



Flammulated Owls (*Otus flammeolus*) Breeding in Deciduous Forests

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Abstract.—The first studies of nesting Flammulated Owls (*Otus flammeolus*) established the idea that the species needs ponderosa pine (*Pinus ponderosa*) forests for breeding. In northern Utah, Flammulated Owls nested in montane deciduous forests dominated by quaking aspen (*Populus tremuloides*). No pines were present but scattered firs (*Abies* and *Pseudotsuga* spp.) were on the study plot and groves of firs existed nearby. Using nest boxes, Flammulated Owls nested 34 times in 5 years (1992-1996). Sixty-five percent of nests produced fledglings. Mean clutch size was 2.6 (range 2-4). On average, 2.1 young fledged per successful nest, and 1.3 were produced per nest attempt overall.

The Flammulated Owl (*Otus flammeolus*) is thought to be a common species in western montane forests. Little is known about its biology, but it possesses some characteristics unusual in owls: (1) has a small clutch size for its body mass, (2) is migratory, and (3) is almost entirely insectivorous (McCallum 1994). The earliest studies of Flammulated Owl nesting were done in forests where ponderosa pine (*Pinus ponderosa*) was a major species (Bull *et al.* 1990, Goggans 1986, McCallum *et al.* 1995, Reynolds and Linkhart 1987). Reynolds and Linkhart (1992) noted that all but one of the nests reported in the literature to that time were in stands containing at least some ponderosa pine. However, more recent studies have found Flammulated Owls nesting in fir (*Abies* spp.) and mixed deciduous forests (Powers *et al.* 1996).

Ponderosa pine does not occur in northern Utah, but Flammulated Owls nest there at high densities, at least locally. In this paper I present a preliminary report on the reproductive biology of Flammulated Owls nesting in a deciduous forest, including information on breeding dates, reproductive performance, and site reuse.

METHODS

Study Area

I studied Flammulated Owls on the Cache National Forest 5.6 km east of Ogden, Weber

County, Utah, at elevations ranging from 1,920-1,980 m. The site is on the eastern face of the Wasatch mountain range at the base of steeper slopes rising to 3,000 m. Both coniferous and deciduous forests are present adjacent to open areas containing shrubs, grasses, forbs, and wetlands. My studies were done in a deciduous forest dominated by quaking aspen (*Populus tremuloides*). Scattered individuals and small groves of Gambel's oak (*Quercus gambelii*), bigtooth maple (*Acer grandidentatum*), and Rocky Mountain maple (*Acer glabrum*) were also present. No pines were extant but scattered Douglas-fir (*Pseudotsuga menziesii*) and white fir (*Abies concolor*) were on the study plot, and groves of firs existed nearby on steeper slopes. Understory was dense and included bracken fern (*Pteridium aquilinum*), western coneflower (*Rudbeckia occidentalis*), slender wheatgrass (*Agropyron trachycaulum*), sticky geranium (*Geranium viscosissimum*), mountain snowberry (*Symphoricarpos oreophilus*), blue elderberry (*Sambucus cerulea*), and nettleleaf giant hyssop (*Agastache urticifolia*).

Nest boxes for Flammulated Owls were attached to living trees, mostly aspen, at heights of 3-4.5 m. Boxes were made from 20-mm-thick pine boards, and most of them had internal dimensions of 19 x 23 x 32 cm with an entrance hole of 7.5 cm. The remaining 10 boxes measured 15 x 19 x 30 cm with an entrance hole of 6.5 cm. Boxes were positioned to permit a flight path clear of vegetation to the box opening. Fifteen boxes were available in the first year (1992), and additional boxes were added each year to a total of 41 in 1996.

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Data Collection

I visited all boxes each spring soon after snow melt, usually in early May, to remove unused squirrel nests (active squirrel nests were left), and to document the first use by owls. I revisited boxes periodically through July to record numbers of eggs and young and to band the adult females and nestlings.

RESULTS

Flammulated Owls arrived on the study area from early to mid-May (USDA Forest Service unpubl. data), and most eggs were laid in the first 2 weeks of June. Eggs found on two occasions in mid-July might have been renests. Most eggs hatched in the first 2 weeks of July, and most young fledged by the end of July.

From 1992 through 1996, I documented 34 nesting attempts where at least one egg was laid (all in nest boxes) of which 79 percent resulted in complete clutches. Twenty-two nests (65 percent of nest attempts) produced fledglings. Five nest failures were due to predation upon the eggs or young, probably by northern flying squirrels (*Glaucomys sabrinus*). Causes of the remaining failures were not known—four occurred at the incubation stage and two at the nestling stage. Mean size of complete clutches was 2.6 eggs (fig. 1). Number of nestlings averaged 2.4 (fig. 2), and 2.1 young fledged per successful nest (fig. 3). Sixty-five percent of eggs laid in complete

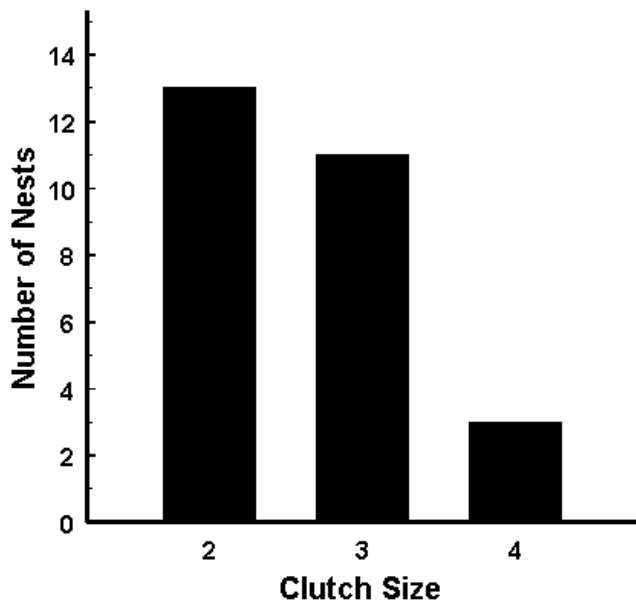


Figure 1.—*Flammulated Owl* (*Otus flammeolus*) clutch size in northern Utah.

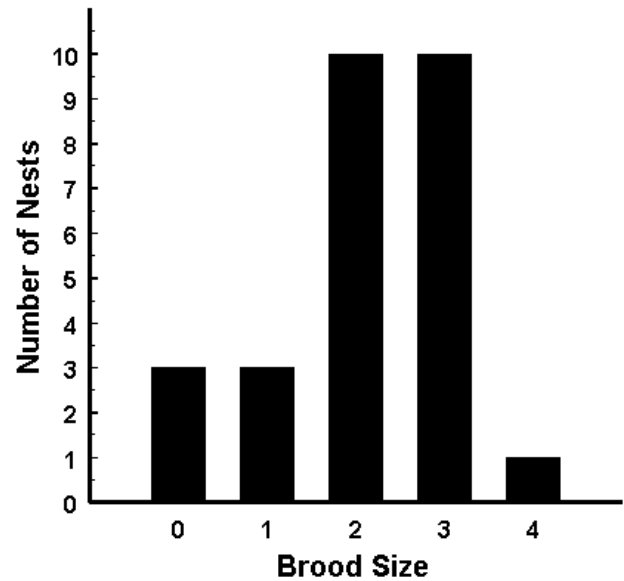


Figure 2.—*Flammulated Owl* (*Otus flammeolus*) brood size in northern Utah.

clutches survived to the age of fledging. Three-egg clutches were the most productive—54 percent of all fledglings came from three-egg clutches, while two-egg clutches produced 28 percent, and four-egg clutches only 8 percent of the fledglings. Furthermore, 45 percent of three-egg clutches produced three fledglings,

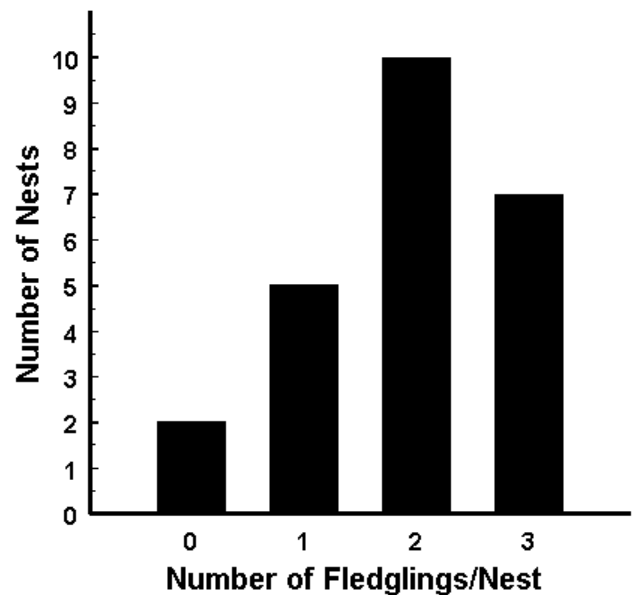


Figure 3.—*Fledglings per nest* in *Flammulated Owls* (*Otus flammeolus*) in northern Utah.

and only one three-egg clutch failed to produce any. Only 33 percent of two-egg clutches resulted in two fledglings, and three of them failed to produce fledglings. Although none of the four-egg clutches yielded four fledglings, one resulted in two and two produced three. Over the 5 years, 1.3 fledglings were produced per nesting attempt. Table 1 lists productivity data and nest site usage by year.

Of boxes available for 5 years, Flammulated Owls used two for 2 years and three for 3 years each. Three boxes available for 3 years were used for 2 years each. Twenty-seven percent of boxes available for 4 years were never used by Flammulated Owls, but two of those boxes were occupied by Northern Saw-whet Owls (*Aegolius acadicus*). Saw-whet Owls also nested in three boxes that Flammulated Owls used in alternate years, so the two owl species were not segregated by nest site location. Northern flying squirrels also built nests in several boxes in alternate years. Saw-whet Owls and flying squirrels both occupied nest sites before Flammulated Owls arrived on the area, thus potentially preventing Flammulated Owls from using some boxes.

I banded 46 nestlings but none were encountered again on the study area—apparently they did not join their natal population as breeders. Fourteen females were banded as breeders and four were recaptured in later years. One bred twice in consecutive years in the same nest box; the other three moved to boxes 50-150 m distant from their original nest site.

DISCUSSION

My northern Utah study area is outside the range of ponderosa pine and is quite different in vegetative composition compared with sites where Flammulated Owls have been studied in Colorado (Reynolds and Linkhart 1987), New Mexico (McCallum *et al.* 1995), and Oregon (Bull *et al.* 1990, Goggans 1986). My findings and those of Powers *et al.* (1996) show clearly that ponderosa pine is not the only vegetative type that supports breeding populations.

Clutch and brood sizes on my site were comparable to those measured in other areas (table 2), but productivity might be lower. Only 1.3 fledglings were produced per nest in Utah compared with 1.5 in New Mexico (McCallum *et al.* 1995), and 2.3 per nest in Colorado (Reynolds and Linkhart 1987). In contrast, only five four-egg clutches had been documented previously for Flammulated Owls throughout their range (McCallum 1994). That fact makes the three four-egg clutches that I found especially noteworthy.

Reynolds and Linkhart (1987) and McCallum *et al.* (1995) also observed that Flammulated Owls hatched on their study sites did not become breeders near their natal sites. Likewise, they and Goggans (1986) noted that birds banded as breeders often returned to the study area, sometimes to the same nest site in subsequent years.

Several authors noted that Flammulated Owls appear to form clusters of breeding pairs with

Table 1.—Nest site usage and productivity by year for Flammulated Owls (*Otus flammeolus*) in northern Utah.

Year	Boxes available	Boxes used	Nests successful	Mean clutch size ¹	Mean number of fledglings ²
1992	15	6	2	?	1.5
1993	15	5	2	2.0	0.75
1994	37	8	7	2.4	2.0
1995	37	6	4	2.5	2.5
1996	41	9	7	2.9	2.3

¹In complete clutches.

²In successful nests.



Table 2.—*Productivity of Flammulated Owls in the western United States* (tabular values are means with ranges in parentheses).

Location	N nests	Clutch	Nestlings	Fledglings
Colorado ¹	? ⁶	2.7 (2-3) n = 11	2.4 (1-3) n = 26	2.6 (1-3) n = 23
Idaho ²	24	?	2.3 (2-3) n = 9	?
New Mexico ³	14	2.3 (2-3) n = 11	2.2 (?) n = 11	1.8 (?) n = 11
Oregon ⁴	19	2.7 (2-3) n = 7	?	2.7 (2-3) n = 9
Utah ⁵	34	2.6 (2-4) n = 27	2.4 (1-3) n = 24	2.1 (1-3) n = 22

¹Reynolds and Linkhart (1987)

²Powers *et al.* (1996)

³McCallum *et al.* (1995)

⁴Goggans (1986)

⁵This study

⁶Value not available

areas of unoccupied habitat between clusters (McCallum 1994 and references therein). The same pattern appeared in northern Utah. My study area contained one such cluster, but other groves of aspens and firs in the vicinity had little, if any, use by Flammulated Owls (USDA Forest Service, unpubl. data). One aspen grove, in particular, located 2 km from my study area and closely resembling it in vegetative structure apparently was not used at all by Flammulated Owls. Another cluster of Flammulated Owls breeding in an aspen grove about 22 km southwest of my study area was reported by Smith (1991). Flammulated Owls in Utah do use vegetative communities other than pure deciduous forests for nesting. Smith (1991) found nests in a mixed coniferous forest in northern Utah, and auditory surveys have also detected males calling in coniferous forests of northern Utah (USDA Forest Service, unpubl. data). Many questions are yet unanswered about nesting habitat selection by Flammulated Owls. Availability of nesting cavities and density of prey in areas used for nesting and areas not used are two factors that need to be investigated.

This study shows that Flammulated Owls can reproduce successfully in deciduous as well as coniferous forests. Because the species is considered sensitive by the USDA Forest Service in the Northern, Rocky Mountain, Southwest-ern, and Intermountain regions (Verner 1994), surveys are being conducted in many localities to document its presence and population den-sity. Such surveys should include pure decid-uous stands in addition to coniferous and mixed forests.

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LITERATURE CITED

Bull, E.L.; Wright, A.L.; Henjum, M.G. 1990. Nesting habitat of Flammulated Owls in Oregon. *Journal of Raptor Research*. 24: 52-55.

- Goggans, R. 1986. Habitat use by Flammulated Owls in northeastern Oregon. Corvallis, OR: Oregon State University. 54 p. M.S. thesis.
- McCallum, D.A. 1994. Flammulated Owl (*Otus flammeolus*). In: The birds of North America. No. 93. Philadelphia, PA: American Ornithologists' Union; Washington, DC: Academy of Natural Science. 23 p.
- McCallum, D.A.; Gehlbach, F.R.; Webb, S.W. 1995. Life history and ecology of Flammulated Owls in a marginal New Mexico population. *Wilson Bulletin*. 107: 530-537.
- Powers, L.R.; Dale, A.; Gaede, P.A.; Rodes, C.; Nelson, L.; Dean, J.J.; May, J.D. 1996. Nesting and food habits of the Flammulated Owl (*Otus flammeolus*) in southcentral Idaho. *Journal of Raptor Research*. 30: 15-20.
- Reynolds, R.T.; Linkhart, B.D. 1987. The nesting biology of Flammulated Owls in Colorado. In: Nero, R.W.; Clark, R.J.; Knapton, R.J.; Hamre, R.H., eds. *Biology and conservation of northern forest owls; Symposium proceedings; 1987 February 3-7; Winnipeg, MB*. Gen. Tech. Rep. RM-142. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 239-248.
- Reynolds, R.T.; Linkhart, B.D. 1992. Flammulated Owls in ponderosa pine: evidence of preference for old growth. In: *Old-growth forests in the southwest and Rocky Mountain regions*. Gen. Tech. Rep. RM-213. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station.
- Smith, V.A. 1991. Some notes on Flammulated Owl nesting behavior in northern Utah. *Utah Birds*. 7: 65-70.
- Verner, J. 1994. Current management situation: Flammulated Owls. In: Hayward, G.D.; Verner, J., tech. eds. *Flammulated, Boreal, and Great Gray Owls in the United States: a technical conservation assessment*. Gen. Tech. Rep. RM-253. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 213 p.