

Table 1. Burrowing Owl nest and egg dimensions from three above-ground nests, Dade Co., Florida, 1987.

| NEST DIMENSIONS (mm) | | EGG DIMENSIONS (mm) ¹ | |
|----------------------|----------------|----------------------------------|-------------------------------------------|
| NEST | (L × W × D) | EGGS | (L × W) |
| 1 | 167 × 148 × 27 | 1 | 34 × 24 ² |
| 2 | 216 × 199 × 17 | 4 | 30.0 × 24.7 31.3 × 25.8 28.0 × 23.4 |
| 3 | 155 × 150 × 19 | 4 | 32.8 × 26.4 |

¹ Measurements were taken following nest abandonment. Some eggs were missing at that time.

² Estimated with ruler, all other eggs measured with calipers.

It is unlikely that these nests were established in response to soil conditions. I observed eight active and four inactive burrows in the sections of lawn (ca. 19 ha total area) containing the above-ground nests. The entrance to one active burrow was within 2.5 m of nest 3. This suggests that soil under the nests was favorable for burrows.

Burrowing Owls nesting above ground lose the thermoregulatory and predator avoidance benefits conferred by burrows. Humidity within a burrow is greater than humidity outside a burrow, resulting in reduced water loss in adult owls (Coulombe 1971). Adults, chicks, and eggs in above-ground nests would be exposed to higher desiccation levels than would their subterranean counterparts. Burrows also provide a place to retreat from enemies (Thomsen 1971). Above-ground nesting owls have no equivalent refuge from predators. While adult owls could

escape via flight, eggs and pre-fledged chicks would be susceptible to predation. Successful nesting, therefore, is less likely to occur above ground than in a burrow. The cause of this unusual and unsuccessful nesting behavior remains unknown.

RESUMEN.—Tres nidos de *Athene cunicularia* han sido hallados en la superficie, sobre el cuidado césped en Florida. Las condiciones disponibles no impedía a los buhos para hacer sus nidos subterráneos, por que madrigueras ocupadas por otros buhos y algunas madrigueras vacías habían en la vecindad. Los tres nidos sobre la superficie estaban abandonados con 9 huevos sin incubar. Las causas de este raro hábito de los buhos para anidar sobre el suelo, son desconocidas.

[Traducción de Eudoxio Paredes-Ruiz]

LITERATURE CITED

- BENT, A.C. 1938. Life histories of North American birds of prey, part 2. U.S. Natl. Mus. Bull. 170.
 COULOMBE, H.N. 1971. Behavior and population ecology of the Burrowing Owl *Speotyto cunicularia*, in the Imperial Valley of California. *Condor* 73:162-176.
 STONER, E.A. 1933. Burrowing Owls occupying unusual quarters. *Condor* 35:36.
 THOMSEN, L. 1971. Behavior and ecology of Burrowing Owls on the Oakland Municipal Airport. *Condor* 73: 177-192.
 WILLIAMS, F. C. 1986. Regional summaries: southern Great Plains region. *Am. Birds* 40:134-138.

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EAGLE OWL (*Bubo bubo*) PREDATION ON JUVENILE BONELLI'S EAGLES (*HIERAAETUS FASCIATUS*)

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The predation of diurnal birds of prey by the Eagle Owl (*Bubo bubo*) is well known. Mikkola (1983) lists 18 species of raptors taken. Glutz von Blotzeim and Bauer (1980) maintain that diurnal raptors can represent up to 5.4% of the Eagle Owl's diet. None of these authors mention the presence of Bonelli's Eagle (*Hieraaetus fasciatus*) in the diet of the Eagle Owl, although the two species are

sympatric in the Mediterranean region and occupy very similar habitats. In this context, Blondel and Badan (1976) state that Eagle Owls do not interfere with Bonelli's Eagles, even when they breed nearby. In contrast, Bayle (1987) mentions a case of possible predation on a Bonelli's Eagle young, nearly fledged whose remains were found in an Eagle Owl nest in France. Other raptors of similar or

greater size known to have been predated by Eagle Owls are young White-tailed Eagles (*Haliaeetus albicilla*) from their eyries in Norway (Wilgohs in Mikkola 1983), Osprey *Pandion haliaetus* (Mikkola 1983) and Short-toed Eagle *Circaetus gallicus* (Donazar 1989).

During a study of a population of 10–14 pairs of Bonelli's Eagles in Catalonia, Spain from 1980 to 1988, Eagle Owls were found nesting in all eagle territories. Owls bred between 0.2 and 5.5 km from the eagles' nests ($\bar{X} = 1.7$ km SD = 1.56, N = 10; Table 1).

In summer 1987 eleven young Bonelli's Eagles were marked with wing tags and five of them, belonging to three different pairs, were tracked from fledging to independence 2 d in every 4 d. One of these pairs had two juveniles (a male and a female) fledged on 23 May. On 11 June, both birds began gliding flights which took them as much as 1000 m from the nest. At 0925, after one of the adults had dived at him apparently in play, the young male flew directly away from the breeding area. He was not seen again that day, or in the next few days, as opposed to the young female who roosted within 500 m of the nest every night. On 23 June, the remains of the young male (left wing, tail, sternum and one wing-tag) were discovered in a recess on a cliff some 200 m below the eagles' eyrie. This hole was only accessible by flight or climbing ropes, so mammalian predators were unable to reach it. In the same hole there were also downy feathers, remains of prey and droppings of young Eagle Owls. In the same place, towards the evening two young Eagle Owls were heard. We interpret the presence of bones and feathers in a cliff occupied by Eagle Owls as indications that the young eagle had been taken by the owls.

In the following years, an Eagle Owl pair had continued to breed in the same small cliff. The eagles had lost two other juveniles, in 1984 and 1988, during the first month after fledging. This represents a high mortality rate for this pair in six years (three fledglings out of 11, 27%). By contrast only one (4.5%) out of 22 juveniles raised by the other pairs that we monitored in 1987–88 died during the post-fledging period, and this was due to starvation.

Our observations, along with that of Bayle (1987), suggest that young Bonelli's Eagles are vulnerable to predation by Eagle Owls. This is especially so during the first few weeks after fledging, when the juveniles tend to settle in low, accessible sites and even roost on the ground, where they are conspicuous.

The proximity of the nests of eagles and owls could be a significant factor in determining predation. In our case, the pair involved had its nest much closer (200 m) to an Eagle Owl nest than any other studied pair (minimum 700 m and average 1900 m, Table 1). In the case of Bayle (1987) the nests were only 300 m apart. Therefore, when breeding in proximity to Bonelli's Eagles, the Eagle Owl apparently can be a serious threat to young eagles during the first weeks after fledging.

Table 1. Distances in metres between the nest of each pair of Bonelli's Eagles and the nearest known pair of Eagle Owls.

| EAGLE PAIR (No.) | DISTANCE TO NEAREST EAGLE OWL PAIR (m) |
|------------------|----------------------------------------|
| I | 700 |
| II | 2.900 |
| III | 5.500 |
| IV | 800 |
| V | 1.500 |
| VI ^a | 200 |
| VIII | 1.200 |
| IX | <2.000 |
| X | 2.500 |
| XI | 1.000 |
| XII | <2.000 |
| XIII | 1.000 |

^a Pair involved in the predation by Eagle Owl.

RESUMEN.—Se describe un caso de predación de Buho Real (*Bubo bubo*) sobre una joven Aguila Perdicera (*Hieraetus fasciatus*) unas 25 días después del abandono del nido, y se hace constar la desaparición frecuente de jóvenes de águila durante este estadio en un solo territorio de águilas (3 jóvenes de un total de 11 desaparecieron en 6 años, 27%). En este territorio una pareja de Buhos Reales anida a tan solo 200 m del nido de las águilas. En contraposición el resto de parejas de Águilas Perdiceras controladas en la zona (9), muestran distancias mucho mayores a sus respectivos Buhos Reales vecinos ($\bar{x} = 1900$ m) y la mortalidad observada en 22 jóvenes ha sido mucho menor (4.5%). En conclusión, se sugiere que cuando las dos especies anidan próximas, el Buho Real puede ser un predador potencial de los jóvenes de Águilas Perdiceras recién salidos del nido.

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LITERATURE CITED

- BAYLE, P. 1987. Découverte des restes d'un aigle de Bonelli *Hieraetus fasciatus* juvenile dans une aire de Hibou Grand-duc *Bubo bubo* en Provence. *Faune de Provence* 8:49–53.
- BLONDEL, J. AND O. BADAN. 1976. La biologie du Hibou Grand-duc en Provence. *Nos Oiseaux* 362:189–219.
- DONAZAR, J. A. 1989. Variaciones geográficas y esta-

- cionales en la alimentación del Buho real (*Bubo bubo*) en Navarra. *Ardeola* 36:25-39.
- GLUTZ VON BLOTZEIM, U.N. AND K. BAUER. 1980. *Handbuch der Vögel Mitteleuropas*. Vol. 9. Akademische Verlagsgesellschaft, Wiesbaden, Germany.
- MIKKOLA, H. 1983. *Owls of Europe*. T. and A.D. Poyser Ltd. Calton, U.K.

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OSPREY NESTLINGS FOSTERED BY HACKED ADULTS TWO WEEKS AFTER PREDATION OF THEIR YOUNG

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Hacking of Osprey (*Pandion haliaetus*) was begun in Pennsylvania in 1980 to restore a breeding population that had been extirpated by pesticide contamination and habitat alterations (Schaadt and Rymon 1983). Between 1980 and 1986, 111 donor nestlings from the Chesapeake Bay area were successfully hacked at mountain lakes and rivers in northeastern Pennsylvania. In 1986, pairs of previously hacked adults returned to produce four healthy chicks, the first to hatch in the state in many decades (Rymon 1989a). Since 1986, over 30 marked adults have returned to release sites and 16 active nests have been established. During the 1986-89 breeding season, a total of 38 chicks hatched and 31 fledged and dispersed. We are now optimistic that our hacking efforts have established the nucleus of a restored breeding population (Rymon 1989b, 1989c).

During their first year of breeding, pairs frequently experience nesting failure which often appears to be related to inappropriate site selection, especially those accessible to climbing predators, mainly Raccoons (*Procyon lotor*). Nest mortalities have also been caused by adverse weather during broodrearing. One possible remedy for lost broods appears to be brood manipulation. Manipulations have been widely conducted in nearby states New Jersey, Connecticut and Massachusetts. Poole (1989) used brood augmentation as a means of testing the ability of males to provide food. He noted that adult ospreys did not discriminate against transferred chicks nor did nestlings show distress or aggression when placed with others.

Rymon (1987) observed fostering in Pennsylvania when a 3 yr old hacked male returned to nest unsuccessfully with an unmarked female in 1985. Seven weeks after nest failure, the male fostered nine hacked fledglings on the abandoned nest. Based on these findings I conducted a fostering experiment in 1988.

Brood Replacement

Among 16 successful nests built by hacked Ospreys that returned as adults during 1986-89, one nest failure in 1988 prompted a brood replacement. One pair, at Pocono Lake, produced two chicks on 13 May. This marked pair previously had raised broods there in 1986 and 1987. On the morning of 12 June, both 4 wk old chicks were missing from the predator guarded nest which was built on a nest pole located in water. The parents showed much distress and visited the nest frequently for the next several days.

At the end of the second week after abandonment the adults had not laid a second clutch but were still in the area. I placed two 5.5 wk old chicks in the nest. The nestlings had been held overnight and been fed before being taken to the nest. At 0800 H they were placed on the nest. My assistants and I then observed the nest from a blind 50 m away. The adults could also be seen perched 100 m on the opposite shore. The adults remained wary but circled the nest minutes after we were hidden in the blind. After this initial overflight the parents returned to perch on snags near the opposite shore. At 1025 H the female flew to the nest carrying a stick in her talons. She deposited it on the nest, looked briefly at the young and after 30 sec flew away.

The adults made no further attempts to return to the nest for over 5 hr. During this period, the nestlings became restless and aggressive. They gave long intermittent begging calls and vigorously pecked at each other, drawing blood several times.

At 1500 H, a series of events began to unfold rapidly. Four other adult ospreys appeared over the nest and an exchange of calls began. In addition to the calling, the nestlings began begging loudly and the intended foster