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NPRC Endangered Species and Cultural
Resources Program

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**ENDANGERED SPECIES AND
CULTURAL RESOURCES PROGRAM
NAVAL PETROLEUM RESERVES IN
CALIFORNIA
ANNUAL REPORT FY97**

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Naval Petroleum Reserves in California
P.O. Box 178, Tupman, California 93276

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ANNUAL REPORT FY97

Work performed for the U. S. Department of Energy,
Naval Petroleum Reserves in California, and
Chevron U.S.A. Production Company under DOE
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to Bechtel Petroleum Operations, Inc.,
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to Enterprise Advisory Services, Inc.

Naval Petroleum Reserves in California
P.O. Box 178, Tupman, California 93276

EXECUTIVE SUMMARY

In FY97, Enterprise Advisory Services, Inc. (EASI) continued to support efforts to protect endangered species and cultural resources at the Naval Petroleum Reserves in California (NPRC) through administering the NPRC Endangered Species and Cultural Resources Program (ESCRP). These efforts are conducted to ensure NPRC compliance with regulations regarding the protection of listed species and cultural resources on federal properties, and frequently have the added benefit of contributing to regional conservation efforts.

The ESCRP underwent significant changes in FY97 due to planned reductions in the program scope resulting from consultation with the U. S. Fish and Wildlife Service (FWS) and also due to the government's proposed divestiture of its interests in Naval Petroleum Reserve No. 1 (NPR-1). Thus, a number of previous activities were discontinued or deferred, and some effort was diverted to supporting the divestiture process. Among the discontinued activities were a number of population monitoring tasks including kit fox reproduction and mortality, small mammal trends, lagomorph trends, and coyote trends. Establishment of an on-site conservation area was deferred pending the outcome of the divestiture process.

Population monitoring activities were conducted for San Joaquin kit foxes, giant kangaroo rats, blunt-nosed leopard lizards, Hoover's wooly-star, and special status plants. Kit fox abundance was assessed on a 117-km² study area located mostly on NPR-1 that has been monitored continuously since 1981. Fox abundance continued to decline, most likely as a result of continued low prey abundance. Small mammals continued to be an important food for kit foxes, but unlike past years when kangaroo rats were the rodents most frequently consumed, San Joaquin antelope squirrels were the species most frequently consumed. Giant kangaroo rat abundance continued to decline, as did blunt-nosed leopard lizard abundance. The reasons for these declines are unknown, but do not appear to be related to oilfield activities. Hoover's wooly-star abundance was higher in 1997 compared to 1996, apparently due to more favorable climatic conditions. Finally, an additional 4,406 ha were surveyed for the presence of special status plants. Populations of eight species were observed including numerous new populations of oil neststraw. Approximately 40% of NPR-1 has now been surveyed for special status plants.

To mitigate impacts of oilfield activities on listed species, 983 preactivity surveys were conducted in FY97. Mitigation measures implemented as a result of survey findings helped prevent incidental takes of listed species. As a result, no takes were documented in FY97. No habitat reclamation was conducted in FY97, but success of past reclamation efforts was evaluated on 60 sites reclaimed in 1987. Cultural resource support provided to NPRC consisted primarily of conducting preliminary surveys for cultural resources during preactivity surveys, and assisting with cultural resources issues associated with the divestiture of NPR-1. A particularly large effort involved surveys of 52 well sites scheduled for abandonment and cleanup. ESCRP staff also assisted with mitigating effects from third-party projects, primarily by conducting biological and cultural resource consultations with regulatory agencies.

ESCRP staff continued to engage in numerous outreach activities. Participation in technical outreach included attending several scientific meetings, presenting papers at conferences, and participating in regional conservation efforts including the Lokern Natural Area Management Group and Kern County Valley Floor Habitat Conservation Plan meetings. Additionally, summaries of findings from program activities were presented at an annual review attended by 72 individuals from 31 federal, state, and private organizations. Educational outreach activities included on-site tours and briefings, visits by school children, visits by ESCRP staff to classrooms, conducting a project WILD (Wildlife in Learning Design) training session, and participation in science fairs and the U. S. Department of Energy (DOE) sponsored Science Bowl. Additionally, assistance was provided to graduate students conducting thesis research at Washington State University, University of Wisconsin, and Humboldt State University.

An extremely important task in FY97 was the continuing effort to analyze existing data and prepare manuscripts for publication. Seven reports and articles were published in FY97 and five others were accepted for publication. Additionally, 10 other manuscripts were completed and submitted for publication. One of these was a monograph summarizing 16 years of demographic data on kit foxes. The information in these manuscripts and publications contributes immensely to both on-site and regional conservation efforts, and the peer-review process associated with publication in the scientific literature enhances the credibility of the NPRC ESCRP. Efforts to complete and publish additional manuscripts will continue in FY98.

ACKNOWLEDGMENTS

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Permission to conduct research on endangered and threatened species was granted by the U. S. Fish and Wildlife Service through permit PRT-683011, and a Memorandum of Understanding between the California Department of Fish and Game and Enterprise Advisory Services, Inc.

This is a continuing program and interpretation of facts contained in this report may change as new data are acquired and analyzed. Results should not be cited without prior consultation.

CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
1.	INTRODUCTION	1
1.1	BACKGROUND	1
1.2	OBJECTIVES	1
2.	ENDANGERED SPECIES MONITORING PROGRAM	3
2.1	MONITOR POPULATIONS OF SAN JOAQUIN KIT FOXES ON NPRC ..	3
2.2	GIANT KANGAROO RAT POPULATION MONITORING	8
2.3	BLUNT-NOSED LEOPARD LIZARD POPULATION MONITORING ...	12
2.4	HOOVER'S WOOLY-STAR POPULATION MONITORING	15
2.5	ASSESSMENT OF SPECIAL STATUS PLANT SPECIES	18
3.	CONDUCT PREACTIVITY SURVEYS FOR NPRC PROJECTS	24
3.1	CONDUCT ENDANGERED SPECIES AND CULTURAL RESOURCE PREACTIVITY SURVEYS	24
3.2	CULTURAL RESOURCE SUPPORT	26
3.3	WESTERN NPR-1 3-D SEISMIC PROGRAM	27
4.	HABITAT RECLAMATION AND MANAGEMENT	31
4.1	MONITORING RECLAMATION SUCCESS	31
5.	PROGRAM ASSISTANCE	34
5.1	PROGRAM SUPPORT	34
5.2	PROJECT DOCUMENTATION	35
6.	PUBLICATIONS	37

TABLES

<u>Table</u>	<u>Title</u>	<u>Page</u>
1.	Number of trap-nights, total captures, individuals, and sex of San Joaquin kit foxes captured during winter live-trapping sessions, Naval Petroleum Reserve No. 1 study area, 1981-1996, Kern County, California	5
2.	Frequency of occurrence (%) of items found in San Joaquin kit fox scat, Naval Petroleum Reserves in California, Kern County, California, during 1997	7
3.	Number of active giant kangaroo rat precincts in colonies monitored in 1994 - 1997, Naval Petroleum Reserves in California, Kern County, California	11
4.	Mean percent cover and mean herbaceous production estimated on the giant kangaroo rat monitoring plot, Naval Petroleum Reserve No.1, Kern County, California, 1995-1997	12
5.	Mean percent cover estimated on the blunt-nosed leopard lizard plots, Naval Petroleum Reserve No. 1, Kern County, California, 1995-1997	15
6.	Total vascular plant cover by lifeform on Hoover's woolly-star reference plots on Naval Petroleum Reserve No. 1, Kern County, California, 1993-1997	18
7.	Floristic survey target species, Naval Petroleum Reserve No. 1, Kern County, California, 1997	20
8.	Special status plant survey results, Naval Petroleum Reserve No. 1, Kern County, California, 1997	22
9.	Summary of endangered species and cultural resource preactivity surveys conducted during FY97 on the Naval Petroleum Reserves in California, Kern County, California	25
10.	Summary of FY97 cultural resource identification and assessment activities on the Naval Petroleum Reserves in California, Kern County, California	27
11.	Cover and frequency of wildlife and their sign observed on reclaimed sites ten years after reclamation at Naval Petroleum Reserve No. 1, Kern County, California	33

ILLUSTRATIONS

<u>Figure</u>	<u>Title</u>	<u>Page</u>
1.	Location of U. S. Department of Energy's Naval Petroleum Reserves in California, Kern County, California	2
2.	Location of San Joaquin kit fox captures, Naval Petroleum Reserves in California, Kern County, California, winter 1996	6
3.	Frequency of occurrence of lagomorph and kangaroo rat remains found in San Joaquin kit fox scat collected during winter trapping sessions, Naval Petroleum Reserve No. 1, Kern County, California, 1983-1996	8
4.	Average Hoover's wooly-star density, frequency of occurrence, and October through March precipitation on permanent reference plots, Naval Petroleum Reserve No. 1, Kern County, California, 1993-1997	17
5.	Areas surveyed for special status plants at Naval Petroleum Reserves in California, Kern County, California, 1995-1997	23
6.	Map depicting Western Naval Petroleum Reserve No. 1 3-D Seismic Survey Program area, Naval Petroleum Reserve No. 1, Kern County, California, 1996 . . .	28

1. INTRODUCTION

1.1 BACKGROUND

The NPRC are oil fields administered by the DOE in the southern San Joaquin Valley of California. Four federally endangered animal species and one federally threatened plant species are known to occur on NPRC: San Joaquin kit fox (*Vulpes macrotis mutica*), blunt-nosed leopard lizard (*Gambelia silus*), giant kangaroo rat (*Dipodomys ingens*), Tipton kangaroo rat (*Dipodomys nitratoides*), and Hoover's woolly-star (*Eriastrum hooveri*). All five are protected under the Endangered Species Act (ESA) of 1973 (as amended) (Public Law 93-205), which declares that it is ". . . the policy of Congress that all federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of the Act." The DOE/NPRC is also obliged to determine whether actions taken by their lessees on Naval Petroleum Reserve No. 2 (NPR-2) will have any effects on endangered species or their habitats.

NPR-1 and NPR-2 are located approximately 40 km southwest of Bakersfield, Kern County, California (Figure 1). NPR-1 encompasses 19,186 ha (47,409 ac) in seven townships and is located just north of NPR-2. The DOE/NPRC owns approximately 14,994 ha (37,049 ac) on NPR-1, while Chevron U.S.A. Production Company (CPDN) owns the remaining 4,193 ha (10,360 ac). NPR-2 consists of 12,173 ha (30,080 ac) in five townships. The DOE/NPRC administers 4,209 ha (10,400 ac) on NPR-2, while the remainder is privately owned. The city of Taft occupies 518 ha (1,280 ac) in the southern portion of NPR-2.

1.2 OBJECTIVES

The primary objective of the EASI ESCRП is to provide NPRC with the scientific expertise necessary for compliance with the ESA, the National Environmental Policy Act (NEPA), and the National Historic Preservation Act (NHPA). The specific objective of this report is to summarize progress, results, and accomplishments of the ESCRП during fiscal year 1997 (FY97).

Figure 1. Location of U. S. Department of Energy's Naval Petroleum Reserves in California, Kern County, California.

2. ENDANGERED SPECIES MONITORING PROGRAM

2.1 MONITOR POPULATIONS OF SAN JOAQUIN KIT FOXES ON NPRC

I. INTRODUCTION

An essential aspect of endangered species monitoring is some knowledge of the size of the population and the foods comprising the species' diet. San Joaquin kit foxes have been trapped annually on NPRC since winter 1981 to provide continuous information on population and diet trends. The information gathered during this project is also useful in understanding the factors that most strongly affect kit fox populations on NPRC. Knowledge of how these factors influence fox numbers can ultimately be used to help formulate species recovery strategies.

II. METHODS AND MATERIALS

Annual San Joaquin kit fox population monitoring was conducted during December 2 - 20, 1996 over approximately 117 km² on and adjacent to NPR-1. This area, known as the NPR-1 Study Area, is located in the south central portion of NPR-1 and the northern portion of NPR-2 (Figure 2), and has been trapped since 1981. One 38 x 38 x 107-cm collapsible wire-mesh live-trap was placed in each quarter section of the study area and operated for four consecutive nights. Trap locations were consistent with 1995, differing only when a particular location was destroyed (e.g., road construction) or became unusable or unsafe (e.g., presence of feral dogs). In these instances new trap locations were established as close as possible to previous locations while minimizing the risk to captured animals. A total of 706 trap-nights of effort was expended at 178 locations during the trapping period. Captured kit foxes were individually marked, sexed, weighed, measured, and released at the capture location. The number of foxes captured was tallied and compared with the results of previous trapping sessions.

Kit fox diet was determined by analyzing scats collected during annual live-trapping efforts. Fresh scats were removed from traps, dried, and sent to a diagnostic laboratory for analysis (Global Ecosystem Managers, Baton Rouge, LA). Differences in the frequency of occurrence of prey items, between NPR-1 and NPR-2, were compared using a Chi-square test with a Cochran correction for continuity.

III. RESULTS

During winter 1996, 24 San Joaquin kit foxes (13 males, 11 females) were captured 34 times on the NPR-1 study area (Table 1). Ten previously untagged foxes (7 males, 3 females) were captured for the first time during this session. Kit fox abundance continued to decline on the NPR-1 study area from a peak in 1994. Prior to 1994, kit fox abundance had been increasing in response to favorable environmental conditions (Table 1). Slightly more males than females were captured during 1996 trapping efforts.

Kit foxes were captured at few locations in 1996 (Figure 2). Most captures occurred in Buena Vista Valley near the southwestern corner of the NPR-1 study area. In addition, one fox was captured in 16G and one was captured in 28S, located in the southeastern corner and along the northern boundary of the study area, respectively. Compared to 1994 and 1995, kit foxes were captured at fewer locations and were less widely distributed.

Of 32 scats collected during FY97 kit fox trapping, rodents, consisting mainly of San Joaquin antelope squirrels and kangaroo rats, occurred in 71.9% of the scats and continued to be the primary prey item consumed by kit foxes on NPRC (Table 2). Insects, primarily grasshoppers, had the second highest frequency of occurrence with 31.3%. Lagomorphs, including jackrabbits and cottontail rabbits, were found in 9.4% of all scats. In previous years, kit foxes have used more lagomorph prey on NPR-2 than on NPR-1, but in FY97 there were no lagomorph remains in kit fox scat collected on NPR-2, while only 14.3% of scats from NPR-1 contained lagomorphs. The frequency of occurrence of kangaroo rats and lagomorphs in scats was similar on NPR-1 and NPR-2 (kangaroo rats: $\chi^2 = 0.57$; $p = 0.45$; lagomorphs: $\chi^2 = 0.46$; $p = 0.50$). Since 1991, the primary prey of kit foxes has shifted from lagomorphs to kangaroo rats (Figure 3).

IV. CONCLUSIONS

Data collected in 1996 indicate that the San Joaquin kit fox population on the NPR-1 study area continued to decline from 1994 levels. Kit foxes appear to be at a density comparable to those observed during the 1985-1989 period. Captures were located primarily in flat to moderately hilly terrain and were most numerous in Buena Vista Valley along the NPR-1/NPR-2 boundary. Fox populations likely responded to recent reduced abundances of small mammal prey species, particularly kangaroo rats (Section 2.2). Reduction in kangaroo rat availability probably also resulted in observed increases in San Joaquin antelope squirrel and insect consumption by foxes. Reduced or limited prey availability can have profound effects on kit fox breeding success, productivity, pup survival, and adult survival. Some or all of these effects are potentially linked to lower kit fox captures in 1996.

Table 1. Number of trap-nights, total captures, individuals, and sex of San Joaquin kit foxes captured during winter live-trapping sessions, Naval Petroleum Reserve No. 1 study area, 1981-1996, Kern County, California.

Year	Trap-nights	Captures	Individuals	Males:Females
1981	711	209	141	76:65
1982	710	117	87	45:42
1983	712	17	17	5:12
1984	711	51	42	21:21
1985	708	31	26	17:9
1986	712	25	22	11:11
1987	712	27	23	14:9
1988	712	27	23	12:11
1989	712	27	26	10:16
1990	712	28	18	6:12
1991	712	2	2	2:0
1992	712	20	16	10:6
1993	712	50	40	20:20
1994	712	80	61	33:28
1995	712	40	33	17:16
1996	706	34	24	13:11

Figure 2. Location of San Joaquin kit fox captures, Naval Petroleum Reserves in California, Kern County, California, winter 1996.

Table 2. Frequency of occurrence (%) of items found in San Joaquin kit fox scat, Naval Petroleum Reserves in California, Kern County, California, during 1997.

Food Item	NPR-1		NPR-2		TOTAL	
	n	%	n	%	n	%
Lagomorph	3	14.3	0	0	3	9.4
Rodent	17	81.0	6	54.5	23	71.9
Kangaroo rat	8	38.1	2	18.2	10	31.3
San Joaquin antelope squirrel	7	33.3	4	36.4	11	34.4
Cricetid	2	9.5	0	0	2	6.3
Bird	2	9.5	0	0	2	6.3
Reptile	1	4.8	1	9.1	2	6.3
Snake	1	4.8	1	9.1	2	6.3
Insect	5	23.8	5	45.5	10	31.3
Cricket/Grasshopper	3	14.3	4	36.4	7	21.9
Beetle	1	4.8	1	9.1	2	6.3
Diptera	1	4.8	0	0	1	3.1
Non-food items	4	19.0	5	45.5	9	28.1
Wool	0	0	1	9.1	1	3.1
Fox hair	2	9.5	2	18.2	4	12.5
Grass	2	9.5	2	18.2	4	12.5
Empty	0	0	3	27.3	3	9.4
Other	5	23.8	2	18.2	7	21.9
Total # of scats collected	21		11		32

Figure 3. Frequency of occurrence of lagomorph and kangaroo rat remains found in San Joaquin kit fox scat collected during winter trapping sessions, Naval Petroleum Reserve No. 1, Kern County, California, 1983-1996.

2.2 GIANT KANGAROO RAT POPULATION MONITORING

I. INTRODUCTION

In 1994, a program was initiated to monitor giant kangaroo rats on NPR-1. The objectives of this program were to: 1) monitor annual populations trends, and 2) collect demographic information that would contribute to regional conservation efforts.

II. METHODS AND MATERIALS

Monitoring was conducted by live-trapping on a grid plot and assessing the dynamics of a sample of giant kangaroo rat colonies. A 12 x 12 trapping grid was established in summer 1994 on a site occupied by giant kangaroo rats. Trap stations were placed at 15-m intervals and one Sherman live-trap was placed at each station. Two trapping sessions were conducted, one in April and one

in September. Traps were prebaited for three nights and then opened in the afternoon, baited, and checked for six consecutive mornings. Captured small mammals were identified to species, marked ventrally with a non-toxic pen, sexed, aged, weighed, and released at the capture site. All kangaroo rats were also eartagged.

Vegetation characteristics including vegetative production, shrub density, and cover of grass, forb, and shrub species were measured on the monitoring plot in 1997. Vegetative production was analyzed using a two-sample *t*-test, and all other results were compared between years using a Chi-square test with a Cochran correction for continuity. This was done to determine whether annual fluctuations in environmental conditions influence giant kangaroo rat population trends.

Beginning in 1993, the dynamics of several giant kangaroo rat colonies were assessed on an annual basis. Colony size was based on the number of active precincts (burrow systems) comprising the colony. Parallel transects were walked through colonies and the number of active precincts were counted. Criteria used to identify active precincts included the presence of clipped vegetation, haystacking of clipped vegetation, large diameter burrow entrances, vertical burrow entrances, pit caching, and large-sized scats (≥ 7 -mm).

III. RESULTS

Live-Trapping

Live-trapping on the 2B plot resulted in no giant kangaroo rat captures in 1997. Small mammal captures resulted in a total of 34 individuals: 16 San Joaquin pocket mice, two San Joaquin antelope squirrels, two southern grasshopper mice, and one short-nosed kangaroo rat in April's trapping session and three San Joaquin pocket mice in the September session. Trapping results indicate a continued decline in both giant kangaroo rat and small mammal numbers since 1994. The reasons for this are not understood but reflect a trend documented in other small mammal monitoring projects in the southern San Joaquin Valley. It should also be noted that on May 19, 1997, a major grass fire burned the 2B plot and several other areas on NPRC. What affect this may have had on small mammals on NPR-1 was not evaluated.

Total plant cover on the monitoring plot did not differ between 1996 and 1997 ($\chi^2 = 2.07$; $p = 0.15$) (Table 3). Likewise, vegetative composition did not vary although grass was slightly more abundant in 1996 ($\chi^2 = 1.18$; $p = 0.28$) and forbs were more abundant in 1997 ($\chi^2 = 1.18$; $p = 0.28$). In addition, mean herbaceous production decreased in 1997, although not significantly ($t = 0.99$; $p = 0.35$).

Colony Assessments

Thirteen colony assessments were conducted in August and September to monitor giant kangaroo rat populations (Table 4). The same colonies were monitored in 1996, except for one in 17B that had no active precincts in 1995 and 1996 and was excluded from the 1997 assessments. Although

all of the colonies decreased in size during 1997, all but five were actively being used. The number of active giant kangaroo rat precincts in each colony ranged from two to 84, down from 1996 when precinct numbers ranged from one to 113 per colony.

IV. CONCLUSIONS

All giant kangaroo rat colonies decreased in size in 1997. Similarly, trapping results indicated a continued decline in population numbers. The reasons for this decline are unknown but do not appear to be related to oilfield activities.

Table 3. Number of active giant kangaroo rat precincts in colonies monitored in 1994 - 1997, Naval Petroleum Reserves in California, Kern County, California.

Section	1994	1995	1996	1997
1B	3	0	-	-
2B	-	6	6	0
9B	46	4	28	17
11B	16	11	3	0
13B	43	15	26	2
15B/21B/22B	36/186	44/178	24/22	22/9
17B	10	0	0	-
35B	93	3	0	0
11G	95	241	113	84
18G	68	12	1	0
10R	-	-	19	8
20S	4	0	-	-
21S	0	0	-	-
26S	0	0	-	-
NE/SE 11Z	-	-	85	27
SE/SE 11Z	-	-	78	11
13Z	-	-	42	7
14Z	-	-	13	0

Table 4. Mean percent cover and mean herbaceous production estimated on the giant kangaroo rat monitoring plot, Naval Petroleum Reserve No.1, Kern County, California, 1995-1997.

Year	Mean Percent Cover (SE)			Mean Production (kg/ha) (SE)		
	Total	Grass	Forb	Total	Grass	Forb
1995	85.4 (2.6)	54.4 (2.6)	31.0 (3.5)	1218.5 (150.8)	709.1 (121.1)	509.4 (111.0)
1996	85.0 (3.8)	81.4 (3.7)	3.6 (1.0)	1542.0 (325.5)	1410.0 (318.1)	131.2 (36.1)
1997	81.4 (2.1)	76.4 (3.3)	5.0 (1.8)	1186.0 (151.5)	1124.0 (165.5)	61.6 (16.4)

2.3 BLUNT-NOSED LEOPARD LIZARD POPULATION MONITORING

I. INTRODUCTION

Studies have been conducted on and adjacent to NPR-1 to define the distribution, abundance, and habitat use of the blunt-nosed leopard lizard. Suitable blunt-nosed leopard lizard habitat is found on NPR-1 in flat areas with sparse vegetation and in gentle to moderate sloping areas with large washes. Blunt-nosed leopard lizards were found to occur in low numbers and generally near the borders of the reserve. The objectives of this monitoring task are to: 1) assess the annual abundance of blunt-nosed leopard lizards, 2) determine whether blunt-nosed leopard lizard population trends differ between a developed area and an undeveloped area, 3) assess the effects of habitat features (e.g., roads, pipelines, and washes) on blunt-nosed leopard lizard space use patterns, 4) collect demographic data to contribute to on-site and range-wide conservation and recovery efforts, and 5) determine whether annual variation in vegetation characteristics influences blunt-nosed leopard lizard abundance.

II. METHODS AND MATERIALS

Blunt-nosed leopard lizards are monitored using transect surveys conducted on two 16-ha study plots established on NPR-1. One plot is located in a section that is less than 5% developed (4B) and the other is located in a section that is more than 15% developed (18G). Both plots have similar terrain and habitat features. Each 16-ha plot is composed of 16 to 20 parallel transects spaced 20 m apart. Ten surveys are conducted on each plot in the spring to assess the abundance of adults, and again in late summer to assess the abundance of juveniles. Surveys are conducted when air temperature is optimal for blunt-nosed leopard lizard activity (25-35° C). When a blunt-nosed leopard lizard is observed, attempts are made to capture it with a noose pole. After a lizard

is captured, it is sexed, aged, weighed, measured, and uniquely marked by clipping one or more toes before it is released at the capture site. The location of each lizard observed is plotted to determine the effects of disturbance and topographic features on blunt-nosed leopard lizard distribution within each plot. In addition, the abundance of blunt-nosed leopard lizard prey, including other lizard species and grasshoppers, is noted. Results were compared between years and monitoring plots using a two-sample *t*-test.

In April, shrub density and cover of grass, forb, and shrub species were estimated to assess differences between the two monitoring plots and between years on each plot. Six 200-m transects were randomly placed on each study plot. At 5-m intervals, five points were sampled for a total of 200 points per transect. Results were compared between years and monitoring plots using a Chi-square test with a Cochran correction for continuity.

III. RESULTS AND CONCLUSIONS

Surveys

Surveys to assess the abundance of adult blunt-nosed leopard lizards were conducted on the two monitoring plots in sections 4B and 18G during May and June. On the 4B plot, there were six sightings of blunt-nosed leopard lizards (two females, three males, and one unknown), of which one female and all three males were captured and marked. In 1996, there were seven (four females, one male, and two unknowns) sightings of adult blunt-nosed leopard lizards on the 4B plot. Four lizards (one male and three females) were captured and marked.

On the 18G plot in 1997, two adult blunt-nosed leopard lizards were observed, including one unknown and one male that was captured and marked. This was the first year in which blunt-nosed leopard lizards were observed during surveys on the 18G plot.

In 1997, blunt-nosed leopard lizards were observed only in sparse vegetation and in the flats, in washes, and on roads. Similarly, during surveys in 1996, blunt-nosed leopard lizards were seen most frequently in roads and washes where the vegetation was sparse and patchy. Blunt-nosed leopard lizards were not observed on hillsides or in areas of dense vegetation. Such areas may constitute poor habitat for blunt-nosed leopard lizards. Dense vegetation may reduce foraging efficiency and also limit blunt-nosed leopard lizards' ability to spot and avoid predators.

The abundance of juvenile blunt-nosed leopard lizards was assessed during August. There were no confirmed sightings of blunt-nosed leopard lizards on either monitoring plot, although one lizard was seen briefly on the 4B plot that may have been a blunt-nosed leopard lizard.

Environmental Conditions

Grasshoppers were more abundant in spring on both the 4B ($t = 20.80$; $p = 0.00$) and 18G ($t = 6.71$; $p = 0.00$) monitoring plots. Conversely, significantly more side-blotched lizards (*Uta*

stansburiana), which may be prey for blunt-nosed leopard lizards, were seen on both the 4B plot ($t = 6.30$; $p = 0.00$) and the 18G plot ($t = 2.19$; $p = 0.04$) in summer.

Significantly more grasshoppers were observed in 1996 than in 1997 on both plots, during adult (4B: $t = 5.89$; $p = 0.00$; 18G: $t = 8.79$; $p = 0.00$) and juvenile (4B: $t = 11.17$; $p = 0.00$; 18G: $t = 11.08$; $p = 0.00$) surveys, which may explain why more blunt-nosed leopard lizards were seen in 1996. However, more side-blotched lizards were seen on the 4B plot in 1997 during both juvenile ($t = 4.09$; $p = 0.00$) and adult ($t = 2.61$; $p = 0.02$) surveys.

The 4B plot had more side-blotched lizards during juvenile surveys ($t = 3.48$; $p = 0.00$) and more grasshoppers during both adult ($t = 10.68$; $p = 0.00$) and juvenile ($t = 7.15$; $p = 0.00$) surveys than did the 18G plot. This greater prey availability may explain the greater number of blunt-nosed leopard lizards on the 4B plot.

The greater abundance of blunt-nosed leopard lizards and their prey on the 4B plot may have been due to differences in vegetation (Table 5). The 4B plot had significantly more bareground ($\chi^2 = 100.3$; $p = 0.00$), cryptogamic crust ($\chi^2 = 9.47$; $p = 0.00$), and forbs ($\chi^2 = 50.3$; $p = 0.00$), and less standing litter ($\chi^2 = 70.1$; $p = 0.00$), shrubs ($\chi^2 = 32.51$; $p = 0.00$), and grass ($\chi^2 = 14.12$; $p = 0.00$) than did the 18G plot. Likewise, the 4B plot had less plant cover ($\chi^2 = 48.66$; $p = 0.00$), grass ($\chi^2 = 19.54$; $p = 0.00$), and forbs ($\chi^2 = 18.11$; $p = 0.00$), but more bareground ($\chi^2 = 34.11$; $p = 0.00$) and litter ($\chi^2 = 9.53$; $p = 0.00$) in 1996 than in 1997, which may explain why more blunt-nosed leopard lizards were seen in 4B during 1996. Greater vegetative cover may decrease habitat suitability for blunt-nosed leopard lizards, which may prefer open habitat that facilitates foraging and predator avoidance.

On the 18G plot in 1997, there were more forbs ($\chi^2 = 55.69$; $p = 0.00$) and litter ($\chi^2 = 59.88$; $p = 0.00$), but less grass ($\chi^2 = 22.57$; $p = 0.00$) and plant cover ($\chi^2 = 52.43$; $p = 0.00$) than in 1996 (Table 5). This may have resulted in more suitable open habitat, leading to blunt-nosed leopard lizards being observed on the 18G plot for the first time.

Table 5. Mean percent cover estimated on the blunt-nosed leopard lizard plots, Naval Petroleum Reserve No. 1, Kern County, California, 1995-1997.

Year	Plot	Percent Ground Cover (SE)				Percent Plant Cover (SE)		
		Plant	Litter	Bare Ground	Crypto	Shrub	Grass	Forb
1995	4B	80.8 (2.8)	8.3 (1.5)	7.6 (1.5)	3.3 (1.0)	3.3 (8.9)	78.5 (4.3)	18.3 (4.8)
	18G	89.5 (1.4)	6.0 (0.8)	3.4 (1.0)	1.1 (0.8)	4.6 (2.0)	77.1 (2.7)	18.4 (1.7)
1996	4B	60.0 (4.8)	14.0 (1.3)	24.6 (4.8)	1.4 (0.4)	1.6 (1.1)	85.7 (1.5)	13.7 (1.6)
	18G	85.9 (1.2)	10.8 (1.2)	3.1 (0.8)	0.3 (0.1)	6.9 (2.6)	91.5 (2.5)	1.6 (0.7)
1997	4B	73.5 (2.7)	9.8 (1.8)	15.0 (2.4)	1.7 (0.1)	1.1 (0.1)	76.7 (4.1)	22.2 (3.4)
	18G	74.0 (3.0)	22.5 (3.9)	3.2 (1.1)	0.3 (0.0)	5.8 (2.6)	84.4 (1.8)	9.8 (2.3)

2.4 HOOVER'S WOOLY-STAR POPULATION MONITORING

I. INTRODUCTION

Hoover's wooly-star, *Eriastrum hooveri*, is a federally threatened annual wildflower that inhabits many areas on NPRC. This species is monitored each spring by sampling six reference plots that were established on known colonies in 1993. The monitoring is conducted to detect trends in Hoover's wooly-star numbers and habitat change over time. Two of the plots are located on the south-facing slope of the Elk Hills formation (Sections 12B and 17G), two are near the crest of the formation (Sections 33R and 33S), and two are on the north-facing slope of the Elk Hills (Sections 20S and 7R).

II. METHODS AND MATERIALS

In April 1997, density, frequency of occurrence, and cover of Hoover's wooly-star and associated grass, forb, and shrub species were measured on the reference plots. Density and frequency data were collected within 50 1 x 1-m frames and cover was estimated using a cover scope with 10X magnification. Data were collected along three permanent linear transects located within each

plot. All data were entered into a database and analyzed. Precipitation data used in this study was derived from the Bakersfield Airport Weather Station, Bakersfield, California, as published monthly by the National Climatic Data Center.

III. RESULTS

In 1997, Hoover's wooly-star density ranged from 0 to 14.9 individuals per square meter on the six reference plots and averaged 6.4 (SE = 1.1) (Figure 4). Hoover's wooly-star frequency of occurrence ranged from 0 to 84.0% within 1 x 1-m sampling frames and averaged 56.6% (SE = 5.9). Precipitation from October through March, the primary months in which precipitation is believed to contribute to spring growth of Hoover's wooly-star and other annual plants, was 163-mm, the same as the 1996 growing season (Figure 4). Although precipitation was the same, 1997 was a better year for Hoover's wooly-star germination and survival. Hoover's wooly-star density and frequency increased from 1996 to 1997. In 1997, shrub cover on the six reference plots averaged 6.3% (SE = 1.3), grass cover averaged 46.1% (SE = 3.0), and forb cover averaged 16.7% (SE = 1.8) (Table 6). Total vascular plant cover averaged 69.1% (SE = 4.0). Forb cover, Hoover's wooly-star density, and frequency increased in 1997, probably due to differences in temperature, relative humidity, and the timing, intensity, and duration of precipitation events between years.

IV. CONCLUSIONS

Although October through March precipitation was similar in 1996 and 1997, Hoover's wooly-star density, frequency, and forb cover exhibited an upward trend in 1997. This indicates that other factors such as temperature patterns, relative humidity, and the timing of major precipitation events may also play key roles in Hoover's wooly-star germination and growth.

Figure 4. Average Hoover's woolly-star density, frequency of occurrence, and October through March precipitation on permanent reference plots, Naval Petroleum Reserve No. 1, Kern County, California, 1993-1997.

Table 6. Total vascular plant cover by lifeform on Hoover's woolly-star reference plots on Naval Petroleum Reserve No. 1, Kern County, California, 1993-1997.

Growing Season	Average Vascular Plant Cover (%) (SE)				PPT ^a (mm)
	Shrub	Grass	Forb	Total	
1993	5.3 (3.30)	35.8 (7.10)	21.9 (3.90)	63.2 (3.19)	224
1994	4.1 (1.06)	15.6 (2.20)	3.9 (1.12)	23.6 (3.38)	113
1995	7.9 (1.83)	45.6 (2.78)	16.6 (1.75)	70.1 (2.53)	227
1996	8.1 (2.03)	52.3 (3.24)	1.1 (0.36)	61.4 (3.73)	163
1997	6.3 (1.26)	46.1 (2.99)	16.7 (1.84)	69.1 (4.03)	163
Overall Average	6.3	39.1	12.0	57.2	125 ^b

^aPrecipitation from October through March contributes to the current year's growth of annual plants.

^bThirty-year average of October through March precipitation.

2.5 ASSESSMENT OF SPECIAL STATUS PLANT SPECIES

I. INTRODUCTION

Surveys for special status plant species on NPR-1 were completed between late February and mid-April 1997. The comprehensive survey of NPR-1 for special status plants began in spring 1995 when approximately 1,685 ha (4,160 ac) were surveyed. In 1996, an additional 648 ha (1,600 ac) were surveyed (Figure 5). Fewer acres were surveyed in 1996 because forb numbers were generally low that year. Although precipitation contributing to plant growth was similar in 1996 and 1997, forbs were more abundant in 1997. Therefore, EASI contracted Aspen Environmental Consulting & Management (AECM) to survey a total of 17 sections of land, or approximately 4,406 ha (10,880 ac), for presence of special status plant species. Table 7 lists the 37 special status species targeted during the surveys.

II. METHODS AND MATERIALS

When selecting areas to be surveyed in 1997, priority was given to: 1) areas likely to be impacted by exploration or development activities in the near future, and 2) areas having habitat likely to support special status plants. Areas in sections 10G, 11G, 8R, 25R, 33S, 34S, 36S, and 24Z were identified by Bechtel Petroleum Operations, Inc. (BPOI) personnel as likely areas of future development. Sections 4B, 11B, 12B, 13B, 14B, 12G, 18G, 18R, 20S, and 12Z were selected based on the second criterion (Figure 5).

Biologists with AECM attended a one-day course on special status plant identification and field survey methodology which was co-instructed by EASI and AECM plant ecologists. Survey methods consisted of searching for species listed in Table 7 while walking north-south or east-west oriented, 0.8-km (0.5-mi) long transects spaced at 30.5-m (100-ft) intervals. Transect direction was maintained using hand-held compasses in combination with sighting poles and pin flags placed at ends of transects. Sensitive plant observations were recorded on 1.5-m (5-foot) contour interval topographic maps. Voucher specimens were collected, pressed, and dried. Records of new occurrences for special status plants were sent to the CDFG for inclusion in the California Natural Diversity Data Base. Digitization of special status plant occurrence data is in progress.

III. RESULTS

Atriplex coronata var. *coronata* was observed in Sections 10G, 11G, 12G, and 33S (Table 8). Occurrences of *Delphinium gypsophilum* ssp. *gypsophilum* were observed in all of the areas surveyed except Section 13B. *Eriastrum hooveri* was observed in all of the areas surveyed except sections 12Z and 24Z. *Eriogonum gossypinum* was observed in all of the areas surveyed except Section 36S. Occurrences of *Eschscholzia lemmonii* ssp. *kernensis* were found in sections 4B, 14B, 8R, and 20S. *Hollisteria lanata* was observed in sections 8R and 24Z. A known occurrence of the NPRC-protected species, *Larrea tridentata*, was revisited in Section 12B. *Stylocline citroleum* was discovered in all of the areas surveyed except sections 12B, 18R, and 12Z. No other special status plants were encountered. Of the 10 special status plant species known to occur on NPR-1 (Table 7), all were observed in 1997 except *D. recurvatum* and *Trichostema ovatum* (Table 8). This latter species was observed on NPR-1 during late summer 1997 after survey work had ended. It is likely that *T. ovatum* was not observed earlier due to its late-season germination habit.

IV. CONCLUSIONS

A total of eight special status plant species were observed during the 1997 surveys. A ninth species was observed after the survey had ended. Four of the species, *D. gypsophilum* ssp. *gypsophilum*, *E. hooveri*, *E. gossypinum*, and *S. citroleum*, appear to be relatively common on NPR-1. The rarest species observed was *L. tridentata*, and the observation was of a previously recorded occurrence. Locational data from 1997 is being digitized for generation of maps and for future incorporation into a geographic information system. This information will contribute to the conservation and recovery of these species.

Table 7. Floristic survey target species, Naval Petroleum Reserve No. 1, Kern County, California, 1997.

Scientific Name	Common Name	Protective Status	Apparent Relative Abundance at NPRC
SPECIES KNOWN TO OCCUR ON NPRC			
<i>Atriplex coronata</i> var. <i>coronata</i>	crownscale	CNPS List 4	uncommon
<i>Delphinium gypsophilum</i> ssp. <i>gypsophilum</i>	gypsum-loving larkspur	CNPS List 4	common
<i>Delphinium recurvatum</i>	recurved larkspur	CNPS List 1B	rare
<i>Eriastrum hooveri</i>	Hoover's eriastrum	FT ^a	common
<i>Eriogonum gossypinum</i>	cottony buckwheat	CNPS List 4	common
<i>Eschscholzia lemmonii</i> ssp. <i>kernensis</i>	Tejon poppy	CNPS List 1B	uncommon
<i>Hollisteria lanata</i>	hollisteria	None	uncommon
<i>Larrea tridentata</i>	creosote bush	NPRC-protected	rare
<i>Stylocline citroleum</i>	oil neststraw	CNPS List 1B	common
<i>Trichostema ovatum</i>	San Joaquin bluecurls	CNPS List 4	common
SPECIES POSSIBLY OCCURRING ON NPRC			
<i>Amsinckia vernicosa</i> var. <i>furcata</i>	forked fiddleneck	CNPS List 4	unknown
<i>Atriplex cordulata</i>	heartscale	CNPS List 1B	unknown
<i>Caulanthus californicus</i>	California jewelflower	FE ^b , CE ^c	unknown
<i>Cirsium crassicaule</i>	slough thistle	CNPS List 1B	unknown
<i>Eremalche kernensis</i>	Kern mallow	FE	unknown
<i>Eriogonum temblorense</i>	Temblor buckwheat	CNPS List 4	unknown
<i>Lembertia congdonii</i>	San Joaquin wooly-threads	FE	unknown
<i>Stylocline masonii</i>	Mason's neststraw	CNPS List 1B	unknown

SPECIES HIGHLY UNLIKELY TO OCCUR ON NPRC			
<i>Androsace elongata</i> ssp. <i>acuta</i>	California androsace	CNPS List 4	absent
<i>Antirrhinum ovatum</i>	oval-leaved snapdragon	CNPS List 4	absent
<i>Atriplex depressa</i>	brittlescale	CNPS List 1B	absent
<i>Atriplex joaquiniana</i>	San Joaquin spearscale	CNPS List 1B	absent
<i>Atriplex minuscula</i>	lesser saltscale	CNPS List 1B	absent
<i>Atriplex tularensis</i>	Bakersfield saltbush	CE	absent
<i>Atriplex vallicola</i>	Lost Hills saltbush	CNPS List 1B	absent
<i>Calochortus striatus</i>	alkali mariposa	CNPS List 1B	absent
<i>Chorizanthe spinosa</i>	Mojave spineflower	CNPS List 4	absent
<i>Clarkia tembloriensis</i> ssp. <i>calientensis</i>	Vasek's clarkia	FC ^d	absent
<i>Cordylanthus mollis</i> ssp. <i>hispidus</i>	hispid bird's-beak	CNPS List 1B	absent
<i>Cordylanthus palmatus</i>	palmate-bracted bird's-beak	FE, CE	absent
<i>Eschscholzia rhombipetala</i>	diamond-petaled California poppy	CNPS List 1A	absent
<i>Hordeum intercedens</i>	vernal barley	CNPS List 3	absent
<i>Layia heterotricha</i>	pale-yellow layia	CNPS List 1B	absent
<i>Layia leucopappa</i>	Comanche Point layia	FC	absent
<i>Layia munzii</i>	Munz's tidy tips	CNPS List 1B	absent
<i>Lepidium jaredii</i> ssp. <i>jaredii</i>	Jared's peppergrass	CNPS List 1B	absent
<i>Madia radiata</i>	showy madia	CNPS List 1B	absent

^aListed as federal threatened species under the federal Endangered Species Act.

^bListed as federal endangered species under the federal Endangered Species Act.

^cListed as California endangered species under the California Endangered Species Act.

^dFederal candidate for listing under the federal Endangered Species Act.

Table 8. Special status plant survey results, Naval Petroleum Reserve No. 1, Kern County, California, 1997.

Species	Species Presence (+) by Section																	
	4B	11B	12B	13B	14B	10G	11G	12G	18G	8R	18R	25R ^a	20S	33S	34S ^a	36S	12Z	24Z
<i>Atriplex coronata</i> var. <i>coronata</i>						+	+	+						+				
<i>Delphinium gypsophilum</i> ssp. <i>gypsophilum</i>	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Eriastrum hooveri</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
<i>Eriogonum gossypinum</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+
<i>Eschscholzia lemmonii</i> ssp. <i>kernensis</i>	+				+					+			+					
<i>Hollisteria lanata</i>										+								+
<i>Larrea tridentata</i>			+															
<i>Stylocline citroleum</i>	+	+		+	+	+	+	+	+	+		+	+	+	+	+		+

^aSections only partially surveyed in 1997.

Figure 5. Areas surveyed for special status plants at Naval Petroleum Reserves in California, Kern County, California, 1995-1997.

3. CONDUCT PREACTIVITY SURVEYS FOR NPRC PROJECTS

3.1 CONDUCT ENDANGERED SPECIES AND CULTURAL RESOURCE PREACTIVITY SURVEYS

I. INTRODUCTION

The preactivity survey program was developed to minimize or eliminate impacts of petroleum-related activities to endangered species and their habitats as well as cultural resources on NPRC. Preactivity surveys are conducted for all projects resulting in habitat disturbance.

II. METHODS AND MATERIALS

Preactivity survey requests are forwarded to EASI by BPOI. During preactivity surveys a biologist examines the anticipated impact area and an adjacent buffer zone for evidence of threatened and endangered species. Specifically, the biologist looks for known San Joaquin kit fox dens, potential kit fox dens, giant kangaroo rat burrows, blunt-nosed leopard lizards, washes representing potential blunt-nosed leopard lizard habitat, and Hoover's wooly-star. Observed kit fox dens, giant kangaroo rat burrows, blunt-nosed leopard lizard habitat, and some populations of Hoover's wooly-star are then identified with wooden stakes and flagging to create avoidance zones consistent with those specified in the 1995 Biological Opinion for petroleum production on NPR-1. Once the preactivity survey has been completed, the biologist contacts the requestor to report any findings and make recommendations to refrain from disturbing the marked area.

Follow-up surveys are conducted, usually within three months of the original survey, to document whether endangered species or their habitat were impacted, recommendations were followed, and activities were confined to the surveyed project area. Recommendations that are not followed are reported in a monthly summary letter that is sent to survey requestors.

III. RESULTS AND CONCLUSIONS

During FY97, 983 preactivity surveys were conducted on or adjacent to NPRC (Table 9). Of these, 164 surveys were classified as emergencies (projects requiring a preactivity survey within three working days). Most emergency surveys were conducted for cleanups, pipelines, new well pads, and other miscellaneous construction projects. Compared with FY96, 676 fewer surveys were conducted in FY97. The average for emergency surveys in FY97 was approximately 17%, compared to 12% in FY96.

Recommendations to prevent potential impacts to endangered species or their habitats were made on a total of 103 projects in FY97. New well pads, pipelines, and other miscellaneous construction or maintenance projects were most often affected. Alterations usually included the establishment of avoidance zones around dens and burrows, restriction of driving on revegetated

sites and in washes, and establishment of avoidance zones around populations of Hoover's woolly-star. Most cleanup sites were restricted to the use of hand tools only.

A total of ten known kit fox dens and 60 potential kit fox dens were identified during surveys in FY97. Populations of Hoover's woolly-star were identified at 41 survey sites, and evidence of giant kangaroo rats was found at nine survey sites. San Joaquin antelope squirrels were located on three survey sites.

Follow-up surveys were conducted on all of the projects where evidence of endangered or threatened species, their habitats, or revegetated areas were encountered during the initial preactivity survey. In addition, follow-up surveys were conducted for most cleanups and some survey areas where no endangered species were found, but where there were causes for concern. During 164 follow-up surveys, it was found that recommendations were not followed on nine projects completed in FY97. These incidents did not result in any take of listed species, and operators and their supervisors were contacted to correct the problems.

Table 9. Summary of endangered species and cultural resource preactivity surveys conducted during FY97 on the Naval Petroleum Reserves in California, Kern County, California.

Type of Disturbance	Number of Surveys	Number of Emergency Surveys
Cleanups	142	38
Pipeline	101	26
Well Pads		
New	20	11
Regrade	133	13
Abandonment	55	2
Powerlines	31	7
Corrosion Protection	53	15
Other ^a	448	52
Totals	983	164

^aIncludes miscellaneous construction and maintenance activities.

3.2 CULTURAL RESOURCE SUPPORT

I. INTRODUCTION

In accordance with federal cultural resources management (CRM) laws and implementing regulations, EASI provided a variety of cultural resources compliance support to the DOE/NPRC in FY97. Routine CRM identification and assessment activities were conducted in FY97 during preactivity surveys. Non-routine activities are summarized in the following paragraphs and in Table 10.

II. METHODS AND MATERIALS

Archaeologists with either EASI or outside consulting firms conduct cultural resource assessments for non-routine and third party projects at NPRC. Cultural resource surveys for routine projects (Section 3.1) are conducted by EASI archaeologists or by EASI scientists who have been trained by qualified archaeologists to detect cultural resources. Routine preactivity survey results are transmitted to the California State Historic Preservation Officer (SHPO) via annual reports. Reports containing identification and assessment information for non-routine and third party projects are sent individually to the SHPO for review. During FY97, EASI archaeologists also updated and maintained the DOE/NPRC's cultural resources data base and artifact collection, and responded to a variety of cultural resources related requests from the DOE/NPRC.

III. RESULTS AND CONCLUSIONS

In March and April 1997, an assessment was completed cooperatively between EASI and BPOI environmental staff for the abandonment of 53 historic oil wells located in the Shallow Oil Zone (SOZ) portion of NPR-1 (Table 10). All 53 well locations were formally recorded. The DOE/NPRC sent the assessment report along with its "no effect" determination to the SHPO. The SHPO concurred with this determination in a letter dated May 27, 1997. In August 1997, EASI and Center for Archaeological Research archaeologists cooperatively completed assessments of historic surface trash areas in Sections 36S and 25S that were scheduled for clean up. One prehistoric archaeological site was recorded in 25S. No other cultural resources were observed. The DOE/NPRC transmitted both reports and its "no effect" determinations to the SHPO. Concurrence from the SHPO is pending.

On August 28, 1997, signs of recent vandalism (digging) were discovered at CA-KER-3079, a prehistoric site at NPR-1 which is potentially eligible for inclusion in the National Register of Historic Places and considered important to Native Americans because of its likelihood to contain Native American graves and associated objects. Security was immediately notified. It was concluded that an individual vandal had entered NPR-1 illegally on foot, probably during the preceding weekend. A Bureau of Land Management (BLM) special agent assisted in recording and reporting the incident to local and federal authorities. Site CA-KER-3079 and others like it are being monitored more frequently and an investigation of the incident is in progress.

Table 10. Summary of FY97 cultural resource identification and assessment activities on the Naval Petroleum Reserves in California, Kern County, California.

Survey Date	Project ^a	Area	# Arch. Sites	# Isolates	SHPO ^b Response
March and April 1997	Abandonment of 53 historic oil wells	Shallow Oil Zone (SOZ) portion of NPR-1	53	0	Received concurrence with "no effect" determination in letter dated 5/27/97 (DOE970430A).
August 1997	Surface trash clean-up	North of well 36-36S	0	0	Pending. The DOE made "no effect" determination in letter dated 10/20/97.
August 1997	Surface trash clean-up	Section 25S	1	0	Pending. The DOE made "no effect" determination in letter dated 10/20/97.

^aDoes not include cultural resource evaluation and data recovery activities done solely as a SHPO requirement for federal divestiture of NPR-1.

^bState Historic Preservation Officer

3.3 WESTERN NPR-1 3-D SEISMIC PROGRAM

I. INTRODUCTION

During the first three months of FY97, a three-dimensional seismic survey initiated in FY96 was completed on the western part of NPR-1 (Figure 6). The purpose of the survey was to determine the potential for presence of hydrocarbon deposits in an approximately 18-km² (7-mi²) target area within a 36-km² (14-mi²) survey activity area. Completion of the survey was expected to increase NPR-1 recoverable reserves, and reduce the risks and costs associated with further exploration and development in the area. The project area included the DOE/NPRC and Bureau of Land Management administered lands, one CDFG parcel, CPDN lands, and other private holdings both on and off of NPR-1. Seismic survey field activities in FY97 consisted of: 1) continued drilling of about 692 115-mm diameter, 99- to 221-m (325- to 725-foot) deep shotholes, loading and backfilling explosive charges in the holes, 2) stringing receiver lines connecting geophone arrays, sequentially detonating the charges, and recording the reflected energy, and 3) cleanup and partial recontouring and disking of shothole locations and access routes. Scientists with EASI provided endangered species and cultural resources compliance support services during seismic survey activities.

Western NPR-1 3-D Seismic Survey Program Area

Figure 6. Map depicting Western Naval Petroleum Reserve No. 1 3-D Seismic Survey Program area, Naval Petroleum Reserve No. 1, Kern County, California, 1996.

II. METHODS AND MATERIALS

Shothole drilling was completed on November 23, 1996. Drilling personnel were initially briefed and received environmental fact sheets. EASI environmental monitors conducted 60-day and 24-hour biological preactivity surveys ahead of drilling crews as needed. EASI staff continued to assist in the relocation of proposed access routes and shotholes and gave recommendations on how to minimize habitat disturbance. Environmental monitors observed drilling crew and water truck activities in the project area to evaluate compliance with environmental requirements. At least one monitor attended the weekly safety and daily project coordination meetings. Monitors provided daily lists of approved shotholes to the drillers and continually updated drill site access maps. Cumulative temporary disturbance was measured and reported to BPOI and the DOE/NPRC.

Recording activities commenced on November 15 and ended on November 28, 1996. Work crews were briefed and received environmental fact sheets. Because receiver lines and geophones were to be laid out by helicopter and on foot, additional biological preactivity surveys were not necessary. In combination with the monitoring of drilling activities, EASI staff monitored recording activities in the project area to provide compliance support and ready assistance when needed to resolve problems as they arose.

Project cleanup began immediately following recording activities in a particular area. Workers removed geophones, receiver lines, lath, flagging, and incidental trash. Temporary facilities at the three staging areas were dismantled and removed. EASI staff members monitored cleanup crews to ensure that all project materials were removed from the project area. Cleanup was completed during the first week of December 1996.

Partial recontouring of disturbed habitat was conducted at certain severely disturbed locations after an endangered species preactivity survey had been completed by an EASI or BPOI environmental staff member. A limited amount of recontouring was done during the drilling phase of the project, but most recontouring was accomplished after February 10, 1997. Under the direction of EASI and BPOI environmental staff members, most earthen pads built during the project were partially recontoured, then disked. Many access routes and shothole locations with deep tire ruts were also disked. An environmental staff member was continuously present during all the recontouring and disking to conduct preactivity surveys, to facilitate and ensure avoidance of sensitive resources, to direct the equipment operator, and to monitor environmental compliance. Recontouring activities were completed on March 4, 1997.

III. RESULTS

With few exceptions, sensitive resources were successfully avoided through the cooperative efforts of the DOE/NPRC, BPOI, EASI environmental monitors, and seismic contractor personnel. Three notable exceptions were: 1) two project shut-downs that were necessary to curb an escalation in off-road driving incidents, 2) a recurring problem of speeding, and 3) the submission of the post-activity compliance report after the 45-day deadline. No unauthorized take of

endangered species or damage to sensitive cultural resources was observed to occur as a result of the non-compliance. One potential kit fox den necessitated monitoring and excavation. Another potential kit fox den was inadvertently driven over by a worker who wandered outside the approved travel corridor. The den did not collapse. In two instances, geodetic surveyors drove over giant kangaroo rat precincts. No collapse of burrows was observed. Four areas with Hoover's wooly-star were impacted by vehicles following seed dispersal. Effects on the Hoover's wooly-star seed bank are not known. Approximately 35.0 ha (86.4 ac) of threatened and endangered species habitat were temporarily disturbed as a result of project activities. About 18.0 ha (44.5 ac) of the habitat temporarily disturbed by seismic survey activities were either disked, or partially recontoured and disked, to enhance natural revegetation and to reduce erosion. The remaining areas were not severely impacted, and therefore were not treated. No impacts to sensitive archaeological sites were observed during the project. No additional cultural resources were reportedly found by project workers. One ancestral zebra fossil was inadvertently exposed during the project and was later removed by Buena Vista Museum of Natural History personnel.

IV. CONCLUSIONS

Overall, compliance with the required mitigation measures was satisfactory. With the exception of Hoover's wooly-star, no direct take of threatened or endangered species was observed. Four areas with Hoover's wooly-star were impacted by vehicles following seed dispersal. Approximately 35.0 ha (86.4 ac) of threatened and endangered species habitat were temporarily disturbed as a result of project activities. About 18.0 ha (44.5 ac) of the disturbed areas were either disked or partially recontoured and disked to facilitate natural revegetation of the habitat. All archaeological sites and the historic railroad grade were successfully avoided. One significant paleontological find was discovered and removed during the project.

4. HABITAT RECLAMATION AND MANAGEMENT

4.1 MONITORING RECLAMATION SUCCESS

I. INTRODUCTION

The success of the habitat reclamation program at NPRC has been monitored since 1987. Vegetation on reclaimed sites was originally monitored by evaluating quantitative vegetation measurements taken at each site. As the number of reclaimed sites continued to increase, a combination of quantitative and qualitative sampling methods was adopted. Since 1994, evaluating success of habitat reclamation has been accomplished by qualitatively comparing vegetative cover on sites reclaimed ten years previous to cover on undisturbed adjacent areas. Sites are deemed successfully reclaimed when vegetative cover is $\geq 70\%$ of the cover observed on adjacent undisturbed areas.

II. METHODS AND MATERIALS

In 1997, a 30% sample of sites reclaimed in 1987 was randomly selected from a pool of 191 sites available for sampling. Samples were chosen in proportion to the number of different disturbance types represented in the pool (cut/fill slopes, well pads, roads, pipelines, and borrow areas). Qualitative estimations were calibrated by post hoc comparison of visual estimates of percent vascular plant cover, litter, and bare ground to quantitative measurements of these same variables at six Hoover's wooly-star reference plots. Following researcher calibration, percent cover of vascular plants, litter, bare ground, and cover by lifeform were estimated for the sample of sites. Total vascular plant cover was estimated on a representative, undisturbed site adjacent to each reclamation site. Evidence of use by wildlife was recorded. Data were entered into a database and statistically summarized.

III. RESULTS

Total vascular plant cover averaged 56.1% (SE = 2.8) for the sample of sites (n = 60) reclaimed in 1987 (Table 11). Litter cover averaged 7.1% (SE = 0.7) and bare ground cover averaged 37.1% (SE = 2.9). Shrubs, grasses, and forbs comprised an average of 18.2% (SE = 2.1), 68.5% (SE = 2.3), and 13.3% (SE = 1.9) of the total vascular plant cover, respectively. In FY97, total vascular plant cover on 1987 reclamation sites was an average of 77.0% (SE = 2.7) of the total cover observed on adjacent undisturbed sites. Forty-three, or 71.7%, of the sites were considered successfully reclaimed. Evidence of herbivory was found on 81.7% of the sites. Small mammal burrows were observed on 86.7% of the sites. Predator dens or potential dens were observed on 13.3% of the sites. Lagomorph, rodent, kit fox, and coyote scat were observed at 76.7%, 83.3%, none, and 31.7% of the sites, respectively. Lagomorphs, coyotes, antelope squirrels, quail, other birds, and other animals were directly observed at 3.3%, none, 1.7%, 1.7%, 5.0%, none, and 3.3% of the sites, respectively.

IV. CONCLUSIONS

Although October through March precipitation was similar in 1996 and 1997, total vascular plant cover on 10-year old reclaimed sites was lower and bare ground cover was higher in 1997. Litter cover was similar to levels observed in previous years. Monitoring indicated that 71.7% of a sample of sites reclaimed in 1987 are successfully reclaimed and will not require future monitoring. Rodent and lagomorph herbivory and site use appeared to be somewhat lower in 1997 than previous years. Use of sites by coyotes was similar to 1996 levels; however, unlike in 1996, no use by San Joaquin kit fox was observed in 1997. One San Joaquin antelope squirrel (a species listed as threatened in the State of California) was observed on one reclaimed site.

Table 11. Cover and frequency of wildlife and their sign observed on reclaimed sites ten years after reclamation at Naval Petroleum Reserve No. 1, Kern County, California.

Habitat Reclamation Site Characteristics	Year Reclaimed		
	1985 ^a	1986 ^b	1987 ^c
Cover (%)			
Total Vascular Plant Cover	63.1	63.4	56.1
Shrubs	26.4	21.5	18.2
Grasses	45.6	71.7	68.5
Forbs	27.8	6.9	13.3
Litter	8.0	6.2	7.1
Bare ground	29.1	30.6	37.1
Adjacent undisturbed ^c	76.9	82.4	77.0
Frequency ^d of Wildlife and their Sign (%)			
Herbivory	94.0	98.5	81.7
Small mammal burrows	100.0	97.0	86.7
Dens	0	12.1	13.3
Scat			
Lagomorph	92.0	100.0	76.7
Rodent	92.0	98.5	83.3
Fox	0	4.5	0
Coyote	18.0	31.8	31.7
Other	0	0	0
Sightings			
Lagomorph	2.0	12.1	3.3
Rodent	2.0	0	0
Fox	0	0	0
Coyote	2.0	3.0	0
Ground Squirrel	0	0	1.7
Quail	16.0	4.5	1.7
Other Bird	2.0	7.6	5.0
Other Animal	2.0	4.5	3.3

^aSites reclaimed in 1985 and sampled in 1995 (n=50).

^bSites reclaimed in 1986 and sampled in 1996 (n=66).

^cSites reclaimed in 1987 and sampled in 1997 (n=60).

^dPercent plant cover on reclamation site divided by percent plant cover on adjacent undisturbed site multiplied by 100.

^ePercent of reclamation sites at which wildlife and their sign were observed.

5. PROGRAM ASSISTANCE

5.1 PROGRAM SUPPORT

A primary objective of the NPRC ESCRП is to provide the expert advice, guidance, and assistance necessary for the DOE/NPRC compliance with the ESA of 1973 (as amended), NEPA, NHPA, and other laws protecting cultural and historic resources. Other objectives include providing technical and management progress reports, presenting and publishing scientific findings, and engaging in information transfer and educational outreach activities.

Support of specific compliance procedures pursuant to the ESA, NEPA, and NHPA and other cultural resource laws was accomplished through preparing the necessary documentation and supporting consultations as required by these laws. ESCRП staff reviewed the draft Supplemental Environmental Impact Statement/Programatic Environmental Impact Report for the sale of NPR-1 and provided technical support during the public hearing in Bakersfield. For historic and cultural resources compliance activities, see section 3.2. EASI staff reviewed the draft Biological Opinion for the Curly-top Virus Control Program proposed by the California Department of Food and Agriculture (CDFA) and also reviewed a draft Environmental Assessment for a proposed project by the CDFA to test biological control strategies for beet leafhoppers which transmit curly-top virus to agricultural crops. The proposal would involve releasing a host-specific parasitic wasp to effect control.

Throughout FY97, the ESCRП provided programmatic management support through a number of activities. These activities included the preparation of weekly coordination summaries, quarterly progress reports, annual scope of work, and detailed project plans. Written input was provided to NPRC's annual Environmental Site Report, Annual Report of Operations, Long Range Plan, and Quarterly Report. EASI staff members attended weekly environmental coordination meetings, the DOE/NPRC Technical Assurance Branch staff meetings, and NPR-1 3-D seismic program meetings. Briefings were provided to NPRC management on the annual scope of work, project progress, and related compliance issues.

Scientific findings based on work performed by the ESCRП at NPRC were presented at various forums, including professional society meetings and at an Annual Program Review attended by approximately 72 people from 31 federal and state agencies, oil and gas companies, and other interested organizations. EASI staff also attended meetings sponsored by the San Joaquin Valley Endangered Species Recovery Planning Program, BLM, Kern County Valley Floor Habitat Conservation Plan Committee, and the Lokern Natural Area Management Program to provide these groups with the information and experience gained through the ESCRП at Elk Hills.

Two ESCRП staff attended the annual meeting of the Society for Conservation Biology held in Victoria, British Columbia. One staff member was a co-organizer of a symposium on use of "umbrella" species in conservation and also was a co-author on a paper presented in the

symposium. An ESCR staff member attended the 1997 Wildlife Society Annual Meeting and presented a paper at the meeting entitled "Conservation of Endangered San Joaquin Kit Foxes at the Naval Petroleum Reserves in California."

Numerous educational outreach activities were conducted throughout the year, including on-site tours and briefings also given to a variety of persons and groups. Students in the GATE Program at Arvin High School visited NPR-1 and participated in a Project WILD exercise and heard presentations on endangered species and biodiversity at NPR-1. EASI made significant contributions to NPRC's annual Earth Day activities held on-site by providing educational booths, displays, activities for visiting school children, and coordinating booths and displays from off-site organizations. The NPRC Earth Day Fair was featured on a local television program called "29 Clean Kids" and several ESCR staff appeared on the show. A Project WILD training session was conducted by the ESCR Project WILD facilitators for educators at the Coles Levee Ecosystem Preserve. An ESCR staff member participated in the Derricks to Desks program sponsored by local industry to inform teachers about oil field operations. ESCR staff participated in several classroom visits to local schools to present information about endangered species. An ESCR staff member participated in a visit to NPRC by Mathematics, Engineering, and Science Achievement students from Arvin High School.

Freeze-dried specimens of species at NPRC were loaned to Allensworth State Historic Park for a Junior Ranger program. Several ESCR staff members judged science fairs at local schools and for the Kern County Science Fair, and participated in the DOE/NPRC's Science Bowl by volunteering their time as coaches and moderators. An article was written for the *Elk Hills Explorer* describing the Wildlife Certification Program sponsored by The Wildlife Society. Previously analyzed kit fox scats from Elk Hills were sent to a graduate student at Humboldt State University who is examining the incidence of kit fox hairs in scats as a means of identifying unknown canid scats. Also, kit fox hair samples were sent to a M.S. graduate student at the University of Wisconsin who is trying to differentiate swift and other kit foxes. EASI staff assisted a Ph.D. student from Washington State University who visited NPRC to collect specimens of *Delphinium gypsophyllum* and *D. recurvatum*.

5.2 PROJECT DOCUMENTATION

Research and monitoring activities conducted by NPRC ESCR staff have resulted in the generation of numerous data of value to regional as well as on-site conservation efforts. In FY94, an effort was initiated to examine existing data collected at NPRC, analyze this data, and prepare manuscripts for submission to scientific outlets for publication. Several manuscripts were completed in FY97 and submitted to journals for publication (see Section 6.0), and significant progress was made on the preparation of several other papers.

Demographic data on San Joaquin kit foxes have been collected since 1980 at NPRC. The purpose of this long-term project was to characterize demographic patterns for kit foxes and to examine the effects of oilfield activities on foxes. These data include abundance, survival rates, causes of mortality, reproductive success, litter size, sex ratios, and age ratios. Additionally, ecological data were collected to identify correlates of demographic patterns observed among kit foxes. These data include precipitation, availability of prey, use of prey by foxes, abundance of potential competitors/predators, and information on oilfield effects. These data have been analyzed to determine the factors that most influence kit fox population dynamics at NPRC. A manuscript reporting the results of this analysis has been completed and submitted to *Wildlife Monographs* for consideration for publication.

Habitat reclamation has been conducted on NPR-1 since 1985 to mitigate the effects of habitat disturbance on the listed species present on site. An assumption has been that revegetating disturbed areas would benefit these species. This assumption was evaluated by examining rates of revegetation on disturbed sites, and assessing use of these sites by listed species and other wildlife. Also, costs of revegetation were compared to other mitigation strategies. A manuscript reporting the results of this evaluation was completed and submitted to *Restoration and Management Notes* for consideration for publication.

From 1980 to 1984, small mammal populations were monitored at a number of sites on NPR-1 and NPR-2. Trapping was conducted monthly to determine the species present and the relative abundance of species within and between sites. Preliminary results indicated that the composition and diversity of rodent communities varied considerably, even between sites in close proximity. Community diversity and dominance patterns were assessed to determine the temporal and spatial variability among rodent communities. A manuscript reporting the results of this investigation was completed and submitted to *The Southwestern Naturalist* for consideration for publication.

In 1994, an oil well on NPR-1 blew out spraying oil over a large area. The impacts of this on animal and plant populations was assessed. Data were collected on small mammals, birds, invertebrates, shrubs, and ground cover in affected and control areas. Also, several habitat restoration strategies including surface scarification and fertilization were tested. A manuscript reporting these results was completed and submitted for consideration for inclusion in the Proceedings of the 5th International Conference on the Effects of Oil on Wildlife.

In addition to the manuscripts above, considerable progress was made on several other manuscripts including an investigation on the social ecology of kit foxes, an assessment of the efficacy of scent-station surveys for indexing kit fox and leporid abundance, an investigation of mass dynamics among kit foxes, and a comparison of condition indices between kit foxes in urban and natural habitats.

6. PUBLICATIONS

In FY97, a number of scientific manuscripts and technical reports were published and accepted or submitted for publication.

Published:

Cypher, B. L. 1997. Effects of radiocollars on San Joaquin kit foxes. *Journal of Wildlife Management* 61:1412-1423.

Cypher, B. L., K. A. Spencer, and J. H. Scrivner. 1996. Food item use by coyote sex and age classes. *California Fish and Game* 82:42-47.

Enterprise Advisory Services, Inc. 1997. Endangered Species and Cultural Resources Program, Naval Petroleum Reserves in California: Annual Report FY96. U. S. Department of Energy Topical Report EASI 97-1. 56 pp.

Otten, M. R. M., and B. L. Cypher. Conservation plan for protected species on Naval Petroleum Reserve No. 1, Kern County, California. U. S. Department of Energy Topical Report EASI 97-2. 39 pp. + appendices.

Otten, M. R. M., and G. L. Holmstead. 1996. Effects of seeding burned lands on the abundance of rodents and leporids on Naval Petroleum Reserve No. 1, Kern County, California. *The Southwestern Naturalist* 41:129-135.

Warrick, G. D., T. T. Kato, M. V. Phillips, and H. J. Hill. 1996. Assessment of impacts and evaluation of restoration methods on areas affected by a well blowout, Naval Petroleum Reserve No. 1, California. U. S. Department of Energy Topical Report. 27 pp. + appendices.

Warrick, G. D., T. T. Kato, M. V. Phillips, and H. J. Hill. 1997. Assessment of impacts and evaluation of restoration methods on areas affected by a well blowout, Naval Petroleum Reserve No. 1, California. *Proceedings of the International Conference on the Effects of Oil on Wildlife* 5:53-66.

Publications in press (date and volume given when known):

Cypher, B. L., J. H. Scrivner, K. L. Hammer, and T. P. O'Farrell. 1998. Viral disease antibodies among coyotes from California. *Journal of Wildlife Diseases* 34.

Cypher, B. L., and K. A. Spencer. 1998. Competitive interactions between coyotes and San Joaquin kit foxes. *Journal of Mammalogy* 79.

- Koopman, M. E., J. H. Scrivner, and T. T. Kato. 1998. Patterns of den use by San Joaquin kit foxes. *Journal of Wildlife Management* 62.
- Holmstead, G. L., and D. C. Anderson. Reestablishment of Hoover's wooly-star (*Eriastrum hooveri*) following disturbance. *Madroño*.
- Warrick, G. D., and B. L. Cypher. 1998. Factors affecting the spatial distribution of a San Joaquin kit fox population. *Journal of Wildlife Management* 62.
- Warrick, G. D., T. T. Kato, and B. R. Rose. 1998. Home range and habitat use of the blunt-nosed leopard lizard. *Journal of Herpetology*.

Manuscripts completed and submitted:

- Anderson, D. C., and G. L. Holmstead. Characterization of *Eriastrum hooveri* (Hoover's wooly-star) habitat on the Naval Petroleum Reserves in California. *Madroño*.
- Cypher, B. L., G. D. Warrick, M. R. M. Otten, T. P. O'Farrell, W. H. Berry, C. E. Harris, T. T. Kato, P. M. McCue, J. H. Scrivner, and B. W. Zoellick. Population dynamics of San Joaquin kit foxes at the Naval Petroleum Reserves in California. *Wildlife Monographs*.
- Frost, N., and B. L. Cypher. Mass variation among arid land small mammals. *Journal of Mammalogy*.
- Hinshaw, J. M., G. L. Holmstead, B. L. Cypher, and D. C. Anderson. Effects of simulated oil field disturbance and topsoil salvage on *Eriastrum hooveri* (*Polemoniaceae*). *Madroño*.
- Hinshaw, J. M., B. L. Cypher, and G. L. Holmstead. Efficacy of habitat reclamation for endangered species on Naval Petroleum Reserve No. 1, California. *Restoration and Management Notes*.
- Koopman, M. E., B. L. Cypher, and D. R. McCullough. Prey selection by San Joaquin kit foxes on the Naval Petroleum Reserves in California. *The Southwestern Naturalist*.
- Otten, M. R. M., and B. L. Cypher. Annual variation in estimates of effective population size for San Joaquin kit foxes. *Animal Conservation*.
- Otten, M. R. M., and B. L. Cypher. Spatial variation in dominance and diversity among rodent communities at the Naval Petroleum Reserves in California. *The Southwestern Naturalist*.
- Scrivner, J. H., T. P. O'Farrell, and K. L. Hammer. Relocation of San Joaquin kit foxes at the Naval Petroleum Reserves in California. *Journal of Mammalogy*.

Standley, W. G., J. H. Scrivner, and D. C. Anderson. The effects of habitat manipulation on nocturnal rodents in a Lower Sonoran Grassland, California. *California Fish and Game*.

Warrick, G. D., J. H. Scrivner, and T. P. O'Farrell. Effects of supplemental feeding on San Joaquin kit foxes. *The Southwestern Naturalist*.