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## ARTIFICIAL BURROWS PROVIDE NEW INSIGHT INTO BURROWING OWL NESTING BIOLOGY

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*Introduction*

The breeding biology of Burrowing Owls (*Athene cunicularia*) is poorly understood, primarily because of the difficulty of studying an underground nesting species. Before the use of artificial burrows (Collins and Landry 1977), few attempts were made to intensively study Burrowing Owl nesting because of the nest destruction problem. Twenty artificial burrows, similar to those used by Collins and Landry (1977), were installed in eastern Oregon (Umatilla and Morrow counties) in the spring and summer of 1979; however, sandy soil and wind erosion resulted in only 12 burrows being relocated in 1980. In 1979 and 1980, we made observations on four nesting attempts by Burrowing Owls using these burrows. Our objective was to collect additional information on the breeding biology of this species. The points made in this paper all come under the basic heading "know the species" which is essential before attempting to develop a *census* procedure, or even a method for evaluating *productivity* of a species.

*Results*

The observations recorded during this study are presented separately for each burrow, although the food habits information is pooled.

Burrow No. 1 (1979)

An artificial nest was placed in a burrow being excavated on 4 April 1979. The site was rechecked on 11 April and contained an owl incubating 10 eggs of which 1 was collected for pesticide analysis. Thus, the Burrowing Owl laid 10 eggs in no more than 8 days; it seems unlikely that a second female contributed eggs to the clutch as additional adults were not observed near the burrow. On 9 May eight young (about 1–2 days old) were in the nest; this suggested an incubation period of about 27–28 days. Seven young were banded in the box on 22 May (Fig. 1). On 6 June (young about 1 month old) two of the banded young were in the nest box in which the eggs were laid, and four of the banded young were in another box about 45 m away. Prey was found in both boxes.

Burrow No. 1 (1980)

The burrow discussed above was first checked on 19 March 1980; two adults were flushed from the burrow. It contained no eggs. On 7 April six cold eggs were present and one was collected for pesticide analysis. No prey was found in the box with eggs, but prey was found in the box 45 m away. On 26 April 11 eggs were in the nest. On 15 May at least six young were in the nest, but some were also in the tunnel. On 22 May no owlets (about 10 days old) were in the box where the eggs were laid, nor were they in the adjacent box. Other natural burrows were known to be in the vicinity. However, on 27 May 10 young were in the nest in which the eggs were laid; these were banded. On 6 August one adult and at least five young were seen nearby.

Burrow No. 2 (1980)

This burrow was first checked on 8 April 1980. An adult flew from the nest, but its mate remained inside. One cold egg was also in the nest. On 14 May the nest was revisited and contained 10 eggs, most of which were pipped, and one had hatched. If the 10 eggs were laid in 8 to 10 days, the incubation period for the clutch was 28 to 30 days. Revisits on 2 and 9 June revealed no young in the box, although they could have moved to a natural burrow nearby; an adult was seen in the vicinity on one visit.

Burrow No. 3 (1980)

On 14 May 1980 an adult was near the entrance, and the female was inside incubating eight eggs of which one was collected. On 2 June seven young, about a week to 10 days old, were in the nest, and they were all banded on 9 June.

Prey species found in the burrows during the nesting season included the following: Ord kangaroo rat (*Dipodomys ordi*) (13), deer mouse (*Peromyscus maniculatus*) (5), vole (probably *Microtus* sp.) (3), northern pocket gopher (*Thomomys talpoides*) (2), Great Basin pocket mouse (*Perognathus parvus*) (2), young mountain cottontail (*Sylvilagus nuttalli*) (1), young black-tailed jackrabbit (*Lepus californicus*) (1), house mouse (*Mus musculus*) (1), and young Ring-necked Pheasant (*Phasianus colchicus*) (1). Numerous authors, using pellet studies, have noted the importance of insects in the diet of Burrowing Owls (e.g., Maser et al. 1971). We also found pellets in mid-August that contained mostly insect remains. Insects, however, would be less likely to be found in burrows because they probably are eaten immediately.

## *Discussion and Conclusions*

Egg laying occurred from early through late April. The clutches were large (12, 10, 10, 8) with the latest clutch initiated being the smallest. Burrowing Owls appear to pro-

duce the largest clutches of any North American raptor. Murray (1976) gathered clutch size data of various owls from museums and egg collections and found that the mean size of 439 Burrowing Owl clutches was 6.48 (range 1–11). Eggs in a nest from this study were laid at a rate of more than one per day (assuming two females were not involved), which is in contrast to reports for most owls (see review, Welty 1962) and a Burrowing Owl in captivity (Howell 1964). Incubation lasted about 4 weeks (27–28 days and 28–30 days) at two nests in this study, which agreed with Zarn (1974), but differed from Bendire's (1892) statement of about 3 weeks. Bendire stated that incubation did not appear to begin until a clutch was nearly completed; that agrees with the findings of this study—a cold, incomplete clutch of six eggs was recorded, and a nearly synchronous hatching of eggs occurred in another clutch. In contrast, Thomsen (1971) assumed that incubation began with the laying of the first egg, based on size of young at first emergence.

Although 1 egg was collected from each clutch, 10, 7, and 7 young reached about 2 weeks of age in 3 nests; however, some attrition appeared to occur over the next 2 weeks. Owlets only 10 days old were known to move among nest burrows, thus making productivity studies difficult. Further, banded young from one nest were found in two different burrows at the same time, making casual counts of young in front of burrows a somewhat tenuous method of obtaining productivity (a minimum count only). Even with artificial burrows, we were uncertain about the outcome of Nest No. 2. The young may have moved to natural burrows. From the literature, the number of young produced per pair is varied, but in some studies it was much lower than the average clutch size. Estimates of attrition of young from the egg stage to fledging may be highly inflated if measurements are not corrected for the movement of young to adjacent burrows.

Following pair formation, Thomsen (1971) reported that some pairs were seen at only one burrow, while others were seen at more than one burrow before choosing one as a nest site. In the present study, even during the egg laying period, some adults used at least two burrows and brought prey to each. The phenomenon even tends to complicate the counting of active nesting pairs—a task originally thought to be relatively straightforward. These cautions are important because the recent concern for Burrowing Owls may result in a number of future studies. Detailed studies of Burrowing Owls are much more difficult than we, and probably most workers, anticipated.

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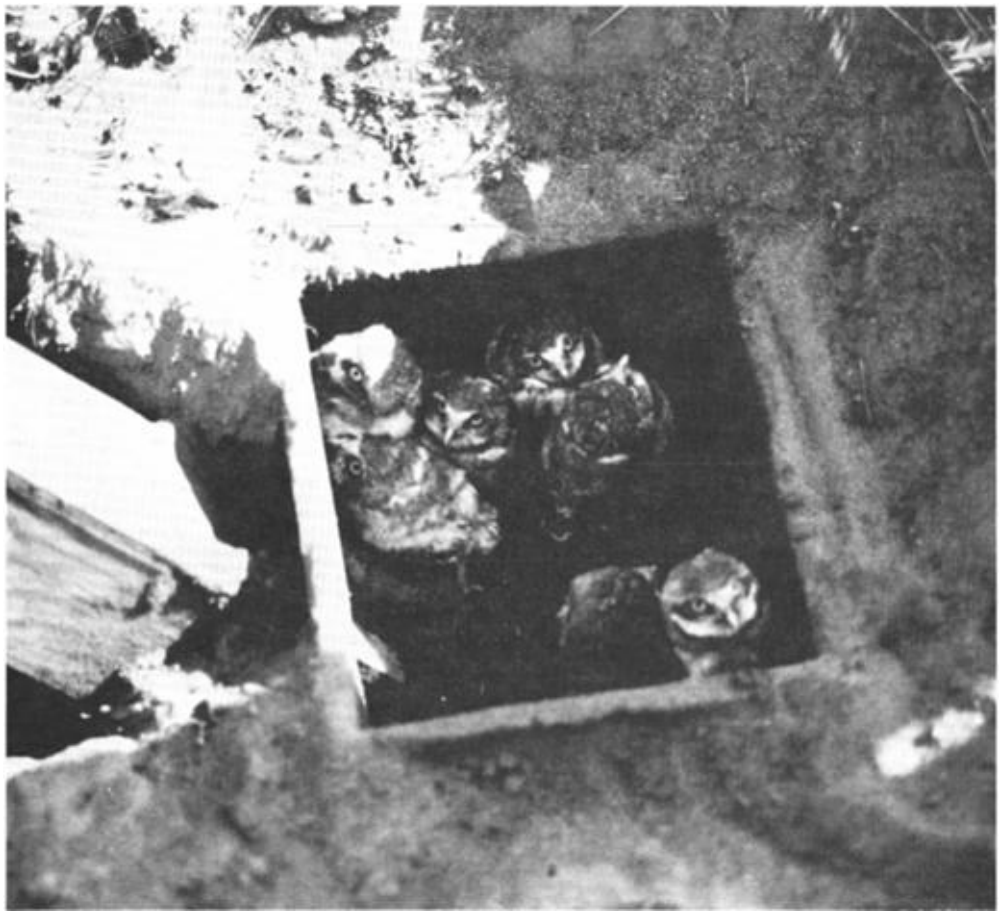

Figure 1. Seven young (14–15 days old) in Burrow #1 on 22 May 1979.