Department of the Interior
U.S. FISH AND WILDLIFE SERVICE
San Luis National Wildlife Refuge Complex

SAN JOAQUIN KIT FOX STUDY

KESTERSON NATIONAL WILDLIFE REFUGE

Annual Progress Report
Fiscal Year 1986

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This report prepared in support of the Kesterson Program and the San Joaquin Valley Drainage Program , through an interagency agreement between the U.S. Fish and Wildlife Service and the U.S. Bureau of Reclamation

TABLE OF CONTENTS

INTRODUCTION

This report summarizes the results of the 1986 field studies to determine selenium levels and land use of the Federal-endangered San Joaquin kit fox (SJKF) during the clean-up of Kesterson Reservoir. This study fulfills, in part, guidelines stated in the San Joaquin kit fox recovery plan established by the U.S. Fish and Wildlife Service (USFWS, 1983). Detailed field studies which result in documention of home ranges, den locations, foraging activity, natality, dispersal, and food habits are required for a Section 7 consultation pursuant to the U.S. Endangered Species Act.

GENERAL PROGRESS AND COORDINATION

Details of goals, methodology, and pertinent literature review were provided in the proposal submitted to the U.S. Bureau of Reclamation (USBR), Department of the Interior in June 1986. State and Federal permits were also applied for in June 1986. The project was formally initiated in mid-June 1986. Interagency Agreement No. 5-AA-20-03530 between the USBR and the FWS providing reimbursement funding for the project was signed in September 1986. Intensive night surveys began in June 1986 and have been performed twice weekly. During late June and early July 1986, equipment and supplies were purchased, and interviews with local agencies and landowners began. Sampling methodologies

were designed and kit fox scats were collected for food habit studies during July 1986.

Investigators Fred Paveglio and Steve Clifton , both of the U.S. Fish and Wildlife Service (FWS), San Luis National Wildlife Refuge (NWR) office, met with California Department of Fish and Game (DFG) personnel at the Los Banos Grandes Project (LBG) on 7 July 1986 to discuss the study proposal and to set up coordination of training with Frank Wernette, LBG Project Leader, and Laurie Briden, Field Investigator. On July 15, 1986, under the guidance of Davis Jessup, DVM, Non-game Mammal Section, DFG, blood samples were drawn from two European ferrets to perfect the venipuncture technique. On 23, 30 and 31 July 1986 field training was provided by Laurie Briden, LBG, at the LBG study site. On 10 September 1986, training in handling live-trapped kit foxes was provided by Laurie Briden, LBG, when two kit foxes were live-trapped and radio-collared with investigators Fred Paveglio and Steve Clifton present.

Review of blood collecting methods was performed by Davis Jessup, DVM, California Department of Fish and Game, and Dr. Jim Byerly, DVM, Merced, CA. All comments and recommendations were reviewed and incorporated into the study design.

Scent station work began on 6 August 1986. Live-trapping began on 23 September 1986.

The majority of the field work to date has consisted of intensive ground searches, night surveys, scent station surveys, and initiation of live-trapping.

SCENT STATIONS

Method

Scent station locations were determined based on results of intensive night surveys for kit foxes. Stations were placed approximately 0.03 km (0.02 mi) apart, alternately on opposite sides of roads or trails, or in areas which kit foxes were sighted. Twenty-two scent stations were constructed. A one square meter area was covered with fine sand and dust sifted through a 30.5 X 30.5 cm (12 X 12 in) wooden frame covered with 1 mm (1/16 in) mesh hardware cloth. Two 2.5 X 5 X 46 cm (1 X 2 X 18 inch) wooden stakes were driven into the ground on opposite sides of the plot and a cotton string was then tied between two stakes approximately 41 cm (16 in) above the substrate. Canned mackerel was then wrapped in cheesecloth and tied at the center of the string. Each scent station was checked within two hours after sunrise the following day for signs of activity. All tracks and sign (i.e. track, scent mark, scat, tail-drag, hair, etc.) were examined and the species identified. Twenty-two scent stations were set for 10 days or until kit fox activity was noted for three consecutive days.

Results and Discussion

Kit fox use was indicated by scent station visits on three locations within the study area. Kit foxes visited various stations on 7 occasions for an average of 0.03 visits per station. Species identified visiting scent stations are listed in Appendix 1.

NIGHT SURVEYS

Method

Night surveys were conducted twice weekly beginning one-half hour after sunset. Routes were predetermined based on records of sightings in order to cover potential kit fox habitat in a thorough, efficient manner. Survey teams consisted of two or three investigators. Vehicle speed was maintained between five and fifteen miles-per-hour. Two 400,000 candlepower hand-held spotlights were used in a sweeping motion to locate eyeshine. When a suspected kit fox was sighted, a 15X spotting scope and binoculars were used to make a positive identification. Vehicle mileage, time, and location was recorded for each kit fox sighting. All animal species identified during the survey were recorded on micro-cassette recorders and transferred to data sheets.

Results and Discussion

Twenty-six kit fox sightings have been recorded during the nine month period between 1 January and 30 September, 1986. Twenty-one sightings were at Kesterson Reservoir and adjacent lands. Three kit fox sightings have occurred on Merced NWR, and 2 on Grasslands State Park. Species identified during night surveys are listed in Appendix II. Kit fox sightings from January 1 through September 30, 1986 are listed in Appendix III.

LIVE-TRAPPING

Method

Trap lines were located based on night surveys and scent station results. Two types of collapsible, wire mesh live-traps are currently being used: double-door traps measuring 38 X 38 X 107 cm (15 X 15 X 42 in), with 2.5 X 5 cm (1 X 2 in) mesh, and single-door 10 X 12 X 32", with 2.5 X 2.5 cm (1 X 1 in) mesh. All traps with 2.5 X 5 cm mesh were covered with 1.25 cm (1/2 in) mesh hardware cloth to prevent kit foxes from injuring gums, teeth and jaws when trapped. Both single and double-door sets were used during trapping. Traps were covered with burlap to aid in calming the animals and shielding them from predators and the elements.

Fresh dirt, or a thin layer of grass (depending on the surrounding area), was placed between the entrance and the treadle of each trap to provide a more natural surface than the wire mesh. The tripping mechanism was adjusted for correct operation.

Bait types used to date include canned mackerel, chicken, turkey, Velveeta cheese, raisins, kangaroo rats, cottontail rabbits, valerian root, beef liver, and American coots. The mackerel, cheese and raisins were wrapped loosely in cheese cloth bags for ease in handling. Bait was wired to the rear door of double-door traps or to the ceiling of single door traps. The bait was positioned in a manner that required an animal to enter the trap to obtain the bait.

In order to minimize exposure of trapped animals and in accordance with State and Federal permit regulations, traps were baited and set approximately one hour before sunset and checked no later than two hours after sunrise . Traps were kept closed during the day.

Results and Discussion

Despite a total of 382 trap nights between 23 September and 1 October, 1986, no kit foxes have been captured. At present, investigators are consulting with local experts concerning the lack of live-trapping success. Two factors exist that may be contributing to trapping difficulties: 1) a low kit fox density within the study area, and 2) the high availability of prey species. With the onset of winter, the rodent population should begin to decline and trapping success improve. Live-trapping results are summarized in Appendix IV.

HANDLING OF ANIMALS

Method

All sampling materials are readied before removal of the animal from the trap. While contained within the trap, the animal is visually inspected for signs of trauma or physical injury. If noted, the animal will be released immediately and all sampling terminated. Injured kit foxes will be observed as long as possible to determine recovery. A kit fox will be removed from the trap by placing a large, dark-colored cloth bag over one end of the trap and securely holding the bag in place

while opening the trap door. After the fox enters the bag, the opening is secured and the bag placed on the ground or work table. Once the position of the head is located, it is exposed thru the bag opening. To prevent escape the fox is gently held by the neck and shoulders so as not to injure the animal or prevent it from breathing. Once the head is exposed and the fox secured a "blinder-bag" is placed over the head of the animal to aid in preventing trauma.

SAMPLE COLLECTION

Method

Blood samples will be taken by Dr. Jim Byerly, DVM, or under his guidance by field investigators. Blood samples will include one 2cc sample with sodium heparin for selenium and trace element analysis, one 2cc sample with EDTA for blood hematology analysis and a 1cc sample without additives for blood chemistry analysis. The skin area to be used for venipuncture will be cleaned and dried. Hair will be close-clipped with scissors or electric trimmers. Care will be taken to avoid cutaneous damage and consequent inflammation. An area approximately 5 cm (2 in) in diameter will be cleared and wetted with alcohol to avoid bacterial contamination and to aid in raising the target vein (Archer, 1965; Schalm et al, 1975). The target vein and its course will then be identified. If possible the vein will be distended using digital pressure to produce an adequate blood flow into the needle when the vein is punctured (Archer). A sterile disposable syringe (5cc volume) fitted with a #22 gauge,

3.8 cm (1.5 in) needle will then be inserted so that it is inserted in the direction of blood flow (i.e. away from the heart). The needle will be sterile and dry (Schalm et al). The needle will be advanced with a single swift stroke through the skin and into the target vein, and then digital pressure relaxed to permit blood to flow into the syringe while creating plunger vacuum until the syringe is full (Archer; Wobeser et al, 1980).

When 5 cc of blood is drawn, a pledget of sterile, dry cotton will be held in place over the site and the needle withdrawn from beneath. Digital pressure for 30-60 seconds should achieve homeostasis of the skin wound. The tubes containing blood samples will be immediately but gently tipped back and forth 10 to 12 times to insure a thorough mix of the sample and additive (Schall et al). The blood samples will then be labeled with the animal I.D. number, location, date of sampling, and type of additive, then immediately packed in ice to prevent spoilage until refrigeration at a temperature of 4^{o} C ($40\ ^{o}$ F) for blood chemistry analysis, or frozen for trace element analysis (Archer; Schalm et al).

One 2 g (0.07 oz) hair sample will be taken from the dorsal area of the neck for selenium and trace element analysis. Hair samples will be placed in a 2 fl oz (60 ml) acid washed sample jar and frozen until analysis.

After blood sampling is completed, all physical data will be recorded on the appropriate data sheet.

Results and Discussion

Eight hair samples have been taken from predator and road-killed kit foxes supplied by personnel operating the Los Banos Grandes Project. These hair samples will be treated as a control group. In addition, three coyotes from Kesterson Reservoir and one from Merced NWR have been collected and will provide additional information concerning selenium levels in canids. Recent water quality studies of the East Grasslands of Merced NWR indicate very low levels of selenium are present in these wetlands (USFWS, in prep.). Blood and hair samples have been taken from nine live-trapped cottontail rabbits. To gain further experience, arrangements have been made with Dr. Jim Byerly, DVM, to practice blood sampling on surrogate animals.

RADIO-COLLARING

Method

Eartags (#4, National Band and Tag Co.) provided by DFG's non-game section will be affixed to each live-trapped kit fox (right ear on females, left ear on males). Radio telemetry collars (Model MMW, AVM Electronics, Livermore, CA) will be affixed to each captured kit fox. Collars have been constructed from 2.5 cm (1 in) wide rubberized nylon belting and are adjustable from 15.5 to 25.0 cm (6 to 10 in). Each transmitter collar weighs between 110 and 130 g (3.8 and 4.5 oz). Transmitters are composed of one 2/3 "C" battery, one SB2 transmitter, one 4 hour mortality sensor, and one 33 cm (13 in)

stainless steel cable whip antenna. Transmitters are hermetically encased in an acrylic resin which fully surrounds the transmitter components.

Prior to attaching a radio-collar, each transmmiter will be activated to insure that it is functional and its frequency recorded. Collars will be attached using two 4.8 mm (3/16 in) diameter aluminum bolts, with super glue applied to the threads to prevent loosening. After collar fitting, animals will be released and observed for as long as possible to note any signs of trauma or problems created by handling or collar attachement.

Results and Discussion

No kit foxes have been radio-collared to date.

RADIO-TELEMETRY

Method

Radio-locations will be made with one vehicle-mounted 7-element null-peak antenna system, and one fixed 12-element null-peak antenna system. Both null-peak antenna systems will be affixed to LA12-DS radio receivers (AVM Electronics).

The mobile null-peak antenna system is mounted on a 1974 Chevrolet 3/4 ton four-wheel drive vehicle. A camper shell was mounted on the vehicle to facilitate taking telemetry bearings in inclement weather. The antenna system was modified from 12-elements to 7-elements to enable it to be permanently mounted on the vehicle. The elements of the antenna were attached to a 188 X 4 cm (74 X 1 1/2 in) galvanized steel tube which functions as a

cross-beam. The cross-beam was then attached to a 5 cm (2 in) telescoping mast which could be extended to a maximum height of 3 m (10 ft). A 5 cm hole was then bored through the top of the camper shell through which the mast projected down to a bearing plate mounted on the bed of the vehicle. Aluminum sockets made from 5 cm channel material were placed on each corner of the camper shell to support the antenna system. When the antenna is lowered and not in use, it is supported by these sockets. By strapping the ends of the antenna into the sockets with elastic straps, it is possible to negotiate extremely rough dirt roads without any movement or damage to the antenna system (Clifton, in prep.)

Upon arrival at the site the antenna is unstrapped and elevated. A beacon box which emits a pulsating signal is used to calibrate the antenna. The beacon box is placed approximately 100 m due north of the vehicle and activated. The antenna mast is rotated until the signal is received. The mast is then carefully rotated back and forth until a "null" is detected in the signal. This "null" indicates the true direction of the signal. A compass rose marked in 0.5^{o} increments, which is located directly under a needle-pointer attached to the mast, is then rotated until due north is indicated by the pointer. At that time the compass rose is locked into place. This system design and calibration technique has a signal range of 12+ mi (19+ km) with an accuracy of ± 0.5 degrees based on initial trials by the investigators (Clifton).

FOOD HABITS

Method

Kit Fox scats were collected beginning in June 1986. Kit Fox scats were identified as having a diameter between 9 and 14 mm (0.35 and 0.49 in) or were collected from known dens (Clifton, unpubl. dat.). Scats were dried in a autoclave until all moisture was absent and then removed and weighed. Each scat was then carefully broken apart and all components were separated into groups by type. A 100 ml graduated cylinder was then filled with 50 ml of deionized water and a component group was placed into the graduated cylinder. The total volume of both the component group and the water was recorded and the original 50 ml of the water was then subtracted from the total amount. This figure represents the volume in milliliters of the component group. This procedure was repeated until all of the component groups of an individual scat were measured.

Results and Discussion

Forty-seven kit fox scats have been collected and stored for future analysis. Qualitative analyses of fifteen scats have been completed. The primary prey species consisted of California ground squirrels, kangaroo rats and voles. Secondary prey items were insects and lizards. Incidental food items were vegetation, cantelope seeds and crayfish. The scats consisting of cantelope seeds were collected adjacent to a cantelope field. Kit fox scat contents are listed in Appendix V.

GROUND TRANSECTS

Method

Ground transects were performed to locate kit fox dens or use areas. Investigators inspected areas of potential kit fox habitat on foot or by using all terrain vehicles. Transects were approximately 10 m (33 ft) apart throughout the study area. All signs of kit fox use and dens were noted.

Results and Discussion

Based on locations of tracks, scats, dens and sightings since January 1986, three centers of kit fox activity were identified within 1.6 km (1 mi) of Kesterson Reservoir. On 9 July 1986 one den was found near Kesterson Reservoir at T 8S, R 10E, Sec 8, SE 1/4 section, 60 m (66 yd) NE of Cell 9. The presence of old kit fox scats, prey remains, and absence of ground squirrel scats aided in den identification. The den was located on a small mound and consisted of two entrances both facing east. Holes sizes were 18 X 20 cm (7 X 8 in) and 15 X 18 cm (6 X 7 in). After monitoring the den for a period of 5 days it was determined to be inactive. On 13 July 1986 a second den was found 1 km (0.6 mi) NE of cell 9 at T 9S, R 10E, Sec 8, NE 1/4 section. The den was located near a large iodine bush on a slightly elevated mound and consisted of two holes facing northeast. Hole sizes were 15 X 20 cm (6 X 8 in) and 15 X 23 cm (6 X 9 in). It was determined to be active and occupied by an adult kit fox and one sub-adult kit fox. The presence of fresh scats and a sighting of both

foxes sunning near the den entrance confirmed their use of the den. At present, both dens are inactive. Kit foxes have been observed foraging within cells 9 and 11 which are well within foraging distances from the dens. Reasons for abandonment of the second den are unclear. A possibility exists that the increased human activity in the vicinity of Kesterson Reservoir may have contributed to the relocation of the den. A third area of high kit fox use was located on the Freitas Ranch at T 8S, R 10E, Sec 15, 16, and 22. This area lies adjacent to, and east of cells 1, 2, and 5 of the Kesterson Reservoir. A one mile diameter area around each den was used to define the centers of kit fox activity. These areas are shown in Figure 1.

PLANS FOR 1986-87

Live-trapping for kit foxes will continue until 15 January 1987, when trapping must cease in accordance with Federal permit regulations. Den surveys and ground transects to locate pupping dens and kit fox use areas will begin on 20 January and continue until 31 May 1987. In addition, during this period, night surveys will be continued twice weekly. Samples collected from coyotes at Kesterson Reservoir will be sent for analysis in early February 1987 along with hair samples from LBG kit foxes. Live-trapping will resume on 1 June 1987. Radio-collared kit foxes will be located and monitored three times per week. Kit fox scats will be continue to be collected for food habits analysis.

Literature Cited

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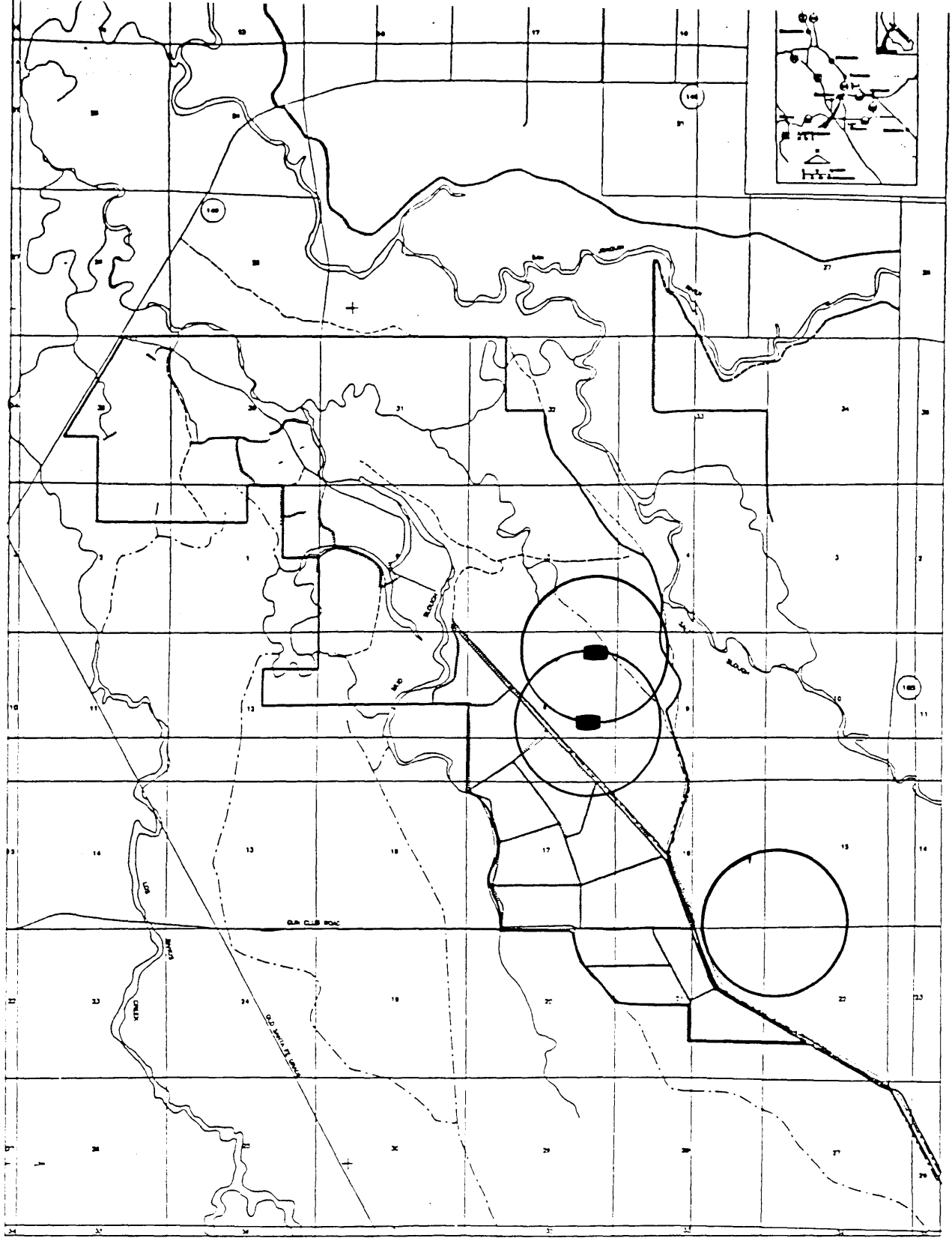

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— ... Use Area
■ ... Den Site

Figure 1 Kit Fox Use Areas and Den Locations

Appendix 1

Scent Station Results

Species	Total No. of Visits	Visits per Scent Station-Night
Kangaroo Rat	47	0.214
Unidentified Mouse	33	0.150
California Ground Squirrel	27	0.123
Cottontail	22	0.100
Striped Skunk	18	0.082
Unidentified Bird	14	0.064
Coyote	8	0.036
Kit Fox	7	0.032
Weasel	4	0.018
Raccoon	4	0.018
Oppossum	3	0.012
Badger	2	0.009
Spotted Skunk	1	0.006

Appendix 11

Species Observed During Night Surveys

Mammals

Coyote	Canis latrans
San Joaquin Kit Fox	Vulpes macrotis mutica
Gray Fox	Urocyon cinereoargenteus
Red Fox	Vulpes vulpes
Badger	Taxidea taxus
Raccoon	Procyon lotor
Weasel	Mustela frenata
Striped Skunk	Mephitis mephitis
Oppossum	Didelphis virginianus
Heerman's Kangaroo Rat	Dipodomys heermani
Meadow Vole	Microtis californicus

Birds

Barn Owl	Tyto alba
Great Horned Owl	Bubo virginianus
Burrowing Owl	Athene cunicularia
Short-eared Owl	Asio flammeus
Black-crowned Night-Heron	Nycticorax nycticorax
Great Blue Heron	Ardea herodias
Great Egret	Casmerodius albus
Cattle Egret	Bubulcus ibis
Snowy Egret	Egretta thula
Northern Harrier	Circus cyaneus
Red-tailed Hawk	Buteo jamaicensis
American Kestrel	Falco sparverius
Lesser Nighthawk	Chordeiles acutipennis
Killdeer	Charadrius vociferus
Horned Lark	Eremophila alpetris
Meadowlark	Sturnella neglecta
Red-winged Blackbird	Agelaius phoeniceus
Tricolored Blackbird	Agelaius tricolor
Ring-necked Pheasant	Phasianus colchicus

Herpitiles

Gopher Snake	Pituophus melanoleucus
Common King Snake	Lampropeltis getulus
Bullfrog	Rana catesbiana
Western Toad	Bufo boreas
Pacific Treefrog	Hyla regilla
Western Spadefoot	Scaphiopus hammondi
Western Pond Turtle	Clemmys marmorata

Appendix III

Kit Fox Sightings Since January, 1986

Date	No.	Location
1/24/86	1	Freitas Ranch
1/28/86	1	Kesterson Reservoir, cell 6
1/30/86	1	Grasslands State Park
1/31/86	1	Freitas Ranch
3/6/86	2	Kesterson Reservoir, 25 m west of cell 6
3/13/86	1	Kesterson Reservoir, 50 m west of cell 10
3/27/86	1	Kesterson NWR, Windmill Pond
4/4/86	1	Kesterson NWR, parking lot 3
4/10/86	2	Kesterson Reservoir, cell 9
4/17/86	2	Kesterson Reservoir, cells 9 and 11
4/24/86	2	Kesterson NWR, 200 m SE of Windmill Pond
5/1/86	2	Kesterson NWR, 300 m west of the East Gate
5/8/86	2	Kesterson Reservoir, 100 m west of cell 6
7/12/86	2	Kesterson NWR, 200 m east of Windmill Pond
8/2/86	1	Merced NWR, East Farm Fields
8/14/86	2	Merced NWR, West Marsh
8/26/86	1	Kesterson NWR, 100 m NE of Windmill Pond
9/12/86	1	Kesterson NWR, 250 m SW of Windmill Pond
Total	26	

Appendix IV

List of Species Live-trapped

Species	No.
Striped Skunk	18
Cottontail Rabbit	5
California Ground Squirrel	2
Spotted Skunk	1
Badger	1
Heerman's Kangaroo Rat	1
Virginia Oppossum	1

Appendix V

Kit Fox Scat Contents

Scat #	Contents
KR001	California ground squirrel...90% Insect parts.....10%
KR002	Kangaroo rat.....100%
KR003	Kangaroo Rat.....100%
KR004*	California vole.....50% Deer Mouse.....40% Insect Parts.....10%
KR005	California ground squirrel..100%
KR006	California ground squirrel..100%
KR007*	California vole.....100%
KR008*	California vole.....90% Vegetation.....10%
KR009	Insect parts.....100%
KR010	Western fence lizard.....50% Insect parts.....40% Vegetation.....10%
SL011	Cantelope seeds.....100%
SL012	Cantelope seeds.....100%
SL013	Crayfish.....50% Cantelope seeds.....50%
MD014	California vole.....100%
MD015	California vole.....100%

* Indicates scats collected at Kesterson Reservoir.