University of Nebraska - Lincoln
DigitalCommons@University of Nebraska - Lincoln

Proceedings of the Eighteenth Vertebrate Pest Conference (1998)

Vertebrate Pest Conference Proceedings collection

1-1-1998

Social And Biological Aspects Of Non-Native Red Fox Management In California

Jeffrey C. Lewis
Washington Department of Fish and Wildlife

Kevin L. Sallee
Ecological Software Solutions

Richard T. Golightly Jr.
Humboldt State University

Ronald M. Jurek
California Department of Fish and Game

Follow this and additional works at: http://digitalcommons.unl.edu/vpc18

Lewis, Jeffrey C.; Sallee, Kevin L.; Golightly, Richard T. Jr.; and Jurek, Ronald M., "Social And Biological Aspects Of Non-Native Red Fox Management In California" (1998). *Proceedings of the Eighteenth Vertebrate Pest Conference (1998)*. Paper 53.
http://digitalcommons.unl.edu/vpc18/53

This Article is brought to you for free and open access by the Vertebrate Pest Conference Proceedings collection at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Proceedings of the Eighteenth Vertebrate Pest Conference (1998) by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

SOCIAL AND BIOLOGICAL ASPECTS OF NON-NATIVE RED FOX MANAGEMENT IN CALIFORNIA

JEFFREY C. LEWIS, Washington Department of Fish and Wildlife, 2108 Grand Boulevard, Vancouver, Washington 98661.

KEVIN L. SALLEE, Ecological Software Solutions, 3145 53rd Street, Sacramento, California 95820.

RICHARD T. GOLIGHTLY, JR., Department of Wildlife, Humboldt State University, Arcata, California 95521.

RONALD M. JUREK, California Department of Fish and Game, 1416 Ninth Street, Sacramento, California 95814.

ABSTRACT: Since the late 1800s, non-native red foxes have been introduced in California for fur farming and fox hunting. Dispersal, population growth, and extensive translocations by humans have aided the expansion of the non-native fox population throughout many of the lowland and coastal areas of the state. Since the 1980s, non-native red foxes have been recognized as predators of a number of endangered species. Trapping and euthanizing non-native red foxes have been used as methods to protect these endangered species, but have been opposed by some members of the public. Opposition by animal rights groups to red fox trapping and euthanization has significantly influenced the management actions and policies of wildlife agencies. Red foxes are among the wildlife species commonly recognized in our culture; however, their historical use as a commodity and a game animal, and their impact on several endangered species, make them a difficult and controversial species to manage. Both fox biology and the public place great demands on wildlife agencies to develop new, proactive management strategies for non-native red foxes.

KEY WORDS: California, introduction, management, non-native red fox, social, *Vulpes vulpes*

Proc. 18th Vertebr. Pest Conf. (R.O. Baker & A.C. Crabb, Eds.) Published at Univ. of Calif., Davis. 1998.

INTRODUCTION

Non-native red foxes (*Vulpes vulpes*) were introduced at many locations in California in the past 130 years. Population growth and dispersal from these points of introduction have resulted in an almost continuous distribution throughout the lowland and coastal areas west of the Sierra Nevada and southern Cascade Range. Their presence attracted little attention until the mid 1980s, when state and federal wildlife agencies were forced to manage foxes as a means of protecting endangered species. Management of non-native red foxes, predominantly by trapping and euthanization, began after they were implicated in the decline of the endangered light-footed clapper rail (*Rallus longirostris levipes*), California clapper rail (*Rallus longirostris obsoletus*), and California least tern (*Sterna antillarum browni*) in several coastal California refuges (U.S. Fish and Wildlife Service and U.S. Navy 1990; U.S. Fish and Wildlife Service 1990; Zembal 1992). Red foxes had become abundant in these coastal marsh refuges. Continual control of red foxes at Seal Beach National Wildlife Refuge (NWR) coincided with increasing counts of light-footed clapper rails (Zembal 1992), and with increased nesting success of California least terns at Bolsa Chica Ecological Reserve (E. Burkett, pers. comm.). While trapping and euthanization have been opposed by some members of the public as management methods, alternative methods such as relocation of captured foxes to zoos or to other states have not been successful; zoos did not need or want additional red foxes, and wildlife officials in other states would not accept non-native red foxes.

Fox management as a means of protecting clapper rail and California least tern populations has received much attention; however, little attention has been focused on fox predation on other endangered species. The western snowy plover (*Charadrius alexandrinus nivosus*), San Joaquin kit fox (*V. macrotis mutica*), salt marsh harvest mouse (*Reithrodontomys raviventris*), and Belding's savannah sparrow (*Passerculus sandwichensis beldingi*) are among some of the threatened or endangered species vulnerable to red fox predation in California. The native Sierra Nevada red fox (*V. v. necator*), a state-listed threatened species, may be vulnerable to non-native red foxes through the effects of interbreeding, disease transmission, and resource competition (Lewis et al. 1995). However, the distribution, prey relations, and population characteristics of the non-native red fox are biological aspects that are often overshadowed by a number of human traditions, events, and cultural issues that have influenced their management in California. A number of historical and recent events were summarized to demonstrate the importance of social issues and biology in shaping non-native red fox management.

A HISTORY OF HUMAN INVOLVEMENT

Non-native red foxes were brought to California largely for fur production and recreation. The appearance of non-native red foxes in northern California in the late 1800s suggested that foxes were brought from the midwest on the Transcontinental Railroad, which was completed in 1869 (Roest 1977). Sleeper (1987) reported the importation, captive breeding, and release of non-native red foxes in southern California from 1905 to 1919, specifically for fox hunting. Presumably the same is true for northern California where red foxes were hunted as early as the 1880s (Grinnell et al. 1937;

Hanson 1944). However, red foxes have been used as a biological control for mammalian pests (Schoen 1970), and it is possible that extensive campaigns in the late 1800s to control California ground squirrels (*Spermophilus beecheyi*) (Grinnell and Dixon 1918) prompted the introduction of non-native red foxes.

Breeding red foxes in captivity for pelt production (i.e., fox farming), became an industry across the United States in the early 1900s (Ashbrook 1923), and arrived in California around 1920 (U.S. Dept. Agric. 1922; Ashbrook 1923; Anonymous 1926). Red fox breeding stock and pelts (predominantly the silver phase) sold for thousands of dollars in the early 1900s, prompting the spread of the industry throughout North America (Jones 1913). In California, the industry was building in the early 1930s, when there were at least 30 fox farms (Anonymous 1930), and was still growing in 1942 when there were around 125 (Vail 1942). The 1940s and 1950s were the heyday of fox farming; thereafter, the industry began to decline and no farms are known to be in operation in the state today. Releases of undesirable foxes and the escape of others were not uncommon occurrences on fox farms (Aubry 1984). The number of farms and their distribution throughout the state reflect the potential for both accidental and intentional introductions (Lewis et al. 1995).

While fox farming and hunting were the major means of historical introductions, more recent introductions appear to be quite different. Red foxes are among animals kept as pets (Leslie 1970). Disenchantment with unruly pet foxes has resulted in their release, which probably contributed to the occurrence of non-native red foxes in many of California's urban areas (Lewis et al. 1993). Similarly, residents of some urban areas have captured non-native red fox pups but have had poor success domesticating them. Unwanted, injured, or rescued non-native foxes are also taken to wildlife rehabilitators and caretakers. Some wildlife rehabilitators have released them in areas not previously occupied by non-native red foxes in California (Estrada 1989; Lewis et al. 1995). As a means of dealing with problem animals, animal-control officials in some municipalities and counties of California have also translocated non-native red foxes. Animal rights activists have also played a role in some red fox introductions, as one animal rights' organization has taken credit for illegally liberating 265 foxes from fur farms in North America in 1995 to 1996 (see internet web page http://envirolink.org/alf/pub/fnsup/fnsup.html). And recently in some southeastern states, demand for fox-hunting opportunities has prompted the illegal marketing, transporting, and attempted containment of red foxes in large hunting enclosures (Poten 1991; Davidson et al. 1992).

BIOLOGICAL ASPECTS OF MANAGEMENT

Non-native red foxes are now widely distributed throughout many of the lowlands and coastal areas of California west of the Cascade range and Sierra Nevada (Lewis et al. 1993). This extensive distribution makes range-wide management difficult. Consequently, management has focused on localized problems (e.g., fox predation on endangered birds in a refuge), with the understanding that this management may be necessary on a long-term basis because foxes may regularly disperse to the problem area (Lewis 1994). Non-native red foxes are effective predators of native prey species because these species lack specific defenses against foreign predators. Ground-nesting birds (e.g., California and light-footed clapper rails), especially those that nest in colonies (e.g., California least tern and western snowy plover), are particularly vulnerable to red fox predation and surplus killing (Kadlec 1971; Kruuk 1972; Maccarone and Montevecchi 1981; Golightly et al. 1994). Many unlisted species of birds, mammals, and insects are also vulnerable to red fox predation (Golightly et al. 1994).

In southern California, urban encroachment has reduced the amount of habitat for the light-footed clapper rail and California least tern, concentrating them in small refuges located on the coast. These refuges, as well as parks, golf courses, agricultural fields, airports, and cemeteries, provide habitat for red foxes within the urban matrix (Lewis et al. 1993). These areas provide suitable habitat for red foxes, in part, because they are generally too small or isolated for an abundance of coyotes (*Canis latrans*) which prey on and compete with red foxes. In the absence of coyotes, non-native red foxes can become abundant within the urban environment (U.S. Fish and Wildlife Service and U.S. Navy 1990; Lewis et al. 1993). Available corridors (e.g., flood channels, railroads, and power lines) within the urban matrix can aid in dispersal of red foxes to wildlife refuges on the coast, perpetuating the need for fox control (Lewis 1994). The U.S. Fish and Wildlife Service and U.S. Navy (1990) considered coyote reintroduction as a means of protecting endangered birds from red foxes and other small carnivores at Seal Beach NWR. However, before any coyote reintroductions were conducted, a number of coyotes apparently recolonized Seal Beach NWR and nearby Bolsa Chica Ecological Reserve (Bolsa Chica) on their own accord; consequently, a number of these coyotes were radio-collared as part of an ecological study (Romsos, in prep.). Monitoring has also shown that the number of red foxes has declined in Seal Beach NWR and Bolsa Chica to the point where few tracks are seen and fox control efforts have not been necessary for several years (C. Knight, USDA Wildlife Services, Sacramento, CA, pers. comm.). Future monitoring will indicate whether these developments are long-term phenomena.

Fox control efforts at coastal refuges have often incorporated the use of padded leg-hold traps. To prevent potentially depredating foxes from learning to avoid leg-hold traps, Lewis et al. (1993) used cage traps to capture non-native red foxes as part of a field study in urban southern California. As red foxes are shy of new structures and odors in their environment, catching foxes, especially adults, is difficult and time consuming when using cage traps. Foxes would have to become accustomed to the traps through prebaiting, which involved offering bait inside and outside a trap while the trap door was wired open. When tracks indicated that a fox fully-entered the trap to get the bait, the trap door would then be unwired so that it would shut when an animal triggered the trap. Prebaiting could take anywhere from one to ten or more days. During one 10-month period, prebaiting accounted for five times as many nights as trap-nights (341 vs. 67; Lewis et al. 1993),

significantly increasing the effort expended to capture a fox. Trapping foxes with leg-hold traps does not involve introducing a visible structure to a fox's environment (i.e., a relatively odor-free trap is covered with a thin layer of soil); its objective is to present nothing new to a fox other than an attractive bait or scent. Consequently, leg-hold trapping has been more effective for capturing foxes than cage trapping (Table 1). Coyotes are also more effectively captured with leg-hold traps than with cage traps (Los Angeles Co., Dept. Agric. Comissioner, unpubl. data).

SOCIAL ASPECTS OF MANAGEMENT

Among animals that play a part in American culture, the red fox has a rich history and broad appeal. Red foxes are found in animated films, television documentaries, internet web pages, calenders, business and product names, children's literature, and wildlife art. Beautiful, sly, crafty, mischievous, and wary are terms commonly used to describe red foxes. These characteristics, as well as the red fox's place in our culture, make them appealing to pet owners, animal rights activists, trappers, fox hunters, fur buyers, wildlife photographers, and the public in general. Unfortunately, many endangered (and consequently obscure) species do not evoke the same sentiment, creating a dilemma for some members of the public who must weigh endangered species protection against trapping and euthanizing red foxes.

In California, red foxes have been managed via hunting, trapping, fur-farming, and predator control by wildlife management agencies. These activities are frequently opposed by animal rights groups, and these groups have influenced red fox management actions and policies. In the late 1980s, animal rights groups opposed to fox trapping and euthanization at Seal Beach NWR won a court order requiring the federal government to prepare an environmental impact statement (EIS) to address potential management alternatives. During preparation, and following completion of the EIS (U.S. Fish and Wildlife Service and U.S. Navy 1990), capture and euthanization were continued as a means of controlling red foxes. However, a number of animal rights groups continued to protest ongoing control efforts. Realizing that animal rights' activists were also likely to protest planned red fox control efforts at the San Francisco Bay NWR, the U.S. Fish and Wildlife Service prepared an environmental assessment of management options to protect endangered species on that refuge. Although there was opposition by animal rights groups, capture and euthanization were used on this refuge to reduce the number of red foxes (U.S. Fish and Wildlife Service 1990). Most animal rights opposition to predator management has been done through lobbying politicians and wildlife management agencies, or through organized protests in the presence of invited news media. However, verbal abuse, harassment, threats, interference with activities and traps, and a gun shot have been directed at field personnel that were involved with capturing foxes at one southern California site (R. Baker, Calif. State Polytech. Univ., Pomona, pers. comm.; Witmer and Baker 1996).

In the Spring of 1991, an extension of California State Highway 55 was about to be opened for commuter traffic in Costa Mesa, California. A construction worker at the highway site alerted the media that the traffic on this freeway extension would kill a family of red foxes that lived in a den in the freeway embankment. At that time, California Department of Fish and Game (CDFG) had an endangered species protection policy at nearby Bolsa Chica that included trapping and euthanizing red foxes. While this strategy was unpopular, it was viewed as the most effective option because no zoo or state would accept non-native foxes. Television newscasters derided CDFG for taking the initial stance of allowing the foxes to remain in place (i.e., risking them to traffic). CDFG

Table 1. Capture data for red foxes when using cage traps and leg-hold traps in California, 1987 to 1997. Since capture rate is positively correlated to density, leg-hold trapping data was limited to the first episode (first four to ten days) of trapping at a trapping locale when fox densities were greatest. Fox densities during this first episode were most comparable to the densities of foxes in areas where cage trapping occurred.

Trap Type	County	Time Period	Trap-Nights	Fox Captures	Capture Rate[a]	Source
Cage trap	Orange	18 months	511	17	3.33	Lewis et al. (1993)
Padded leg-hold	Orange	4 days	68	8	11.76	Calif. Dept. Fish & Game, unpubl. data
Padded leg-hold	Alameda, Santa Clara	10 days	160	17	10.63	T. Elliot, USDA, Wildl. Serv., San Diego, unpubl. data
Padded leg-hold	Los Angeles	5 days	48	13	27.08	R. Baker, Calif. State Polyt. Univ., unpubl. data

[a]Capture rate = (fox captures/trap nights) x 100.

chose this stance because the same pair of adult foxes (the adult male was radio-collared) had denned and had successfully raised a litter of pups on a freeway embankment near traffic the year before (Lewis et al. 1993), and because CDFG did not typically rescue non-native red foxes. Alternatively, CDFG could have trapped and euthanized them, consistent with their policy at Bolsa Chica, although this was not their preferred option. Television broadcasters portrayed CDFG as a heartless bureaucracy and urged the public to call CDFG and the Governor and give their opinion. The pressure generated by the public prompted the Governor to direct CDFG to capture and deliver the foxes to two zoos which had offered space for the red foxes to help resolve the controversy. An adult female and her six pups were captured. One zoo received considerable media attention by holding a contest to name two of the freeway fox pups. This controversy demonstrated the sensitivity of the public toward red foxes, the ability of the news media to exploit it, and the need for developing new, proactive management strategies.

In 1996, an animal rights group opposed the capture and euthanization of non-native red foxes at Shoreline Park in Mountain View, California. This city park is located adjacent to the San Francisco Bay NWR, which supports several endangered species including the California clapper rail and salt marsh harvest mouse. A survey indicated that red foxes had become more abundant at Shoreline, and these foxes were approaching golfers and park employees for food (City of Mountain View 1997). Shortly after the survey, a number of foxes became sick and park employees became concerned about health risks to themselves and the public. The foxes had contracted sarcoptic mange and, consequently, died of the disease. The city considered alternatives for managing non-native red foxes given the growing number of red foxes, their proximity to endangered species populations, the risk of disease transmission to park visitors, an animal rights group's opposition to capturing and euthanizing foxes, and the inability of park personnel to manage foxes. Maintaining the status quo, and capture and euthanization of foxes at the site were two of the three options considered (Harvey and Associates 1996). An animal rights group proposed a third option: after being treated for diseases and sterilized, foxes would be kept in a fox refuge where they would be fed at feeding stations. Regular applications of coyote urine along the designated, unfenced perimeter of the refuge was suggested by the animal rights group as a means to contain the foxes and prevent them from preying on nearby endangered species. After a review of the proposals by an independent consulting group (Harvey and Associates 1996), the City of Mountain View developed a long-term policy for non-native red foxes that involved capturing and euthanizing red foxes unless they could be placed in homes where they would not be released (City of Mountain View 1997).

In 1996, several trapping and sportsmen's groups proposed a hunting and trapping season for non-native red foxes. The season was intended to provide additional hunting and trapping opportunities to the public, but it could also act to control the spread of non-native red foxes and reduce their population in the state (Calif. Fish and Game Comm. 1996). This proposal, which was supported by CDFG, presented a means of managing the non-native red fox population across much of its range. The California Fish and Game Commission decided to delay voting on the proposal until a later date (R. Pelzman, Calif. Fish and Game Comm., pers. comm.), effectively delaying a possible red fox season. Members of sportsmen's groups attributed the postponement to the lobbying efforts of animals rights groups (R. Aiton, Calif. Trappers Assoc., pers. comm.).

In 1997, a group of animal rights organizations proposed a statewide ballot initiative that would prohibit the use of body-gripping traps for recreational trapping, commercial trapping, and endangered species protection efforts in California (Initiative coordinator, Attorney General's Office, State of California, pers. comm.). Proponents of the proposed initiative collected enough signatures for the initiative to be included on the November 1998 ballot. This initiative, if passed, will undoubtedly have a significant effect on endangered species protection efforts. Similar ballot initiatives were passed in Arizona, Colorado, Massachusetts, and New Jersey.

In some urban and suburban areas, red foxes are fed by the public (Golightly et al. 1994). This feeding can maintain unusually high densities of foxes in and near areas where people, their pets, and endangered wildlife occur (Lewis et al. 1993; Golightly et al. 1994). Although disease transmission from red foxes to humans or their pets has not been documented in California, the potential for this transmission exists, especially in urban areas where fox densities are greatest. Sarcoptic mange, a contagious mite-infestation observed in canids, has been found in several urban fox populations in California (Lewis et al. 1993; Harvey and Associates 1996), reflecting the potential for disease transmission to domestic dogs (Stone et al. 1972). Rabies is another disease threat that red foxes present (Wandeler 1980). Given the density of red foxes in some urban areas and their proximity to humans, health officials and wildlife managers need to consider potential management options should rabies become an issue.

CONCLUSIONS

Attitudes toward red foxes have changed dramatically in California over the last 130 years. Red foxes were first viewed as a commodity and as a game species. More recently, they have been viewed by some as a non-native predator of endangered fauna and by others as an animal with inherent value that should not be managed or harmed by humans. These differing views have led to conflicts among some of the public and the agencies charged with wildlife management. While non-native red fox management in California may represent a unique situation, similar conflicts in other regions may arise where red foxes adapt to urban areas or where they are introduced in the future. Past events indicated that proactive strategies were necessary for managing non-native red foxes and should include: 1) greater consideration given to protecting other special status species from predation; 2) maintaining current assessments of red fox distribution and density, especially in urban areas; 3) preventing introductions and

translocations; 4) developing management strategies that are effective at regional and range-wide scales; 5) preparing for endangered species protection efforts without the use of leg-hold traps; 6) preparing plans to prevent or manage fox-transmitted disease epidemics; and 7) improving communication with the public about fox management issues. Several documents have been published that explain some of these issues to the public (Burkett and Lewis 1992; Jurek 1992; CDFG 1994); however, non-native red fox management, among other important wildlife management issues, warrants much more attention.

LITERATURE CITED

ANONYMOUS. 1926. A unique fox ranch. Amer. Game 15(3):58.

ANONYMOUS. 1930. Agricultural news—northern California. Calif. Cultivator. April 5, 1930, p. 396.

ASHBROOK, F. G. 1923. Silver fox farming. U.S. Dep. Agric., Dep. Bull. No. 1151. 59 pp.

BURKETT, E. E., and J. C. LEWIS. 1992. The spread of the red fox. Outdoor Calif. 53(2):1-4.

CALIFORNIA DEPARTMENT OF FISH AND GAME. 1994. Managing non-native species in California: the red fox. Calif. Dept Fish and Game, Sacramento. Non-game Bird and Mammal Sect., inform. leaflet. 8 pp.

CALIFORNIA FISH AND GAME COMMISSION. 1996. Initial statement of purpose for regulatory action: amend Sections 460 and 472, and add section 477, Title 14, California Code of Regulations, January 8, 1996. Sacramento, CA.

CITY OF MOUNTAIN VIEW. 1997. Shoreline red foxes—long-term policy (memorandum dated April 24, 1997). Mountain View, CA.

ESTRADA, J. 1989. Raising baby raccoons just comes with the job. Temple City Times, Temple City, CA. October 15, 1989.

DAVIDSON, W. R., M. J. APPEL, G. L. DOSTER, O. E. BAKER, and J. F. BROWN. 1992. Diseases and parasites of red foxes, gray foxes, and coyotes from commercial sources selling to fox chasing enclosures. J. Wildl. Dis. 28:581-589.

GOLIGHTLY, R. T., M. R. FAULHABER, K. L. SALLEE, and J. C. LEWIS. 1994. Food habits and management of introduced red fox in southern California. Proc. Vertebr. Pest Conf. 16:15-20.

GRINNELL, J., and J. S. DIXON. 1918. Natural history of the ground squirrels of California. Calif. State Comm. of Hort. Monthly Bull. 7:597-709.

GRINNELL, J., J. S. DIXON, and J. M. LINSDALE. 1937. Furbearing mammals of California. Univ. of Calif. Press, Berkeley. 777 pp.

HANSEN, N. W. 1944. As I remember. Broyles and Camper, Chico, CA. 191 pp. (Available at California State Library, California Section, Sacramento).

HARVEY AND ASSOCIATES. 1996. Report on red foxes at Shoreline Park, Mountain View, California. Alviso, CA.

JONES, J. W. 1913. Fur-farming in Canada. Commission of Conservation, Canada, Ottawa. 166 pp.

JUREK, R. M. 1992. Non-native red foxes in California. Calif. Dept. Fish and Game, Sacramento, Non-game Bird and Mammal Sect. Rep. 92-04. 16 pp.

KADLEC, J. A. 1971. Effects of introducing foxes and raccoons on herring gull colonies. J. Wildl. Manage. 35:625-636.

KRUUK, H. 1972. Surplus killing by carnivores. J. Zool. 166:233-244.

LESLIE, R. F. 1970. Wild Pets. Crown Publ. Inc., NY.

LEWIS, J. C. 1994. Dispersal of introduced red foxes in urban Southern California. M.S. Thesis. Humboldt St. Univ., Arcata, CA. 57 pp.

LEWIS, J. C., K. L. SALLEE, and R. T. GOLIGHTLY. 1993. Introduced red fox in California. Calif. Dept. Fish and Game, Sacramento. Non-game Bird and Mammal Sect. Rep. 93-10. 70 pp.

LEWIS, J. C., R. T. GOLIGHTLY, and R. M. JUREK. 1995. Introduction of non-native red foxes in California: implications for the Sierra Nevada red fox. Trans. West. Sect. Wildl. Soc. 31:29-32.

MACCARONE, A. D., and W. A. MONTEVECCHI. 1981. Predation and caching of seabirds by red foxes (*Vulpes vulpes*) on Baccalieu Island, Newfoundland. Canadian Field-Nat. 95:352-353.

POTEN, C. J. 1991. A shameful harvest: America's illegal wildlife trade. Nat. Geogr. 180:106-132

ROEST, A. I. 1977. Taxonomic status of the red fox in California. Calif. Dept. of Fish and Game, Nongame Wildl. Invest. Final report. 15 pp.

ROMSOS, J. S. In prep. Home range, habitat use, and movement of coyotes in a southern California urban environment. M.S. Thesis. Humboldt St. Univ., Arcata, CA.

SCHOEN, J. W. 1972. Mammals of the San Juan Archipelago: distribution and colonization of native land mammals and insularity in three populations of Peromyscus maniculatus. M.S. Thesis, Univ. Puget Sound, Tacoma, WA. 119 pp.

SLEEPER, J. 1987. Bears to Briquets: A history of Irvine Park 1897-1997. Calif. Classics, Trabuco Canyon, CA. 32 pp.

STONE, W. B., E. PARKS, B. L. WEBER, and F. J. PARKS. 1972. Experimental transfer of sarcoptic mange from red foxes and wild canids to captive wildlife and domestic animals. New York Fish and Game J. 19:1-11.

U.S. DEPARTMENT OF AGRICULTURE. 1922. Report of the Chief of the Bureau of Biological Survey. U.S. Gov. Printing Office, Washington, DC. 40 pp.

U.S. FISH AND WILDLIFE SERVICE. 1990. Predator management plan and environmental assessment, San Francisco Bay National Wildlife Refuge, Newark, CA. Draft rep. 26 pp.

U.S. FISH AND WILDIFE SERVICE, AND U.S. NAVY. 1990. Endangered species management and

environmental impact statement. Portland, OR. 591 pp.

VAIL, E. L. 1942. Fox ranching in southern California. Calif. Fish and Game 28:87-88.

WANDELER, A. I. 1980. Epidemiology of fox rabies. Pages 237-249 *in* E. Zimen, ed. The red fox. Biogeographica. Vol. 18. Dr. W. Junk, The Hague, The Netherlands.

WITMER, G. W., and R. O. BAKER. 1994. The protection of research personnel, equipment, and data (abstract only). Northwest Sci. 68:158.

ZEMBAL, R. 1992. Status and management of light-footed clapper rails in coastal southern California. Trans. West. Sect. Wildl. Soc. 28:1-5.