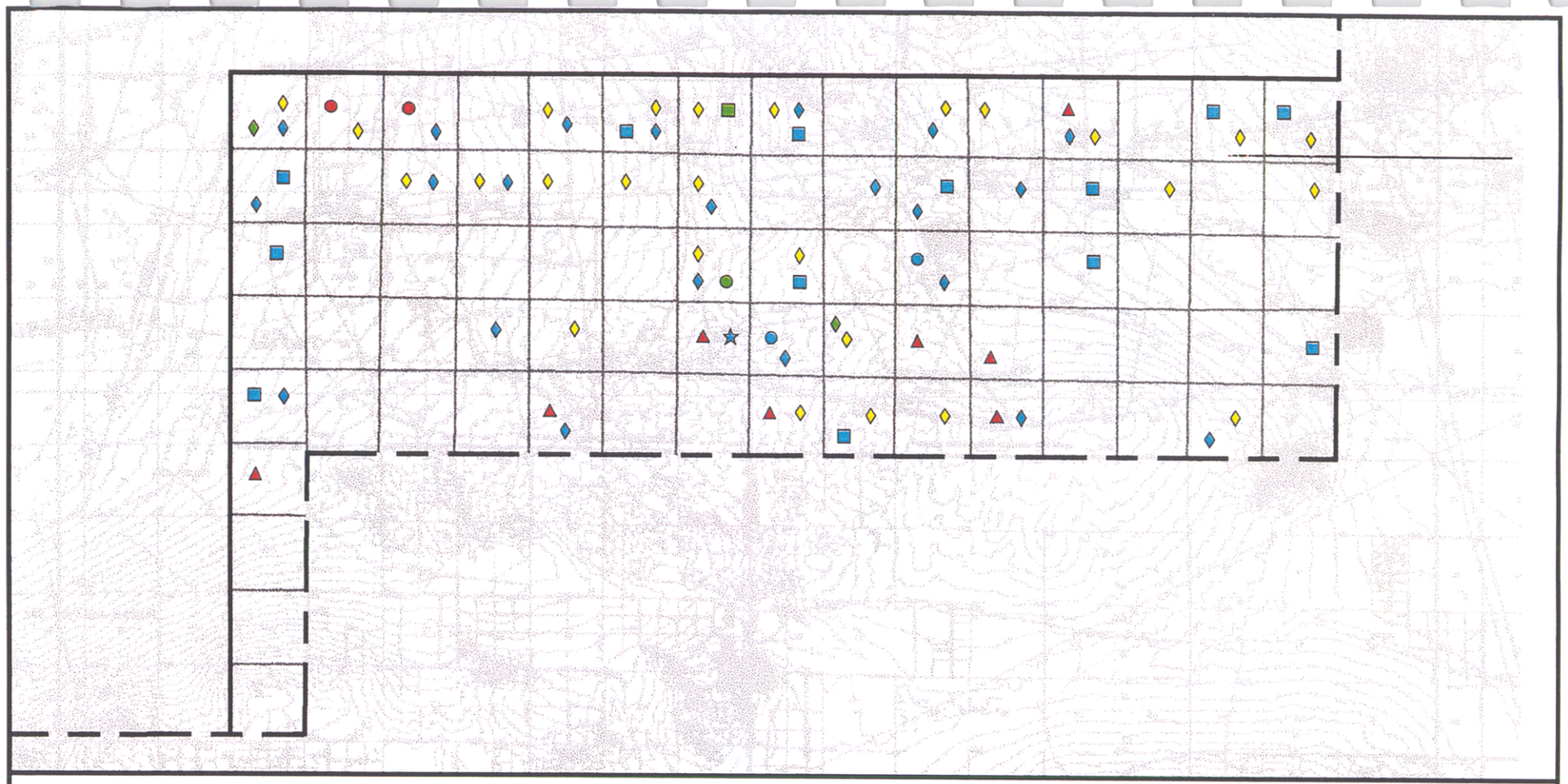
FIGURE C-2C
APPROXIMATE LOCATIONS OF INCIDENTAL SENSITIVE SPECIES DETECTIONS

NORTH

0' 8000' 16000' 24000'

EDWARDS AFB

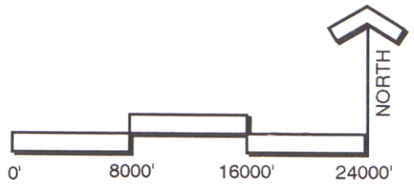
E165_12.MAC 9/11/96

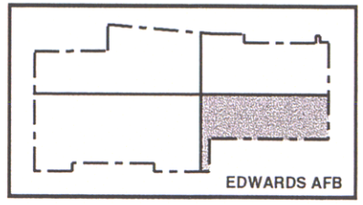


LEGEND

- Base Boundary
- Desert tortoise *(Gopherus agassizii)*
- Mohave ground squirrel *(Spermophilus mohavensis)*
- American badger *(Taxidea taxus)*
- Cooper's hawk *(Accipiter cooperi)*
- Golden eagle *(Aquila chrysaetos)*
- Ferruginous hawk *(Buteo regalis)*
- Northern harrier *(Circus cyaneus)*
- Prairie falcon *(Falco mexicanus)*
- Short-eared owl *(Asio flammeus)*
- Burrowing owl *(Athene cunicularia)*
- Le Conte's thrasher *(Toxostoma lecontei)*
- Loggerhead shrike *(Lanius ludovicianus)*
- Long-eared owl *(Asio otus)*

FIGURE C-2D
APPROXIMATE LOCATIONS OF INCIDENTAL SENSITIVE SPECIES DETECTIONS





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