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NATURAL HISTORY AND PROTECTION OF BURROWING OWLS

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ABSTRACT: Burrowing owls *{Speotyto cunicularia)* were monitored over a four year period at Naval Air Station North Island, a developed area at the north end of San Diego Bay, California. Protection of the nest burrows and a burrow marking program were initiated in 1991. The breeding population increased from 14 to 27 nests after this marking program began. Burrow types and ways to differentiate burrows used by owls from those used by California ground squirrels *(Spermophilus beecheyi)* are outlined. The importance of burrows and their management is discussed with reference to the natural history of the owl.

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INTRODUCTION

Burrowing owls *{Speotyto cunicularia)* are semi-colonial nesting raptors whose densities depend on a commensal relationship with rodents that maintain complex burrow systems. In southern California, burrowing owls depend upon California ground squirrels *{Spermophilus beecheyi)* to develop such systems. Since the early 1970s, burrowing owl populations have been reported in decline (Zara 1974, Collins 1979), where the primary causes have been loss of habitat (Howie 1980) and rodent control (Butts 1973). Each of these factors directly affects the creation of burrows for owls to utilize.

Originally the range of burrowing owls encompassed short-grass prairie and shrub-steppe habitats. In the absence of these habitats, owls and their commensal burrowing mammals utilize urban areas where vegetation is kept short (Hennings 1963). It may be common to have owls nesting along golf courses or airport runways, where regularly mowed vegetation provides the horizontal visibility important for owls to detect predators (Coulombe 1971, Byrkjedal 1987). However, owls are adversely affected when these mammals, and their burrows, are eliminated as pests and/or hosts for disease vectors.

The concern to protect owls and their burrows may increase, as presently burrowing owls are being proposed for candidate status under the Endangered Species Act of 1973, as amended. Currently, burrowing owls and their nests are protected from destruction under the Migratory Bird Treaty Act of 1918. However, if they are listed as endangered or threatened by the U.S. Fish and Wildlife Service, considerations for their management may dominate some pest control programs. The occurrence of burrowing owls does not necessarily preclude the control of pest species if burrows supporting owls are segregated from those that owls do not utilize.

The purpose of this paper is to identify management criteria for burrowing owls, particularly in urban areas, such that rodent control programs can be adjusted to affect owl populations minimally. I also discuss the natural history of non-migratory burrowing owl populations and how that influences management considerations.

NATURAL HISTORY

Burrowing owls range from North America, southern Canada and western United States, into South America, southern Argentina and western Chile. An isolated subspecies occurs in the southern panhandle of Florida and West Indies (Bent 1938). The species is migratory throughout the northern portion of its range, however, in southern California burrowing owls are year round residents. In the United States, this non-migratory pattern begins in central California, extends along the coast and continues eastward into Texas.

Burrowing owls feed most frequently on insects, but small rodents, lizards and birds form the bulk of biomass consumed. Females are monogamous and courtship takes place from March through April. The female incubates one of clutch of three to eight eggs per year. Incubation is 21 days and semialtricial young fledge 30 days later. (Zarn 1974, Gleason 1978, Erlich et al. 1988).

The only subterranean dwelling owls in the Americas, burrowing owls are semi-colonial nesting birds, relying on fossorial mammals to construct their burrows. Most of their activities center near and around the nest burrow, with foraging distances generally within 600 to 700 m (Green and Anthony 1989, Haug and Oliphant 1990). They are associated with prairie dogs *{Cynomys* spp.) and ground squirrels *{Spermophilus* spp.), where their ranges overlap (Zarn 1974). Burrowing owls also will utilize den systems created by other mammals, and in New Mexico are associated with kangaroo rats *{Dipodomys spectabilis)* (Best 1969). Burrowing owls will use burrows, for purposes other than nesting, that are inhabited by ground squirrels. Although the two species do not appear to occupy the burrow simultaneously, they can reside in the same burrow during a 24 hour period (Winchell, unpublished data).

Daily activity patterns of burrowing owls change throughout the year and presumably are tied to food supply and the energetics of mating (Best 1969). Although feeding may occur nocturnally, especially during winter months, burrowing owls can be seen during daylight hours perched adjacent to their burrow entrance any time during any season. This is especially the case during the spring, when the male stands sentry next to the

burrow entrance almost continually through the daylight hours. This single behavioral pattern is critical to the wildlife manager because nest burrows can be located by surveying for sentry males during daylight hours.

Burrowing owls line their nests with duff or divots (Hennings 1963). This material flows out of the entrance and tends to form a mat in front of the burrow. Only the nest burrow has this material laid down, and therefore, will indicate that the burrow is being used by burrowing owls to incubate their eggs. This nesting material tends to accumulate during the breeding season, and is mixed with castings and prey items. Once burrows are located by observing sentry owls and confirmed as active nests by the presence of nesting material, then habitat and burrows utilized by owls can be marked and protected.

Ground squirrels, like many ground dwelling rodents, feed near their burrow entrance leaving plant clippings scattered about in no particular pattern. These clippings are not to be confused with the patterned distribution of nesting material that is restricted to the burrow entrance and continues to flow down the burrow. Additionally, nesting material is composed mostly of a variety of dried materials and brown in appearance, whereas clippings from rodents are continually refreshed with recently harvested vegetation and limited to a few species.

STUDY AREA

Naval Air Station (NAS) North Island lies west of downtown San Diego across San Diego Bay at the tip of a peninsula forming the entrance to San Diego Bay. The west and north sides of NAS North Island border the bay, while the south side borders the Pacific Ocean. The Station is 1,130 ha and 4 km across from ocean to bay. Adjacent to the east and south of North Island is the City of Coronado, a residential area with a population of 26,600.

NAS North Island is heavily developed, with 750 buildings and 17.5 km of runways or taxiways covering its surface. Areas supporting vegetation where burrowing owls and ground squirrels are found are predominantly green belts adjacent to taxiways and a golf course adjacent to beach dunes. Of these open areas, 60% was created from dredge spoils and is composed of sandy-shell soils. The other 40 % is the original land mass and is composed of sandy-loam and clay soils.

METHODS

The entire Station was surveyed for burrowing owls yearly during March, April, May and June from 1990 through 1993. Burrows where owls were sighted were marked and cataloged. Vinyl stake flags with Station grid coordinates and hole number were used to mark burrows. The behavior an owl exhibited and the exterior condition of each burrow entrance were also noted. Throughout the remaining months areas were surveyed for burrowing owls, however, only their behaviors were recorded in relation to previously marked burrows. New burrows were not marked during this time.

Beginning the summer of 1991 nest burrows were located and marked with a yellow sign noting the nest (Figure 1). Signs measured 20 cm X 30 cm and were riveted to a PVC post 1.5 m above the ground, within .25 meters of the burrow entrance.

Burrowing owls were trapped at their burrow entrance using methods described by Ferguson and Jorgensen (1981), Plumpton and Lutz (1992), and Winchell and Turman (1992). Captured birds were banded with a U.S. Fish and Wildlife Service lock-on band and a plastic-laminate color band on their opposite leg. Each auxiliary band was coded with a unique color and digit combination. Using this marking scheme, owls could be individually identified using a spotting scope. In addition, their behavior and breeding status within the colony could be identified and associated with specific burrows.

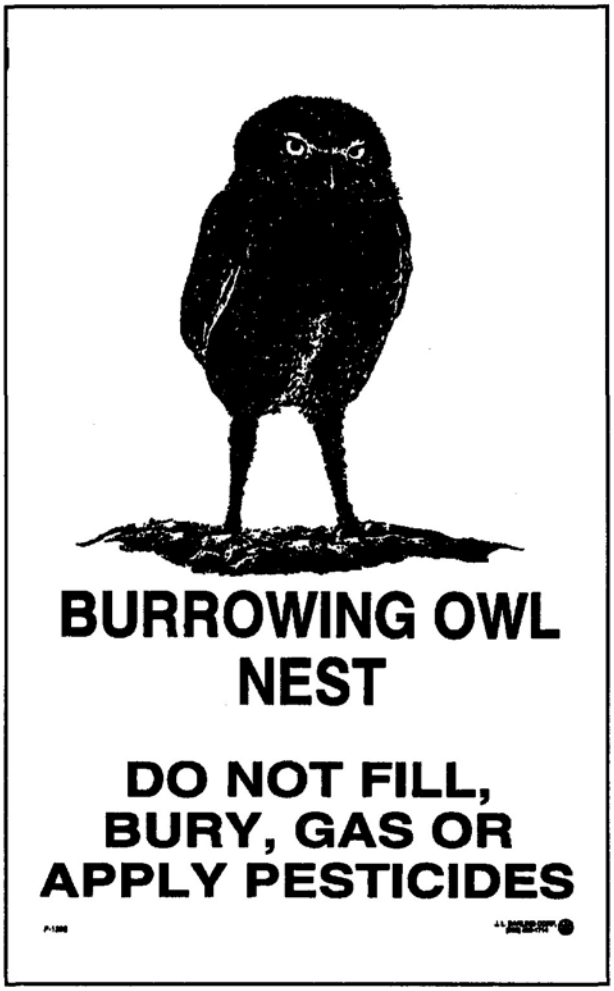

Figure 1. Sign used to mark burrows. Signs were purchased form J.L. Darling Corporation, Tacotna, Washington, as sign *tf* P-1288. Use of company name or this product does not imply endorsement by the U.S. Navy or Federal Government.

RESULTS AND DISCUSSION

One-hundred and thirty-six burrowing owls were captured and banded from 1990 through 1993. These owls used 224 separate burrows, of which 56 contained nests. These numbers demonstrate that owls occupy more than one burrow within their home range. In 1992 and 1993, a total of 17 pairs were banded and the number of burrows each pair utilized during the breeding season was recorded. Seventy-six percent or 13 of these pairs occupied two or more burrows, with one pair using up to

10 separate burrows. These only include burrows used by the breeding pair. If their young are included, the number of burrows utilized by the family increases as fledglings begin to disperse. Two types of burrows were defined. Nest burrows were those where eggs are incubated and were always distinguished by the presence of nesting material matted at the burrow entrance. Auxiliary burrows contained no nesting material and were located by observing owls using the burrow, mainly standing at the entrance. No data were collected as to the function of these burrows. However, it is assumed they are important for owls to escape from predators while foraging, maintain territory boundaries, provide secondary burrows to place fledgling young, and provide alternate burrows to move to if the nest burrow becomes heavily infested with ectoparasites during chick rearing.

A burrowing owl nest can be defined as a complex of burrows, which includes the nest or incubation burrow. This complex can be identified either by observation or flushing adult owls off their nest burrow. Over time, owls can be observed utilizing all the burrows comprising the complex. However, this method may require weekly observations, covering each activity period, throughout the breeding season to locate each burrow. Once owls are located standing next to burrow entrances and nest burrows have been identified, owls can be flushed repeatedly from the nest burrow to the auxiliary burrows in their home range. Through this process they will return, repeatedly, to the nest burrow.

Observing breeding pairs continually throughout the breeding season is presumably the most accurate method to determine a nest complex, however, this is most impractical for either the wildlife manager or pest control agent. The second method, flushing, can be employed to determine the minimum burrows making up the complex. Accuracy of the flushing method should increase if it is repeated several times during the nesting season.

The number of nests increased dramatically from 14 in 1990 to 27 in 1993 (Table 1). During the 1991 breeding season nest complexes were marked with signs. Each nest complex was marked by a series of signs, in one case 10 signs. Burrows marked by signs protected nest complexes by alerting management personnel to the presence of owls so that particular burrows would not be treated or disturbed. Signs also presented a physical impediment to equipment operators such that they avoided crushing burrow entrances. Protecting nest burrows from destruction increases survival rates for both adults and chicks, while protecting the integrity of the nest complex. Additionally, this maintains the structure of the habitat burrowing owls require, and provides alternate burrows for young to disperse and possibly establish a nest during the next season. It is believed that this single management act of marking burrows with clearly visible signs resulted in the marked increase in the nesting burrowing owl population at the Station.

SUMMARY

Identifying and marking burrows became the key element of burrowing owl management at NAS North Island in two ways. First, signs protected the physical integrity of burrows by alerting turf maintenance crews to the location of owl burrows and thereby avoiding the collapse of entrances by equipment. Second, signs alert pest control agents not to apply pesticides, most notably fumigants, to these burrows.

Burrowing owls generally maintain a series of burrows, forming a complex, one of which is the nest burrow used for incubation. Other holes are utilized as auxiliary burrows. All burrows comprising the complex should be marked and protected from destruction. Land managers can identify these complexes by first locating sentry owls adjacent to the entrances of nest burrows indicated by the presence of duff or divots. Once nest burrows are identified and marked, adult owls can be flushed to their auxiliary burrows. Using this method, the minimum number of burrows utilized by a breeding pair in their home range can be located. It is important to mark and protect these burrow complexes in order to maintain the structural dynamics of the habitat required for burrowing owls to establish breeding colonies.

Table 1. Population of burrowing owls at NAS North Island, by year, represented by the number of active nests.

Year	Number of Nests
1990	14
1991	17
NESTS MARKED WITH YELLOW SIGNS	
1992	26
1993	27

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