Strix use buildings, especially barns, as nest sites. The Tawny Owl (*Strix aluco*) uses buildings as nest sites 15% of the time, similarly, the Ural Owl (*Strix uralensis*) nests in buildings 2–4% of the time (Mikkola 1983).

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LITERATURE CITED

BENT, A. C. 1938. Life histories of North American birds of prey. U.S. Nat. Mus. Bull. 170:182–201.

HOUSTON, C. S. 1959. First records of the Barred Owl in Saskatchewan. Blue Jay 17:94.

HOUSTON, C. S. 1961. First Saskatchewan nest of Barred Owl. Blue Jay 19:114–115.

JOHNSON, D. H. AND D. G. FOLLEN. 1984. Barred owls and nest boxes. Raptor Res. 18:34–35.

MAZUR, K. M., P. C. JAMES, AND S. D. FRITH. 1997. Barred Owl (*Strix varia*) nest site characteristics in the boreal forest of Saskatchewan, Canada. U.S. Forest Service General Technical Report NC-190: 267–271.

MIKKOLA, H. 1983. Owls of Europe. Buteo Books, Vermillion, South Dakota.

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Double Brooding in the Long-eared Owl

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ABSTRACT.—Owls in the family Strigidae typically raise no more than one brood per year. We documented what apparently is the first unequivocal case of double brooding in Long-eared Owls (*Asio otus*). A banded female raised 12 young in two nesting attempts compared with a mean of 5.3 young for three single-brooded females that nested in the same grove. Two factors may have influenced the occurrence of double brooding: the first nest was initiated unusually early in the year (mid-February) and food availability (in the form of voles) was high. The rare description of double brooding in Long-eared Owls may be due to the difficulty of detecting it. Alternatively, double brooding may be uncommon because it is seldom an economically viable strategy. Factors that would select against double brooding include low probability of recruitment of the first-brood young, and reduced survival and fecundity of the adults. *Received 17 Sept. 1998, accepted 29 Dec. 1998.*

The number of young raised per year is an important component of an individual's lifetime reproductive success. Double brooding, in which a second brood is attempted after a successful first attempt, is a viable strategy if the increase in fitness that results outweighs the cost of any reduction in future survival or fecundity of the adults and their young from the first brood. The occurrence of double brooding may be influenced by factors such as length of the breeding season, food availability, growth rates of the young, and the duration and quality of parental care (e.g., Drent and Daan 1980, Askenmo and Unger 1986, Tinbergen and van Balen 1988).

Double brooding is relatively rare in raptors, presumably because the length of the breeding cycle and extended postfledging care preclude its occurrence (Newton 1979, Morrison 1998). Among nocturnal raptors, double brooding occurs regularly in Barn Owls (*Tyto alba*; Marti 1992, 1997) and occasionally in Florida Burrowing Owls (*Athene cunicularia floridana*; Millsap and Bear 1990) and Boreal Owls (*Aegolius funereus*; Kellomäki et al. 1977, Solheim 1983). During a study of breeding Long-eared Owls (*Asio otus*), we documented a female that raised two broods during the same nesting season. Here, we describe the event and discuss factors that may have influenced its occurrence.

STUDY AREA AND METHODS

The study area is a small grove (ca 2 ha) of quaking aspens (*Populus tremuloides*) and black hawthorns (*Crataegus douglasii*) located about 16 km west of Polson, Lake County, Montana (47° 40′ N, 114° 20′ W). The elevation at the site is 888 m, and the nesting

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grove is surrounded by grasslands and agricultural fields (mostly hay). The 11 Long-eared Owl nests that occurred in the grove in 1997 and 1998 were in old nests of Black-billed Magpies (*Pica pica*) and American Crows (*Corvus brachyrhynchos*).

Adults were captured at night in mist nests placed near the nest or at dusk with the aid of a plastic decoy of a Great Horned Owl (*Bubo virginianus*). Captured adults were classified as after hatching year (AHY) or after second year (ASY) based on the absence or presence of two generations of secondaries, respectively (see Pyle 1997). During the breeding season, the sex of most adults can be determined in the field by differences in plumage coloration and in the hand by presence or absence of an incubation patch (Marks et al. 1994).

RESULTS

On 16 February 1998, we observed a female Long-eared Owl incubating at a nest (PSNII) about 25 m north of a nest that had produced young the previous year. The male was roosting nearby, but we could not determine whether he was banded. Three of the five Long-eared Owl nests that occurred in the grove in 1998 were initiated in February; PSNII appeared to be the earliest of these nests. On 2 April, JSM captured the adult (AHY) female (band no. 951) by hand at PSNII as she was brooding seven young that ranged in age from about 1 to 3 weeks old. Based on the estimated age of the chicks and an incubation period of 28 days (Marks et al. 1994), female 951 would have initiated egg laying on 12 February, and the oldest chick would have hatched on 12 March. Other duties prevented us from catching the mate of female 951 during this nesting attempt.

During a visit to the nesting grove on 25 June, we found a new Long-eared Owl nest at the northern edge of the grove 28 m from nest PSNII. A female was brooding small chicks that appeared to be about 2 weeks old, and a male was flushed from the same roost site typically used by the PSNII male earlier that spring. We returned to the nest on the evening of 30 June and captured the female in a mist net placed directly in front of the nest. She proved to be 951, the same female that had fledged seven chicks earlier in the spring. The next morning we banded her five chicks, which were about 2 to 3 weeks old. Female 951 was very aggressive as we handled her chicks, diving and perching within 1 m of us and enabling us to observe her band and to note her pattern of flight-feather molt that we had confirmed in the hand the previous night (4 primaries and 2 secondaries growing on each wing). Also at this time, we noticed that her mate was banded. After several attempts, we succeeded in capturing the male on the evening of 13 July, at which time the oldest chicks were capable of short flights from tree to tree. The male proved to be no. 914, the same male that had nested at this site in 1997. Female 951 was still present, and both adults presumably were provisioning their fledglings. Interestingly, male 914 had not started flight-feather molt.

Female 951 fledged 12 young (defining "fledging" as capable of sustained flight; Marks 1986) in two nesting attempts compared with a mean of 5.3 young (range 5 to 6) produced by the other three pairs that nested in the grove in 1998. The estimated time between the initiation of 951's two nesting attempts was 90 days (i.e., 12 February and 12 May). At the time 951 initiated her second clutch, the oldest offspring from her first brood would have been about 6 weeks old.

DISCUSSION

Several records of double brooding by Long-eared Owls have been reported in Europe (Reinsch and Warncke 1968, Rinne 1981, Scott 1997), but in each case the evidence was circumstantial. To our knowledge, ours is the first report of double brooding in Long-eared Owls based on a banded individual.

We suspect that weather and food availability played a major role in this case of double brooding. The winter of 1998 was unusually mild in western Montana. The ground at the study area was virtually free of snow from January onward (pers. obs.), and the mean temperature in February was 2.1° C above normal at the Kerr Dam weather station 13 km from the study area (data obtained from the National Climatic Data Center). In addition, voles (*Microtus* spp.) were abundant in winter and spring; we saw many during the day, and other vole-eating raptors [i.e., Northern Harrier (*Circus cyaneus*), Rough-legged Hawk (*Buteo lagopus*), and Short-eared Owl (*Asio flammeus*)] were numerous in the study area. The mild weather and abundant food probably induced Long-eared Owls to nest in February, which is very early for this species (see Marks

et al. 1994). The continued high numbers of voles in summer provided an opportunity for double brooding, at least for one of the three pairs that began nesting in February.

In general, the incidence of second nesting attempts in facultatively double-brooded species is negatively correlated with the laying date of the first clutch (e.g., Smith et al. 1987, Geupel and DeSante 1990, Morrison 1998). Our case agrees with this finding, but it raises the question of why the other two Long-eared Owl pairs that nested early did not raise a second brood. One possibility is that the phenotypic quality of the double-brooded pair was high relative to the other pairs (see Verboven and Verhulst 1996). Although we have no objective measure of phenotypic quality in the Long-eared Owls we studied, we note that the male of the second nesting attempt had bred successfully at the site in the previous year (the other males did not breed there in 1997), and the female that nested twice was in good physical condition and was unusually aggressive. Indeed, during her first attempt she attacked JSM when he entered the nest. Moreover, the ratio of her body mass (g) to wing length (mm) at first capture (1.33) was higher than that of all but one of the other eight females captured late in the brooding-rearing period in 1997 and 1998 ($\bar{x}$ = 1.11 ± 0.13 SD, range 0.98–1.34). The local experience of the male and the physical condition and aggressiveness of the female are consistent with the notion that they were high-quality individuals relative to the other early nesters in the grove.

Double brooding in Long-eared Owls may be more common than previously thought. Alternatively, it may indeed be rare because it is seldom an economically viable strategy. For instance, the fitness gain from double brooding would be marginal if the probability of recruitment of first-brood young is low (i.e., because of reduced care from parents that direct their efforts to a new brood), or if future survival and fecundity of the adults are reduced. Female Long-eared Owls in Idaho deserted their broods when the young were 6.5 to 8 weeks old, and males continued to care for the young until they were 8.5 to 11 weeks old (Ulmschneider 1990). If parental care of this duration is typical in Long-eared Owls, then the first of the two broods would have received a normal amount of parental care (the second clutch was started when the oldest chicks from the first nest were 6 weeks old) only if the female changed mates between nesting attempts (and the male continued to care for the young), or if one or both parents continued to provision the first brood while starting the second (an unlikely occurrence given that the male must provide food to the incubating female). Moreover, the timing of second broods could interfere with the molt schedule of adults. Long-eared Owls generally begin molting in early June soon after breeding (Marks et al. 1994). The male attending the second brood had not started flight-feather molt in mid-July, suggesting that his molt was delayed because of the late breeding effort. Delayed molt potentially could influence survivorship and fecundity (see Pietiäinen et al. 1984, Kjellén 1994).

In conclusion, double brooding appears to be rare in Long-eared Owls, and it probably occurs only when first nests are initiated early and food availability is high. Nothing is known about how double brooding affects recruitment of young from first versus second broods, or whether it affects the survivorship and future fecundity of the parents. Whether double brooding is a viable strategy in Long-eared Owls remains to be determined from additional research.

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LITERATURE CITED

ASKENMO, C. AND U. UNGER. 1986. How to be double-brooded: trends and timing of breeding performance in the Rock Pipit. Ornis Scand. 17:237–244.

DRENT, R. H. AND S. DAAN. 1980. The prudent parent: energetic adjustments in avian breeding. Ardea 68:225–252.

GEUPEL, G. R. AND D. F. DESANTE. 1990. Incidence and determinants of double brooding in Wrentits. Condor 92:67–75.

KELLOMÄKI, E., E. HEINONEN, AND H. TIAINEN. 1977. Two successful nestings of Tengmalm's Owl in one summer. Ornis Fenn. 54:134–135.

KJELLÉN, N. 1994. Moult in relation to migration in birds: a review. Ornis Svecica 4:1–24.

MARKS, J. S. 1986. Nest site characteristics and reproductive success of Long-eared Owls in southwestern Idaho. Wilson Bull. 98:547–560.

MARKS, J. S., D. L. EVANS, AND D. W. HOLT. 1994. Long-eared Owl (*Asio otus*). *In* The birds of North America. No. 133 (A. Poole and F. Gill, Eds.). Academy of Natural Sciences, Philadelphia, Pennsylvania; American Ornithologists' Union, Washington, D.C.

MARTI, C. D. 1992. Barn Owl (*Tyto alba*). *In* The birds of North America, no. 1 (A. Poole, P. Stettenheim, and F. Gill, Eds.). Academy of Natural Sciences, Philadelphia, Pennsylvania; American Ornithologists' Union, Washington, D.C.

MARTI, C. D. 1997. Lifetime reproductive success in Barn Owls near the limit of the species' range. Auk 114:581–592.

MILLSAP, B. A. AND C. BEAR. 1990. Double-brooding by Florida Burrowing Owls. Wilson Bull. 102: 313–317.

MORRISON, J. L. 1998. Effects of double brooding on productivity of Crested Caracaras. Auk 115:979–987.

NEWTON, I. 1979. Population ecology of raptors. Buteo Books, Vermillion, South Dakota.

PIETIÄINEN, H., P. SAUROLA, AND H. KOLUNEN. 1984. The reproductive constraints on moult in the Ural Owl *Strix uralensis*. Ann. Zool. Fenn. 21:277–281.

PYLE, P. 1997. Flight-feather molt patterns and age in North American owls. Am. Birding Assoc. Monogr. Field Ornithol. 2:1–32.

REINSCH, A. AND K. WARNCKE. 1968. Zweibruten bei der Waldohreule. Anz. Ornithol. Ges. Bayern 8: 400–401.

RINNE, U. 1981. Beitrag zur Brutbiologie der Waldohreule (*Asio otus*). Ornithol. Mitt. 33:62–65.

SCOTT, D. 1997. The Long-eared Owl. The Hawk and Owl Trust, London, U.K.

SMITH, H. G., H. KÄLLANDER, AND J.-Å. NILSSON. 1987. Effect of experimentally altered brood size on frequency and timing of second clutches in the Great Tit. Auk 104:700–706.

SOLHEIM, R. 1983. Bigyny and biandry in the Tengmalm's Owl *Aegolius funereus*. Ornis Scand. 14: 51–57.

TINBERGEN, J. M. AND J. H. VAN BALEN. 1988. Food and multiple breeding. Acta Congr. Int. Ornithol. 19:380–391.

ULMSCHNEIDER, H. 1990. Post-nesting ecology of the Long-eared Owl (*Asio otus*) in southwestern Idaho. M.S. thesis, Boise State Univ., Boise, Idaho.

VERBOVEN, N. AND S. VERHULST. 1996. Seasonal variation in the incidence of double broods: the date hypothesis fits better than the quality hypothesis. J. Anim. Ecol. 65:264–273.

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Planning to Facilitate Caching: Possible Suet Cutting by a Common Raven

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ABSTRACT.—Many species of birds feed on suet in winter. As far as is known, they all take bite-sized chunks by pecking into this food randomly and/or they tear off protruding pieces. I compared the peck-marks left on suet by Blue Jays (*Cyanocitta cristata*) and American Crows (*Corvus brachyrhynchos*) with those left by Common Ravens (*Corvus corax*). Although most ravens feed like jays and crows, at least one individual made distinct grooves, aligning dozens of consecutive pecks, apparently to cut transportable chunks off large suet blocks. *Received 28 Aug. 1998, accepted 7 Jan. 1999.*

The Common Raven, *Corvus corax*, is a feeding generalist (Bent 1946, Ratcliffe 1997). Ravens feed on carrion (Ewins et al. 1986), fruit, grain, eggs, and "garbage" (Nelson 1934, Marquiss and Booth 1986, Engel and Young 1989). Ravens also capture insects, reptiles, amphibians, fish, small mammals, and other birds (Marr and Knight 1982, Camp et al. 1993). I here describe a raven removing fat from a chunk of suet in an unusual or aberrant way that differs markedly from the method used by jays, crows, and most other ravens.

Chunks of beef suet that were either of sufficient size so that they could not be carried off or that were nailed onto the frozen ground

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