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NEST DESTRUCTION ASSOCIATED WITH MORTALITY AND DISPERSAL OF BURROWING OWLS IN THE IMPERIAL VALLEY, CALIFORNIA

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Abstract—We documented the effects of inadvertent nest destruction from road maintenance activities on the survivorship, reproductive success, and breeding dispersal of burrowing owls (*Athene cunicularia*) breeding in natural burrows along the water delivery system in the Imperial Valley of California. The activities affected 4 nests (7 adult owls) along an 800-m section of road, filling in or destroying all of the burrows. Three of 7 adult owls in the impacted area were killed, 2 of 2 active nests failed, 2 nests that had previously failed were destroyed and might have led to the dispersal of the surviving adults. We suggest that artificial burrows will reduce the conflict between maintenance and burrowing owl nests, which will benefit both owls and landowners.

Resumen—Documentamos los efectos de la destrucción inadvertida de nidos causada por el mantenimiento vial en la sobrevivencia, el éxito reproductivo, y la dispersión de la lechuza llanera (*Athene cunicularia)* anidando en madrigueras naturales a lo largo del sistema de distribución de agua del Imperial Valley de California. Las actividades afectaron cuatro nidos (7 lechuzas adultas) a lo largo de una sección de 800 m de carretera, llenando o destruyendo todas las madrigueras. Tres de los siete adultos en el área impactada murieron, dos de los dos nidos activos fallaron, dos nidos que habían fallado previamente fueron destruidos y puede ser por lo que los sobrevivientes adultos se dispersaron. Sugerimos que unas madrigueras artificiales pueden reducir el conflicto entre el mantenimiento y los nidos de la lechuza llanera, lo cual será un beneficio para las lechuzas y para los propietarios de tierras.

The burrowing owl (*Athene cunicularia*) is a Species of Special Concern in California and has declined in some parts of its range (Haug et al., 1993; Klute et al., 2003). A major threat to burrowing owls is the loss of habitat due to development and the decline of burrowing mammals (Desmond et al., 2000; Holroyd et al., 2001; Klute et al., 2003). In contrast, burrowing owls are known to thrive in areas of intense agriculture (Desante et al., 2004; Rosenberg and Haley, 2004), and even the presence of agricultural fields near nests is associated with increased productivity (Belthoff and King, 2002). Owls that inhabit already highly developed agricultural areas might be negatively affected by the loss of nesting burrows because of regular maintenance of water delivery systems and the roads near these systems (Coulombe, 1971; Rosenberg and Haley, 2004). Here we document the effects of such maintenance on the survival, reproductive success, and breeding dispersal of burrowing owls.

Our study site was located within the Sonny Bono Salton Sea National Wildlife Refuge Complex and adjacent private agricultural lands in the Imperial Valley of southeastern California (33°07′N, 115°31′W). This region contains the largest population of burrowing owls in California (Desante et al., 2004). The study area is within the Colorado Sonoran Desert region, characterized by extreme summer temperatures and low precipitation. It is an intensive-use agricultural region, supporting crops throughout the year (Molina and Shuford, 2004). Natural owl burrows and artificial owl nest boxes existed primarily along canals and drains within the agricultural matrix (Rosenberg and Haley, 2004).

We trapped breeding owls during the 2002 breeding season (April to August) within an 11.7-km^2 central area of the study area by using spring-loaded traps and 2-way burrow traps (Catlin, 2004). Owls were fitted with radio transmitters that had an approximately 400-day battery life (American Wildlife Enterprises, Monticello, Florida), a permanent harness mount, and a 5.08 ± 0.02 g (mean ± 1 *SE*; $n = 36$) total assembly weight. These owls were initially included in an experiment investigating the effects of nest depredation on dispersal (Catlin, 2004).

We used ground and aerial surveys to locate radio-tagged owls from June 2002 to April 2003. The receiving antenna consisted of 2, 4-element, Yagi antennae (Cushcraft Corp., Manchester, New Hampshire) joined by a null combiner (Telonics, Inc., Mesa, Arizona) and mounted to the back of a pickup truck (Gervais et al., 2003). Ground surveys were performed weekly (June through August 2002) or biweekly (September 2002 to April 2003; Catlin, 2004). After we located an owl via radiotelemetry, we attempted to confirm visually the status of the owl (alive or dead). In the case of owls that were found in the nest burrow, we used an infrared probe (Sandpiper Technologies, Manteca, California) to confirm the status at each interval. We used aerial surveys to locate owls that could not be located using the ground methods. We consistently searched an area of ca. 2,250 km^2, providing a maximum area of detection of ca. 23 to 27 km from the central study-area (Catlin, 2004). All of the owls included in the analyses presented here were relocated by the end of the study.

On 23 May 2002, during our weekly searches, we discovered that road grading and ditch maintenance, characteristic of agricultural operations in the region (Coulombe, 1971), had inadvertently destroyed 4 nests with 7 radio-harnessed adults. All holes to nesting and satellite burrows were covered or destroyed along an 800-m section of road. We observed that nest destruction was not only associated with mortality, but also with breeding dispersal. The nests that were destroyed were located on the earthen banks adjacent to water delivery ditches. Two of 4 nesting attempts were buried and failed because of the road and waterway maintenance. One of the destroyed nests contained young chicks, while the other was at the egg stage. Of the other 2 nests, one clutch was removed as part of an experiment (Catlin, 2004) and the other seemed to be abandoned before the maintenance. Therefore, all nests active at the time of the maintenance were destroyed.

Of the 7 radio-harnessed owls, 3 owls (2 male, 1 female) were buried in their burrow and died, 1 owl (male) died of unknown causes on or before the day of the maintenance (only the transmitter was found), and 3 owls (1 male, 2 female) survived throughout the season to breed the following year. The 3 adult owls that survived dispersed 1,064 ± 508 m (mean ± 1 *SE*) between breeding seasons.

Road and waterway maintenance activities are common within the Imperial Valley (D. H. Catlin, pers. obser.). Prior to this study, it was believed these activities might cause the loss of burrows (Coulombe, 1971; Rosenberg and Haley, 2004), but it was difficult to determine if owls were buried or if they escaped. Our observations indicate that, although some owls did escape and disperse, some of the owls in the impacted area did not survive because of nest destruction during the breeding season, and this number might have been higher had it not been for the death of mates and nest failure prior to nest destruction. Moreover, all of the nests that were believed to be active at the time of the maintenance were destroyed. Our observations indicate that maintenance had an effect on local survival, nest success, and dispersal, but our sample sizes are small.

The Imperial Valley has an extremely high density of breeding burrowing owls (Desante et al., 2004; Rosenberg and Haley, 2004), and inadvertent nest destruction has the potential to affect many owls. Maintenance activities, however, also benefit burrowing owls, as they clear the waterways of vegetation, making the habitat suitable for the owls (Coulombe, 1971; Green and Anthony, 1989; Rosenberg and Haley, 2004). Destruction of these nests during the breeding season is a violation of the Migratory Bird Treaty of 1972 (Holroyd et al., 2001; Klute et al., 2003), but the activities that contribute to nest destruction are ultimately positive. We suggest that artificial burrows (Trulio, 1995; Rosenberg and Haley, 2004) would alleviate some of this problem. Because they are more permanent and can be clearly marked, they are less likely to be destroyed inadvertently, allowing for both waterway maintenance and burrowing owl nesting.

The construction of artificial nests as a management tool is well documented (Trulio, 1995; Smith and Belthoff, 2001*a*; Belthoff and Smith, 2003), and these artificial burrows might benefit the owls in other ways, such as increasing reoccupancy rates and providing long-term burrows in an otherwise intensively managed landscape (Belthoff and Smith, 2003). Care should be taken when installing burrows, because occupancy is related to size (Smith and Belthoff, 2001*b*), and not all individuals will relocate to closely placed artificial burrows (Smith and Belthoff, 2001*a*). Smith and Belthoff (2001*a*) successfully relocated 2 of 5 artificial nests threatened by development. With such high densities already in the Imperial Valley, the primary benefit to the installation of artificial nest boxes would be a reduction of mortality and nest failure related to road and waterway maintenance activities. Furthermore, maintaining high burrowing owl densities could benefit farmers because burrowing owls consume a large number of agricultural pests (York et al., 2002; Rosenberg and Haley, 2004). Considering recent declines, listing in Canada, and petitions to list in the United States, another benefit to installing artificial burrows would be the reduction of tensions between private landowners and groups concerned with the protection of burrowing owls.

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REDUCING COWBIRD PARASITISM WITH MINIMAL-EFFORT SHOOTING: A PILOT STUDY

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Abstract—Overall, trapping of brown-headed cowbirds (*Molothrus ater*) on Fort Hood, Texas, has reduced parasitism on black-capped vireos (*Vireo atricapilla*). However, parasitism remained high (92.0% in 1999) on a disjunct, 20-ha patch of habitat. As an alternative to trapping, we shot cowbirds for 1 h per week in this patch during the 2000 and 2001 breeding seasons, removing up to 7 female cowbirds each season. Parasitism decreased following shooting (0 to 25%) and did not immediately revert to the pre-shooting level one year following the cessation of shooting. An increase in fledgling success from 0% prior to shooting to 75 to 100% following shooting suggests that shooting had a positive effect on vireo nest success. Our results from one study site suggest