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1996 Waste Isolation Pilot Plant Threatened and Endangered Species Survey

15 November 1996

Processing and final preparation of this report were performed by
the Westinghouse Electric Corporation's Waste Isolation Division,
the management and operating contractor for the Waste Isolation Pilot Plant, under the
U.S. Department of Energy contract DE-AC04-86AL31950 by James W. Dawson,
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P.O. Box 42273, Tucson, Arizona 85721, (520) 319-1746,
Contract Purchase Order 72849,
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LIST OF ACRONYMS

BLM	Bureau of Land Management
ca.	Circa
C	Celsius
cm	Centimeters
DOE	Department of Energy
F	Fahrenheit
ft	Feet
GPS	Global Positioning System
km	Kilometers
m	Meters
mi	Miles
mm	Millimeters
NEPA	National Environmental Policy Act
NMDGF	New Mexico Department of Game and Fish
SLL	Standard Lizard Line
T/E	Threatened and Endangered
U.S.	United States
USFWS	United States Fish and Wildlife Service
VES	Visual Encounter Survey
WID	Waste Isolation Division
WIPP	Waste Isolation Pilot Plant
WLWA	WIPP Land Withdrawal Area

1.0 INTRODUCTION

The Waste Isolation Pilot Plant (WIPP) is designed to permanently dispose of transuranic radioactive waste left over from the research and production of nuclear weapons. Located in the southeastern corner of New Mexico, project facilities include disposal rooms, excavated in an ancient stable salt formation 655 m (2,150 ft) underground. Transuranic waste consists of clothing, tools, rags, and other such items contaminated with trace amounts of radioactive elements, mainly plutonium. Westinghouse Electric Corporation's Waste Isolation Division (WID), is the managing and operating contractor for the U.S. Department of Energy (DOE) Carlsbad area office at WIPP.

Consultation pursuant to Section 7 (c) of the Endangered Species Act was done in 1980 (DOE, 1980), concurrent with the preparation of the WIPP Environmental Impact Statement. The presence or absence on WIPP lands of plants and animals listed as threatened or endangered (T/E) by Federal or State agencies was evaluated at that time. Data resulting from a suite of studies done from 1977 to 1980 was used in the evaluation (DOE, 1980). In 1989, a second T/E consultation with the U.S. Fish and Wildlife Service (USFWS) and New Mexico Department of Game and Fish (NMDGF) was initiated by WIPP/DOE. No additional fieldwork was deemed necessary at that time.

Other WIPP efforts that have indirectly monitored T/E species were performed by the WIPP Environmental Monitoring Program (DOE/ WIPP 96-2194). Breeding birds, mammals, and vegetation have been the targets of studies since 1980. In addition, the WIPP Raptor Research and Management Program has focused on monitoring the raptor populations health in the area since 1983.

The DOE is currently preparing the *Disposal Decision Environmental Impact Statement for the Waste Isolation Pilot Plant* (DOE/SEIS-0026-S-Z). The SEIS-II will be the National Environmental Policy Act (NEPA) review for the WIPP disposal phase. The NEPA review will address the DOE proposal to continue the phased development of the WIPP and to begin disposal of transuranic and transuranic mixed-waste at the WIPP facility.

To ensure that WIPP environmental protection programs are current in their consideration of sensitive and protected species, the *1996 Waste Isolation Pilot Plant Threatened and Endangered Species Survey* was conducted from August to November, 1996. The WIPP has formulated a list of plant and animal species which are listed as threatened or endangered, and which have a potential presence on WIPP lands. The species list was based on current information obtained directly from the USFWS and NMDGF. Both agencies provided lists of T/E species that may occur in Eddy and Lea Counties, New Mexico. In addition, WIPP used information about habitat preferences to identify T/E species that could occur on WIPP lands. Original field work was conducted with the specific objective of surveying WIPP lands for the presence of T/E plants and animals.

This report describes the methods and results of the *1996 Waste Isolation Pilot Plant Threatened and Endangered Species Survey.* Data collected during previous studies is reviewed and compared with information obtained during the survey. Habitat requirements, life histories, and likelihood of occurrence of T/E species on WIPP lands are discussed.

2.0 SITE CHARACTERISTICS

2.1 GENERAL DESCRIPTION OF THE REGION

The WIPP site is located in southeastern New Mexico about 42 km (26 mi) east of the city of Carlsbad, in Eddy County, in an area known locally as Los Medaños (the dunes). The area is classified as a desert region and is part of the Pecos Valley section of the Great Plains physiographic province (Powers et al., 1978). Topographical relief is slight in the region: land elevations range from 1260 m to 915 m (6930 ft to 2518 ft) and the landscape is generally flat or gently sloping. Soils are sandy and well-drained and dune structures occur in widely scattered clumps throughout the area. Active dunes, stabilized dunes, and hummocks are all found to some degree in the area. Natural surface water is extremely limited and is totally absent from WIPP lands. The closest large source of fresh water is the Pecos River, 22.4 km (14 mi) from the WIPP site.

The region is classified as Chihuahuan Desert and the climate is warm and semi-arid. An average of about 31 cm (12 in) of precipitation falls during the year in a bimodal annual pattern. About half of the annual rainfall occurs in the months of June to September. Summer temperature can exceed 38°C (100°F) and winter temperatures may drop as low as -10°C (14°F). More detailed information about climate and geology are included in the WIPP Environmental Monitoring Plan (DOE/WIPP 96-2194).

Vegetation in the region of the WIPP site is transitional between the Chihuahuan Desert and the Great Plains Short-grass Prairie. Shrubs dominate the vegetative communities in the region, possibly representing a disclimax situation resulting from long term overgrazing (DOE, 1980). At least 15 vegetation communities have been identified in the

Stabilized dunes covered by mesquite-grassland vegetation associations on the WLWA.

area (DOE, 1980). Major vegetation zones include mesquite-grassland mesa, central dunes, creosote flats, Livingston ridge, and tobosa flats. Some dominant plants in the area include shinnery oak (*Quercus havardii*), honey mesquite (*Prosopis glandulosa*), Western soapberry (*Sapindus drummondii*), snakeweed (*Gutierrezia sarothrae*), creosote (*Larrea tridentata*), and brown spine prickly pear (*Opuntia phaeacantha*).

Animal communities are diverse in the area, possibly due to vegetation diversity in the ecotone between the Chihuahuan Desert and Short-grass Prairie. A unique mix of desert and prairie animals occurs in the region. Detailed descriptions of faunal communities were provided in earlier studies done in the region (reviewed in DOE, 1980). Unusual reptiles species in the area include roundtail horned lizards (*Phrynosoma modestum*), six-lined racerunners (*Cnemidophorus sexlineatus*), sand dune lizards (*Sceloporus arenicolus*), Texas longnose snakes (*Rhinocheilus lecontei tessellatus*), and Western coachwhips (*Masticophis flagellum testaceus*). Mammals in the region include banner-tailed kangaroo rats (*Dipodomys spectabilis*), porcupines (*Erethizon dorsatum*), black-tailed jackrabbits (*Lepus californicus*), badgers (*Taxidea taxus*), and mule deer (*Odocoileus hemionus*). Harris' Hawks (*Parabuteo unicinctus*), Swainson's Hawks (*Buteo swainsoni*), Chihuahuan Ravens (*Corvus cryptoleucus*), Loggerhead Shrikes (*Lanius ludovicianus*), Northern Orioles (*Icterus galbula*), Northern Flickers (*Colaptes auratus*), Sandhill Cranes (*Grus canadensis*), Cattle Egrets (*Bubulcus ibis*), Prairie Falcons (*Falco mexicanus*), and Burrowing Owls (*Athene cunicularia*) are a few species that make-up the diverse avi-fauna of the region.

2.2 THE WIPP LAND WITHDRAWAL AREA

Surveys for T/E species were limited to lands administrated by DOE/WIPP to include the WIPP Land Withdrawal Area (WLWA) and existing assessments and rights of way (described in Section 2.3). The WIPP facility is situated in the center of a 6.4 km (4 mi) by 6.4 km (4 mi) block of land composed of 16 sections (Township 22 South, Range 31 East, Sections 15 to 22 and 27 to 34). The WIPP Land Withdrawal Act (Public Law 102-579, signed on 30 October 1992) formalized the withdrawal of the 16 sections of land from public land laws and transferred administration of the area from the Bureau of Land Management (BLM) to the DOE. The 16 section area is referred to as the WIPP Land Withdrawal Area, or WLWA.

Mining and drilling for oil and gas are severely restricted on the WLWA. Consequently, the area is relatively undisturbed compared with the frequency of oil and gas operations on adjacent public land. The grazing of livestock is allowed on the WLWA.

Surface features (e.g., buildings, parking lots, salt piles, equipment storage yards) of the facility are primarily confined to a 200 acre area in the center of the WLWA. With the exception of the facility itself, the entire WLWA was considered during the design of T/E surveys.

2.3 THE WIPP WATERLINE RIGHT-OF-WAY

Another area included in surveys was the buried water pipeline right-of-way area that provides water to the WIPP facility. The waterline originates about 50 km (31 mi) north of the WIPP facility and runs along the north-south paved road (Lea County 126) that links the town of Maljamar to Highway 62/180. The waterline continues south of Highway 62/180 and eventually parallels the WIPP North Access Road to the facility. The right-of-way for the pipeline is about 50 m wide. Vegetation on the right-of-way appears to be much reduced in height compared to surrounding vegetation. This is probably due to disturbance when the line was installed. Right-of-way vegetation most likely represents an earlier successional stage of surrounding vegetative communities.

3.0 METHODS

3.1 SURVEY DESIGNS

The goal of surveys was straightforward: to detect the presence of any T/E species on WIPP lands. During preliminary discussions among WIPP personnel, it was decided that this project would focus on finding T/E species, and that more complex research (i.e., abundances, population sizes and trends) on T/E species would be done in later studies. Survey methods were based on standard techniques referenced in the scientific literature. Because surveys were being conducted within a relatively brief time span (August to November, 1997), an intense field effort was designed that maximized the potential to find T/E species. The following objectives were used when designing surveys:

- To thoroughly cover WIPP lands;
- To cover the spatial and temporal variation of species occurrence;
- To provide maximum detectability of Priority T/E Species;
- To search for other listed species of similar taxon, behavioral ecology, or habitat preferences;
- To minimize the use of techniques that were invasive or required the capture or collecting of animals;

Two issues that were of special concern were to survey reptiles before they hibernated and to survey birds that were resident only in summer.

3.2 PRIORITIZING T/E SPECIES

Only one listed species, the sand dune lizard (See Section 4.0 for species description) was known to occur regularly at the northern extent of the WIPP waterline, about 50 km (31 miles) north of the WIPP site. To develop an approach to searching for other T/E species, WIPP obtained lists of species listed as T/E from the USFWS and NMDGF (Correspondence provided in Appendix B). These lists were incorporated into a master list by WIPP that included both Federal and State-listed species (Table 3-1) that could occur on WIPP lands. The determination of whether a species could occur on WIPP lands was based on range, distribution, and habitat preference information.

Habitat types for several listed species were not present on WIPP lands. For example, the Western river cooter (*Pseudemys gorzugi*) is an aquatic turtle whose general range includes the area of WIPP (Painter, 1991). However, the river cooter requires developed bodies of surface water, most typically riverine situations. Natural permanent water bodies are not present on WIPP lands. Artificial water sources in the area consist mainly of ephemeral run-off ponds and cattle ponds consisting of raised-sided metal tanks. Using these basic criteria, a list of priority species was formulated (Table 3-1). Surveys were designed to search specifically and most intensively for priority species.

Table 3-1. A List of Threatened and Endangered (T/E) Species Derived from Lists Provided by the U.S. Fish and Wildlife Service and the New Mexico Department of Game and Fish. All species were considered during survey Designs, however, Priority Species (those with the greatest likelihood of occurring on WIPP Land) were given full attention during the formulation of survey methods. Listing Codes are: E = Endangered, T = Threatened, sc = Special Concern, and NL = Not Listed.

Common Name	Scientific Name	USFWS Listing	NMDGF Listing	Occurrence on WIPP Lands	Survey Designation
Western river cooter	*Pseudemys gorzugi*	NL	T	Potential presence in Riverine/Lake habitat	
Sand dune lizard	*Sceloporus arenicolus*	NL	T	Known to occur on WIPP waterline	Priority
Arid land water snake	*Thamnophis proximus*	NL	T	Potential resident in man-made water (no recent records)	Priority
Aplomado Falcon	*Falco femoralis*	E	E	Potential breeding habitat (no historic breeding records)	Priority
American Peregrine Falcon	*Falco peregrinus*	E	E	No breeding habitat but foraging/ wintering habitat	Priority
Bald Eagle	*Haliaeetus leucocephalus*	E	E	No breeding/foraging habitat but potential transient presence	Priority
Common Ground Dove	*Columbina passerina*	NL	E	Potential breeding presence	Priority
Southwestern Willow Flycatcher	*Empidonax traillii*	E	T	No breeding habitat/potential transient presence	Priority
Bell's Vireo	*Vireo bellii arizonae*	NL	T	Potential breeding presence	Priority
Baird's Sparrow	*Ammodramus bairdii*	NL	T	Potential wintering presence	Priority
Gypsum wild buckwheat	*Eriogonum gypsophilum*	T	NL	Possibly some conducive habitat	Priority
Lee's pincushion cactus	*Coryphantha sneedii var. leei*	T	NL	Conducive habitat, no known records in area	Priority
Lloyd's hedgehog cactus	*Echinocereus lloydii*	T	NL	Conducive habitat, (no known records in area)	Priority
Tharp's bluestar	*Amsonia tharpii*	sc	NL	Conducive habitat (no known records)	
Dunes goosefoot	*Chenopodium cycloides*	sc	NL	Conducive habitat (no known records in area)	

3.3 OBSERVER QUALIFICATIONS AND TRAINING

Qualifications and backgrounds of the Principal Investigator and Project Leader are given in Appendix B. Field technicians, (also referred to as observers) were required to be undergraduates or degree-holders in Wildlife Biology, Ecology, Environmental Science or a related program. An emphasis was placed on finding observers that had prior experience with survey techniques and with the taxa of interest in this survey.

The importance of adequate training for observers in surveys, censuses, and counts has been stressed by many researchers (Fannes and Bystrak, 1981; Kepler and Scott, 1981; Bart, 1985; Verner and Milne, 1989) in order to reduce observer bias and error. A training program was incorporated into the survey that involved the following steps:

- Applicants for field technician positions were screened to assure they could perform essential job functions, are qualified, and are fit for duty.
- Observers were provided with visual aids (field guides, books, and slides) and auditory aids (bird song tapes).
- Time was spent in the field for the sole purpose of observing as many species as possible and working through species identifications on a group and individual level. In the case of reptile identifications, observers captured non-T/E species, examined them in the hand, and released them unharmed at the capture site.
- Over 15 hours of instruction were provided in the field and classroom by Phillip Steven West, an ornithologist with expertise in the local avifuana, working through identification procedures for use with problematic bird species.
- A field session to identify local plants was held with Douglas Lynn, Jr., WIPP Land Use Coordinator. Plants were collected, pressed, and identified using standard herbarium protocols for the purpose of building a plant collection to aid in identifications during surveys.

The progress of observers in developing identification skills was monitored and assignments were made to ensure that personnel with adequate identification skills were involved in each segment (reptiles, birds, and plants) of the survey.

3.4 REPTILES

A variety of sampling schemes have been used to census reptiles (e.g., road surveys and capture programs), however, systematic searches of defined areas are perhaps most useful because they can yield multiple lines of useful data (Jones, 1986). Searching an area, rather than using straight transect lines, is most appropriate with species that use limited habitat patches that are clumped (and cannot be thoroughly sampled by running a single transect line through habitat patches). The sand dune lizard appears to fit this description because the species uses dune habitat that may occur in small, scattered, and irregularly-shaped patches.

The Visual Encounter Survey (VES)(Crump and Scott, 1981) is an observational method that is appropriate for both inventorying and monitoring studies. The VES method (also referred to as the "time-constrained technique") can produce data on species richness,

to assemble a list of species in an area, and to estimate the abundance of a species within an assemblage (Crump and Scott, 1981). A powerful feature of VES is that the method is not restricted to use with straight line transects and can be used with plot designs or within irregularly shaped habitat patches (e.g., along streams).

Crump and Scott (1981) described the use of VES in combination with the systematic search of a defined area in their description of a quadrat design. Variations and modifications of this approach have been used to census reptiles in a host of different projects in the Southwest (e.g., Murray, 1995). These projects have produced useful data about species occurrence and did so in a cost and time efficient manner.

Again, the primary objective of reptile surveys was to investigate the occurrence of T/E species on WIPP lands. Therefore, a method that would yield a comprehensive species list was desired. Several reptile surveys have been done on the WLWA in the past and the herpetofauna of the area is reasonably well known. WIPP personnel were most interested in intense surveys of potential sand dune lizard habitat on the WLWA rather than broad-scale sampling of the entire area.

Hence, a sampling design was formulated for use with reptiles that incorporated a quadrat design (an area search), a systematic search protocol, and general VES approaches. The methods described by Lowe and Rosen (1991) for standardized lizard line (SLL) transects were also integrated into the research design wherever appropriate. Finalized sampling design called for a series of plots, or quadrats, to be placed along the waterline and on the WLWA with an emphasis on potential habitat of the sand dune lizard. In order to fully assess the limited sand dune lizard habitat on the WLWA, repeated sampling of quadrats was chosen over the one-time sampling of a large number of quadrats.

3.4.1 Quadrat Placement

Because the sand dune lizard (*Sceloporus arenicolus*)(Degenhardt and Jones, 1972) was the only T/E species known to occur near the WIPP site, special emphasis in the survey was placed on reptiles (specifically lizards). The sand dune lizard has been reported to occur on the northernmost extent of the waterline (Snell et al.,1994, Degenhardt et al., 1996), however, a primary question about the species was whether its range extended into the WLWA. The sand dune lizard appears to prefer the vicinity of active and semi-stabilized sand dunes (Sena, 1985; Degenhardt et al., 1996) partially vegetated with shinnery oak (*Quercus havardii)* and sand sagebrush (*Artemisia filifolia*; Degenhardt et al., 1996). The first reptile quadrats were established in areas on the waterline known to be occupied by sand dune lizards. Subsequent quadrats were placed in potential habitat of the sand dune lizard (dune complexes) on the WLWA whenever possible.

Of a total of sixteen quadrats that were established: seven quadrats were placed along the waterline (four were near the northern extent of the waterline within the range of the sand dune lizard and three quadrats were situated in dune complexes further south). Due to the sensitive nature of location information about T/E species, specific locations of quadrats that contained *S. arenicolus* are not presented herein. Within the WLWA,

nine quadrats were placed within the habitat type stratifications described by Martin (1978) for the WIPP site (Figure 3-1). Ideally, each quadrat was situated such that at least a portion of the quadrat was dune habitat. However, several quadrats also included flatter areas adjacent to the dunes. Several other quadrats on the WLWA were flat, without dunes, but contained one or both of the favored vegetation species. Two quadrats were placed in association with a vegetation enclosure on the WLWA (one within and one outside of the enclosure). WIPP requested that comparative sampling be done for reasons unrelated to the survey.

Patternless morph of the side-blotched lizard (*Uta stansburiana*) in dune habitat.

3.4.2 Quadrat Design

Each quadrat was 100 m on each side (see Figure 3-2). Technicians established quadrats by placing a permanent stake in the center of the quadrat and then taking compass bearings to each of the corners. Each corner of the quadrat was marked with a stake and color-coded plastic tape which was used by observers to confirm their locations within the quadrat while conducting surveys. Hand-held Global Positioning Systems were used to derive and record locations when quadrats were selected.

Surveys were started no sooner than two days after the quadrat was established in order to allow reptiles to recover from disturbance caused during quadrat set-up. After the initial set-up, quadrats were surveyed no more frequently than every other day to allow recovery time for reptiles and reduce researcher-induced stress.

Two observers worked simultaneously within a quadrat. Each observer surveyed two adjacent quarter sections (Figure 3-2) and both observers attempted to move at a similar speed through the quadrat. Starting points and directions that observers walked

through quadrats were rotated 180° from one survey to the next in order to reduce habituation by reptiles to the direction of approach by observers. Reptiles that anticipated the direction an observer would approach may have fled before the observer could identify and record them.

Observers worked on a rotating schedule in terms of which observer surveyed which quadrat so that observers surveyed each quadrat approximately the same number of times. This system was used to minimize the influences of any variation in observer abilities and skills (i.e., potential biases influencing counts in all quadrats equally). This approach made it easier to tease apart the variables of observer bias and variation in reptile abundance among quadrats.

Surveys began each day several hours after sunrise (after reptiles had become active) and continued throughout the late afternoon. Quadrats generally took from 35 to 55 minutes to survey. Technicians began at predetermined starting points and routes (for north-south or east-west travel) and walked the quadrats systematically recording the species they sighted. Technicians used one meter plastic rods to flush reptiles from vegetation as they walked through and past clumps of plants. Use of flushing sticks was started after it became obvious that counts of sand dune lizards were greatly enhanced by using sticks.

Observers recorded the species sighted, age (adult or juvenile; when it was possible to determine), sex if possible, general habitat notes of where it was found (e.g., the type of vegetation it was associated with), and the time it was initially spotted. General weather conditions were also recorded at the beginning of surveys.

The 16 quadrats were surveyed at least 12 times each. Reptile surveys were terminated when lizard abundance diminished due to colder autumn temperatures. When an unusual reptile was sighted or a species identification was in question, a team of up to 5 observers returned the following day, conducted an intense search of the immediate area of the observation, and attempted to relocate the species.

3.4.3 Examinations of Man-made Water Sources

National Pollution Discharge Elimination System stormwater retension basins (DOE/WIPP 93-004) that approximated natural water sources (i.e., had dirt banks) were examined during late summer for the presence of reptiles and amphibians. Examinations consisted of slowly walking the periphery of water sources and searching the banks, vegetation, and water for snakes and toads. Water sources were also examined at night following summer rain storms while amphibians were actively breeding. Whenever possible, non-threatened and non-endangered reptiles and amphibians were captured, closely examined, identified, weighed, measured, and then were released at the capture site.

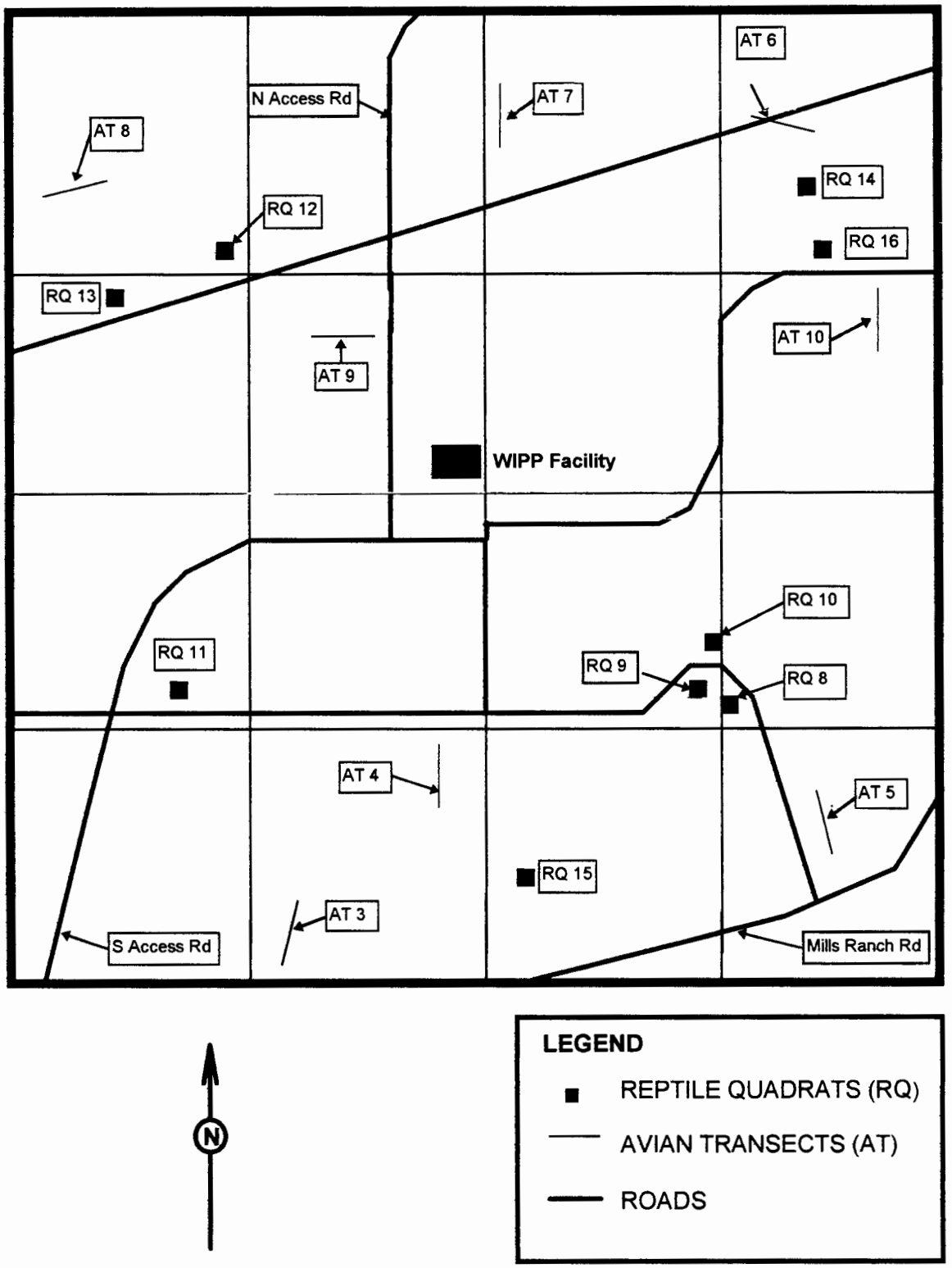

Figure 3-1. Locations of Reptile Quadrats and Avian Strip Transects on the WIPP Land Withdrawal Area

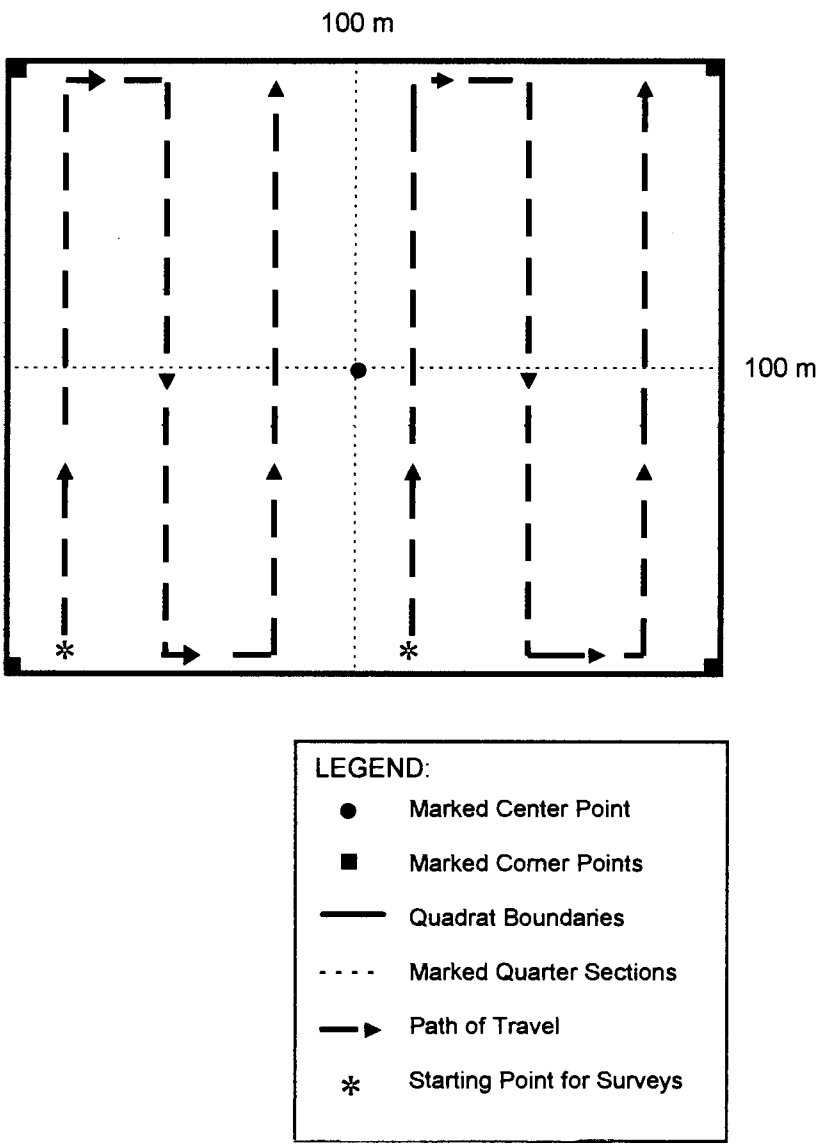

Figure 3-2. Diagram of Reptile Quadrats and Survey Routes used Simultaneously by Two Observers

3.5 BIRDS

3.5.1 Selection of a Survey Technique

Among birds, priority species fell into two general taxa: Passerines and Falconiformes. To maximize detection of priority species, a general survey was done for all species and a second survey was done specifically for raptors (described in Section 3.5.4). Selection of an appropriate technique to search for Passerines was complicated. In spite of the considerable effort expended over the past 50 years to develop powerful monitoring tools for bird populations, ornithologists are often disagree over the most accurate and efficient method to census birds in a given habitat. Habitat characteristics, behavior of target species, and research objectives further complicate the choice of an appropriate technique (e.g., Reynold et al., 1980; Bull, 1981; Dawson, 1981; DeSante, 1981; Eckman, 1981; Edwards et al., 1981; Verner, 1985; Verner and Milne, 1989, 1990; Tomiakojc and Verner 1990, Ralph et al., 1993).

A primary consideration when designing bird surveys was to incorporate the established survey protocols for the Southwestern Willow Flycatcher (*Empidonax traillii extimus*) used by the U.S. Fish and Wildlife Service (Tibbets et al., 1994). Direct application of the protocol on this survey was hampered, however, by two issues. First, potential breeding habitat for Willow Flycatchers could not be located on WIPP lands during field work, as described in Tibbets et al. (1994) and in subsequent revisions (Tibbets et al., 1996). Interviews with area specialists also indicated that WIPP lands did not comprise potential breeding habitat for willow flycatchers (West, 1989).

A second factor considered during surveys was that the protocol was essentially a breeding survey and must be conducted in May and June (Tibbets et al., 1994) when flycatchers are nesting. In the unlikely event that willow flycatchers were nesting on WIPP lands, breeding would not occur during the survey period of August to November.

It is possible, however, that willow flycatchers use WIPP lands during post-fledging movements or while on migration in fall and winter. Detection of non-breeding, non-territorial flycatchers poses essentially the same problems as surveying other species during late summer/fall. Presence of transient migrants could be misinterpreted as evidence of breeding residency. It was expected, however, that the survey design used on the project would be as likely to detect willow flycatchers as other species and that establishing the breeding status of any detected species would require further work in the spring and summer.

Among methods used to monitor bird populations (Emlen, 1971; Svensson, 1981; Szaro and Jakle, 1982), transect techniques have proven to be useful (Franzreb, 1981). Measures of species richness, or total number of species observed, were found using transects by Ratkowsky and Ratkowsky (1979), to be maximized. Point counts provide an alternative method to obtain a species list for a given area but have been controversial. In comparison with transect methods, point counts have been variously found to be less effective than transect methods (Ratkowsky and Ratkowsky, 1979), of equal power (Verner and Ritter, 1985; Anderson and Ohmart, 1981), or more powerful

than transect counts (Edwards et al., 1981). However, support for the use of transect methods in desert habitats was reported by Anderson and Ohmart (1981). They worked in desert-riparian habitat in Arizona and found that their transect technique was most useful in level terrain with well-marked transect routes.

A transect technique was chosen for this study for the following reasons:

- Methods that were based on breeding behavior (i.e., spot mapping) were not applicable to the survey due to its timing during a nonbreeding period.
- Openness of the vegetation structure (tallest vegetation < 2 m in height) and level topography in the study areas allowed observers to see birds at greater distances from the transect line, move easily across the landscape, and cover greater distances. The *effective area* sampled in the low-lying vegetation around the WIPP site would be sufficient to garner a good measure of species richness.
- The objective of the study was to detect T/E species. Primary advantages of other techniques (e.g., determining density of species) were not needed and the likelihood of observing T/E species would be higher with a transect method than with any other standard technique.

It was felt that any advantages of other methods (i.e., point counts) would be negligible in the Chihuahuan Desert. Using a transect method allowed the research team to sample more area and provide more thorough coverage of WIPP lands than other methods. More importantly, the likelihood of observing T/E birds would be as high or higher with a transect method as it would be with any other widely accepted technique.

3.5.2 Strip Transects

A strip transect is a method in which a line is laid out across the landscape, observers walk along the line, and all birds seen within a predetermined distance on both sides of the line are counted (Gates, 1981; Hutto and Mosconi, 1981). Distance from the line (or the strip width) is ideally the distance at which an average observer can see and identify the smallest, most cryptically colored, or shyest bird species. Strip width is determined beforehand based on target species size, colors, behavior, and vegetation structure in terms of obstructing vision (Oelke, 1981). Starting and ending points of the line are permanently marked and additional markers are used along the line to aid observers in staying on the line as they walk through vegetation.

For bird surveys, each strip transect consisted of a 400 m center-line that was marked with stakes at the origin and end points (Figure 3-3). Birds that were perched or flying within 100 m of the line were given priority during surveys, however, birds seen outside of strip transects were also recorded. Eight transects were placed on the WLWA (Figure 3.1) and two were placed on the waterline. Locations of transects were determined by placing them in major habitat types in proportion to the total percentage of each habitat type on WIPP lands.

The direction of transect lines from the starting points was determined based on habitat characteristics. A priority on the survey was to maximize opportunities to observe Southwestern Willow Flycatchers. Therefore, transects that were near mature trees, situated along arroyos, or near any kind of water, were positioned so that observers would have a good view of those landscape features .

Birds typically are most active near sunrise or in the following hour, decline around midday, and reach a second activity peak in evening (Robbins, 1981; Skirvin, 1981; Verner and Ritter, 1986). In order to survey during bird activity, observers started transects just before sunrise (ca. 0700 hours) and surveyed until about 0900 hours. A second survey period was done from ca.1630 to 1800 hours. Surveys were not conducted on rainy or very windy days.

During surveys on strip transects, an observer looked for birds while walking at a slow but even pace. Each observer was equipped with a pair of 7 X 42 binoculars, a spotting scope, and a hand-held GPS unit. When a bird was seen, the observer recorded the time, species of bird, number of individuals, distance of the bird from the transect line, distance of the bird from observer, and how the bird was first detected (sighting or hearing). Prepared data forms were used to record data in the field.

3.5.3 Observational Criteria

Once selection of a transect method was made, another difficulty included the choice of observational criteria used by observers during counts. Many bird censuses rely heavily on observers using bird calls as a means of identifying individuals that cannot be seen. Often species identification and number of individuals is recorded without the advantage of sight confirmation. While bird songs are certainly species specific and can be used to identify species that cannot be seen, considerable skill is required to differentiate

between different species of closely related taxa. Variation is high among observers, however, in terms of their skills in detecting and correctly identifying birds (Emlen, 1971; Svensson, 1977; Cyr, 1981; Kepler and Scott, 1981; Scott et al., 1981; Verner and Milne, 1989). If bird songs are used to identify species during surveys, differences among observers in hearing abilities and abilities to recognize calls can produce very misleading results (Fannes and Bystrak, 1981; Bart, 1985; Verner and Milne, 1989). Bart (1985) examined observer variation in a project that incorporated both song and sight identifications and found that even "expert birdwatchers" over-counted, under-counted, or misidentified birds. This type of "measurement error" may greatly influence the amount of variance in data and is difficult to assess after field work is done (Raitt, 1981). Every attempt should be made to minimize measurement error when formulating a research design.

Difficulties in finding personnel with a high degree of expertise in recognizing bird calls, and in compiling a team of observers with equivalent skill levels, are so great that they nearly render song identification unusable as a standard survey method. Moreover, training inexperienced observers sufficiently that they can reliably identify residents and migrants is very time-consuming and costly. The addition of more experienced observers tends to reduce variation in data, but, as Milne and Verner (1989) pointed out, a compromise may have to be made when designing monitoring programs between

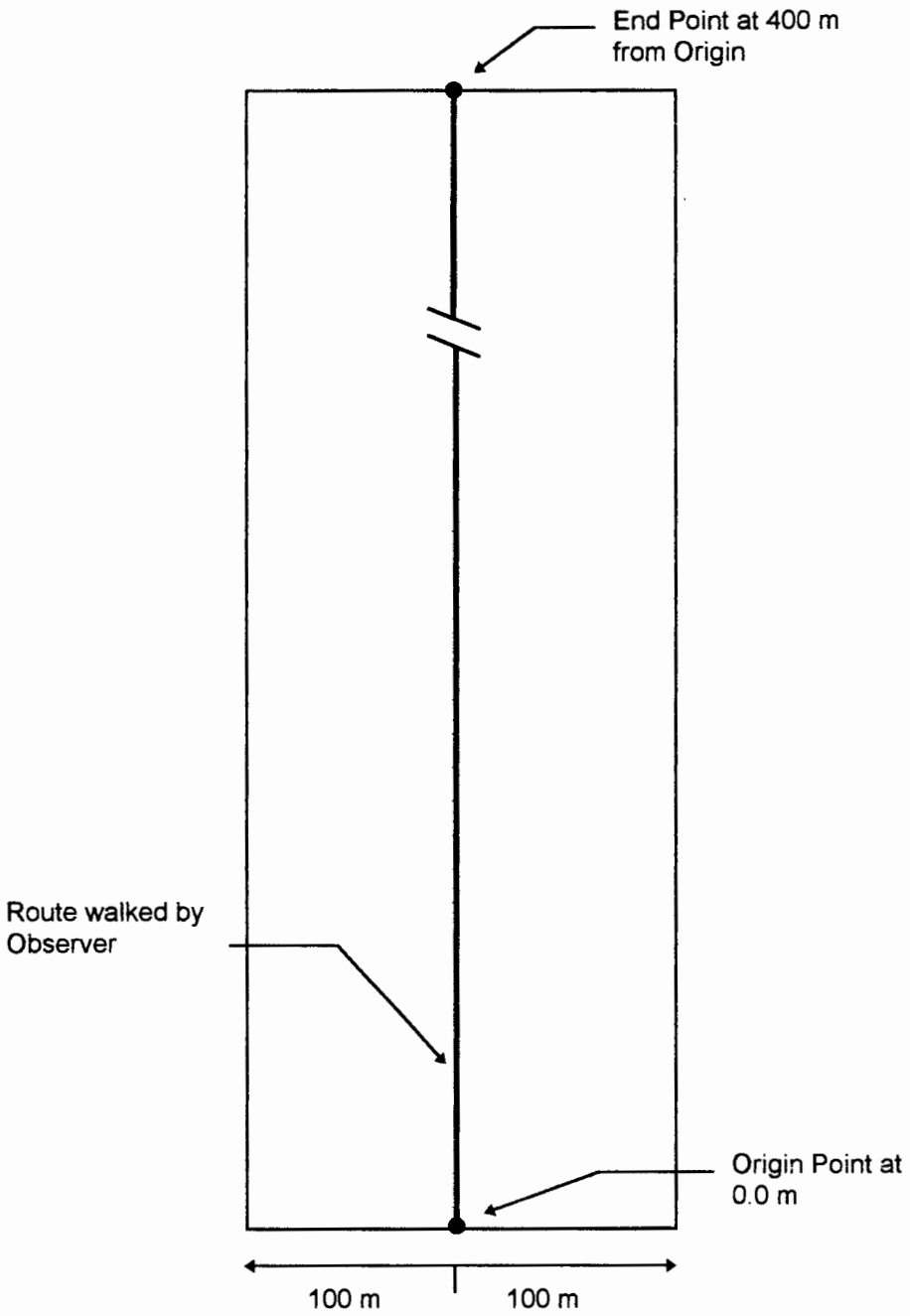

Figure 3-3. Diagram of a Strip Transect Used to Survey Birds on the WLWA. All birds that were seen within 100 m of the transect line were identified and counted.

adding additional observers (thus reducing variation and error) and increasing costs. Taken together, these factors suggest that the value of bird vocalizations as a means of identifying birds to the species level is extremely limited.

The decision was made on this project to use only sight-confirmed species identifications during surveys in order to reduce measurement error (Mayfield, 1981) and to allocate resources more efficiently to cover more area and T/E taxa. Observers were instructed to use vocalizations only as an aid to confirm the species or subspecies of sighted birds. No species were identified or counted based on vocalizations only.

3.5.4 Raptor Surveys

Although raptors were regularly seen during strip transects for birds, a second survey method was established to search specifically for Peregrine Falcons, Aplomado Falcons, and Bald Eagles. An unusual characteristic of raptors in the Carlsbad area is that a large number of individuals appear to be extremely wary of people on foot (D. Lynn pers. com.), but pay little attention to moving vehicles. Counting raptors from a moving vehicle is a widely used method of obtaining survey data (Fuller and Mosher, 1981) and a standard road count protocol was chosen for the WIPP survey. The unusual wariness of raptors led to the decision not to use regular stopping points to search for raptors (Leal et al., 1995) because at least some birds would immediately leave the area if a vehicle stopped.

Raptors were surveyed by using a route that covered the WLWA. A team of two technicians began the survey at the start point and drove approximately 25-35 mph searching for raptors. When a raptor was sighted, the observers stopped and identified the species, time, location, age, and sex of the bird when possible. Observers did not leave the vehicle during observations of raptors. The route was driven once a week in the latter half of the T/E survey period.

Immature Peregrine Falcon (*Falco peregrinus*)

3.6 VEGETATION

Two T/E plant species were designated as priority species during the survey (Table 3-1). The vegetation survey consisted of two different techniques that were done together at sampling sites. A 100m line transect was done in which all plants contacted by the line were identified and measured. A strip transect of 1m on either side of the line transect was done in a similar arrangement as avian strip transects (Figure 3-3). The purpose of strip transects was to broaden the search for cacti. All cacti and shrubs were identified and measured in strip transects.

The locations of line transects/strip quadrats were determined by calculating the percentage of WIPP lands composed of each habitat type (Martin, 1978) and then dividing the starting points among habitat types along the same percentages. Thus, the most common habitat type on WIPP lands received the most surveys. A preferred approach would have been to use habitat preference of the species of interest as a means of identifying potential habitat for each species, however, information on preferred habitats was either too vague to be of use, or the habitat type described was not present on WIPP lands. A positive aspect of using habitat type area percentages to locate sampling points was that it allowed for a broad-scale sampling of WIPP lands. Novel vegetation associations, range extensions, or habitat preferences are most likely to be detected this way. Directions of line transects from starting points were randomly selected using a random number table.

4.0 LIFE HISTORIES OF T/E SPECIES

4.1 REPTILES

4.1.1 Western River Cooter (*Pseudemys gorzugi*)

The Western river cooter, also known as the Rio Grande Cooter, is found in rivers and permanent related streams. *Pseudemys gorzugi* ranges from the lower Rio Grande and Pecos River drainages from Tamaulipas, Nuevo Leon, and Coahuila, Mexico and south Texas, through west Texas to southeastern New Mexico. The species is restricted to the lower Pecos River drainage in New Mexico including lower Brantley Reservoir and the entire length of the Black and Delaware Rivers (Degenhardt et al., 1996).

Western river cooters are large, ranging from 80-285 mm (3.1-11.2 in), with females generally larger than the males (Painter 1991). The turtle is greenish brown with elaborate whorls of black and yellow lines, each surrounded by thick yellow lines. The plastron (lower shell) is yellow with thick, dark lines along the seam. The head and neck are dark with yellowish green stripes on the head, with a blotch of similar color on each side of the head behind the eyes. The legs are marked with red, yellow, and black. The webbing in between the toes is red with half moon shaped black spots (Garrett and Barker, 1987; Degenhardt et al., 1996). Males can be distinguished from females by their long, straight foreclaws and long, thick tails, and smaller size (Degenhardt et al., 1996).

In New Mexico gravid females and their nests have been observed in late May. The female digs a shallow nest in the soil near the water and deposits eggs (Garrett and Barker, 1987). Females have been reported to lay seven to nine eggs and hatching occurs approximately 70 days after the eggs are laid. In April, seven hatchlings from one nest were discovered along the Pecos River near Carlsbad (Degenhardt et al., 1996).

In New Mexico it is likely that the Western river cooter feeds on a variety of aquatic plants, invertebrates, and vertebrates. Specimens that have been examined have shown vegetable matter, particularly green algae, in their system (Degenhardt et al., 1996).

Western river cooters generally prefer riverine habitats and are confined to deeper pools found along the Pecos, Black and Delaware Rivers. Aquatic vegetation for foraging and cover is desirable but not necessary. The waters are generally muddy, sandy, and contain areas of algae-covered limestone (Degenhardt et al., 1996).

4.1.2 Sand Dune Lizard (*Sceloporus arenicolus*)

The sand dune lizard is a small-sized species of *Sceloporus* that occurs in southeastern New Mexico and Texas. In southeastern New Mexico its range extends from northeastern Chaves County southward and eastward through eastern Eddy County

and southern Lea County (Sena, 1985; Censky, 1986; Conant and Collins, 1991). None were sighted or trapped on previous studies conducted on small dune complexes on the WIPP site (DOE, 1980; E. Akers, 1996, unpubl. data).

Sceloporus arenicolus is a pale light brown lizard with a poorly defined, grayish dorsal stripe that extends from the ear opening to its tail (Smith and Brodie, 1982; Garrett and Barker, 1987; and Degenhardt et al., 1996). From snout to tip of the tail, the lizard measures 49-62.2 mm (1.9-2.4 in), with the tail length usually slightly longer than the head-body length (Degenhardt et al., 1996). The dorsal scales are keeled, pointed and non-overlapping. The male has scattered blue patches on the belly that may be partially bordered in black. Neither sex has blue coloration on the throat, however, the females may have a pinkish color on the sides of the neck. During vitellogenesis (egg yolk production and development), the female has a yellow-orange coloration on the belly from the neck extending onto the tail (Garrett and Barker, 1987; Degenhardt et al., 1996).

Vitellogenesis begins in late April (Sena, 1985) with the first clutch of eggs laid in late June and the second clutch in late July to early August (Degenhardt and Jones, 1972; Sena, 1985). Females are sexually mature the first spring after hatching and lay one to two clutches per year with an average of five eggs/clutch. Hatchlings appear between the end of July and the end of September. In spring there are two distinct size classes of females, suggesting that some individuals reach at least two years of age (Degenhardt et al., 1996).

The primary food sources of the sand dune lizard include ants, ant pupae, small beetles and larvae, crickets, grasshoppers, and spiders. Lizards tend to be wary and feed near or in vegetation. Frightened individuals use plants, dry leaves, and loose sand as escape cover and may run to opposite sides of dunes or hummocks when approached (Degenhardt et al., 1996). The light and nearly patternless dorsal color of adults appears to be conspicuous when an individual is held in the hand but is surprisingly cryptic against light desert sands (Garrett and Barker, 1987).

The habitat of the sand dune lizard is restricted to areas surrounding active and semi-stabilized sand dunes. The dominant vegetation association is shin oak (*Quercus havardii*) and sand sagebrush (*Artemisia filifolia*) (Fitzgerald, et al., 1995; Sena, 1985). While the side-blotched lizard (*Uta stansburiana*) may be found in similar habitat, there is a marked negative relationship between the two species. Sena (1985) suggests that these two species may occupy different microhabitats within the area.

This species was formerly classified as a subspecies of the sagebrush lizard and may be listed as *S. graciosis arenicolus* in publications prior to 1991. The possibility that sand dune lizards were simply classified as *S. graciosis* should be considered when reviewing literature. A recent change in the common name of the species from the dunes sagebrush lizard to the sand dune lizard has been made based upon the designation of *S. arenicolus* as a distinct species and the lack of a strong association between the lizard and sagebrush.

4.1.3 Arid Land Water Snake (*Thamnophis proximus*)

The arid land water snake (*Thamnophis proximus*) ranges from southern Wisconsin to the Gulf Coast, through northeastern Mexico to Costa Rica, and from eastern New Mexico to the Mississippi River. In New Mexico the species is scattered in areas of permanent water like the lower Pecos River drainage near Carlsbad, Artesia and Roswell (Tennant, 1984; Williamson, Hyder and Applegarth, 1994; and Degenhardt et al., 1996). No specimens have been recorded or collected on WIPP lands in recent studies (DOE, 1980; Akers, 1996, unpubl. data)

The arid land water snake averages 50.8-86.4 cm (20-34 in) and is a dark olive-brown color with three bright, longitudinal stripes. Lateral stripes occupy the third and fourth scale rows. The head is noticeably wider than the neck and the tail is approximately one-third of the entire body length. The scales on this species are keeled. The New Mexico form is characterized by an orange vertebral stripe and a narrow dark ventrolateral stripe. (Tennant, 1984; Williamson, et al., 1994; and Degenhardt et al., 1996).

Females are slightly larger than males and reach sexual maturity at approximately one to two years of age (Tinkle, 1957). Mating occurs in July and August with some broods produced as late as October (Degenhardt et al., 1996). This species bears its young live with an average clutch size of 12 young. While reproduction of this species in New Mexico has not been extensively studied, it is suspected that the species has one brood per year.

The primary food sources of the arid land water snake include frogs, toads, smallmouth salamanders, leopard frog tadpoles, ground skinks and fish (Degenhardt et al., 1996). The species is quick to seek shelter if startled; however, if captured, the arid land water snake will emit an offensive smell from its cloaca (Williamson, et al., 1994).

In New Mexico this species is semi-aquatic and rarely found away from permanent water sources. It inhabits rivers and streams, irrigation canals, stock tanks, and rocky creeks where frogs and fish might remain. Often it is found on overhanging branches or in thick streamside vegetation (Williamson, et al., 1994; and Degenhardt et al., 1996).

4.2 BIRDS

4.2.1 Aplomado Falcon (*Falco femoralis*)

The historical distribution of the Aplomado Falcon in the U.S. extended from southern and western Texas to southern Arizona. The falcon also occurred in suitable habitat through all of Mexico, Central America, and also throughout South America, including Trinidad, to Tierra del Fuego (Cade, 1982; Clark and Wheeler, 1987; Snyder and Snyder, 1991).

The species has virtually disappeared from much of its U.S. range in the late 1800's becoming increasingly less common throughout the remainder of its range. The

species is regarded as being extirpated in the U.S. and has not been reported nesting in New Mexico since 1952 (Cade, 1982; Clark and Wheeler, 1987). However, the Aplomado Falcon has been recently sighted in scattered locations in southern New Mexico (Hector, 1980; and P. Jungemann, pers. com.) suggesting that a small breeding population exists in Southern New Mexico or in Mexico. Nonetheless, no documentation of any sighting of the Aplomado Falcon on WIPP lands could be found during this review.

The Aplomado Falcon has a distinct head pattern with a lead gray crown, black line behind the eye, and a thin black mustache. The superciliary lines, cheek and throat are creamy to whitish. The superciliary lines join on the back of the neck to form a V-shape. The Aplomado Falcon has a whitish to buffy or rufescent throat and upper breast with a few short, dark streaks that are heavier on females. The mid-section of the belly has a black cummerbund-like band extending and becoming wider on the sides. The lower belly, thighs, and under tail-coverts are rufescent. Back and upperwing coverts are lead gray. The trailing edge of the dark wings has a noticeable light edge extending from the body to the tips of the primaries. The long black tail has seven or more thin white bands. The cere, eye-ring and legs are all yellow (Grossman and Hamlet, 1964; Cade, 1982; Clark and Wheeler, 1987; National Geographic Society, 1987).

The length from head to tip of the tail of the falcon ranges from 35-39 cm (13.8-15.4 in) for males and 41-45 cm (16.1-17.7 in) for females. Wingspread for the males range from 78-84 cm (30.7-33.1 in) and 93-102 cm (36.6-40.2 in) for the females (Cade, 1982; Clark and Wheeler, 1987).

The immature Aplomado Falcon is similar to the adult, however, its back has a brownish cast and rufous feather edges. The breast is more heavily streaked and the dark cummerbund has buffy streaks. The tail of the immature has nine or more thinner, buffy bands. The cere, eye ring, and leg colors are a paler yellow (Clark and Wheeler, 1987).

Existing stick nests built by other birds are used as the Aplomado's eyrie (nest). In New Mexico the falcons usually chose Chihuahuan Raven (*Corvus cryptoleucus*) nests located approximately 2.5-8 m (8.2-26.2 ft) above the ground built in yuccas (species unknown) or mesquites (*Prosopis glandulosa*). Falcons lay two to three eggs, rarely producing four eggs at differing times of the year depending on locality. In New Mexico, the eggs are laid from March to June with both parents incubating (Brown and Amadon, 1968; Cade 1982).

The Aplomado Falcon preys primarily on birds, captured after a rapid direct flight from a perch or sometimes in a long tail-chase or pursuit on foot through heavy brush. Flying insects are also taken on the wing, and the species is known to sweep back and forth in front of grassland fires to catch locusts and other escaping insects. In addition, the species also preys upon small rodents, reptiles, and even bats. The Aplomado has also been recorded pirating prey from other raptors (Mader, 1981; Hector, 1980; Cade 1982; Clark and Wheeler, 1987).

Open grasslands and savannas with tall cacti, yuccas, mesquites, or taller pines and oak trees in open stands are the favored habitats for this species. The species tolerates a wide bioclimatic range from summer-rainfall deserts of North America, arid tropical

zones, humid tropical coastal plains, montane grasslands of the Andes, to wind-swept tableland of Tierra del Fuego (Cade, 1982).

4.2.2 American Peregrine Falcon (*Falco peregrinus anatum*)

The Peregrine Falcon (*Falco peregrinus*) is found worldwide mainly in arctic to temperate climates. One of the three subspecies of the falcon have occurred in North America at one time or another (Clark and Wheeler, 1987). The American Peregrine Falcon, known as the continental form, was formerly widespread with local breeding birds in continental North America, except in the Southeast and Great Plains. These falcons are migratory, however, and some remain in North America year round especially along the coasts (Hickey, 1969; Evans, 1982; Clark and Wheeler, 1987).

The American Peregrine Falcon is mid-sized in comparison to the other two sub-species of Peregrines. This species has a black head with white to buffy cheeks and throat and contrasting wide, dark mustache marks. The white breast may be solid or lightly streaked and the white belly is barred with black. Females often have rufous wash on their breast. Back and upperwing coverts are a dark slate in color with blue-gray bars. The blackish tail has eight or more gray bands and a thick, white terminal band. Uppertail coverts are bluish-gray with black barring. The leg feathers are white with black barring (Grossman and Hamlet, 1964; Cade, 1982; Clark and Wheeler, 1987; National Geographic Society, 1987; Stokes and Stokes, 1996).

Measurements of the total length of this falcon range from 37-41 cm (14.6-16.1 in) for male and 42-46 cm (16.5-18.1 in) for the female. The wingspread of the male ranges from 94-100 cm (37-39.4 in) and 102-116 cm (40.1-45.7 in) for the female (Clark and Wheeler, 1987).

Immature American Peregrine Falcons have similar plumage to the adults, however, the head is dark blackish-brown, and the back and upperwing coverts are brown with rufous edging. Creamy underparts and belly are heavily streaked in brown. Also the tail is brown with 10 or more buffy incomplete bands, with a terminal white band (Grossman and Hamlet, 1964; Cade, 1982; Clark and Wheeler, 1987; National Geographic Society, 1987; Stokes and Stokes, 1996).

The American Peregrine nests in a variety of locations, but is limited by its inability to construct a nest. The falcon relies on old nests of Ravens, Rough-legged Buzzards, Golden Eagles, or sometimes makes a shallow scrape in loose soil to serve as a nest (Cade, 1982). In addition to natural nests, this species also utilizes ledges on skyscrapers or bridges (Groskin, 1952; Cade, 1982; Snyder and Snyder, 1991). Generally the Peregrine lays three or four eggs that are buff in color with heavy rust-brown markings (Walters, 1994).

The Peregrine diet includes a great variety of birds and it is estimated that in North America, the falcon may consume approximately 200 different avian species (Cade, 1982). The preferred bird species include Flickers (*Colaptes* spp.), Meadowlarks (*Sturnella* spp.), Red-winged Blackbirds (*Agelaius phoeniceus*), Blue Jays (*Cyanocitta cristata*), Common Snipe (*Gallinago gallinago*), Rock and Willow Ptarmigan (*Lagopus mutus* and *L. lagopus*), Mourning Doves (*Zenaida macroura*), Teals (*Anas* spp.) and

Shrikes (*Lanius* spp.). In addition flying insects and occasionally bats are preyed upon by the falcon. Specifically in New Mexico, common prey consist of Jays, Woodpeckers, and Band-tailed Pigeons (*Columba fasciata*) (DOE, 1980).

A common hunting style of the falcon is to perch on a high cliff or building, waiting to stoop on the prey that passes beneath it. Another method used is to spot birds flying above and "ring up" above them and then dive on them. Alternatively a falcon may watch prey flying below it and wait until it is in an optimal position and then stoop on it (Cade, 1982; Snyder and Snyder, 1991).

While the American Peregrine Falcon hunts in a variety of habitats, suitable cliffs for nesting and roosting do not exist on WIPP lands. No sightings of the species have been made on the WLWA. A Peregrine was sighted once in the 1980 WIPP avifauna study near Laguna Grande de la Sal, a large saline lake about 19 km (12 mi) from the WIPP site (DOE. 1980). Peregrine Falcons have occasionally been sighted near saline lakes more recently (P.S. West, pers. com.) and twice in 1996 near the town of Carlsbad by personnel of the WIPP Raptor Research and Management Program (J. Dawson, pers. com.).

4.2.3 Arctic Peregrine Falcon (*Falco peregrinus tundrius*)

The Arctic Peregrine Falcon ranges from arctic regions of Canada and Alaska to southern North America and possibly Central America (Clark and Wheeler, 1987; Snyder and Snyder, 1991). The coastal region of western Canada, portions of the U.S. Southwest and portions of the eastern U.S. coast are used as wintering and breeding grounds for the Peregrine Falcon (Clark and Wheeler, 1987).

The Arctic Peregrine Falcon differs from its American form in size and color. The Arctic or Tundra Peregrine is smaller, darker, and has a thinner mustache mark on its face. The overall coloration is black instead of slate or bluish-gray, with only a faint rufous wash on the breast at most (Clark and Wheeler, 1987).

The immature Arctic Peregrine Falcon is similar to the adult form, however, it may have a buffy forehead and usually a much narrower mustache mark. Back and upperwing coverts are brown with wide buffy or rufous fringes. The streaks on the underparts are much narrower than on the American Peregrine immature (Clark and Wheeler, 1987).

The prey of the Arctic Peregrine is similar to the American Peregrine, however, consists more heavily of northern dwelling passerines. While the American Peregrine breeds and winters in southern New Mexico, the arctic subspecies breeds in regions farther north (Cade, 1982) and occurs in the area only as a migrant.

4.2.4 Bald Eagle (*Haliaeetus leucocephalus*)

The Bald Eagle is widespread in its distribution but is generally found in association with water. In North America, these eagles winter along the western coast of Alaska and Canada, throughout the U.S. and into northern Mexico. Their breeding range is

restricted to Alaska, Canada, the U.S. Northwest, around the Great Lakes, along the east coast and along the Gulf Coast and Florida (Clark and Wheeler, 1987; Snyder and Snyder, 1991).

Breeding areas of the Bald Eagle are almost always near waters (Snyder and Snyder, 1991; Clark and Wheeler, 1987) in which fish can be captured, a landscape feature that is lacking on WIPP lands. In New Mexico the eagle nests on rock pinnacles, cliffs, or trees near water. Bald Eagles have not been sighted on the WIPP site breeding or roosting (DOE ,1980).

The adult plumage of the Bald Eagle is similar in both sexes and is not obtained until the bird is approximately four years old. The head and tail are white with a dark brown body. Beak, cere, and legs are bright orange-yellow. The iris color is a pale yellow. The leading edge of the wing is nearly parallel with the trailing edge of the wing when in flight (Clark and Wheeler, 1987; National Geographic Society, 1987).

The first full plumage of the eagle is used until the bird is approximately one year old. The head, tail, breast and flight feathers are dark brown while the back and upperwing coverts may have a lighter, tawny brown color. The belly is pale to tawny brown. The beak and cere are black and the iris is dark brown (Clark and Wheeler, 1987; National Geographic Society, 1987). This plumage can easily be confused with the Golden Eagle (*Aquila chrysaetos*), however, in flight the Bald Eagles head protrudes more than half the tail length and also the belly is lighter (Clark and Wheeler, 1987).

In the first spring, the Bald Eagle molts in light belly feathers and some white on the upperwing coverts and back, forming an upside down "V". Some dark flight feathers may be replaced, but the color remains the same. The beak and cere fade to a slate color and the eye lightens to amber (Clark and Wheeler, 1987).

Two and three year old Bald Eagles both have variable plumage. The head begins to lighten, while the body darkens. The cere, beak, and iris begin to fade into adult colors. The length of the Bald Eagle from head to tail ranges from 70-90 cm (27.6-35.4 in) and the wingspread range is 180-225 cm (70.9-88.6 in) (Clark and Wheeler, 1987; National Geographic Society, 1987).

The prey of the Bald Eagle consists of primarily fish but also waterfowl and occasionally carrion. This species also pirates food from other raptors, especially fish from Osprey (*Pandion haliaetus*). While the eagle is an agile hunter, it prefers to obtain food in the easiest manner possible (Clark and Wheeler, 1987; National Geographic Society, 1987).

4.2.5 Common Ground Dove (*Columbina passerina*)

The range of the Common Ground Dove range extends from the southeastern U.S. to southern California and south into Mexico (National Geographic Society, 1987; Stokes and Stokes, 1996). The species was not sighted on the WIPP site during the initial biological assessment (DOE, 1980).

The Common Ground Dove is a stocky bird with a scaled look on its head and breast. Overall color is brownish on the males and grayish on the females. The tail is short,

often raised. The primaries are bright chestnut as are some of the upperwing coverts. The male has a slate colored crown and pinkish-gray underparts. The female is more uniformly gray (Clark and Wheeler, 1987; Stokes and Stokes, 1996).

Nests constructed from sticks, grasses and roots are placed on the ground in a saucerlike shape. The female lays about two to three eggs which hatch in approximately two weeks. These birds spend most of their time on the ground and are generally unafraid of humans (Stokes and Stokes, 1996).

This species forages in the open ground in the east and also in brushy rangeland in the west. The Common Ground Dove eats weeds, grass, waste grain seed, crumbs, insects and small berries (Stokes and Stokes, 1996).

4.2.6 Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

The Southwestern Willow Flycatcher is one of four or five subspecies of Willow Flycatcher recognized in North America based on differences in color and morphology (Sferra et al., 1995). The breeding range includes the southern U.S. and northern Mexico. Migration patterns are unknown, but it is suspected that this species winters in Central and South America (Sferra et al., 1995).

The Willow Flycatcher has a dark brownish-olive head, back, and upperparts. The throat is white with a pale olive breast, and a pale yellow belly (National Geographic Society, 1987; Stokes and Stokes, 1996). This species has a less conspicuous eye ring than other *Empidonax* and is slightly paler overall. The most distinguishing feature of this subspecies is the "fitz-bew" song (Sferra et al., 1995).

This species is a riparian obligate and is restricted to breeding in dense streamside vegetation. The Willow Flycatcher was historically found along river systems like the Colorado, Gila, Salt, San Pedro, Santa Cruz, and Agua Fria (Sferra et al., 1995). A single Willow Flycatcher was observed on the WIPP site during the past 10 years or so (P.S. West, pers. com.). Due to the lack of permanent river systems and the appropriate streamside vegetation on WIPP, it is unlikely to find the species breeding here.

4.2.7 Bell's Vireo (*Vireo bellii*)

The Bell's Vireo usually occurs in dense shrubland or woodland along lowland streams where willows, mesquites, and seepwillows are dominant vegetative species (DOE, 1980). The breeding range of this species includes the US Midwest clear south into Mexico as well as portions of the southwestern states (Stokes and Stokes, 1996). The Bell's Vireo winters in Central America (National Geographic Society, 1987). The species occurs locally near Carlsbad Caverns and in the Guadalupe Mountains. Ligon and Cole (1978; DOE, 1980) did not record the Bell's Vireo during bird surveys done in the WIPP area in the late 1970's.

The Bell's Vireo in the western region of their range are grayish above and whitish below, with indistinct spectacles. In the eastern portion, the species is greenish above and yellowish below. This species has two white wing bars, with the lower one more

prominent. The tail is long and dark. Their song is distinctive among vireos (National Geographic Society, 1987; Stokes and Stokes, 1996).

This species forages low to the ground in dense brush and shrubs. An active vireo, this species feeds on insects, spiders, and fruits. They nest about 0.5-3 m (1.64-9.84 ft) above the ground on tree branches. The nest is constructed of bark, plant fibers, and a spun lining of hair and grasses. Approximately three to five eggs are laid that are white with brown spots (Stokes and Stokes, 1996).

The Bell's Vireo occurs in Carlsbad Caverns National Park, the canyons of the Guadalupe Mountains, and possibly along the lower Pecos River (DOE, 1980). This species was not sighted on WIPP during the 1980 inventory (DOE, 1980).

4.2.8 Baird's Sparrow (*Ammodramus bairdii*)

The summer range for the Baird's Sparrow is in southern Canada and the northern central U.S., while its winter range includes northern Mexico and portions of southern Arizona, New Mexico, and Texas (National Geographic Society, 1987; Stokes and Stokes, 1996).

This species is buffy overall with fine black streaks on the nape and sides of crown. The crown has one rich, buff central stripe. Two dark stripes border the sides of the throat and also dark streaks form a necklace on the throat. The scapulars are a bright chestnut color. The tail is short and dark with light edging. The voice is distinctive among sparrows (National Geographic Society, 1987; Stokes and Stokes, 1996).

In the summer, this species feeds on insects like spiders and grasshoppers. In winter it feeds primarily on seeds of weeds. The Baird's Sparrow builds a cuplike nest of grasses which is placed on the ground. Three to five white eggs with dark marks are laid. These sparrows rarely fly, preferring to walk among the grasses (Stokes and Stokes, 1996).

This species could potentially be found in the grasslands of New Mexico as a migrant. However in the 1980 inventory (DOE, 1980), there were no confirmed sightings of this bird.

4.3 PLANTS

4.3.1 Gypsum Wild Buckwheat (*Eriogonum gypsophilum*)

Gypsum wild buckwheat is a woody stemmed perennial that grows in dense clumps and is approximately 20 cm (7.9 in) tall. The dark green, thick leaves grow to approximately 1.5-2.5 cm (0.6-1.0 in) wide, are hairless, and attach at the base of the plant. The leaves turn bright red in the fall. The yellow flowers are 1-2 mm (0.3-5.1 in) long and appear from May to July in dense clusters (Limerick, 1984).

This wild buckwheat is found only on gravely gypsum outcrops on hills covered with a limestone cap 15.2-30.5 m (50-100 ft) thick (Reveal, 1976; Wooton and Standley, 1913).

This species is known to occur only in a small locale near the Seven Rivers Hills area, about 29 km (18 mi) northwest of Carlsbad (Limerick, 1984).

Gypsum wild buckwheat generally occurs in the same areas as *Eriogonum harvardii*. While the plants appear similar, *E. harvardii* is 30 cm (11.8 in) or more higher and also has silvery, hairy leaves. Additionally *E. harvardii* occurs on limestone while *E. gypsophilum* is found on gypsum (Spellenberg, 1977; Martin and Hutchins, 1980).

4.3.2 Lee's Pincushion Cactus (*Coryphantha sneedii*)

Lee's pincushion cactus is found on limestone ledges of the Chihuahuan Desert at approximately 1,200-1,500 m (3,936-4,920 ft). The cactus forms large green clumps to 30 cm (11.8 in) or greater in diameter. The plant masses contain many small white-spined balls and give the effect of a shag rug carpet. The central spines are white tipped with lavender or pink. The flower is pink, rose, magenta, and partly brownish and is about 1.2-2 cm (0.5-0.8 in) in diameter and long (Benson, 1982).

4.3.3 Lloyd's Hedgehog Cactus *(Echinocereus lloydii)*

Lloyd's hegdehog cactus has a single stem or several in a clump 15-20 cm (5.9-7.9 in) high and 30 cm (11.8 in) or greater in diameter. The stem is green and the spines are dense but only partly obscure the stem. The central spines are red and the sepaloids (portion of leaves surrounding the base of the flower) are purplish with lavender margins. The flower petals are approximately 5-6 cm (2.0-2.4 in) and lavender and magenta in color. The fruit of Lloyd's hedgehog cactus is green tinged with pink and has spines. This species is generally found in sandy or gravely soils in the flats of the Chihuahuan Desert at approximately 900 m (2,952 ft) (Warnock and Koch, 1974; Benson, 1982).

5.0 RESULTS

One of New Mexico's threatened species, the sand dune lizard, was sighted during the survey. This species was not found on the WLWA but was found at the waterline. No other reptiles, birds, or plants were sighted that are currently on either the State or Federal listing of threatened and endangered species. The following results include specific data regarding the sand dune lizard and a brief summary of the other reptile, avian, and plant species observed on the WLWA and the waterline.

5.1 REPTILE RESULTS

Twelve different species of reptiles were observed on the WLWA and the waterline (Table 5-1).

Table 5-1. Reptile Species Sighted on WLWA or the Waterline

Common Name	Scientific Name
Six-lined racerunner	Cnemidophorus sexlineatus sexlineatus
Western whiptail	Cnemidophorus tigris
Great plains skink	Eumeces obsoletus
Western skink	Eumeces skiltonianus
Leopard lizard	Gambelia wislizenii wislizenii
Lesser earless lizard	Holbrookia maculata maculata
Coachwhip	Masticopohus flagellum testaceus
Texas horned lizard	Phrynosoma cornutum
Sand dune lizard	Sceloporus arenicolus
Southern prairie lizard	Sceloporus undulatus consobrinus
Side-blotched lizard	Uta stansburiana steinegeri
Ornate box turtle	Terrapene ornata ornata

Reptiles sighted varied from plot to plot as well as from the WLWA to the waterline. Also the abundance of each species varied among plots. The side-blotched lizard, for example, was sighted only 110 times on two different plots and was sighted 320 times on another plot. Other species like the leopard lizard were observed rarely on about half of the plots and never on the remaining plots. Some species like the great plains skink, Western skink, and ornate box turtle were only sighted once or twice throughout the entire survey period.

The most commonly recorded reptile on all plots was the side-blotched lizard. While its numbers varied from plot to plot, it was always more abundant than any other reptile. Other reptiles commonly sighted on the waterline plots include the sand dune lizard, Western whiptail, and the Southern prairie lizard. On the WLWA, Western whiptails and Southern prairie lizards were the most commonly encountered species, after the ubiquitous side-blotched lizard

The highest total number of reptiles observed on a plot was 405 on waterline plot four, and the lowest were two plots, 8 and 16, with only 110 reptiles each. A summary of the numbers of reptile species sighted on each plot is given in Table 5-2. These numbers represent the sum of each species by plot over the entire survey period. The first seven plots were located at the waterline and plots 8-16 were all on the WLWA. Plot 16 was located inside the WIPP enclosure area and appears to have a slightly lower diversity of species as well as abundance. However, the most abundant lizard in plot 16, like all other plots, was the side-blotched lizard.

As stated earlier in this report, the threatened sand dune lizard was only sighted on the waterline plots. The mean number of reptiles/plot on the waterline was 276.14 reptiles, which is higher than the WLWA mean of 216.44 reptiles/plot. The increased mean is partially due to the sand dune lizard presence, but also three of the WLWA plots had comparatively lower reptile abundances than all other plots.

Plots in which the sand dune lizard was present were of primary interest due to the threatened status of the species. In addition to species totals of each plot, waterline plot data are presented by survey day in Tables 5-3 and 5-4. In Table 5-3, figures are based on total numbers of all reptile species for plots 1-7 per survey day. The waterline plots are of primary concern in relation to the sand dune lizard and represent the only WIPP realty containing the species. Table 5-4 presents information on the sand dune lizard on plots 1-7 per survey day.

Sand dune lizards clearly were most abundant on plots 1-4 rather than plots 5-7, as demonstrated by a greater numbers recorded on the former plots. The patterns observed in lizard abundance could be due to several factors, including the spatial relationships of plots. Plots 1-4 were in greater proximity to one another than to plots 5-7 and were also the northern most plots established during the study. Plots 5-7 were south of plots 1-4 and north of plots 8-16. It is possible that a north-south gradient of abundance of sand dune lizards reflects species distribution.

Another possibility is that the density of other species may affect sand dune lizard numbers. It is possible that competition between species of similiar behavioral ecologies results in one species dominating the other. One possible result of competition could be that one species increases in abundance while another declines. The data

Table 5-2. Total Number of Reptile Species Sighted

	Plot Number															
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Six-lined racerunner	2	8	4	4	0	1	2	0	0	0	1	2	0	0	0	0
Western whiptail	0	1	0	3	15	25	6	7	6	3	23	6	9	0	11	0
Great plains skink	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Leopard lizard	0	0	0	0	1	0	0	0	1	1	1	1	1	0	0	0
Lesser earless lizard	7	9	4	5	0	4	0	0	0	0	0	0	0	0	0	2
Coachwhip	1	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0
Texas horned lizard	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Sand dune lizard	45	13	23	23	1	4	5	0	0	0	0	0	0	0	0	0
Southern prairie lizard	15	11	8	8	9	18	11	3	8	18	11	5	5	1	9	0
Side-blotched lizard	215	215	145	156	193	320	221	93	11	17	27	17	27	6	21	9
Unidentified reptile	22	22	22	36	11	32	22	7	182	191	285	225	265	135	191	99
Ornate box turtle	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0
Western skink	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
TOTAL	308	279	207	236	230	405	268	110	208	231	350	257	307	142	232	110

Table 5-3. Mean Numbers of Reptiles Sighted on the Waterline Plots/Day

Plot Number	Mean No. Reptiles/Day	Minimum No. Reptiles/Day	Maximum No. Reptiles/Day
1	27.6	3	42
2	27.9	9	38
3	20.5	16	37
4	21.5	2	34
5	23.2	12	33
6	40.7	30	53
7	26.7	29	38

Table 5-4. Mean Number of Sand Dune Lizards in Waterline Plot per Day

Plot Number	Mean Number of Sand Dune Lizards/Day	Minimum Number of Sand Dune Lizards/Day	Maximum Number of Sand Dune Lizards/Day
1	4.3	1	10
2	1.3	0	2
3	2.1	0	6
4	2.0	0	6
5	0.1	0	1
6	0.4	0	1
7	0.5	0	2

presented herein were not conlcusive in supporting competition between side-blotched and sand dune lizards. For example, plot 6 contained the greatest numbers of the side-blotched lizard compared to the other plots. Plot 6 also had very few sand dune lizards. However, other plots showed parallel abundance trends between side-blotched and sand dune lizards. The data are not suggestive of a clear negative correlation between side-blotched and sand dune lizards. Potential factors influencing the distribution of lizard species are presented in Section 6.0

The longitude and latitude coordinates of the center points of plots are presented in Table 5-5. The center points for plots 1-7 are not given in order to maintain security regarding the presence of the threatened sand dune lizard.

Table 5-5. GPS Locations for Reptile Plot Center Points.

Plot	North	West	Elevation (ft)	Plus or Minus Elev (ft)
8	32°21.200'	103°46.441'	3611	175
9	32°21.357'	103°46.489'	3507	239
10	32°21.533'	103°46.523'	3768	492
11	32°21.372'	103°48.834'	3582	138
12	32°23.044	103°48.546'	3200	440
13	32°22.900'	103°49.088'	3754	492
14	32°21.357'	103°46.489'	3507	239
15	32°20.695'	103°47.490'	3435	116
16	32°23.083'	103°45.973'	3395	113

5.2 AVIAN RESULTS

No threatened or endangered birds were sighted in either the avian transects, nor the raptor surveys. The avian data has been divided such that the transects are summarized and reviewed separately from the raptor survey data. All species identified on the transects throughout the survey are presented in Table 5-6. This table includes the common name and the scientific name of all species sighted.

Table 5-6. Avian Species Identified on the Transects

Common Name	Scientific Name
Great-blue Heron	*Ardea herodias*
Turkey Vulture	*Cathartes aura*
Northern Harrier	*Circus cyaneus*
Harris' Hawk	*Parabuteo unicinctus*
Swainson's Hawk	*Buteo swainsoni*
Red-tailed Hawk	*Buteo jamaicensis*
American Kestrel	*Falco sparverius*
Prairie Falcon	*Falco mexicanus*
Scaled Quail	*Callipepla squamata*
Sandhill Crane	*Grus canadensis*
Mourning Dove	*Zenaida macroura*
Greater Roadrunner	*Geococcyx californianus*

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Table 5-6. Avian Species Identified on the Transects

Common Name	Scientific Name
Ladder-backed Woodpecker	*Picoides scalaris*
Northern Flicker	*Colaptes auratus*
Scissor-tailed Flycatcher	*Tyrannus forficatus*
Western Kingbird	*Tyrannus verticalis*
Barn Swallow	*Hirundo rustica*
Cactus Wren	*Campylorhynchus brunneicapillus*
Bewick's Wren	*Thryomanes bewickii*
Ruby-crowned Kinglet	*Regulus calendula*
Blue-gray Gnatcatcher	*Polioptila caerulea*
American Robin	*Turdus migratorius*
Northern Mockingbird	*Mimus polyglottos*
Sage Thrasher	*Oreoscoptes montanus*
Crissal Thrasher	*Toxostoma crissale*
Northern Shrike	*Lanius excubitor*
Loggerhead Shrike	*Lanius ludovicianus*
Virginia's Warbler	*Vermivora virginae*
Yellow Warbler	*Dendroica petechia*
Yellow-rumped Warbler	*Dendroica coronata*
Townsend's Warbler	*Dendroica townsendi*
Pyrrhuloxia	*Cardinalis sinuatus*
Blue Grosbeak	*Guiraca caerulea*
Green-tailed Towhee	*Pipilo chlorurus*
Cassin's Sparrow	*Aimophila cassinii*
Chipping Sparrow	*Spizella passerina*
Clay-colored Sparrow	*Spizella pallida*
Brewer's Sparrow	*Spizella breweri*
Field Sparrow	*Spizella pusilla*
Vesper Sparrow	*Pooecetes gramineus*
Lark Sparrow	*Chondestes grammacus*
Black-throated Sparrow	*Amphispiza bilineata*
Sage Sparrow	*Amphispiza belli*
Lark Bunting	*Calamospiza melanocorys*
Baird's Sparrow	*Ammodramus bairdii*
Song Sparrow	*Melospiza melodia*
White-crowned Sparrow	*Zonotrichia leucophrys*
Harris' Sparrow	*Zonotrichia querula*
Eastern Meadowlark	*Sturnella magna*
Western Meadowlark	*Sturnella neglecta*
Brewer's Blackbird	*Euphagus cyanocephalus*
Brown-headed Cowbird	*Molothrus ater*

Two of the most common species sighted on the transect surveys were the lark bunting and the mourning dove. The lark bunting was recorded 2,919 times over the survey period, while the mourning dove had 977 records. Other common species on nearly all transect lines include the Brewer's sparrow, black-throated sparrow, Cassin's sparrow, clay-colored sparrow, chipping sparrow, cactus wren, Eastern meadowlark, pyrrhuloxia, vesper sparrow, and white-crowned sparrow.

Some species like the scaled quail, sage sparrow, sandhill crane, green-tailed towhee, and American robin were abundant on certain transect lines and absent altogether on others. Of these species that had a moderate number of sightings, they were not all sighted together on particular transect lines.

There was a small list of rarely sighted species from only one or several transects. Some of these species include the yellow-rumped warbler, Virginia's warbler, ruby-crowned kinglet, Harris' sparrow, great blue heron, field sparrow, blue grosbeak, blue-grey gnatcatcher, and Bewick's wren. These rare birds seemed to be distributed more or less equally on different transects. In other words, not all of these species were concentrated on any one or two transects.

Overall the transect lines had total bird numbers ranging from 655 to over 1000, with only two transect lines with unusually low total numbers (196 and 302). One of these transect lines was located on the Waterline while the other was in the WLWA. A second transect line was placed at the Waterline and it had one of the highest abundances of birds.

The two transect lines that ran near the Enclosure area (no Tebuthiuron sprayed in this area nor cattle grazing), transects 6 and 10, had a relatively high abundance of birds recorded. Both of these transects had very high numbers of lark buntings present (446 and 381 respectively) and also a great number of the birds that had a moderate number of occurrences.

A brief summary of the birds sighted on the transect lines in shown in Table 5-7 (transect lines 1-5) and Table 5-8 (transect lines 6-10). The totals for each transect line do not include birds which were recorded as an unidentified sparrow or unidentified warbler. At times the observers were unable to get a confirmed identification on some of the sparrows and warblers if they were in thick vegetation or in flight. Therefore the totals represent confirmed sightings only.

Table 5-7. Number of Individual Birds Sighted on Transect Lines (1-5)

Common Name	Line 1	Line 2	Line 3	Line 4	Line 5
Great-blue Heron	0	1	0	0	0
Turkey Vulture	0	0	0	1	0
Northern Harrier	3	2	5	6	4
Harris' Hawk	0	0	1	0	0
Swainson's Hawk	0	1	0	3	0
Red-tailed Hawk	0	2	1	0	1
American Kestrel	0	0	0	1	2
Prairie Falcon	0	0	0	0	0
Scaled Quail	1	34	2	5	1
Sandhill Crane	52	51	0	0	0
Mourning Dove	17	193	87	162	141
Greater Roadrunner	0	0	0	2	2
Ladder-backed Woodpecker	0	3	8	6	4
Northern Flicker	0	1	1	0	1
Scissor-tailed Flycatcher	0	0	0	0	0
Western Kingbird	0	0	0	0	0
Barn Swallow	0	0	0	6	0
Cactus Wren	0	12	11	14	22
Bewick's Wren	0	0	0	1	0
Ruby-crowned Kinglet	0	1	0	0	0
Blue-gray Gnatcatcher	0	0	1	0	0
American Robin	0	0	0	0	0
Northern Mockingbird	0	2	1	4	1
Sage Thrasher	1	0	0	0	0
Crissal Thrasher	0	5	4	6	3
Northern Shrike	0	0	0	0	0
Loggerhead Shrike	9	11	14	17	14
Virginia's Warbler	0	0	0	0	0
Yellow Warbler	6	0	0	0	0
Yellow-rumped Warbler	0	0	0	0	0
Townsend's Warbler	5	0	0	0	0
Pyrrhuloxia	0	11	10	31	19
Blue Grosbeak	0	1	0	0	0

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Table 5-7. Number of Individual Birds Sighted on Transect Lines (1-5)

Common Name	Line 1	Line 2	Line 3	Line 4	Line 5
Green-tailed Towhee	0	9	1	4	9
Cassin's Sparrow	1	5	1	10	28
Chipping Sparrow	6	11	5	28	52
Clay-colored Sparrow	1	6	6	0	59
Brewer's Sparrow	3	5	9	17	28
Field Sparrow	0	0	0	0	0
Vesper Sparrow	6	11	11	26	53
Lark Sparrow	0	0	0	0	45
Black-throated Sparrow	3	8	5	6	17
Sage Sparrow	0	1	0	1	6
Lark Bunting	14	518	45	237	259
Baird's Sparrow	0	0	0	0	0
Song Sparrow	0	5	1	1	6
White-crowned Sparrow	1	12	3	9	23
Harris' Sparrow	0	1	0	0	0
Eastern Meadowlark	8	26	8	13	36
Western Meadowlark	5	1	0	0	12
Brewer's Blackbird	0	1	0	0	3
Brown-headed Cowbird	0	0	0	0	0
TOTAL	142	951	241	617	851

Table 5-8. Numbers of Individual Birds Sighted on Transect Line (6-10)

Common Name	Line 6	Line 7	Line 8	Line 9	Line 10
Great-blue Heron	0	0	0	0	0
Turkey Vulture	0	0	0	1	0
Northern Harrier	11	3	6	2	7
Harris' Hawk	1	0	2	0	0
Swainson's Hawk	0	1	0	0	0
Red-tailed Hawk	0	1	0	0	0
American Kestrel	0	4	0	1	1
Prairie Falcon	0	1	0	0	0
Scaled Quail	9	0	2	8	1

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Table 5-8. Numbers of Individual Birds Sighted on Transect Line (6-10)

Common Name	Line 6	Line 7	Line 8	Line 9	Line 10
Sandhill Crane	11	25	0	0	0
Mourning Dove	32	176	31	105	33
Greater Roadrunner	1	0	1	0	0
Ladder-backed Woodpecker	0	0	0	10	2
Northern Flicker	0	0	0	0	0
Scissor-tailed Flycatcher	0	0	0	2	0
Western Kingbird	0	0	0	0	1
Barn Swallow	0	0	0	0	0
Cactus Wren	20	16	18	14	12
Bewick's Wren	1	0	0	0	0
Ruby-crowned Kinglet	1	0	1	0	0
Blue-gray Gnatcatcher	1	0	0	0	0
American Robin	3	3	1	0	0
Northern Mockingbird	5	2	3	4	0
Sage Thrasher	1	8	0	2	0
Crissal Thrasher	5	2	6	10	5
Northern Shrike	1	0	1	0	0
Loggerhead Shrike	15	0	15	12	12
Virginia's Warbler	1	0	0	0	0
Yellow Warbler	0	0	0	0	0
Yellow-rumped Warbler	1	0	0	0	0
Townsend's Warbler	0	0	0	0	0
Pyrrhuloxia	27	9	29	31	16
Blue Grosbeak	0	0	0	0	0
Green-tailed Towhee	14	1	20	12	2
Cassin's Sparrow	30	19	12	9	25
Chipping Sparrow	39	0	11	17	53
Clay-colored Sparrow	22	8	17	7	57
Brewer's Sparrow	80	17	20	12	118
Field Sparrow	0	0	0	0	2
Vesper Sparrow	97	33	23	33	78
Lark Sparrow	6	0	5	8	11
Black-throated Sparrow	10	10	8	17	13
Sage Sparrow	19	2	0	8	10

Continued on next page

Table 5-8. Numbers of Individual Birds Sighted on Transect Line (6-10)

Common Name	Line 6	Line 7	Line 8	Line 9	Line10
Lark Bunting	446	197	551	271	381
Baird's Sparrow	1	0	0	0	0
Song Sparrow	8	1	1	2	8
White-crowned Sparrow	43	3	40	15	30
Harris' Sparrow	0	0	0	0	0
Eastern Meadowlark	27	26	16	0	22
Western Meadowlark	7	12	2	2	2
Brewer's Blackbird	0	0	0	0	0
Brown-headed Cowbird	0	0	1	0	0
TOTAL	**977**	**578**	**843**	**616**	**892**

Overall two transects, number 2 and 6, had bird sightings totaling over 1,000. These transects were not located near one another as one was on the WLWA and the other on the Waterline. The minimum number of birds sighted per day on each of these transects was 5 and 23 respectively. The maximum number of birds sighted on these transects per day was 268 and 195 respectively.

Three transects had bird sightings totaling from 900-1,000. These transects, 5, 8, and 10 were all located on the WLWA. However they were spread out from each other in the southeastern, northwestern, and northeastern corners respectively of the WLWA. As previously mentioned, transect 10 was located near the Enclosure area but did not run through it. The minimum number of birds sighted on these transects per day was 27, 1, and 5 respectively. The maximum number of birds sighted on transects 5, 8, and 10 per day was 205, 260, and 224 respectively.

Transects 4, 7, and 9 had moderate total numbers of birds sighted ranging from 655-784. Both their minimum and maximum numbers for birds sighted per day are lower than the transects with higher total numbers. These transects were not located together but were scattered in the southern, northern, and western areas of the WLWA. However, these transects were closer to the WIPP site than the transect lines with highest total number of birds sighted.

Transect lines 1 and 3 had the lowest total number of birds sighted over the survey period as well as day to day. Transect line 1 was on the Waterline and line 3 was in the southwestern area of the WLWA near transect line 4. Lines 1 and 3 had the lowest maximum number of birds sighted per day, 73 and 54 respectively. Comparing day to day numbers of individuals sighted, these two transect lines usually had the fewest birds recorded.

Table 5-9 lists the total numbers of birds sighted per transect line throughout the survey period. Also this table presents the mean number of birds sighted per transect line, with the minimum and maximums for each line per day.

Table 5-9. Avian Sightings/Transect Line for the Survey Period

Line No.	Total No. Birds Sighted/Line	Mean No. Individual Birds/Line	Maximum No. Birds/Line	Minimum No. Birds/Line
1	196	19.6	5	73
2	1017	101.7	5	268
3	302	30.2	6	54
4	784	78.4	2	165
5	937	93.7	27	205
6	1086	108.6	23	195
7	655	65.5	3	169
8	926	92.6	1	260
9	687	68.7	7	109
10	977	97.7	5	224

In addition to comparing total numbers of birds sighted per transect line, Table 5-10 summarizes the number of different species sighted per transect line over the entire survey period. The two transect lines with overall lower abundances of birds have lower species diversity also. However after dismissing these transect lines, species diversity is relatively similar across the other transect lines.

The most diverse transect lines, based on the maximum number of different species sighted in one day, are transect 8 and 10. Other transect lines with moderate to high diversity of species per day include transect lines 5 and 6. Most of the other lines all have at least several day with diversities over 15, with the exception of the transect lines 1 and 3. Again lines 1 and 3 had the lowest total numbers of birds sighted over the survey period.

Table 5-10. Numbers of Avian Species Sighted at Transect/Day

Day	Line 1	Line 2	Line 3	Line 4	Line 5	Line 6	Line 7	Line 8	Line 9	Line 10
1	4	4	11	14	20	19	10	14	16	18
2	6	10	4	2	12	11	3	1	5	4
3	5	10	6	10	11	10	6	14	8	15
4	3	13	10	10	20	18	10	17	16	9
5	2	9	13	15	15	14	14	11	7	16
6	6	12	7	18	15	18	18	17	17	16
7	6	13	10	11	18	15	14	14	14	13
8	5	9	7	12	20	19	14	22	18	19
9	6	16	7	16	13	13	12	17	17	14
10	11	16	8	6	11	18	8	15	14	22

The GPS locations of the endpoints for the avian transect lines are given in Table 5-11. Most endpoints were nearly visible from the start point, however, some had vegetation in path. The staring points are labeled as "Stake A" while the endpoints are "Stake B".

Table 5-11. Longitude and Latitude Locations for Avian Transect Lines

Line	Stake	North	West	Elevation (ft)	Pl/min elev(ft)
1	a	32°47.009'	103°48.861'	3870	165
1	b	32°46.855	103°48.638'	4120	289
2	a	32°35.591'	103°47.884'	3565	125
2	b	32°35.373'	103°47.907'	3675	190
3	a	32°20.478'	103°48.428'	2925	322
3	b	32°20.616	103°48.387'	3154	138
4	a	32°21.309'	103°47.746'	3713	294
4	b	32°21.054'	103°47.762'	3361	216
5	a	32°20.850	103°46.036'	3481	211
5	b	32°21.050	103°46.135'	3689	170
6	a	32°23.542'	103°46.283'	3566	260
6	b	32°23.547'	103°46.540'	3616	105
7	a	32°23.335'	103°47.446'	3200	188
7	b	32°23.605'	103°47.476'	3838	164

Table 5-11. Longitude and Latitude Locations of Avian Transect Lines

Line	Stake	North	West	Elevation (ft)	Plus/minus Elev(ft)
8	a	32°23.396'	103°49.515'	3604	162
8	b	32°23.573'	103°49.373'	3342	136
9	a	32°22.898'	103°47.933'	3550	285
9	b	32°22.859'	103°48.187'	3540	203
10	a	32°23.023'	103°45.727'	3714	160
10	b	32°22.814'	103°45.742'	3414	610

5.3 RAPTOR SURVEY RESULTS

No threatened or endangered raptor species were sighted during the avian transects nor the raptor surveys. There were a total of 6 raptor surveys conducted, each one week apart. Loggerhead shrikes were also counted on the raptor surveys as they were easily identifiable on this type of survey and abundant on the WLWA.

Table 5-12 summarizes the raptor species sighted during the survey. The list included both the common and scientific name. Several of these species were included in the avian transects also.

The most abundant raptors sighted were the Northern Harrier and the red-tailed hawk. In general, more Swainson's Hawks were sighted in the beginning of the survey (late summer) and red-tailed hawks became more common in the fall. This trend was probably due to migration behaviors of both species. The golden eagle, burrowing owl, and ferruginous hawk were among the species sighted the least. Table 5-13 summarizes the number of each species sighted throughout the survey period on the raptor surveys only.

Table 5-12. Raptor Species Sighted on the Raptor Surveys.

Common Name	Scientific Name
Golden Eagle	*Aquila chrysaetos*
Northern Harrier	*Circus cyaneus*
Harris' Hawk	*Parabuteo unicinctus*
Swainson's Hawk	*Buteo swainsoni*
Red-tailed Hawk	*Buteo jamaicensis*
Ferruginous Hawk	*Buteo regalis*
American Kestrel	*Falco sparverius*
Prairie Falcon	*Falco mexicanus*
BurrowingOwl	*Athene cunicularia*

Table 5-13. Total Number of Individual Species Sighted on Raptor Surveys

Species	Number
Golden Eagle	1
Northern Harrier	35
Harris' Hawk	16
Swainson's Hawk	12
Red-tailed Hawk	33
Ferruginous Hawk	2
American Kestrel	11
Prairie Falcon	9
Burrowing Owl	2
Unidentified Falcon	1
Unidentified Hawk	1
TOTAL	**123**

The raptor surveys varied from survey to survey, but in general 4-8 different species were sighted, with approximately 10-35 species per survey. Surveys complimented the transect lines and added several species to our bird lists. For example, the golden eagle was only sighted on the raptor survey.

5.4 VEGETATION RESULTS

No threatened or endangered plants were found during the vegetation survey. A list of the plants recorded during the survey is presented in Table 5-14. This list was compiled from quadrat data and line intercept data.

Table 5-14. Plant Species Sighted on WLWA or the Waterline

Common Name	Scientific Name
Broomrape	*Orobanche multiflora*
Annual Buckwheat	*Eriogonum annuum*
Christmas Cholla	*Opuntia leptocaulis*
Dalea	*Dalea spp.*
Plains Yucca	*Yucca campestris*
Euphorbia	*Euphorbia spp.*
Four-wing Saltbush	*Atriplex canescens*

Continued on next page

Table 5-14. Plant Species Sighted on WLWA or the Waterline

Common Name	Scientific Name
Bindweed Heliotrope	*Heliotropium convolvulaceum*
Havard Shin Oak	*Quercus havardii*
Limoncillo	*Pectis angustifolia*
Mat Bluets	*Houstonia humifosa*
Honey Mesquite	*Prosopis glandulosa*
Plains Blackfoot	*Melampodium leucanthum*
Prickly Pear	*Opuntia engelmannii*
Prairie Sunflower	*Helianthus petiolaris*
Pigweed	*Amaranthus palmeri*
Russian Thistle	*Salsola kali*
Drummond Soapberry	*Sapindus drummondii*
Arizona Snakecotton	*Froelichia arizonica*
Silverleaf Nightshade	*Solanum elaeagnifolium*
Stickleaf	*Mentzelia humilis*
Snakeweed	*Gutierrizia sarothrae*
Spectacle Pod	*Dithyrea wislizenii*
Sand Sagebrush	*Artemisia filifolia*
Southwest Rabbitbrush	*Chrysothamnus pulchellus*
Texas Croton	*Croton texensis*
Thickleaf Goosefoot	*Chenopodium dessicatum*
Tumble Ringwing	*Cyclocoma atriplicifolium*
Whiteball Acacia	*Acacia texensis*
Yellow Woollywhite	*Hymenopappus flavescens*

The following Tables 5-15 through 5-17 are lists of the numbers of species recorded in each quadrat. The most commonly recorded plants in the survey were lemonseal, plains blackfoot, Arizona snakecotton, shinnery oak, sand sagebrush, dune yucca, and dalea. The maximum number of plants counted in one quadrat was 869 while the minimum was 196 plants.

Table 5-15. Species Recorded on Vegetation Quadrats (1-7)

SPECIES	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	Q 7
Broomrape	0	0	0	0	0	0	0
Annual Buckwheat	1	0	5	2	3	0	0
Christmas Cholla	0	0	0	0	0	0	0
Dalea	2	4	5	0	0	0	0
Plains Yucca	11	1	6	7	18	21	7
Euphorbia	1	3	17	0	24	5	0
Four-wing Saltbush	0	0	1	2	8	0	0
Bindweed Heliotrope	0	0	0	0	0	1	0
Limoncillo	204	20	86	61	70	16	2
Mat Bluets	0	0	0	11	0	0	0
Honey Mesquite	2	14	0	2	0	13	7
Plains Blackfoot	5	0	2	23	0	34	104
Prickly Pear	0	0	0	0	0	0	0
Prairie Sunflower	0	0	0	0	2	0	0
Pigweed	0	0	0	0	1	1	0
Russian Thistle	0	1	0	0	0	0	0
Drummond Soapberry	0	0	0	0	0	0	0
Arizona Snakecotton	0	0	0	35	51	0	14
Silverleaf Nightshade	0	0	0	0	0	0	0
Stickleaf	0	0	0	0	0	0	0
Snakeweed	1	0	11	9	0	13	24
Havard Shin Oak	116	234	268	6	326	130	29
Spectacle Pod	1	2	2	2	8	18	3
Sand Sagebrush	18	4	10	37	35	5	0
Southwest Rabbitbrush	0	0	2	29	0	1	0
Texas Croton	0	0	0	4	0	0	23
Thickleaf Goosefoot	0	0	2	0	0	0	0
Tumble Ringwing	0	0	0	0	0	0	0
Whiteball Acacia	0	0	0	0	1	0	0
Yellow Woollywhite	0	0	0	0	0	0	2
Unidentified	0	1	2	3	1	0	5
TOTAL	362	284	419	233	548	258	220

Table 5-16. Species Recorded on Vegetation Quadrats (8-14)

SPECIES	Q 8	Q 9	Q 10	Q 11	Q 12	Q 13	Q 14
Broomrape	0	0	1	0	0	0	0
Annual Buckwheat	1	7	8	1	1	7	21
Christmas Cholla	0	0	0	1	0	0	0
Dalea	2	4	3	39	5	2	0
Plains Yucca	0	29	20	18	13	5	0
Euphorbia	0	1	2	1	0	6	0
Four-wing Saltbush	0	2	0	19	4	3	7
Bindweed Heliotrope	0	0	0	0	0	0	0
Limoncillo	0	38	30	64	28	17	37
Mat Bluets	0	0	0	0	0	0	0
Honey Mesquite	3	11	1	0	0	2	1
Plains Blackfoot	0	0	2	0	0	1	0
Prickly Pear	0	0	0	0	0	0	0
Prairie Sunflower	0	20	0	0	0	3	0
Pigweed	0	0	0	0	0	0	1
Russian Thistle	0	0	0	0	0	0	0
Drummond Soapberry	0	0	0	0	0	0	0
Arizona Snakecotton	0	0	1	2	0	4	0
Silverleaf Nightshade	0	0	1	0	0	0	0
Stickleaf	0	0	1	0	0	0	0
Snakeweed	10	31	5	0	0	3	3
Havard Shin Oak	224	4	175	282	301	114	258
Spectacle Pod	9	5	2	5	3	2	3
Sand Sagebrush	11	0	11	11	18	14	28
Southwest Rabbitbrush	9	0	1	0	0	2	2
Texas Croton	0	4	0	1	0	0	1
Thickleaf Goosefoot	0	0	0	0	0	0	0
Tumble Ringwing	0	0	0	0	0	0	0
Whiteball Acacia	0	0	0	0	0	0	0
Yellow Woollywhite	0	20	1	9	0	5	6
Unidentified	2	0	0	8	1	1	0
TOTAL	271	176	265	461	374	191	368

Table 5-17. Species Recorded on Vegetation Quadrats (15-20)

SPECIES	Q 15	Q 16	Q 17	Q 18	Q 19	Q 20
Broomrape	0	0	0	0	0	0
Annual Buckwheat	8	0	2	10	3	0
Christmas Cholla	0	0	0	0	0	0
Dalea	5	0	2	2	14	0
Plains Yucca	0	18	5	20	1	7
Euphorbia	0	17	0	24	5	2
Four-wing Saltbush	0	0	15	0	0	0
Bindweed Heliotrope	0	0	0	0	0	0
Limoncillo	0	3	30	0	0	0
Mat Bluets	0	0	0	0	0	0
Honey Mesquite	0	12	0	0	0	0
Plains Blackfoot	0	0	4	0	0	0
Prickly Pear	0	0	1	0	2	3
Prairie Sunflower	7	0	6	4	1	33
Pigweed	0	1	0	0	0	13
Russian Thistle	0	0	0	0	0	0
Drummond Soapberry	2	0	0	0	0	0
Arizona Snakecotton	0	0	40	0	0	0
Silverleaf Nightshade	0	0	0	0	0	0
Stickleaf	3	2	0	17	0	0
Snakeweed	0	29	0	0	0	0
Havard Shin Oak	758	110	96	533	397	285
Spectacle Pod	5	0	2	6	6	0
Sand Sagebrush	28	0	18	1	4	8
Southwest Rabbitbrush	47	0	0	5	1	7
Texas Croton	0	4	0	0	0	0
Thickleaf Goosefoot	0	0	0	0	0	0
Tumble Ringwing	0	0	0	0	0	8
Whiteball Acacia	0	0	0	0	0	0
Yellow Woollywhite	1	0	0	0	0	0
Unidentified	5	0	2	17	5	0
TOTAL	869	196	223	639	439	366

Table 5-18. GPS Locations for Vegetation Transect/Quadrat Endpoints.

Line	Stake	Waypoint	North	West	Elevation (ft)	Plus/minus Elev (ft)
1	A	VEG1A	32°21.354'	103°47.641'	3275	149
1	B	VEG1B	32°21.287'	103°47.651'	3650	152
2	A	VEG2A	32°21.125'	103°49.124'	3590	121
2	B	VEG2B	32°21.128'	103°49.108'	3102	158
3	A	VEG3A	32°20.609'	103°46.726'	3179	492
3	B	VEG3B	32°20.630'	103°46.703'	3417	107
4	A	VEG4A	32°23.558'	103°46.087'	3556	225
4	B	VEG4B	32°23.709'	103°46.072'	3466	108
5	A	VEG5A	32°23.392'	103°46.957'	3606	239
5	B	VEG5B	32°23.396'	103°46.952'	3421	509
6	A	VEG6A	32°23.356'	103°47.504'	3377	99
6	B	VEG6B	32°23.362'	103°47.462'	3638	105
7	A	VEG7A	32°23.024'	103°48.457'	3567	111
7	B	VEG7B	32°23.086'	103°48.466'	3112	388
8	A	VEG8A	32°23.811'	103°49.539'	3205	492
8	B	VEG8B	32°23.796'	103°49.515'	3379	115
9	A	VEG9A	32°23.261'	103°49.511'	3449	492
9	B	VEG9B	32°23.226'	103°49.525'	3520	195
10	A	VEG10A	32°22.858'	103°47.903'	3420	145
10	B	VEG10B	32°22.881'	103°47.930'	3627	157
11	A	VEG11A	32°23.034'	103°45.590'	3414	128
11	B	VEG11B	32°23.028'	103°45.568'	3471	140
12	A	VEG12A	32°21.806'	103°48.865'	3740	510
12	B	VEG12B	32°21.800'	103°48.886'	2465	492
13	A	VEG13A	32°21.459'	103°46.440'	3310	120
13	B	VEG13B	32°21.480'	103°46.384'	3657	121
14	A	VEG14A	32°20.910'	103°45.684'	3481	204
14	B	VEG14B	32°20.888'	103°45.650'	3899	189
15	A	VEG15A	32°36.051'	103°47.881'	3850	227
15	B	VEG15B	32°36.072'	103°47.896'	3327	241
16	A	VEG16A	32°35.601'	103°47.864'	3614	158
16	B	VEG16B	32°35.601'	103°47.869'	3715	168
17	A	VEG17A	32°23.111'	103°46.038'	3414	166
17	B	VEG17B	32°23.093'	103°46.075'	3407	189
18	A	VEG18A	32°46.527'	103°48.297'	3881	152
18	B	VEG18B	32°46.519'	103°48.325'	4047	150
19	A	VEG19A	32°46.626'	103°48.451'	4090	118
19	B	VEG19B	32°46.637'	103°48.477'	4061	108
20	A	VEG20A	32°46.968'	103°48.835'	3515	340
20	B	VEG20B	32° 47.007'	103°48.882'	3966	289

5.5 AMPHIBIAN RESULTS

Observations at several of the water encatchments and ponds near the WIPP site and on the WLWA yielded information on amphibian species. In several ponds there were no adult toads sighted but several egg masses, usually in one section of the pond. When toads were sighted, they were captured, identified, and measured. The total body length was recorded, sex when possible, and also any unusual characteristics. Table 5-19 summarizes the species sighted with both common and scientific names.

Table 5-19. Amphibian Species Sighted

Common Name	**Scientific Name**
Plains Spadefoot	*Spea bombifrons*
Couches Spadefoot	*Scaphiopus couchii*

Of the two toads that were sighted, the Couches spadefoot was the most common. The measurements on this toad ranged from .069-.081m from head to tail. The plains spadefoot was not as common, with only two individuals sighted. These individuals measured .0052 and .0059m.

6.0 DISCUSSION

No Threatened or Endangered species were found on the WLWA during the 1996 survey. On the WIPP waterline, the sand dune lizard was the only T/E species found. The sand dune lizard has been previously reported to occur north of the WLWA and was expected to be recorded during this survey. The data reported here support the conclusions of other studies (i.e., DOE, 1980) that found no T/E species on the WLWA. Taken together, these data suggest that dense and permanent populations of T/E species do not presently occur on WIPP lands.

Juvenile sand dune lizard (*Sceloporus arenicolus*) in hand. This individual was found in an exhausted state in the open and was left in heavy cover.

The 1996 surveys involved examinations of different taxa, utilized several different survey methods, and were rigorous in terms of observer training, field methods, and data collection. The length and timing of the survey, however, warrants some discussion. The August to November survey represents a truncated survey period and a year-long survey period that covered all phases of activity by T/E species would have been ideal. However, several factors suggest that a longer survey period may not have yielded different conclusions. Although the 1996 survey did not cover peak breeding periods for most birds, the lists of T/E species provided by agencies (Appendix B) did not contain any avian species that could realistically be expected to breed on WIPP lands. Reptile surveys done in late summer (during peak activity periods for many reptiles and amphibians) should have been very timely. Among plants, the two cacti of concern were detectable during the survey period. Only gypsum wild buckwheat would have been more thoroughly surveyed during a period inclusive of spring and summer. Additional work to survey herbaceous plants during growth and flowering periods would strengthen the floristics data presented in this report.

6.1 FACTORS INFLUENCING THE PRESENCE OF T/E SPECIES

For the majority of T/E species listed for Eddy and Lea Counties (See Table 3-1 and Appendix B), their recorded absences on WIPP lands are probably due to a lack of suitable habitat. Habitat requirements for species are presented in Section 4.0. Potential exceptions are the sand dune lizard and Aplomado Falcon (discussed in Sections 6.1.1 and 6.1.2 respectively).

For avian species that were expected to use the area in nonbreeding contexts (during migration, dispersal, or wandering movements), such as the Southwestern Willow Flycatcher, Bell's Vireo, and Baird's Sparrow, a lack of observations does not preclude their potential and occasional use of WIPP lands. It is important to recognize the value of maintaining and enhancing nonbreeding habitat as a means of contributing to T/E species conservation. It is recommended that WIPP formulate an approach to the maintenance of habitat for winter migrant birds. Information is needed, however, about how WIPP lands are used by T/E migrants, or their close taxonomic relatives. In the interim, maintaining the integrity of historic vegetation associations on the WLWA would provide a basic step toward a more an enhanced habitat.

6.1.1 Sand Dune Lizard

The absence of the sand dune lizard from the WLWA is puzzling. The range boundaries of the lizard are relatively close to the site and dune habitat that appears suitable for the lizard is present on the WLWA. The closest population to the WIPP site found during the 1996 survey was located over 40 km (25 mi) north of the site. Fitzgerald et al. (1995) found other localized sub-populations that occurred closer to WIPP and were within 29 km (18 mi) of the WLWA. They found, however, that the species did not extend south of Highway 62/180 in the vicinity of WIPP.

There were no indications that sand dune lizards have ever been found on the WLWA. Gennaro (reviewed in DOE, 1980) collected reptiles in and near the WLWA and did not list *S. graciosis* (the former species designation of *S. arenicolus)* as a species encountered. Preliminary surveys by researchers working with the sand dune lizard were also unsuccessful in finding the species on the WLWA (WIPP Land Use Coordinator, pers. com.)

A more recent study of reptile communities on the WLWA was done in 1995 (E. Akers, unpub. data). The study design was based on the placement of 72 pitfall traps and resulted in a list of 16 species of reptiles and amphibians that were found in traps. The sand dune lizard was not among the species recorded during the study (E. Akers, unpub. data).

At least two explanations are possible for the observed absence of the species from the WLWA:

- First, it is possible that the lizard is present on the site, either in places that were not surveyed or in very low numbers. Because the sand dune lizard appears to have distinct habitat requirements and because quadrants were placed in the most likely areas to support the species; the possibility that the species occurs in dense sub-populations on the WLWA is unlikely in our view.

  However, low densities can be expected at the periphery of a species range and the possibility remains that lizards occur in very low numbers somewhere on the WLWA. The WIPP personnel in the Environmental Monitoring Program should continue to be vigilant for the species. The past cooperation with researchers interested in searching for the sand dune lizard on WIPP lands (WIPP Land Use Coordinator, pers. com.) should be continued.

- A second explanation is that the 1996 survey results accurately reflect the absence of the species from the WLWA.

Patternless morph of the side-blotched lizard *(Uta stansburiana)* encountered on the WLWA during surveys.

Both explanations beg the question of why the species is not present in suitable habitat on WLWA. Fitzgerald et al. (1995) investigated the range of the sand dune lizard and found that only about 50% of seemingly suitable habitat in New Mexico was occupied. Two factors may account for the observed presence of unoccupied habitat:

- Sand dune lizards may require habitat features that are not yet apparent to researchers and current habitat profiles for the species may be incomplete. Areas that have been considered as suitable by researchers may actually be marginal or non-habitat for the species. If this is the case, the present range may represent the extent of suitable habitat for the species.

- A second possibility is that the species range may have been reduced in the past due to unfavorable ecological conditions caused by natural factors (i.e., extended drought), artificial influences (i.e., habitat alteration due to human activities), or sociobiological factors (i.e., competition with other species). Although sand dune lizards are negatively impacted by treatments of rangeland with chemical herbicides (Snell et al., 1985), only a small portion of the WLWA has been chemically treated (WIPP Land Use Coordinator, pers. com.) within the last twenty years. Other human-caused factors that may have led to the extirpation of the species are unknown. A discussion of natural factors that may have led to a shrinking of the species range would be equally speculative.

In the second scenario, the lizard should return to its former range when conditions become favorable again. Dispersing and locating suitable habitat in which to breed, however, may occur slowly for sand dune lizards due to their low motility and narrow habitat preferences. Dispersal entails significant risks for any animal due to the threat of predation and the possibility of not being able to locate suitable habitat. These risks may be significant for the sand dune lizard because it appears to be closely tied to a complex of habitat features including dunes, blowouts, and shinnery-oak vegetation.

Dune complexes are scattered in the WIPP area and are separated by extensive areas lacking in one or more of these features. The survivorship of dispersing lizards may be low when crossing areas that lack adequate escape cover in which to evade predators. The wariness of sand dune lizards suggests that predation pressure is high even in preferred habitats. It is possible that predators effectively restrict the species to occupied habitat. A related idea is that human-caused habitat changes may have led to increases in predator populations (e.g., Chihuahuan ravens [*Corvus cryptoleucus*]), a factor that could further stultify dispersal by lizards.

The absence of the sand dune lizard from the WLWA should also be considered in light of opportunities for species management and conservation. If suitable habitat is present on the WLWA, the opportunity for a translocation of individuals into the WLWA exists that could be of value in helping to answer questions regarding habitat characteristics and would increase the range of the species. Most importantly, a successful translocation would establish a sub-population in an area that is buffered from oil and gas activities and is subject to a high level of environmental monitoring. For an endemic species with a limited distribution that occurs in areas subject to impactive land uses, establishing a sub-population in a protected area could be regarded as a useful step in species conservation. The designation of the translocated population as an experimental population would ensure that its presence would pose no problems in the operation of the WIPP facility.

6.1.2 Raptors

Migratory birds such as the Peregrine Falcon and Bald Eagle are most likely to use the WIPP only on a temporary basis, perhaps as a foraging area. The value of WIPP lands to serve as a place for transient T/E raptors to hunt and winter should not be overlooked. Mortality is high during migration and WIPP lands could provide food resources and habitat that are not affected by the dominant land uses in the area. This aspect should be considered when planning land management activities on the WLWA.

The WLWA may contain habitat that is suitable for the Aplomado Falcon. Historic information suggests that Aplomado Falcons nested in mesquite-grassland associations in the southwest (Snyder and Snyder, 1991). Although the species is presently extirpated in the U.S., attempts to repatriate it in the southwestern U.S. have occurred recently. The WLWA may provide a useful site for reintroduction efforts. Again, the legal designation of released birds as an experimental population would preclude conflicts between WIPP operation and the Endangered Species Act. The involvement of WIPP in a release program for the species would increase the public profile of DOE and WIPP among biologists, Federal agencies, and the interested public.

The potential for the WLWA to serve as a site for the conservation of habitats and wildlife should be emphasized. In most instances, maintaining and enhancing the natural character of the WLWA can be done without conflicting with the mission of WIPP. The occasional presence of T/E raptors and other species, in addition to the rich population of wildlife in the WIPP area, presents an excellent opportunity to enhance recreational opportunities for bird watchers and nature enthusiasts. In addition, the WIPP area also affords hunters great opportunities due to the presence of numerous game species. Recognition and development of this aspect of WIPP by managers represents a contribution to local communities, the State of New Mexico, and, ultimately, to conservation on a global scale. The present policy taken by DOE and WIPP to monitor and manage the unique raptor community in the WIPP area is a positive indication that balanced resource management will continue on the WLWA.

7.0 REFERENCES

Anderson, B.W. and R.D. Ohmart, 1981, *Comparisons of Avian Census Results using Variable Distance Transect and Variable Circular Plot Techniques,* Studies in Avian Biology No. 6:186-192.

Bart, J., 1985, *Causes of Recording Errors in Singing Bird Surveys,* Wilson Bull. 97:161-172.

Benson, L., 1982, *The Cacti of the United States and Canada*, Stanford University Press, Stanford, California.

Brown, L., and D. Amadon, 1968, *Eagles, Hawks and Falcons of the World, Vol. 2,* Country Life Books, London.

Bull, E., 1981, *Indirect Estimates of Abundance of Birds*, In: Ralph. C.J. and J.M. Scott (eds.), Estimating Numbers of Territorial Birds, Studies in Avian Biology No. 6:76-80.

Cade, T.J., 1982, *The Falcons of the World,* Cornell University Press, Ithica, New York.

Censky, E. J., 1986, *Sceloporus graciosus*. Catalogue of American Amphibians and Reptiles: 386.1-386.4.

Clark, W.S., and B.K. Wheeler, 1987, *A Field Guide to Hawks of North America,* Houghton Mifflin Company, Boston, Massachusetts.

Conant, R., and J. T. Collins, 1991, *A Field Guide to Reptiles and Amphibians of Eastern and Central North America*, Third Edition, Houghton Mifflin Co., Boston, Massachusetts.

Crump, M.L. and N.J. Scott, 1981, *Visual Encounter Surveys,* In: Heyer, W.R., M.A. Donnelly, R.W. McDiarmid, L.A.C. Haye, and M.S. Foster (eds.), Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians, Smithsonian Institution Press, Washington.

Cyr, A., 1981, *Limitation and Variability in Hearing Ability in Censusing Birds,* In: Ralph. C.J. and J.M. Scott (eds.), Estimating Numbers of Territorial Birds, Studies in Avian Biology No. 6:327-333.

Dawson, D. G., 1981, *Counting Birds for a Relative Measure (Index) of Density,* In: Ralph. C.J. and J.M. Scott (eds.), Estimating Numbers of Territorial Birds, Studies in Avian Biology No. 6: 12-16.

Degenhardt, W. G., and K. L. Jones, 1972, *A New Sagebrush Lizard, Sceloporus graciosus, from New Mexico and Texas*, Herpetologica 28(3):212-217.

Degenhardt, W. G., C. W. Painter, and A. H. Price, 1996, *The Amphibians and Reptiles of New Mexico*, University of New Mexico Press, Albuquerque, New Mexico.

DeSante, D.F., 1981, *A Field Test of the Variable Circular-Plot Censusing Technique in a California Coastal Scrub Breeding Bird Community.* In: Ralph. C.J. and J.M. Scott (eds.), Estimating Numbers of Territorial Birds, Studies in Avian Biology No. 6:177-185.

DOE, 1980, *Biological Assessment: Potential Impacts on State-Designated Endangered Species from the Proposed Construction and Operation of the Waste Isolation Pilot Plant (WIPP),* U.S. Department of Energy, Albuquerque, New Mexico.

DOE/SEIS-0026-S-Z, Waster Isolation Pilot Plant Disposal Phase Draft Supplement Environmental Impact Statement, November 1996.

DOE/WIPP 93-004, Waste Isolation Pilot Plant Land Management Plan.

DOE/WIPP 96-2194, Waste Isolation Pilot Plant Envrionmental Monitoring Plan.
Edwards, D.K., G.L. Dorsey and J.A. Crawford, 1981, *A Comparison of Three Avian Census Methods,* In: Ralph. C.J. and J.M. Scott (eds.), Estimating Numbers of Territorial Birds, Studies in Avian Biology No. 6:170-176.

Eckman, J., 1981, *Problems of Unequal Variability,* In: Ralph. C.J. and J.M. Scott (eds.), Estimating Numbers of Territorial Birds, Studies in Avian Biology No. 6:230-234.

Edwards, D.K., G.L. Dorsey, and J.A. Crawford. 1981, *A Comparison of Three Avian Census Methods,*Studies in Avian Biology No. 6:170-176.

Emlen, J.T., 1971, *Population Densities of Birds Derived from Transect Counts,* Auk 88:323-342.

Evans, D.L., 1982, *Status Report on Twelve Raptors,* USDI Fish and Wildl. Ser. Spec. Rep.-Wildl. No. 238. Washington, D.C.

Fannes, C.A. and D. Bystrak, 1981, *The Role of Observer Bias in the North American Breeding Bird Survey,* In: Ralph. C.J. and J.M. Scott (eds.), Estimating Numbers of Territorial Birds, Studies in Avian Biology No. 6:353-359.

Fitzgerald, L. A., D. S. Sias, H. L. Snell, and C. W. Painter, 1995, *Distribution Survey of the Dunes Sagebrush Lizard, Sceloporus arenicolus, in Southeastern New Mexico, Progress Report, 1994 Field Studies*, Department of Biology, University of New Mexico, Albuquerque, NM, and Endangered Species Program, New Mexico Department of Game and Fish, Santa Fe, New Mexico.

Franzreb, K.E., 1981, *A Comparative Analysis of Territorial Mapping and Variable-Strip transect Censusing Methods,* In: Ralph. C.J. and J.M. Scott (eds.), Estimating Numbers of Territorial Birds, Studies in Avian Biology No. 6:164-169.

Fuller, M.R. and J.A. Mosher, 1981, *Methods of Detecting and Counting Raptors: a Review,* In: Ralph. C.J. and J.M. Scott (eds.), Estimating Numbers of Territorial Birds, Studies in Avian Biology No. 6:235-246.

Garrett, J., and D. G. Barker, 1987, *A Field Guide to Reptiles and Amphibians of Texas*, Texas Monthly Press, Inc., Austin, Texas.

Gates, C.E., 1981, *Optimizing Sampling Frequency and Numbers of Transects and Stations,* In: Ralph. C.J. and J.M. Scott (eds.), Estimating Numbers of Territorial Birds, Studies in Avian Biology No. 6:399-404.

Groskin, H., 1952, *Observations on Duck Hawks nesting on man-made structures,* Auk 69:246-253.

Grossman, M.L., and John Hamlet, 1964, *Birds of Prey of the World,*Bonanza Books, New York.

Hector, D.P., 1980, *Our rare falcon of the desert grassland,* Birding 12 (3):93-102.

Hickey, J.J. (ed.), 1969, *Peregrine Falcon Populations: Their Biology and Decline,* Univ. of Wis. Press, Madison.

Hutto, R.L. and S.L. Mosconi, 1981, *Lateral Detectability Profiles for Line Transect Bird Censuses: Some Problems and Alernative,* In: Ralph. C.J. and J.M. Scott (eds.), Estimating Numbers of Territorial Birds, Studies in Avian Biology No. 6:382-387.

Jones, K.B., 1986, *Amphibians and Reptiles,* In: Cooperrider, A.Y., R.J. Boyd, H.R. Stuart (eds.), Inventory and Monitoring of Wildlife Habitat, U.S. Dept. of the Interior, Bureau of Land Management, Denver, CO.

Kepler, C.B. and J.M. Scott, 1981, *Reducing Bird Count Variability by Training Observers,* In: Ralph. C.J. and J.M. Scott (eds.), Estimating Numbers of Territorial Birds, Studies in Avian Biology No. 6:366-371.

Leal, D.A, A.B. Montoya, and K.E. Cathey, 1995, *Survey Methodology for the Northern Aplomado Falcon (Falco femoralis septentrionalis),* Draft Publication, U.S. Fish and Wildlife Service, Ecological Services Field Office, Austin, TX.

Ligon, J. D., and D. C. Cole, 1978, *Densities and Species Composition of the Avifauna of the Los Medaños WIPP Site, Southeastern New Mexico*, In Annual Report of Biological Investigations at the Los Medaños Waste Isolation Pilot Plant (WIPP) Area of New Mexico for FY1978, (Best, T.L. and D.W. Jackson, eds.), A Report submitted to Sandia Laboratories under contract nos. 05-7862, 07-1489, 07-8239, 07-9252, and 13-0806, Albuquerque, New Mexico.

Limerick, S., 1984, *Gypsum Wild Buckwheat (Eriogonum gypsophilum) Recovery Plan*, Office of Endangered Species, U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

Lowe, C.H. and P.C. Rosen, 1991, *Sensitive Ecosystems Program (SEP) Lizard Monitoring Protocol,* Unpubl. Draft Report to Organpipe Cactus National Monument. Nat. Park Serv., NBS, Univ. of Ariz., Tucson, AZ.

Mader, W.J., 1981, *Notes on nesting raptors of the llanos in Venezuela,* Condor 83:48-51.

Martin, W.C., 1978, *Floristics of the Los Medaños WIPP Study Area*, In (Best, T.L. and D.W. Jackson, eds.), Annual Report of Biological Investigations at the Los Medaños Waste Isolation Pilot Plant (WIPP) Area of New Mexico for FY1978, A Report submitted to Sandia Laboratories under Contracts 05-7862, 07-1489, 07-8239, 07-9252, and 13-0806, Albuquerque, New Mexico.

Martin, W. C., and C. R. Hutchins, 1980, *A Flora of New Mexico*, J. Cramer, Hirschberg, Germany.

Mayfield, H.F., 1981, *Problems in Estimating Population Size Through Counts of Singing Males,* In: Ralph. C.J. and J.M. Scott (eds.), Estimating Numbers of Territorial Birds, Studies in Avian Biology No. 6:220-224.

Murray, R., 1995, *Amphibian and Reptile Inventory,* In: Harris, L.K. and C.R. Swalbe (eds.), Wildlife Inventory of the Rincon Valley Heritage Project (U93007), Arizona Game and Fish Dept., Phoenix, AZ: 50-79.

National Geographic Society, 1987, *Field Guide to the Birds of North America*, Second Edition, The National Geographic Society, Washington, D.C.

Oelke, H., 1981, *Limitations of Estimating Bird Populations Because of Vegetation Structure and Composition,* In: Ralph. C.J. and J.M. Scott (eds.), Estimating Numbers of Territorial Birds, Studies in Avian Biology No. 6:316-321.

Powers, D.W., S.J. Lambert, S.E. Shaffer, L.R. Hill, and W.D. Weart (eds.), 1978, *Geological Characterization Report, Waste Isolation Pilot Plant (WIPP) Site, Southeastern New Mexico*, Sandia National Laboratories Report SAND78-1596, Albuquerque, New Mexico, Vol. 1 and 2.

Painter, C. W., 1991, *Preliminary Investigations of the Distribution and Natural History of the Rio Grande River Cooter (Pseudemys concinna gorzugi) in New Mexico,* Unpublished Report, New Mexico Department of Game and Fish to Bureau of Land Management, Carlsbad Resource District.

Raitt, R.J., 1981, *Introductory Remarks: Observer Variability.* In: Ralph. C.J. and J.M. Scott (eds.), Estimating Numbers of Territorial Birds, Studies in Avian Biology No. 6:326.

Ralph, C.J., G.R. Guepel, P. Pyle, T.E. Martin,and D.F. DeSante, 1993, *Handbook of Field Methods for Monitoring Landbirds*, Gen. Tech. Rep. PSW-GTR-144, Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Dept. of Ag.

Ratkowsky, A.V. and D.A. Ratkowsky, 1979, *A Survey of the Birds of the Mt. Wellington Range, Tasmania, during the Non-breeding Months,* Emu 78:223-226.

Reveal, J. L., 1976, *Eriogonum (Polygonaceae) of Arizona and New Mexico*, Phytologia 34:409-484.

Reynolds, R.T., J.M. Scott, and R.A. Nussbaum, 1980, *A Variable Circular-Plot Method for Estimating Bird Numbers*, Condor 82:309-313.

Robbins, C.S., 1981, *Effect of Time of Day on Bird Activity,* In: Ralph. C.J. and J.M. Scott (eds.), Estimating Numbers of Territorial Birds, Studies in Avian Biology No. 6:275-286.

Scott, J.M., F.L. Ramsey, and C.B. Kepler, 1981, *Distance Measurements as a Variable in Estimating Bird Numbers from Vocalizations,* In: Ralph. C.J. and J.M. Scott (eds.), Estimating Numbers of Territorial Birds, Studies in Avian Biology No. 6:334-340.

Sena, A. P., 1985, *The Distribution and Reproductive Ecology of Sceloporus graciosus arenicolus in Southeastern New Mexico*, Final draft, Ph.D. Dissertation, University of New Mexico, Albuquerque, New Mexico.

Sfera,S.J., Meyer, R.A., and T.E. Corman, 1995, *Arizona Partners in Flight: 1994 Southwestern Willow Flycatcher Survey,* Final Tech. Report 69, Nongame and Endangered Wildlife Program, Airz. Game and Fish Dept., Phoenix, Arizona.

Skirvin, A.A., 1981, *Effect of Time of Day and Time of Season on the Number of Observations and Density Estimates of Breeding Birds,* In: Ralph. C.J. and J.M. Scott (eds.), Estimating Numbers of Territorial Birds, Studies in Avian Biology No. 6:271-274.

Smith, H. M., and E. D. Brodie Jr. 1982, *A Guide to Field Identification Reptiles of North America*, Golden Press, New York, New York.

Snell, H.R., L.W. Gorum, M.W. Doles, and C.K. Anderson, 1981, *Results of Third Years (1993) Research on the Effect of Shinnery Oak Removal on the Dunes Sagebrush Lizard, Sceloporus arenicolus, in New Mexico,* Report submitted to New Mexico Department of Game and Fish, New Mexico.

Snyder, N. and H. Snyder, 1991, *Birds of Prey: Natural History and Conservation of North American Raptors,* Voyageur Press, Inc., Stillwater, Minnesota.

Spellenberg, R., 1977, *A Report on the Investigation of Eriogonum gypsophilum and Haplopappus spinulosus subspecies laevis in the Vicinity of Brantley Reservoir, Eddy County, New Mexico.*

Stokes, D. and L. Stokes, 1996, *Stokes Field Guide to Birds,* Little, Brown and Company, New York, New York.

Svensson, S.E., 1977, *Land Use Planning and Bird Censuswork with Particular Reference to the Application of the Point Sampling Method*, Pol. Ecol. Stud. 3:99-117.

Svensson, S.E., 1981, *Do Transect Counts Monitor Abundance Trends in the Same Way as Territory Mapping in Study Plots?,* In: Ralph. C.J. and J.M. Scott (eds.), Estimating Numbers of Territorial Birds, Studies in Avian Biology No. 6:209-214.

Szaro, R.C. and M.D. Jakle, 1982, *Comparison of Variable Circular-Plot and Spot-Mapping Methods in Desert Riparian and Scrub Habitats.* Wilson Bull. 94:546-550.

Tennant, A, 1984, *The Snakes of Texas,* Texas Monthly Press, Austin, Texas.

Tennant, A, J. E. Werler, and B. Marvel, 1985, *A Field Guide to Texas Snakes*, Gulf Publishing Company, Houston, Texas.

Tibbets, T.J., M.K. Sogge, and S.J. Sferra, 1994, *A Survey Protocol for the Southwestern Willow Flycatcher (Empidonax trailii extimus),* Tech. Report NPS/NAUCPRS/NRTR-94/04, Nat. Park Serv., Colorado Plateau Res. Sta. at NAU, Flagstaff, AZ.

Tibbets, T.J., M.K. Sogge, and S.J. Sferra, 1996, *Protocol Changes and Criteria for Assessing Suitable Survey Habitat for the Southwestern Willow Flycatcher,* Arizona Partners in Flight Survey Training, May 1996, Supplement to NPS/NAUCPRS/NRTR-94/04, Nat. Park Serv., Colorado Plateau Res. Sta. at NAU, Flagstaff, AZ.

Tinkle, D. W., 1957, *Ecology, Maturation, and Reproduction of Thamnophus sauritus proximus*, Ecology 38(1):69-77.

Tomiakojc, L. and J. Verner, 1990, *Do Point Counting and Spot Mapping Produce Equivalent Estimates of Bird Densities?,* Auk 107:447-450.

Verner, J., 1985, *Assessment of Counting Techniques*, Current Ornithology, Vol. 2, Plenum Publ.

Verner, J. and K.A. Milne, 1989, *Coping with Sources of Variability when Monitoring Population Trends*, Ann. Zool. Fennici 26:191-199.

Verner, J. and K.A. Milne, 1990, *Analyst and Observer Variability in Density Estimates from Spot Mapping,* Condor, 92:313-325.

Verner, J. and L.V. Ritter, 1985, *A Comparison of Transects and Point Counts in Oak-Pine Woodlands of California,* Condor 87:47-68.

Verner, J. and L.V. Ritter, 1986, *Hourly Variation in Morning Point Counts of Birds,* Auk 103:117-124.

Walters, M., 1994, *Bird's Eggs,* Dorling Kindersley Book, Madison Ave., New York.

Warnock, B. H., and P. Koch, 1974, *Wildflowers of the Guadalupe Mountains and the Sand Dune Country, Texas*, Sul Ross State University, Alpine, Texas.

West, S., 1989, *Checklist of Birds for Eddy County, New Mexico,* Priv. Publ., P.O. Box 2489, Carlsbad, New Mexico.

Williamson, M. A., P. W. Hyder, and J. S. Applegarth, 1994, *Snakes, Lizards, Turtles, Frogs, Toads, and Salamanders of New Mexico*, Sunstone Press, Santa Fe, New Mexico.

Wooton, E. D., and P. C. Standley, 1913, *Description of New Plants Preliminary to a Report upon a Flora of New Mexico*, Contributions from the U.S. National Herbarium 16:109-196.

APPENDIX A

QUALIFICATIONS OF PRINCIPAL INVESTIGATORS

CURRICULUM VITAE

Name: James William Dawson

Address: P.O. Box 42273
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Phone: (520) 319-1745 (Home and Office)
(520) 319-1746 (FAX)

Birth Date: February 13, 1957

ACADEMIC PREPARATION

1978-1981 Arizona State University, Tempe, Arizona, USA
Completed majority of requirements for
Bachelor of Science in Wildlife Biology.

1982-1983 University of Arizona, Tucson, Arizona, USA
Division of Wildlife and Fisheries Science,
School of Renewable Natural Resources,
Bachelors of Science

1984-1988 University of Arizona, Tucson, Arizona, USA
Master of Science, Wildlife Ecology.

1989-1996 University of Arizona, Tucson, Arizona, USA
Ph.D. program, Wildlife Science.
Expected graduation date is December 1997

EMPLOYMENT

1996; Principal Investigator. 1996 WIPP Threatened and Endangered Species Survey. Department of Energy/Westinghouse Electric Corporation, Carlsbad, New Mexico. I designed and conducted a survey for threatened and endangered plants and animals on lands associated with the Waste Isolation Pilot Plant in southeastern New Mexico. The objective was to conduct an exhaustive search for T/E species in 3 months. A field strategy was designed that was cost/time efficient, and employed current and rigorous survey approaches. Custom databases were designed that reduced the likelihood of technician (type II) error and optimized the timely analysis of field data. Important species considered during surveys included bald eagles (*Haliaeetus leucocephalus)*, southwestern willow flycatchers (*Empidonax trailii extimus)*, sand dune lizards (*Sceloporus arenicolus)*, and gypsum wild buckwheat (*Eriogonum gypsophilium)*. I employed, trained, and supervised 6 field technicians and administrated all aspects of the project and contract. A final report was produced and submitted within 2 weeks of the end of field work.

1995; Principal Investigator. WIPP Raptor Research and Management Program, Department of Energy/Westinghouse Electric Corporation, Carlsbad, New Mexico. I supervised the WIPP Raptor Program, a cooperative research and environmental education effort between Westinghouse Electric Corporation, Bureau of Land Management, and New Mexico Game and Fish Department. I designed and implemented a comprehensive research program with the raptors nesting near Carlsbad. Administrative duties included budget development and tracking. Research was targeted toward answering questions of importance to area managers and to address questions of scientific significance. A program to increase public awareness and appreciation for birds of prey was conducted that incorporated presentations to local schools and promotion of the project on a community level. Four technicians were hired and supervised during the project.

1994-1996; Project Leader. The St. Lucia Parrot Project. Wildlife Preservation Trust International. I developed and administrated a two-year program conducted on the Caribbean island of St. Lucia, an independent country in the Lesser Antilles island group. The objectives of the program were to research the life history of the endangered St. Lucia parrot (*Amazona versicolor*) and to train St. Lucian Forestry personnel in research and conservation methods. I worked closely with the St. Lucia Forestry Department and supervised a 6 person field-crew of St. Lucian biologists. In 1995, I organized a intern program for American students in St. Lucia and supervised 9 student interns. I solicited collaborations with other scientists to increase the scope of the project and initiated 3 new projects within the scope of the existing program. I collaborated with other endangered species projects on the island and helped to initiate a detailed study of the endangered white-breasted thrasher

1992-1993; Principal Investigator. Review and Evaluation of the Los Medanos Cooperative Raptor Management Program. Department of Energy/Westinghouse Electric Corporation, Carlsbad, New Mexico. I reviewed past field research conducted by cooperators in the Los Medanos Cooperative Raptor Management Program during 10 years of study in Southeastern New Mexico. I evaluated field methods used in the past and formulated recommendations for improving research questions and field methods.

1989-1993; Graduate Research Assistant. The Urban Ecology of the Harris' Hawk in Tucson, Arizona. University of Arizona, Tucson, Arizona. I studied the ecology and habitat requirements of the Harris' hawk (*Parabuteo unicinctus*) in urban environments in Tucson, Arizona. I monitored reproductive success at about 50 nests each year, color-marked over 200 hawks, and studied foraging behavior at 10 nests using radio-telemetry. I measured vegetation characteristics of foraging sites and nest areas. I recorded about 150 instances of mortality and evaluated mortality factors through laboratory necropsies of fresh carcasses. In order to facilitate field research in a populated area, I organized a public relations program using original educational literature, presentations, and local media coverage.

1990; Graduate Teaching Assistant. Lab Section; Wildlife Conservation for Nonmajors. University of Arizona, Tucson, Arizona. I organized and taught 2 three-hour laboratory sections per week for WFSc 125 (Wildlife Conservation for Nonmajors).

1988; Principal Investigator. Spotted Owl Survey on the Kaibab Plateau. U.S.D.A. Forest Service, Flagstaff, Arizona. I conducted a survey of Spotted Owls (*Strix occidentalis*) on a 52,000 acre study area on the North Kaibab Ranger District, Arizona (Forest Service contract 43-8156-8-445). I organized a remote field camp and supervised a 5-person survey crew during field operations.

1984-1987; Graduate Research Assistant. The Social Organization of Harris' Hawks in Arizona. University of Arizona, Tucson, Arizona. I examined the social organization, population dynamics, and behavioral ecology of cooperatively breeding Harris' hawks in the Sonoran Desert of southern Arizona. The study emphasized parental investment, dominance relationships, cooperation during nesting, and territorial behaviors. I color-banded 537 Harris' hawks and used direct observations from blinds (3,180 hours of observation) at nests and radio-telemetry to examine parental and helping behaviors.

1983; Biological Consultant. The Peregrine Fund. Santa Cruz, California. I located 31 elf owl (*Micrathene whitneyi*) nests in the Sonoran Desert and collected 10 nestlings (from 10 nests) for captive breeding.

1982; Research Assistant. Food Habits of the Peregrine Falcon in the Southwest. Institute for Raptor Studies, Oracle, Arizona. I identified prey species of the peregrine falcon (*Falco peregrinus*) from feather and bone remains taken from nest sites. Over 400 individual birds were identified to species. I prepared 150 study skins of birds for a reference collection for identifying feathers.

1981; Field Technician. Nesting Ecology of Peregrine Falcons in Arizona. Institute for Raptor Studies, Oracle, Arizona. I searched for nest sites and evaluated productivity of prairie (*Falco mexicanus*) and peregrine falcons in Arizona. I collected and field-processed birds (n = 500 specimens) of various avian groups as part of a study of pesticide contaminants in prey species of the peregrine falcon.

1980; Field Technician. Field Survey of Peregrine and Prairie Falcons in Arizona. Institute for Raptor Studies, Oracle, Arizona. I surveyed and evaluated productivity at prairie falcon and peregrine falcon nest sites throughout Arizona. I observed and recorded the behavior of prairie falcons during low flights by military aircraft as part of a study of the effects of jet aircraft noise on raptor productivity. I also surveyed scientific literature and reviewed papers as part of manuscript preparation.

1976-1979; Research Assistant. Ecology of Raptors in the Sonoran Desert. Arizona Game and Fish Department. Phoenix, Arizona. I designed and conducted studies of the breeding biology of desert nesting raptors in central Arizona. I banded over 300 birds including red-tailed hawks (*Buteo jamaicensis*), Harris' hawks, and great horned owls (*Bubo virginianus*).

PROFESSIONAL ACTIVITIES

Research collaborations:

1985-1987; with Dr. Carol M. Vleck & Nora Mays, Department of Ecology and Evolutionary Biology, University of Arizona--Hormonal correlates of parental and helping behavior in cooperatively breeding Harris' hawks.

1987-1992; with Dr. Karen Oishi & Robert R. Sheehy, Committee on Genetics, University of Arizona--Analysis of molecular genetic variation within cooperative breeding groups of Harris' hawks.

1991-1993; With Carol Howard, School of Renewable Natural Resources, University of Arizona; C. Reggiardo, UA Veterinary Diagnostic Laboratory; J. deVos, Arizona Game and Fish Department--Incidence of avian chlamydia and trichomoniasis in free-living Harris' hawk populations.

Intermural Activities:

1990, 1992; Member of awards committee for outstanding theses and dissertations, School of Renewable Natural Resources.

Extramural Activities:

1989-present; formed and chaired the Avian Study Group, Tucson, Arizona, a group composed of local biologists and wildlife enthusiasts that promoted interdisciplinary cooperation among researchers.

1988-present; Associate Wildlife Biologist for the Raptor Education Foundation, Aurora, Colorado, a nonprofit group that provides environmental education through educational presentations and publications. I wrote articles for the quarterly newsletter, reviewed educational material, and evaluated research proposals submitted to the foundation for funding.

1988-present; consultant to the Tucson Rehabilitation Council, Tucson, AZ., a nonprofit group that provides care and rehabilitation of injured wildlife. I worked in cooperation with Arizona Game and Department to establish guidelines for release of rehabilitated birds.

1992-1993; Referee for editorial boards of the Wildlife Society Bulletin (5 manuscripts) and the Journal of Raptor Research (4 manuscripts).

Presentations

Scholarly:

Composition, size and behavior of breeding groups of Harris' hawks in Arizona. 103rd stated meeting of American Ornithologists Union. Arizona State University, Tempe, 1985.

The cooperative breeding system of the Harris' hawk in Arizona. Annual Raptor Research Foundation Meeting, Boise, Idaho, 1987.

Management of raptors in arid environments. Invited speaker, Our Sonoran Desert: a Conservation Workshop. Sponsored by the Arizona Game and Fish Dept. and the Fish and Wildlife Service, 1987.

Territoriality and sociality in the Harris' hawk. Raptor Research Foundation Meeting, Minneapolis, Minnesota, 1988.

The social system of the Harris' hawk. Natural Resource Lecture Series, University of Arizona, 1988.

The ecology of desert raptors. Invited speaker, The Arizona-Sonora Desert Museum Lecture Series, Tucson, Arizona, 1989.

Dispersal in Harris' hawks: male and female options. World Working Group of Birds of Prey and Annual Raptor Research Foundation Meeting, Vera Cruz, Mexico, 1989.

The social system of the Harris' hawk. Invited speaker, International Wildlife Rehabilitators Council Annual Meeting, Washington D.C., 1990.

Mating systems among birds of prey. Invited speaker, Biology Lecture Program, Department of Veterinary Science and Biology Department, University of Guelph, Ontario, Canada. 1991.

The urban ecology of the Harris' hawk in Arizona: habitat and resource use. Joint Annual Meeting, Arizona and New Mexico Chapters of the Wildlife Society, 1992.

Ecology of Harris' hawks in urban jungles. School of Renewable Natural Resources Lecture Series, University of Arizona, Tucson, Arizona, 1993.

Electrocution as a mortality factor in an urban population of Harris' hawks. Annual Raptor Research Foundation Meeting, Flagstaff, Arizona, 1994.

The ecology and conservation of the St. Lucia Parrot (Amazona versicolor). School of Renewable Natural Resources Lecture Series, University of Arizona, Tucson, Arizona, 1995

Other Presentations:

The Harris' hawk -- a social raptor. Tucson Audubon Society, Tucson, Arizona, 1984.

The social system of the Harris' hawk. University of Arizona Student Chapter of the Wildlife Society, Tucson, Arizona, 1985.

The cooperative breeding system of the Harris' hawk. Arizona State University Student Chapter of the Wildlife Society, Tempe, Arizona, 1986.

Capture methods for raptors. Annual Meeting of the Western Bird Banding Association, Tucson, Arizona, 1987.

Group living in the Harris' hawk. University of Arizona Student Chapter of the Wildlife Society, Tucson, Arizona.

Movements and dispersal of Harris' hawks in Arizona. Arizona Wildlife Rehabilitators Council, Arizona-Sonora Desert Museum, Tucson, Arizona, 1988.

Cooperative hunting in the Harris' hawk. Raptor Education Foundation, Denver, Colorado, 1989.

Breeding strategies of Harris' hawks. University of Arizona Student Chapter of the Wildlife Society, Tucson, Arizona, 1990.

The urban ecology of the Harris' hawk. University of Arizona Student Chapter of the Wildlife Society, Tucson, Arizona, 1991.

The conservation of the St. Lucia Parrot. Keynote address of the Annual Membership and Directors Meeting, Wildlife Preservation Trust International, San Francisco, California, 1994

Media Projects

1993; Scientific and technical consultant. National Geographic Society, Washington D.C. I developed a film treatment of my field research and results about Harris' Hawk ecology. I successfully presented the concept to the Story Review Board in Washington, D.C. and served as a scientific advisor during filming. I organized and supervised a 6-person field crew that located nests, transported equipment, and scouted film locations. The 40-minute film was shown on television in 1994 as a feature segment of National Geographic's Explorer Series. The film was nominated for Emmy Awards in two categories in 1995 and received an Emmy for Best Documentary Sound.

1990; Scientific and technical advisor. The Natural History Unit of the British Broadcasting Company. I biological information about cooperative hunting by Harris' Hawks, and organized a 6-person field crew to locate nests, and erect photography blinds. The resulting 4.5 minute segment was incorporated into a television series on animal behavior entitled "The Trials of Life" and has received international exposure.

1987; Scientific advisor. The Natural History Unit of the British Broadcasting Company. I provided information Harris' Hawks and assisted in locating and filming hawks. The 6.5 minute segment was used in a television show entitled "Land of the Eagle" and has received international exposure.

1985; Scientific advisor. Wolfgang Bayer Films. I provided scientific information about Harris' hawks and placed blinds at active nests for filming purposes. The 4 minute segment was incorporated into a 1 hour show entitled "Saguaro, Sentinel of the desert".

Publications

Refereed Publications:

Dawson. J. W. 1982. Golden Eagle mobbed while preying on Common Raven. Raptor Research 16:136.

Dawson, J. W. and R. W. Mannan. 1989. A comparison of methods of estimating group size in the Harris' hawk. Auk 106:480-483.

Dawson, J. W. and R. W. Mannan. 1991a. The role territoriality in the social organization of the Harris' hawk. Auk 108: 661-672.

Dawson, J. W. and R. W. Mannan. 1991b. Dominance hierarchies and helper contributions in the Harris' hawk. Auk 108: 649-660.

Vleck, C.M., Mays, N.A., Dawson, J.W., and A. R. Goldsmith. 1991. Hormonal correlates of parental and helping behavior in cooperatively breeding Harris' Hawks (Parabuteo unicinctus). Auk 108: 638-648.

Mays N.A., Vleck, C. M., and J. W. Dawson. 1991. Plasma luteinizing hormone, steroid hormones, behavioral role, and nest stage in cooperatively breeding Harris' (Parabuteo unicinctus). Auk 108: 619-637.

Bednarz, J. C., J. W. Dawson, and W. H. Whaley. 1988. The status of the Harris' hawk in the southwestern United States. IN: Proceedings of the southwest raptor management symposium and workshop. (R. L. Glinski, B. Giron Pendleton, M. B. Moss, M. N. LeFranc Jr., B. A. Milsap, S. W. Hoffman, Eds.) National Wildlife Federation, Washington, D.C.

Sheehy, R. R., J. W. Dawson, and K.K. Oishi. 1995. Polyandry and polygyny in cooperative breeding groups of Harris' hawks (Parabuteo unicinctus). Submitted to the National Academy of Science.

Publications in Preparation:

Dawson, J. W. 1995. Use of a conspecific decoy for Harris' Hawks. To be submitted to the Wildlife Society Bulletin.

Dawson, J. W., C. A. Howard, and R. W. Mannan. 1995. Avian chlamydia and trichomoniasis in free-living Harris' hawks. To be submitted to the Journal of Wildlife Diseases.

Dawson, J. W., W. Mader, and R. W. Mannan. 1995. The use urbanized areas by Harris' Hawks in Arizona. in prep. To be published in Symposium proceedings on raptors in human altered environments.

Book Chapters:

Dawson, J. W. 1992. The Harris' hawk. IN: Raptors of Arizona. (R. L. Glinski, Ed.), In press., Arizona Game and Fish Dept., Phoenix, Arizona.

Dawson, J. W. 1992. The Prairie Falcon. IN: Raptors of Arizona. (R. L. Glinski, Ed.), In press., Arizona Game and Fish Dept., Phoenix, Arizona.

Dawson, J. W. 1992. The Great Horned Owl. IN: Raptors ofArizona. (R. L. Glinski, Ed.), In press., Arizona Game and Fish Dept., Phoenix, Arizona.

Dawson, J. W. And B. C. Taubert. 1992. Falconry. IN: Raptors of Arizona. (R. L. Glinski, Ed.), In press., Arizona Game and Fish Dept., Phoenix, Arizona.

Honors and Awards:

James R. Silliman Memorial Research Grant, Department of Ecology and Evolutionary Biology, University of Arizona, 1986.

Seegmiller Award for Excellence in Research, School of Renewable Natural Resources, University of Arizona, 1989.

Ray E. Cowden Scholarship, School of Renewable Natural Resources, University of Arizona, 1990.

Extramural Graduate Predoctoral Fellowship, Graduate College, University of Arizona, 1991.

Seegmiller Award for Excellence in Research, School of Renewable Natural Resources, University of Arizona, 1992.

Professional Organizations

American Ornithologists Union
Cooper Ornithological Society
Raptor Research Foundation

Teaching experience

1991; I organized and taught a 3-day workshop on methods for birds of prey at the Department of Veterinary Science, University of Guelph, Ontario, Canada. About 40 undergraduate and graduate students participated and the course was divided into 1/3 lecture, 1/3 practical demonstrations, and 1/3 personal instruction. Humane treatment, reduction of stress to research subjects, and safety of personnel were emphasized during the workshop.

1989; As a teaching assistant, I taught 2 lab sections per as part of a 1 semester course entitled "Wildlife conservation for nonmajors" (wfsc 126). The course the natural history of selected desert animals, ecological concepts, and selected research techniques. Lab exercises were designed to promote an interest in wildlife and conservation as well as to impart information. Topics of controversy in wildlife management were presented in order to promote discussion in class and increase
student awareness of current problems. I led 5 field trips as part of the class.

1987-1990; During each spring semester, I organized and taught a two-week lab section about raptor identification, ecology, management as part of a course entitled " Wildlife management; avian species" (wfsc 446). I presented ecological and management information during lectures and led a field trip to observe, trap and band raptors. The raptor section was made incorporated as a permanent part of the course.

CURRICULUM VITAE

Name:	**Susanne C. Tygielski**
Address:	143 Ardmore Street Hamden, Connecticut 06517
Phone:	(203) 248-1808
Birth Date:	February 14, 1972

ACADEMIC PREPARATION.

1986-1990; St. Ignatius College Preparatory, Chicago, Illinois, USA.
High School Diploma, 1990

1990-1994; University of Arizona, Tucson, Arizona, USA.
Division of Wildlife and Fisheries Science, School of Renewable Natural Resources,
Bachelor of Science, Wildlife Ecology, 1994.

1995-Present; School of Forestry & Environmental Studies, Yale University, New Haven, Connecticut, USA.
Master of Science in Environmental Studies, Expected Graduation December 1997

EMPLOYMENT

1996-Present; Environmental Educator and Resident Naturalist, Connecticut Audubon Coastal Center, One Milford Point Road, Milford, Connecticut, 06460. I taught structured presentations to children using live marine animals and props designed to creatively teach students about aquatic systems. I used the live animals in shows designed to entertain and educate children at birthday parties held at the Coastal Center. I acted as the Resident Naturalist at the Coastal Center on Sundays and assisted docents in responding to the public's questions about the surrounding marsh and marine habitats. I developed programs given at the Coastal Center and assisted in proposal and final report writing for the Coastal Center.
Supervisor: Barbara Milton (203-878-7440)

1996-Present; Graduate Student Collaborator, WIPP Raptor Research and Management Program, Research Partnerships, Carlsbad Field Office, P.O. Box 204, Carlsbad, New Mexico, 88220-0204. As part of the educational component of the WIPP Raptor Research and Management Program, and the degree requirements for a MS program at the Yale School of Forestry and Environmental Studies, I designed and initiated a study of attitudes toward wildlife among elementary children. The proximate objectives of the study were to evaluate the effectiveness of educational efforts by the Raptor Program and to identify teaching approaches and techniques that were most effective with children. An additional area of investigation was to assess regional attitudes toward wildlife in comparison with attitudes held by children in other areas. The study utilized a series of questionnaires submitted to each child before and

after environmental presentations that surveyed children's understanding, knowledge, and attitudes about wildlife, ecology, and conservation.
To date, over 2,000 children have been queried during the study.
Supervisor: James W. Dawson (505-885-0476)
Academic Advisor: Stephen Kellert (203-432-5114)

1996; Education Specialist, WIPP Raptor Research and Management Program, Research Partnerships, Carlsbad Field Office, P.O. Box 204, Carlsbad, New Mexico, 88220-0204. The Raptor Program is an integrated research and education project funded by the Department of Energy, Bureau of Land Management, and Westinghouse Electric Corporation that is focused on raptors in the Southeastern corner of New Mexico. I designed and initiated an education program directed toward enhancing public empathy for native wildlife. Primary goals of the program were to reduce illegal acts of shooting of protected species and to instill a deeper understanding of life histories, ecology, and conservation. A one hour classroom program was designed that was focused around live raptors and reptiles and utilized graphics as well as interactive activities. Class sizes were restricted to no more than 50 students in order to provide an intimate experience with animals. Presentations were given to over 50 classes and reached an estimated 3200 children in 27 schools in the area. I supervised 3 technicians during the project and trained them in presentation techniques, animal handling, and public speaking.
Supervisor: James W. Dawson (505-885-0476).

1996; Project Leader, 1996 WIPP Threatened and Endangered Species Survey, Research Partnerships, Carlsbad Field Office, P.O. Box 204, Carlsbad, New Mexico, 88220-0204. I organized and supervised all aspects of a survey of Threatened and Endangered species on lands associated with the Waste Isolation Pilot Plant (Department of Energy) in Southeastern New Mexico. The survey covered birds, mammals, reptiles and plants and was time-constrained (survey period was not to exceed 4 months). I hired a 4-person field crew and organized training sessions on data collection methods, species identification, general field operations, and safety procedures. I directed the placement of survey plots and transects and organized field schedules. I oversaw the acquisition of all materials and equipment, personnel assignments, and payroll. An important part of my duties was to interface regularly with government contractors and wildlife agencies. I wrote bi-weekly status reports and shared 50% responsibility for the writing of the final report. The project was finished ahead of schedule and the final report was submitted within 2 weeks after the completion of data collection (and was accepted without substantive revision).
Supervisor: James W. Dawson (505-885-0476).

1996; Research Assistant, Green-Rumped Parrotlet Project , Yale School of Forestry and Environmental Studies, Llanos, Venezuela. I collected data about the social aspects of non-breeding birds, collected general nesting data, captured and banded parrotlets, organized data files on site for the crew, and trained new crew members in general data collection and bird handling techniques.
Supervisor: Steven R. Biessinger (203-432-5120).

1996; Technical Editor, Review and Revision of 1995 Final Report of the WIPP Raptor Research and Management Program, Department of Energy/ Westinghouse Electric Corporation, Carlsbad, New Mexico. I was contracted to edit and revise a technical report in preparation for the authorized release of the document. I extensively reformatted and rewrote the document in accordance with DOE guidelines for technical writing.
Supervisor: Douglas Lynn (505-234-8739)

1996; Research Assistant, Yale School of Forestry and Environmental Studies. I analyzed field data collected in Venezuela during the previous summer and fall. I supervised four lab technicians working on data entry. I created a GIS map of the Venezuela study site and analyzed acompanying nesting and dispersion data. The nesting information resulted in a scientific paper about nest defense behavior that has been submitted to a peer-reviewed journal.
Supervisor: Steven R. Biessinger (203-432-5120).

1995; Research Assistant, Green-Rumped Parrotlet Project in Venezuela, Yale School of Forestry and Environmental Studies. I spent 6 months living at a primitive research station in the Llanos region of Venezuela serving as a field technician on a study of the biology of the Green-Rumped Parrotlet. I collected experimental data on nest box defense behavior during incubation. I also collected general nesting data, captured and banded parrotlets on site, and contributed to other ongoing projects on parrotlets.
Supervisor: Steven R. Biessinger (203-432-5120).

1995; Field Production Assistant, Oxford Scientific Films/ National Geographic Society. I searched for and evaluated locations areas in southern Arizona for wildlife filming, gathered research information on species of interest, and assisted in equipment set-ups in the field.
Supervisor: Sean Morris (011-44-993-881881).

1995; Field Technician, Raptor Consulting Services, Carlsbad, New Mexico. As part of a field study of nesting raptors in Southeastern New Mexico, I built and maintained raptor traps, assisted in field efforts including trapping, banding, and blood sampling. I also participated in writing weekly status reports for the Department of Energy.
Supervisor: Pete Jungemann (505-525-9495).

1994; Field Technician, St. Lucia Parrot Project, St. Lucia Division of Forestry and Lands, St. Lucia, West Indies. I worked on the Caribbean Island of St. Lucia assisting the St. Lucian Department of Forestry in a study of the endangered St. Lucia Parrot. I worked in the highland rain-forest and conducted observations of St. Lucia Parrots at the nest. I also searched for nest cavities, took measurements of nest trees, took photographs for use in presentations, and assisted with data entry.
Supervisor: Michael Bobb (809-459-7161).

1993; Assistant to the Producer and Sound Recordist, National Geographic Society. I organized logistics for the field production of a film, entitled "Wolves of the Air", for the National Geographic Society Explorer Series. I organized and coordinated equipment and personnel and interacted with National Geographic personnel in Washington, DC. I served as a sound recordist for the film and recorded natural sounds of wildlife and the environment. Based on sound recordings, I received an Emmy Award in 1995 from the National Academy of Television Arts and Sciences in the category of Best Sound in a Documentary.
Supervisor: Michael Richards (011-44-458-832836).

1993; Technician, Environmental Research Laboratory, University of Arizona. I conducted literature reviews and assembled apparatus for micro-organism gas-exchange experiments. I monitored alfalfa plants in greenhouse setting and recorded relative weights to compare growth in various soil types.
Supervisor: Mary Olsen (520-296-0868).

1992-1993; Field Technician, Urban Harris' Hawk Project, School of Renewable Natural Resources, University of Arizona, Tucson, Arizona. I worked as a technician on a study of urban-nesting Harris' hawks in the city of Tucson. I collected carcasses of Harris' Hawks for necropsies, distributed information on the hawks to interested local residents, and assisted with data entry and editing.
Supervisor: R. W. Mannan (520-621-7283).

1992; Keeper-Intern, Reid Park Zoo, City of Tucson, Arizona. I cleaned and prepared exhibits for public viewing, and released zoo animals into the exhibits. I also fed and medicated zoo animals, monitored ill and newly born animals, and cleaned enclosures. I wrote daily journals of the animals' behavior and notes on medication.
Supervisor: Leslie Waters (520-791-3204).

1990-1991; Horse Wrangler, Pusch Ridge Stables, Tucson, Arizona. I fed, groomed, and medicated horses and mules used for riding. I cleaned the facilities, guided tours through the open desert, and took reservations for rides. I also assisted in catering large hayrides.
Supervisor: Vickie Pitts (520-825-1664).

1989-1990; Kindergarten Teacher, Young Men's Christian Association, La Grange, Illinois. I developed and implemented lesson plans for a group of twenty kindergartners. The lessons emphasized the environment and world around them. I also arranged several safety field trips (i.e., to the fire department).

REPORTS AND PUBLICATIONS.

Dawson, J. W. and S. C. Tygielski. 1996. 1996 WIPP Threatened and Endangered Species Survey. DOE Technical Report, Carlsbad Area Office, New Mexico.

Beissinger, S. R., S. C. Tygielski, and B. Eldred. 1997. Incubation as a nest defensive behavior: a nest box addition experiment. In Prep.

AWARDS.

Emmy Award 1995; National Academy of Television Arts and Sciences, Best Sound in a Documentary; Sound Recordist for the film, "Wolves of the Air", National Geographic Society Explorer Series.

PROFESSIONAL ORGANIZATIONS.

American Ornithologists Union
UA Student Chapter of the Wildlife Society

PROFESSIONAL SKILLS.

Proficient in computer programs: ArcInfo, Corel Draw, Excel, Idrisi, Systat, Word and Wordperfect.
Global Positioning Systems operation and use.
Cardiopulmonary Resuscitation and Emercency Cardiac Care Provider.

REFERENCES.

James W. Dawson, Principal Investigator
Research Partnerships
Carlsbad Field Office
P.O. Box 0204
Carlsbad, New Mexico 88221-0204
Ph: 505-885-0476

Douglas Lynn, Land Use Coordinator
Waste Isolation Pilot Plant
Westinghouse Electric Corporation
Carlsbad, New Mexico
Ph: 505-234-8739

Barbara Milton, Executive Director
Connecticut Audubon Coastal Center
One Milford Point Road
Milford, Connecticut 06460
Ph: 203-878-7440

APPENDIX B

CORRESPONDENCE WITH FEDERAL AND STATE AGENCIES

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New Mexico Ecological Services Field Office
2105 Osuna NE
Albuquerque, New Mexico 87113
Phone: (505) 761-4525 Fax: (505) 761-4542

July 9, 1996

Cons. #2-22-96-I-361

Mr. William A. Most
Westinghouse Waste Isolation Division
P.O. Box 2078 MS-170
Carlsbad, New Mexico 88221

Dear Mr. Most:

This responds to a June 20, 1996, letter from S.C. Kouba requesting a list of federally endangered, threatened, or proposed species. The proposed action is the Disposal Decision Environmental Impact Statement for the Waste Isolation Pilot Plant. Due to staffing constraints, we are unable to provide a list of species specific to your immediate action area. However, a list of endangered, threatened, and candidate species, and species of concern that may be found in the counties where your proposed action is located is enclosed. Under the Endangered Species Act (Act), it is the responsibility of the Federal action agency or its designated representative to determine whether the proposed action "may affect" any listed or proposed species.

Candidates are those species for which the U.S. Fish and Wildlife Service (Service) has sufficient information on their biological status and threats to propose them as endangered or threatened, but for which issuance of a proposed rule is precluded by work on higher priority species. Species of concern include those for which further biological research and field study are needed to resolve their conservation status. Candidate species and species of concern have no legal protection under the Act and are included in this document for planning purposes only. However, the Service is concerned and would appreciate receiving any status information that is available or gathered on these species.

Wetlands, riparian vegetation, and listed species' sensitive habitats on or near the site should be protected. If adverse impacts cannot be avoided, we would appreciate discussing your action in more detail.

We suggest you contact the New Mexico Department of Game and Fish and the New Mexico Energy, Minerals, and Natural Resources Department, Forestry and Resources Conservation Division for information regarding animals and plants of State concern.

In future communication with the Service on this action, refer to consultation

#2-22-96-I-361. If we can be of further assistance, please contact Charlie McDonald at (505) 761-4525.

Sincerely,

Jennifer Fowler-Propst
Field Supervisor

Enclosure

cc: (wo/enc)
Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico
Director, New Mexico Energy, Minerals, and Natural Resources Department, Forestry and Resources Conservation Division, Santa Fe, New Mexico
Geographic Manager, New Mexico Ecosystems, U.S. Fish and Wildlife Service, Albuquerque, New Mexico

Threatened and Endangered Species, Candidate Species, and Species of Concern
Eddy and Lea Counties, New Mexico
July 9, 1996

Eddy

Arizona black-tailed prairie dog, Cynomys ludovicianus arizonensis, SC
Big free-tailed bat, Nyctinomops macrotis (=Tadarida m., T. molossa), SC
Black-footed ferret, Mustela nigripes, E
Cave myotis, Myotis velifer, SC
Fringed myotis, Myotis thysanodes, SC
Gray-footed chipmunk, Tamias canipes, SC
Guadalupe southern pocket gopher, Thomomys umbrinus guadalupensis, SC
Long-legged myotis, Myotis volans, SC
Occult little brown bat, Myotis lucifugus occultus, SC
Pale Townsend's (=western) big-eared bat, Plecotus townsendii pallescens, SC
Pecos River muskrat, Ondatra zibethicus ripensis, SC
Small-footed myotis, Myotis ciliolabrum, SC
Swift fox, Vulpes velox, C
Yuma myotis, Myotis yumanensis, SC
American peregrine falcon, Falco peregrinus anatum, E
Arctic peregrine falcon, Falco peregrinus tundrius, T (S/A)
Baird's sparrow, Ammodramus bairdii, SC
Bald eagle, Haliaeetus leucocephalus, T
Black tern, Chlidonias niger, SC
Brown pelican, Pelecanus occidentalis, E
Ferruginous hawk, Buteo regalis, SC
Interior least tern, Sterna antillarum, E
Loggerhead shrike, Lanius ludovicianus, SC
Mexican spotted owl, Strix occidentalis lucida, T w/CH
Northern aplomado falcon, Falco femoralis septentrionalis, E
Northern goshawk, Accipiter gentilis, SC
Southwestern willow flycatcher, Empidonax traillii extimus, E w/PCH
Western burrowing owl, Athene cunicularia hypugea, SC
White-faced ibis, Plegadis chihi, SC
Blue sucker, Cycleptus elongatus, SC
Headwater catfish, Ictalurus lupus, SC
Pecos bluntnose shiner, Notropis simus pecosensis, T w/CH
Pecos gambusia, Gambusia nobilis, E
Pecos pupfish, Cyprinodon pecosensis, C
Plains minnow, Hybognathus placitus*, SC
Rio Grande shiner, Notropis jemezanus, SC
Dunes sagebrush lizard, Sceloporus arenicolus, SC

Eddy, continued

Texas horned lizard, Phrynosoma cornutum, SC
Ovate vertigo (snail), Vertigo ovata, SC
Pecos springsnail, "Fontelicella" pecosensis, SC
Texas hornshell (mussel), Popenaias popei, SC
Few-flowered jewelflower, Streptanthus sparsiflorus, SC
Glass Mountain coral-root, Hexalectris nitida, SC
Guadalupe rabbitbrush, Chrysothamnus nauseosus var. texemsis, SC
Gypsum wild-buckwheat, Eriogonum gypsophilum, T w/CH
Kuenzler hedgehog cactus, Echinocereus fendleri var. Kuenzleri, E
Lee pincushion cactus, Coryphantha sneedii var. leei, T
Lloyd's hedgehog cactus, Echinocereus lloydii, E
Mat leastdaisy, Chaetopappa hershevi, SC
Tharp's blue-star, Amsonia tharpii, SC
Wright's water-willow, Justicia wrightii, SC

Lea

Black-footed ferret, Mustela nigripes, E
Cave myotis, Myotis velifer, SC
Swift fox, Vulpes velox, C
American peregrine falcon, Falco peregrinus anatum, E
Arctic peregrine falcon, Falco peregrinus tundrius, T (S/A)
Baird's sparrow, Ammodramus bairdii, SC
Bald eagle, Haliaeetus leucocephalus, T
Ferruginous hawk, Buteo regalis, SC
Loggerhead shrike, Lanius ludovicianus, SC
Northern aplomado falcon, Falco femoralis septentrionalis, E
Western burrowing owl, Athene cunicularia hypugea, SC
Dunes sagebrush lizard, Sceloporus arenicolus, SC
Texas horned lizard, Phrynosoma cornutum, SC

Index

E	=	Endangered
T	=	Threatened
CH	=	Critical Habitat
PCH	=	Proposed Critical Habitat
C	=	Candidate Species
SC	=	Species of Concern
S/A	=	Similarity of Appearance
•	=	Introduced Population

GOVERNOR
Gary E. Johnson

STATE OF NEW MEXICO
DEPARTMENT OF GAME & FISH

Villagra Building
P. O. Box 25112
Santa Fe, NM 87504

DIRECTOR AND SECRETARY
TO THE COMMISSION
Gerald A. Maracchini

STATE GAME COMMISSION
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Gus Elgin
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Steve Padilla
Albuquerque, NM
Dr. Charles Meyer
Albuquerque, NM
Gail J. Cramer
Farmington, NM

RECEIVED
AUG 12 1996

August 8, 1996

Mr. K. S. Donovan, Manager
Environment, Safety, and Health
Westinghouse Electric Corporation
Waste Isolation Division
Box 2078
Carlsbad, New Mexico 88221

Dear Mr. Donovan:

The Department of Game and Fish (Department) has received your letter of July 16, 1996, requesting survey protocols for T&E species which may exist at the Waste Isolation Pilot Plant (WIPP). The following comments pertain only to the state-listed reptiles referred to in your letter.

Western River Cooter *Pseudemys gorzugi*

In New Mexico, *P. gorzugi* is confined to south-central Eddy County where it occurs only in the Pecos River below Brantley Dam and throughout the entire length of the Black and Delaware rivers. It does not occur in any man-made waters with the exception of Willow Lake near Malaga. The species is not expected to occur on the WIPP site.

Arid Land Ribbon Snake *Thamnophis proximus*

In New Mexico, *T. proximus* is known from 900-1500 m at scattered localities in the eastern third of the state where permanent water is present, such as along the lower Pecos River drainage near Artesia, Carlsbad, and Roswell. The species is semiaquatic and is rarely found away from permanent water sources. Habitats include rivers and streams, irrigation canals, large stock tanks, and rocky

intermittent creeks where large deep pools with abundant frogs and fish remain. Isolated stock tanks that contain water only during the rainy season are generally not occupied. The species is currently not known to occur on the WIPP site.

Sand Dune Lizard *Sceloporus arenicolus*

This lizard has recently been the subject of intense study by department personnel and others. Much of the effort has been directed at determining the total distribution of the species in southeast New Mexico. Although suitable habitat exists, the species is not known to occur on the WIPP site or south of US Highway 62/180 and NM Highway 176.

Please note our recommended use of the common name "Sand dune lizard" to replace "Dunes sagebrush lizard." This usage accurately reflects the habitat of this unique species which is not associated with sagebrush.

The standard protocol used to investigate the presence or absence of these species is well explained in Jones, K.B. 1986. Amphibians and reptiles. Pp. 267-290 In Cooperrider, A.Y. et al (eds.). Inventory and Monitoring of Wildlife Habitat. USDI Bur. Land Manage. Service Center, Denver, CO. xviii + 858 p. The survey protocol for *S. arenicolus* is explained in Fitzgerald et al. (1995 a&b) included with this letter.

We recommend that you contact the U.S. Fish and Wildlife Service for protocols regarding federally listed species, and the New Mexico Forestry and Resources Conservation Division for information on state-listed plants.

If you have questions or require additional information regarding the state-listed amphibians and reptiles expected to occur on the WIPP site please call Charlie Painter at (505) 827-9901, or call Bob Wilson at (505) 827-7827.

Sincerely,

Andrew V. Sandoval, Chief
Conservation Services Division

AVS/BW/ia

xc: Jennifer Fowler-Propst (Ecological Services Supr. USFWS)
Tom Moody (Southeast Area Operations Div. Chief, NMGF)
Jim Bailey (Asst. Cons. Services Division Chief, NMGF)
Bob Wilson (Habitat Specialist, NMGF)
Charlie Painter (Endangered Species Biologist, NMGF)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New Mexico Ecological Services Field Office
2105 Osuna NE
Albuquerque, New Mexico 87113
Phone: (505) 761-4525 Fax: (505) 761-4542

RECEIVED
AUG 23 1996

August 19, 1996

Cons. #2-22-96-I-361

K. S. Donovan, Manager
Environment, Safety, and Health
Westinghouse Waste Isolation Division
P.O. Box 2078
Carlsbad, New Mexico 88221

Dear Mr. Donovan:

This responds to a July 16, 1996, letter requesting information on survey protocols for threatened or endangered species. Enclosed is the survey protocol for southwestern willow flycatcher and a draft survey protocol for northern aplomado falcon. There are no written survey protocols for any of the other threatened or endangered species that may occur on WIPP lands. We would expect, however, that surveys will be done during the times when the species are most conspicuous or likely to be present. For resident and migratory breeding birds this will be during the breeding season (generally May - August); for wintering and nonbreeding birds this will be during the season of residence or migration; for plants this will usually be during the blooming period.

For your information, the correct Federal status for Lloyd's hedgehog cactus is endangered. However, this species was proposed for delisting due to a determination that it is a hybrid. The enclosed delisting proposal was published in the *Federal Register* on June 14, 1996 (61 FR 30209).

If we can be of further assistance, please contact Charlie McDonald at (505) 761-4525.

Sincerely,

Jennifer Fowler-Propst
Field Supervisor

Enclosures

THREATENED, ENDANGERED, PROPOSED & CANDIDATE WILDLIFE: Eddy County, N

Common Name	SCIENTIFIC NAME	FEDERAL END.	FED.... THREAT.	PROP. CAND.	Prev.. C2...	STATE END.	STAT THRE
Mexican Tetra	Astyanax mexicanus	.	.	.	.	.	
Plains Minnow	Hybognathus placitus	.	.	.	X	.	
Rio Grande Shiner	Notropis jemezanus	.	.	.	X	.	
Pecos Bluntnose Shiner	Notropis simus pecosensis	.	X	.	.	.	
Blue Sucker	Cycleptus elongatus	.	.	.	X	X	
Gray Redhorse	Moxostoma congestum	.	.	.	.	.	
Headwater Catfish	Ictalurus lupus	.	.	.	X	.	
Pecos Pupfish	Cyprinodon pecosensis	.	.	C	.	.	
Pecos Gambusia	Gambusia nobilis	X	.	.	.	.	
Greenthroat Darter	Etheostoma lepidum	.	.	.	.	.	
Bigscale Logperch	Percina macrolepida	.	.	.	.	.	
Western River Cooter	Pseudemys gorzugi	.	.	.	.	.	
Texas Horned Lizard	Phrynosoma cornutum	.	.	.	X	.	
Dunes Lizard	Sceloporus arenicolus	.	.	.	X	.	
Blotched Water Snake	Nerodia erythrogaster	.	.	.	.	.	
Arid Land Ribbon Snake	Thamnophis proximus	.	.	.	.	.	
Mottled Rock Rattlesnake	Crotalus lepidus lepidus	.	.	.	.	.	
Brown Pelican	Pelecanus occidentalis	X	.	.	.	X	
Neotropic Cormorant	Phalacrocorax brasilianus	.	.	.	.	.	
White-faced Ibis	Plegadis chihi	.	.	.	X	.	
Fulvous Whistling Duck	Dendrocygna bicolor	.	.	.	X	.	
Bald Eagle	Haliaeetus leucocephalus	.	X	.	.	.	
Northern Goshawk	Accipiter gentilis	.	.	.	X	.	
Ferruginous Hawk	Buteo regalis	.	.	.	X	.	
Aplomado Falcon	Falco femoralis septentrionalis	X	.	.	.	X	
American Peregrine Falcon	Falco peregrinus anatum	X	.	.	.	X	
Interior Least Tern	Sterna antillarum	X	.	.	.	X	
Black Tern	Chlidonias niger	.	.	.	X	.	
Common Ground-dove	Columbina passerina	.	.	.	.	X	
Burrowing Owl	Speotyto cunicularia hypugaea	.	.	.	X	.	
Mexican Spotted Owl	Strix occidentalis lucida	.	X	.	.	.	
Broad-billed Hummingbird	Cynanthus latirostris	.	.	.	.	.	
Southwestern Willow Flycatcher	Empidonax traillii extimus	X	.	.	.	.	
Bell's Vireo	Vireo bellii arizonae	.	.	.	.	.	
Gray Vireo	Vireo vicinior	.	.	.	.	.	
Varied Bunting	Passerina versicolor	.	.	.	.	.	
Baird's Sparrow	Ammodramus bairdii	.	.	.	X	.	
Yuma Myotis Bat	Myotis yumanensis	.	.	.	X	.	
Cave Myotis Bat	Myotis velifer	.	.	.	X	.	
Fringed Myotis Bat	Myotis thysanodes	.	.	.	X	.	
Long-legged Myotis Bat	Myotis volans	.	.	.	X	.	
Western Small-footed Myotis Bat	Myotis ciliolabrum	.	.	.	X	.	
Townsend's Big-eared Bat	Plecotus townsendii pallescens	.	.	.	X	.	
Big Free-tailed Bat	Nyctinomops macrotis	.	.	.	X	.	
Gray-footed Chipmunk	Tamias canipes	.	.	.	X	.	
AZ Black-tailed Prairie Dog	Cynomys ludovicianus arizonensis	.	.	.	X	.	
S. Guadalupe Pocket Gopher	Thomomys bottae guadalupensis	.	.	.	X	.	
Pecos River Muskrat	Ondatra zibethicus ripensis	.	.	.	X	.	
Swift Fox	Vulpes velox	.	.	C	.	.	
Pope's Mussel	Popenaias popei	.	.	.	X	X	
Ovate Vertigo	Vertigo ovata	.	.	.	X	.	
Pecos Spring Snail	Pyrgulopsis pecosensis	.	.	.	.	.	

NEW MEXICAN WILDLIFE of SPECIAL CONCERN

* BY COUNTY *

May 17, 1996

INCLUDES SPECIES THAT ARE:

STATE THREATENED & ENDANGERED †

FEDERAL THREATENED, ENDANGERED & CANDIDATE

EXTIRPATED IN EACH COUNTY

TABLE HEADING	LEGAL STATUS
FEDERAL END.	Federal Endangered
FED. THREAT.	Federal Threatened
PROP. CAND.	Federal Proposed Endangered (PE) & Federal Candidate (C)
Prev. C2 ‡	previously federal candidate category 2 (Of concern but provides no legal standing)
STATE END.	State Endangered
STATE THREAT.	State Threatened

† Note: The New Mexico list of threatened and endangered species has not been modified with new information since 1990. This list may contain species extirpated from the state, species non-native to the state, and species whose classification as threatened or endangered may be outdated. In addition, the list does not include some species that are rare in New Mexico.

‡ The Prev. C2 category is no longer an official federal category. This information is provided to alert users that the status of these species is uncertain and justifies concern and caution.

FAX TRANSMITTAL COVER SHEET

GAME AND FISH LABORATORY
FAX (505) 827-9956

MAILING ADDRESS: NEW MEXICO DEPARTMENT OF GAME AND FISH
PO BOX 25112
SANTA FE, NM 87504
TEL (505) 827-9904

TO: FAX NUMBER 885-4562

INDIVIDUAL Hillie Most

ADDRESS Westinghouse WIPP Project - Carlsbad NM.

FROM: INDIVIDUAL Alicia DATE 6/19/96

NUMBER OF PAGES INCLUDING COVER SHEET 5

MESSAGE

As requested

cc: (wo/enc)
Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico
Director, New Mexico Energy, Minerals, and Natural Resources Department, Forestry and Resources Conservation Division, Santa Fe, New Mexico
Geographic Manager, New Mexico Ecosystems, U.S. Fish and Wildlife Service, Albuquerque, New Mexico

NATIVE WILDLIFE APPARENTLY NO LONGER OCCURRING IN EDDY COUNTY

Spotted Gar	Lepisosteus oculatus	(extirpated from NM)	
American Eel	Anguilla rostrata	(extirpated from NM)	
Rio Grande Silvery Minnow	Hybognathus amarus		(fed. endan. / NM threat.)
Mouse. Pocket. Rock	Chaetodipus intermedius		
Gray Wolf	Canis lupus	(extirpated from NM)	(federal endangered)
Grizzly Bear	Ursus arctos	(extirpated from NM)	(federal threatened)
American Bison	Bos bison		
Desert Bighorn Sheep	Ovis canadensis mexicana		(NM endangered)
Merriam's Elk	Cervus elaphus merriami	(extinct)	
Wide Pea-clam	Musculium transversum		(NM threatened)

THREATENED, ENDANGERED, PROPOSED & CANDIDATE WILDLIFE:

Lea County, N

Common Name	SCIENTIFIC NAME	FEDERAL END.	FED.... THREAT.	PROP. CAND.	Prev.. C2...	STATE END.	STAT THRE
Texas Horned Lizard	Phrynosoma cornutum	-	-	-	X	-	
Dunes Lizard	Sceloporus arenicolus	-	-	-	X	-	
Arid Land Ribbon Snake	Thamnophis proximus	-	-	-	-	-	
Bald Eagle	Haliaeetus leucocephalus	-	X	-	-	-	
Ferruginous Hawk	Buteo regalis	-	-	-	X	-	
Aplomado Falcon	Falco femoralis septentrionalis	X	-	-	-	X	
American Peregrine Falcon	Falco peregrinus anatum	X	-	-	-	X	
Burrowing Owl	Speotyto cunicularia hypugaea	-	-	-	X	-	
Bell's Vireo	Vireo bellii arizonae	-	-	-	-	-	
Baird's Sparrow	Ammodramus bairdii	-	-	-	X	-	
Cave Myotis Bat	Myotis velifer	-	-	-	X	-	
Swift Fox	Vulpes velox	-	-	C	-	-	

NATIVE WILDLIFE APPARENTLY NO LONGER OCCURRING IN LEA COUNTY

Arid Land Ribbon Snake	Thamnophis proximus diabolicus		(NM threatened)
Merriam's Elk	Cervus elaphus merriami	(extinct)	
American Bison	Bos bison		
Gray Wolf	Canis lupus	(extirpated from NM)	(federal endangered)
Black-footed Ferret	Mustela nigripes	(extirpated from NM)	(federal endangered)

TELEPHONE CONFERENCE MEMORANDUM
WESTINGHOUSE FORM 22822 B

DATE 6/17/96

☐ INCOMING ☒ OUTGOING C.O. _____ G.O. _____

WITH U.S. GAME & FISH OF THE ENDANGERED SPECIES OFFICE FOR

WITH STEVE CHAMBERS OF THE _____

COPIES TO: _____

SUBJECT: RQMNTS FOR T&E SURVEY TIME 10:15 AM

COST _____

FILE SGIS-II & T&E CHARGE _____

DETAIL OF CONFERENCE ABQ - FIELD OFFICE HAS ~~RESPONSIBILITY~~ RESPONSIBILITY
Sonja Jahrsdoerfer
761-4525.

DEPT. _____ _____ (SIGNATURE) EXT. NO. _____

TELEPHONE CONFERENCE MEMORANDUM
WESTINGHOUSE FORM 22822 B

DATE 6/27/96

☐ INCOMING ☒ OUTGOING C.O. _____ G.O. _____

WITH SANDY WILLIAMS OF THE NEW MEXICO DEPT OF GAME & FISH

WITH _____ OF THE _____

COPIES TO: JIM DAILSON SUB-CONTRACTOR TO ENV WID INFORM. TOR

SUBJECT: T&E SURVEY REQUIREMENTS FROM THE STATE OF NEW MEXICO TIME 1330 COST _____

FILE T&E CHARGE _____

DETAIL OF CONFERENCE I ASKED QUESTIONS REGARDING STATE T&E REQUIREMENTS (SURVEY PROTOCOLS, ETC). OF THE SEVEN SPECIES LISTED IN THEIR 1989 LETTER TO WIPP REGARDING T&E, HE SAID NONE SHOULD BE ON THE WIPP WITHDRAWAL

1. MISSISSIPPI KITE — NO LONGER ON LISTS
2. BALD EAGLE — MIGRANT
3. PEREGRINE — MIGRANT
4. LEAST TERN — MAY FIND AT SALT PLAYAS
5. SOUTHWEST WILLOW FLYCATCHER — DOESN'T EXPECT — RIPARIAN
6. BELL'S VIREO — RIPARIAN — DOESN'T EXPECT
7. BAIRDS SPARROW — MIGRANT

ALPOMADO FALCON — FOLLOW USFWS PROTOCOL
LOOK FOR SNOW PLOVER — SPECIES OF CONCERN.

DUNES SAGEBRUSH LIZARD — HAS PROTOCOL. I MENTIONED THEIR SURVEY RECENTLY CONDUCTED FOR DUNES SAGEBRUSH LIZARD. I'LL TRY TO GET DATA, IF DONE ON WATERLINE. SANDY SAID DR. JIM BAILEY ~~WOULD~~ MAY BE APPROPRIATE CONTACT

DEPT. ES&H (SIGNATURE) EXT. NO. 596

TELEPHONE CONFERENCE MEMORANDUM
WESTINGHOUSE FORM 22822 B

DATE

☐ INCOMING ☐ OUTGOING C.O. G.O.

WITH SONJA JAHRSGOEFER OF THE FWS ABQ FIELD OFC

WITH OF THE

COPIES TO:

SUBJECT: T&E SURVEY TIME

COST

FILE CHARGE

DETAIL OF CONFERENCE

Descript of Habitat
Consultation #
They send County list. WE REDUCE IT
TO THOSE IN OUR HABITAT

send letter to 2105 OSUNA NE
ABQ 87113

c/o JENNIFER FOWLER-PROPST

Review time 1-MONTH

DEPT. (SIGNATURE) EXT. NO.

TELEPHONE CONFERENCE MEMORANDUM
WESTINGHOUSE FORM 22822 B

DATE 8/15/9C

☐ INCOMING ☒ OUTGOING C.O. _____ G.O. _____

WITH Bob Savinsky OF THE _____

WITH New Mex Forestry Div OF THE _____

COPIES TO: Sue RESEARCH PARTNERSHIPS

SUBJECT: _____ TIME _____

COST _____

FILE _____ CHARGE _____

DETAIL OF CONFERENCE

THARP'S BLUE STAR FED SC
STATE ENDANGERED

Dunes goosefoot CHENOPODIUM
CYCLOIDES
Fed SC
St. NL

DEPT. ESCH (SIGNATURE) EXT. NO. 896