J. Raptor Res. 26(1):33–35

SHORT COMMUNICATIONS

METHODS OF LOCATING GREAT HORNED OWL NESTS IN THE BOREAL FOREST

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The boreal forest is one of the largest and least understood ecosystems in North America, and is currently being logged at an alarming rate (Pruitt 1978, McLaren 1990). The owls and diurnal raptors of the boreal forest are no exception to this lack of knowledge (Duncan 1991). Great Horned Owls (*Bubo virginianus*) are common throughout North America and are one of the most abundant predators in the boreal forest, but almost all research on them has been carried out in the temperate zone of the continent (Donázar et al. 1989). The northernmost population study was a project in central Alberta in an area of mainly poplar (*Populus* sp.) forest mixed with agricultural land (Rusch et al. 1972, McInvaille and Keith 1974, Adamcik et al. 1978). To our knowledge, the only published research on Great Horned Owls in the coniferous boreal forest is a diet study based on four nests found in the Yukon Territory and Alaska (Weir and Hanson 1989). There are two reasons for this lack of information. First, the vast area of the boreal forest biome (about 3.3 million km^2 in Canada) is largely uninhabited, making access and logistics difficult. Second, and probably more important, Great Horned Owl nests are extremely difficult to find in the dense cover of the coniferous boreal forest.

As part of a collaborative project on the boreal forest ecosystem, we are studying the Great Horned Owls at Kluane Lake in the southwestern Yukon (Krebs et al. 1986). At first, we had great difficulties finding nests, but we have now developed an efficient method. We describe this method here in the hope of encouraging research on these birds in northern forests. The methods may also apply to other dense coniferous forests, such as temperate rainforests in the Pacific Northwest, where Great Horned Owls have recently gained attention as possible competitors and predators of Spotted Owls (*Strix occidentalis*; Gutierrez 1985, Carey et al. 1990).

Step 1: Acoustic Triangulation of the Nesting Area. Great Horned Owl nests stand out in deciduous forests and can be detected over large areas with systematic searches from the air or from the ground in late winter (Rusch et al. 1972, Petersen 1979). In coniferous forests, such methods are not feasible because of the dense cover. In this case, the nesting area has to be pinpointed before a visual search can begin. The roosting and calling behavior of the male are the key to the location of the nesting area. We found that four radio-tagged males regularly roosted within 100 m of the incubating female. Roosting males leave secretively when an observer approaches, and they are difficult to find. However, of 19 nests checked during incubation in March and April 1991, 10 departing males were discovered closer than 100 m from the nest (median distance 35 m). Petersen (1979) also reported that all three of his radio-tagged males used to roost within 75 m of the nests in his study area in Wisconsin. As a result of this roosting behavior, males begin their hooting close to the nest about 1 hr after sunset, and again hoot in the nesting area about 1 hr before sunrise when they settle down for the daytime. The females on the nest usually join the males with one to several hoots at the beginning and the end of each activity period. Triangulations on hooting birds during these specific times provide a preliminary location of the nest site. This then serves as a starting point for a detailed visual search of the area. Depending on the terrain and on the experience of the observers, one to several hooting sequences may be required to locate a nesting area accurately.

Step 2: Visual Search for the Nest. Great Horned Owls in the Yukon breed mainly on "witches' brooms" (fungus-induced clumps of dense foliage in White Spruce *Picea glauca*), or they use old nests built by Red-tailed Hawks (*Buteo jamaicensis*) or Common Ravens (*Corvus corax*). The incubating female is often not visible from the ground, and the large number of witches' brooms in our study area required careful visual inspection of almost all individual trees in a nesting area. In all 36 nests that we found by visual searches from 1988–91, we saw at least one down feather at the edge of the nest or in nearby branches. This was also true for 21 nests that were found by locating radio-tagged females and for 4 nest sites re-

used from previous years. We therefore conclude that the presence of fresh down feathers is the best visual cue to determine whether a witches' broom is used as a Great Horned Owl nest or not. Such feathers are particularly conspicuous when moving in a breeze, or when seen against the sunlight. The maximum size of an area that can be searched reliably depends on the local situation and on the experience of the observer. In our case, this was usually about 200 m in diameter. If a nest is not found, one can return to the first step and locate the nesting area more accurately.

DISCUSSION

The method described is time-intensive but reliable. It enabled us to find 23 nests in 28 searched owl territories after 1–5 triangulations for step 1, and 0.5–5 hr searching time for step 2. After 5 hr of unsuccessful search we usually stopped the search until the time near fledging. At this stage the adults engage more aggressively in nest defense and are likely to hoot when an observer approaches close to a nest.

A possible improvement to this method involves daytime playback of Great Horned Owl hoots. Males might reply from the roost, thereby revealing the nest location. We found one nest within minutes of using this method, but systematic trials using daytime playback during incubation in 1990 and 1991 showed that only 3 of 10 males responded Perhaps playbacks could be applied more efficiently at particular stages of the breeding cycle and times of day (e g., dawn).

A concern over any new technique is the disturbance it causes to the animals. For example, it is possible that daytime playbacks of hoots, or visits to nests disturb pairs and cause eggs or young chicks to chill (Fyfe and Olendorff 1976). In our study, we have little evidence of observer disturbance. We approached more than 50 nests of 20 different pairs during incubation or with young nestlings, and only 6 females were flushed from the nest. Two broods failed, but we suspect that the very late breeding date and food shortage explained these failures. We therefore feel that the "triangulation-and-search" technique described here causes little disturbance. Further tests of playback methods may be useful to see if their efficacy can be enhanced, and if they can be used without disturbing the owls.

RESUMEN.—En la foresta boreal predominan las coníferas y debido a la densa vegetación es difícil localizar nidos de Tecolote Cornudo (*Bubo virginianus*). Recomendamos un método que sa basa en dos etapas. Primera: El área de los nidos es determinada por una triangulación del lugar donde los buhos ululan. Con este método se tiene más éxito en la madrugada y al atardecer, cuando los machos emiten su llamado cerca del nido y las hembras que están incubando puede que respondan. Segunda: Una vez que el área de localización del nido es determinada, se efectúa una intensa búsqueda para ubicarlo. Plumones al borde del nido fueron el mejor indicio visual, y durante nuestro estudio notamos que el observador desde el suelo puede causar sólo mínima perturbación a las aves en el nido. Este método puede también aplicarse para otras especies de buhos, en hábitats con densa vegetación.

[Traducción de Eudoxio Paredes-Ruiz]

ACKNOWLEDGMENTS

We are thankful to Christoph Schmid for sharing many hours of locating owl nests, and to J.N.M. Smith, C.L. Esser, and C.J. Krebs for their help in improving the manuscript. We were supported by the National Sciences and Engineering Research Council of Canada (Collaborative Project Grant to C.J. Krebs), and an R.J. Thompson Wildlife Fellowship to Ch. Rohner.

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Received 18 June 1991; accepted 13 September 1991

J Raptor Res. 26(1):35–36

FOOD HABITS OF THE SHORT-EARED OWL (*Asio flammeus*) IN SOUTHERN SOUTH AMERICA

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Although the Short-eared Owl (*Asio flammeus*) is distributed throughout the Americas, its food habits have received considerable study only in North America (Clark 1975 and references therein). Currently, there is no published quantitative information on its food habits in all of South America, except for a report made by Fulk (1976) from central Chile, who unfortunately pooled the pellets of both Short-eared and Common Barn Owls (*Tyto alba*).

We report the prey identified in 53 pellets of the Short-eared Owl, collected May–June (Winter) 1986 and September (early Spring) 1987–89 at Fundo Quirislahuén, Alberto Hott Siebert Airport and Isla Teja island. The first two places are pasture grasslands located at the outskirts of the city of Osorno, southern Chile (40°34′S 73°08′W). The third site consists of marshland in the city of Valdivia (39°48′S 73°14′W). Seven of the 53 pellets contained no identifiable prey remains, 17 were weathered and 29 were fresh. Prey remains (mostly native cricetid rodents) were identified using keys for tooth rows (Reise 1973).

The 29 fresh pellets measured 33.5 (SD = 1.9) by 18.1 (SD = 0.9 mm) ($\bar{x} \pm 2$ SE length times maximum width) and the mean dry weight was 3.0 ± 0.4 g. All measurements were lower than those reported by Holt et al. (1987), possibly because of our small sample (29 compared to 180 pellets).

To increase the sample size, we pooled pellets from different areas. Among 46 pellets, we found 69 vertebrate prey items (96%) and only three invertebrates (4%). The diet of the Short-eared Owl by number of occurrences was as follows: 34 (47%) Olivaceus Field-mice (*Akodon olivaceus*), 8 (11%) Austral Greater Mice (*Auliscomys micropus*), 8 (11%) Long-haired Field-mice (*Akodon longipilus*), 2 (3%) Long-tailed Rice Rats (*Oryzomys longicaudatus*), 2 (3%) unidentified members of *Akodon*, 3 (4%) Black Rats *Rattus rattus,* 1 (1%) Darwin's Leaf-eared Mouse (*Phyllotis darwini*), 11 (16%) unidentified cricetids, 1 (1%) Gryllid and 2 (3%) unidentified insects. The most frequent mammalian prey of Short-eared Owls, Olivaceus Field-mice, Long-haired Field-mice and Austral Greater Mice weighed 23.9 ± 0.5, 34.7 ± 0.3, and 57.6 ± 1.9 g, respectively (Pearson 1983). Overall, the mean number of prey items/pellet was 1.7 ± 0.2 (N = 29, range 1–4).

The high consumption of the Olivaceus Field-mouse by Short-eared Owls was in close agreement with the fall peak of this vole-like mouse at the prairie-scrublands of San Martín, Valdivia (Murúa and González 1986), a site located approximately 192 km north by road from Osorno.

Judging from previous records in North America (Clark 1975 and references therein), the food habits of the Short-eared Owl in southern South America are very similar to those in the northern hemisphere.

RESUMEN.—Aunque el nuco (*Asio flammeus*) tiene una amplia distribución, su dieta ha sido estudiada sólo en América del norte. Analizamos 46 egagrópilas colectadas en dos áreas del sur de Chile durante invierno (1986) y primavera (1987–89). Se identificaron 72 presas, de las cuales un 96% correspondió a vertebrados. El roedor *Akodon olivaceus* constituyó casi la mitad de la dieta. En Sudamérica meridional, la estenofagia del nuco es similar a la documentada para el hemisferio norte.

ACKNOWLEDGMENTS

We thank E. Ide, owner of the Fundo Quirislahuén and the staff of Alberto Hott Siebert Airport, for their