MONITORING BURROWING OWLS IN ARTIFICIAL BURROWS

FINAL REPORT

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Young western burrowing owls (*Athene cunicularia hypugaea*)
at the entrance to an artificial burrow

PROJECT SUMMARY

This study was designed to monitor use of artificial burrows by nesting burrowing owls (*Athene cunicularia*) in and near the Snake River Birds of Prey National Conservation Area. My students and I have monitored nesting burrowing owls near Kuna Butte since 1994 and since 1996 in the Grand View area. This report summarizes information from the 1999 and 2000 breeding seasons.

In 1999, I captured 317 burrowing owls in the two study areas, of which 14 were owls originally banded in a previous year. I was able to obtain productivity estimates for 49 nests in artificial burrows (N = 10 in Kuna Butte and N = 39 in Grand View) in 1999. Clutch sizes (minimum) were 9.3 ± 1.4 (range: 7 - 11; N = 10) and 9.1 ± 1.6 (range: 3 - 11; N = 39) in Kuna Butte and Grand View, respectively. Overall in 1999, I banded 5.7 ± 3.0 young per nest (range: 0 - 10) at the 49 nests.

In 2000, I captured 145 burrowing owls in the two study areas, of which 16 were originally banded in a previous year .I monitored 49 nests in artificial burrows (N = 9 in Kuna Butte and N = 40 in Grand View). These nests in Kuna Butte and Grand View had minimum clutch sizes that averaged 6.4 ± 3.8 (range: 1 - 11; N = 9) and 8.5 ± 1.3 (range: 5 - 11; N = 40), respectively. I banded 1.9 ± 2.1 young per nest in the 49 nests during 2000 (Kuna Butte: 3.1 ± 2.5, N = 9; Grand View: 1.7 ± 2.0, N = 40).

Lower numbers of young banded in 2000 reflect very poor reproduction this year, presumably because of adverse weather conditions (hot, dry) and lower than usual prey populations. For example, almost half of all nests in Grand View failed to produce fledglings in 2000, and predation by badgers was higher than in any previous year. Moreover, there is a continuing trend for fewer nests in the Kuna Butte area that reflects increased development and destruction of both natural and artificial nest burrows. Nonetheless, artificial burrows continue to provide important habitat for burrowing owls in the Lower Snake River District and Snake River Birds of Prey National Conservation Area. Clearly, it is imperative to continue to monitor the health and reproduction of the southwestern Idaho burrowing owls and to seek opportunities to improve habitat and nesting opportunities when possible.

INTRODUCTION

Burrowing owls (*Athene cunicularia*) are declining throughout much of their range (Haug et al. 1993, James and Espie 1997), and the U.S. Fish and Wildlife Service currently is conducting a status review to determine whether official listing of this species under the Endangered Species Act is warranted. However, owl numbers in southwestern Idaho, and within the Snake River Birds of Prey National Conservation Area do not appear to be declining as precipitously as in other areas, although no systematic surveys have been published. Nonetheless, the southwestern Idaho population is becoming increasingly valuable for understanding the biology of burrowing owls. Ideally, information gained from this larger than average population not only will help manage it effectively, but it will aid wildlife managers throughout the species' range to slow population declines.

One essential component of endangered species management is to understand a species' requirements for successful reproduction. In the case of western burrowing owls, which can be considered secondary cavity nesters in Idaho because they cannot dig their own burrows, this means understanding their requirements for underground burrow systems used for nesting and roosting. While information on the above-ground features of burrowing owl nest sites has been available in the literature (Rich 1986, Plumpton and Lutz 1993, Belthoff and King, in review), there is virtually no information on below-ground features of burrows important to nesting owls. Our recent studies using artificial burrows (Belthoff and Smith 1999, Smith and Belthoff, in press a) have documented that burrowing owls prefer artificial burrows with large (68-L) chambers and small-diameter (10 cm) tunnels. These types of burrows are now being deployed in many areas for research and management of burrowing owls.

My objectives in the present study were to (1) continue color-banding burrowing owls in the Snake River Birds of Prey National Conservation Area to continue long-term studies of demography and movements, and (2) monitor nesting activities by burrowing owls in artificial burrows. This report summarizes results obtained during the 1999 and 2000 breeding seasons, during which time there were 99 nests in the clusters of artificial burrows originally placed in 1997 and 1998.

METHODS

Study Areas

I studied burrowing owls in and near the Snake River Birds of Prey National Conservation Area. The first general area, in which my students and I have monitored nesting burrowing owls since 1994, was located approximately 3.2 km south of Kuna and 23 km north of the Snake River Canyon, in Ada County (Fig. 1). This area is characterized by big sagebrush (*Artemisia tridentata*) shrubland, and disturbed grasslands dominated by cheatgrass (*Bromus tectorum*) and tumble mustard (*Sisymbrium* *altissimum*). Surrounding areas contain irrigated agricultural fields (primarily alfalfa, mint, and sugar beets), scattered residential homes, and several large dairy farms. The topography is flat to rolling with elevations ranging from 841 m to 896 m. Rock outcrops and a few isolated buttes (e.g., Kuna Butte, elev. 986 m) exist in the region. Mean annual temperatures range from -20°C to 45°C, and annual precipitation averages less than 20 cm (NOAA 1985). In this area there is a relatively high density of burrows excavated by American badgers (*Taxidea taxus*), which burrowing owls use for nesting and shelter throughout the breeding season and during the post-fledging dispersal process (King and Belthoff, in press).

A second area is located approximately 8 km north-northeast of Grand View, in Elmore County, Idaho and adjacent to State Highway 67 (Fig. 2). This area was a mosaic of irrigated agriculture and disturbed grasslands. Elevations range from 853 m to 922 m. The area contains very few homes, several paved and dirt roads, and an electrical substation. The Snake River is located approximately 7 km south-southwest of this study area. Mean annual low and high temperatures are -29°C and 43°C, respectively, and precipitation averages 26 cm per year (NOAA 1985). My students and I have monitored burrowing owls in this area since 1996.

Artificial Burrow Placement

Before burrowing owls arrived from wintering areas in 1997 and 1998, clusters of two and three artificial burrow systems (ABSs) were buried in or around the two study areas (Belthoff and Smith 1998, 1999). The clusters of three artificial burrows, which were used to test for chamber size preferences, encircled natural burrows that were used for nesting in previous years. Within the clusters of three, each artificial burrow consisted of a 15 cm diameter tunnel made of flexible, perforated plastic pipe and a plastic nest chamber. Each cluster had chambers of three sizes: a 30 cm x 30 cm x 20 cm (17-L; 4.5 gal) plastic container, a 19 L (5 gal) bucket with a 30 cm diameter, and a 50 cm x 35 cm x 40 cm (68 L, 18 gal) plastic tub (Fig. 3a). All entrances within a cluster were equal distance (5 m) from, and were oriented in the same direction as the historical nest burrow entrance (Fig. 3b). Tunnel entrances were 120 degrees apart, and chamber size was randomly assigned within each cluster. All ABS tunnels were 2 m long with a 90 degree turn between the entrance and the ABS chamber. Each tunnel sloped downward (20-30 degrees) towards the chamber, within the range typical of nest burrows within both study areas (Belthoff and King 1997, in review). The tunnel inserted into the chamber on a level plane. The top of each ABS chamber was at least 30 cm underground. To increase the probability of ABS use, a wooden perch was placed in the center of the cluster as in King (1996). Additionally, all historical nest burrow entrances, and any suitable burrow within a 10 m radius, were blocked with large rocks to prevent their use during this study. The rocks were removed after juveniles fledged so the burrows could be used as refuge burrows (satellites) if desired.

Clusters of two artificial burrows were placed in areas where habitat appeared similar to those areas in which burrowing owls have nested and were designed to test for preference of tunnel diameter. One artificial burrow had a 15 cm diameter tunnel, and the other had a 10 cm diameter tunnel. Chamber size was held constant by deploying 19-L plastic buckets for both chambers (Fig. 4a). The two burrows were buried adjacent to one another, with 3 m between each entrance (Fig. 4b). In the Kuna Butte study area, tunnel entrances were oriented in a south-southeast direction, which is typical for natural burrows used as nest sites in this area (Belthoff and King 1997). Entrances in the Grand View study area were oriented in a north-northeast direction, which is typical for most natural burrows in the area (Belthoff and King 1997). A wooden perch was placed between the tunnel entrances in all clusters of two. Tunnel lengths and slopes, chamber depths, and all other methods were similar to those used for deployment of clusters of three.

Locating and Capturing Burrowing Owls

We searched suitable habitat in each study area for burrowing owls both on foot and from automobiles. Most surveys were performed during daylight hours. After locating owls, we monitored their nesting activities on a regular basis. Also, historical nest sites were revisited to search for nesting owls.

To capture owls we used Havahart® traps and noose rods as described in Belthoff et al. (1995) and King (1996). We also used one-way basket traps to capture adults as they departed artificial burrows. These traps consisted of a 0.5 m section of flexible plastic pipe (10 cm diameter), a small piece of transparent Plexiglas, and an enclosure made of "chicken wire". The Plexiglas was fastened to one end of the pipe but could hinge upwards. This end of the pipe was inserted into the wire basket. The open end of the pipe was inserted into artificial burrow tunnels when the status of a nest in an ABS needed to be checked. Digging down to the artificial chamber caused any adults in the nest chamber to enter the basket, and the hinged door closed behind it and trapped the owl.

Upon capture, we recorded each owl's mass to the nearest gram, wing length, tarsus length, tail length, and length of exposed culmen (all to nearest 0.5 mm). We classified adult owls as females if they had well-developed brood patches. We were unable to discern sex of young owls based on appearance or morphological measurements, so they were classified as unknown sex. The classification of adult males was based on lack of a brood patch, their lighter plumage, and behavior near nests. We fitted owls with a U.S. Geological Survey aluminum leg band and up to three plastic, colored leg bands (National Band and Tag Co., Newport, KY) for future identification.

Owl Monitoring

Regular follow-up visits were made to each nest to determine minimum number of eggs produced, nestling survival, and number of banding age young produced. Successful nests had at least one young owl survive to fledging age (> 28 days). Means ± SD are presented throughout this report.

RESULTS AND DISCUSSION

Trapping and Banding

Between 17 April - 19 July 1999, I captured 317 burrowing owls in the two study areas. These included 1 adult male, 33 adult females, 1 adult of unknown sex, and 282 nestlings and fledglings. Fourteen of 35 (40.0%) adults captured were owls originally banded in a previous year. Appendix A contains band numbers, capture dates, color band combinations, age and sex information for owls initially captured or recaptured during 1999.

From 21 April - 27 June 2000, I captured 145 burrowing owls in the two study areas. These included 6 adult males, 45 adult females, and 94 nestlings and fledglings. Sixteen of 51 (31.4%) adults captured were owls originally banded in a previous year. Lower number of young banded in 2000 reflects very poor reproduction this year, presumably because of adverse prey supplies and weather conditions (see below). Appendix B contains band numbers, capture dates, color band combinations, age and sex information for owls initially captured or recaptured during 1998.

Reuse of Sites

Tables 1 and 2 summarize use and reuse of clusters of artificial burrows in the Kuna Butte and Grand View study areas, respectively, since 1997. In Kuna Butte, burrowing owls nested in 11 of 32 (34.4%) clusters monitored in 1999 and nine of 38 (23.7%) clusters monitored in 2000. In general, the number of nesting pairs in Kuna Butte has declined since 1997 - 1998 (Table 1). This decline may be related to increasing vegetation heights (which owls avoid), increased development (including dwellings, dairies, sewage treatment ponds), and a decline in the number of artificial burrows available because of destruction by construction and various agricultural activities. In contrast, burrowing owl use of artificial burrows has remained high in Grand View. Burrowing owls nested in 39 of 55 (70.9%) and 40 of 55 (72.7%) available clusters in Grand View in 1999 and 2000, respectively (Table 2). This area has remained virtually unchanged in terms of vegetation structure and agricultural activities since artificial burrows were initially installed.

Reproductive Success of Pairs

During 1999 - 2000, productivity estimates were available for 98 nests in artificial burrows (N = 19 in Kuna Butte and N = 79 in Grand View; one nest, John Hayes #2, in

Kuna Butte had a nest in 1999 but was not monitored sufficiently to record productivity). Following are annual productivity summaries for these nests.

1999 - I was able to obtain productivity estimates for 49 nests (N = l0 in Kuna Butte and N = 39 in Grand View) in 1999. Clutch sizes (minimum) were 9.3 ± 1.4 (range: 7 - 11; N = 10) and 9.1 ± 1.6 (range: 3 - 11; N = 39) in Kuna Butte and Grand View, respectively (Tables 3 and 4, Fig. 5). Some of these eggs (1 egg per nest at all but one nest where 3 were collected) were removed for an egg physiology study in collaboration with Dr. Del Kilgore at the University of Montana (Table 3). Number of young banded at artificial burrows in Kuna Butte and Grand View, which represent the estimated minimum productivity, were 5.4 ± 3.6 and 5.8 ± 2.9, respectively (Tables 3 and 4, Figs. 6 and 7). Overall for 1999, I banded 5.7 ± 3.0 young per nest (range: 0 - 10) at the 49 nests.

2000 - I monitored 49 burrowing owl nests in artificial burrows (N = 9 in Kuna and N = 40 in Grand View) in 2000. Minimum clutch sizes averaged 6.4 ± 3.8 (range: 1 -11; N = 9) in Kuna Butte (Table 3), although three nests were not monitored until young were present, so actual clutch sizes were probably much higher than these minimums. Clutch sizes in Grand View were 8.5 ± 1.3 (range: 5 -11; N = 40; Table 4). Overall, I banded 1.9 ± 2.1 young per nest in the 49 nests during 2000 (Kuna Butte: 3.1 ± 2.5, N = 9; Grand View: 1.7 ± 2.0, N = 40; Tables 3 and 4).

As evident above, productivity was much lower in 2000 than in 1999. For example, 19 of 40 nests (47.5%) in Grand View failed to produce any young. American badgers depredated many of these nests, and others were abandoned for unknown reasons, although I presume the chicks starved and parents abandoned nesting attempts. Weather conditions were hot and very dry during 2000 following the time period when chicks initially hatched, and these conditions seemed to be combined with a reduction in the availability of mammalian prey. The latter point is supported by the facts that badgers were more on the move (presumably in search of prey) than in any previous year and that most prey remains in and near nests consisted of invertebrates (scorpions, beetles) or birds rather than voles at the time when chicks were hatching and growing.

SUMMARY AND CONCLUSIONS

Our ongoing, multiple-year studies of burrowing owls have yielded important information about the population dynamics, productivity, return rates, post-fledging and between-year movements of burrowing owls in southwestern Idaho (Belthoff et al. 1995, Belthoff and King 1997, Belthoff and Smith 1998, 1999, King and Belthoff, in press, Smith and Belthoff, in press b). In 1997, my students and I also initiated a field experiment to examine nest-site selection in burrowing owls using artificial burrow systems. These studies found that owls prefer artificial burrows with large chambers and small tunnels (Smith and Belthoff, in press a), and these results should and are changing the way artificial burrow systems are deployed in owl management and mitigation activities. During 1999 and 2000 I continued to monitor burrowing owls breeding in the artificial burrows in Kuna Butte and Grand View. There were 99 nests in artificial burrows during these two years, of which 74 (74.7%) successfully produced young. Productivity was high during 1999 but plummeted in 2000 when almost half of the nests in Grand View produced no banding-age young, presumably because of weather extremes and low prey availability. Nonetheless, artificial burrows continue to provide important habitat for burrowing owls in the Lower Snake River District and Snake River Birds of Prey National Conservation Area (Fig. 8). Moreover, the southwestern Idaho population of burrowing owls continues to be a stronghold for this species, although recent declines in Kuna Butte are concerning and could signal future more widespread declines. Clearly, it is important to continue to monitor the health and reproduction of the southwestern Idaho burrowing owls and to seek opportunities to improve habitat and nesting opportunities when possible.

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