PROLONGED INCUBATION AND TWO CLUTCHES IN A NEW MEXICO GREAT HORNED OWL NEST: 2011–2012

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Widely spread across the phylogenetic tree in three avian orders, birds of prey are linked by their food habits and convergent evolution of talons and strong beaks. Second clutches/broods are rare among raptors; instead, a tendency to extend incubation beyond the time required for hatching has been documented in 12 species of the Accipitriformes, four of the Falconiformes, but only two of the Strigiformes (Margalida et al. 2006). With an average incubation period of 33 days (Arturo et al. 2014), the Great Horned Owl (*Bubo virginianus*) has not previously been reported to extend incubation. Furthermore, the species was previously known to lay a second clutch only after the death of the male early in incubation of the first clutch (Marti 1969).

In late January 2008 a resident pair of Great Horned Owls chose to occupy an artificial nest I had maintained for five years in a pinyon pine (*Pinus edulis*) 50 m from my home office, 15 km south of Santa Fe, New Mexico. They subsequently used the same nest annually through 2015 and often roosted nearby while not nesting. The subdivision containing my house is located in pinyon pine–juniper (*Juniperus* sp.) savanna with a mean elevation of 2050 m above sea level. Large lots (0.5 to 1 ha), limits to yard/garden size, and extensive greenbelts have resulted in a largely intact natural habitat and prey base, but with an above-average density of roof-top perches.

From 2009 to 2012, the timing of these owls' nesting was remarkably consistent. The adult female spent the full day of 11 or 12 February in an incubation posture on the nest. That was followed by one (2009, 2010) or two (2012) days with the female perched a few meters from the nest, then continuous incubation was initiated on 14 February. In each year, therefore, I estimated hatching on 17 March, and nestlings 5–6 weeks old were likely by the first week of May. This timing is typical of the Great Horned Owl in New Mexico (Dickerman et al. 2010).

On 12 February 2011 the "pre-incubation" day again occurred on schedule; the female was off the nest until I departed at 11:00 on 13 February for a 5-week field project. Neighbors confirmed incubation multiple times during my absence, but the exact day of initiation was not documented. On my return on 22 March, the female was still incubating/brooding, but as April passed it became clear that there were no chicks. Incubation continued until at least 5 May but became intermittent by 7 May. On 11 May the female was off the nest all afternoon, so I collected two addled eggs (deposited with the Museum of Southwestern Biology, University of New Mexico). Presuming incubation did begin on 14 February, the extended incubation in 2011 lasted ~75 days.

Again in 2012 the start of laying/incubation was unchanged, with full incubation initiated on 14 February. During the following weeks, I observed the female incubating throughout the day, though I was gone at intervals for multiple days. Incubation was continuous 9–11 March. On the afternoon of 11 March I observed an intense mobbing by Common Ravens (*Corvus corax*), which lasted 30 minutes and involved six to eight ravens approaching to within 1 m of the incubating female owl. The male owl pursued several ravens; he also stood for a time in the nest by the female. While the female never came off the eggs during the mobbing or the remainder of the day, she spent all of 12 March perched 1–2 m from the nest. I departed that evening and was gone 13–29 March. I observed the female incubating in late afternoon on 30 March and on each subsequent check throughout April and into May. I assumed she would eventually give up the effort as the female had in 2011, and she did appear to

be sitting higher in the first week of May. After a 5-day absence, I found the female feeding two owlets ~2.5 weeks old (Arturo et al. 2014) on 20 May, so the incubation of the eggs that produced these two owlets was initiated ~1 April. Incubation on this one nest again lasted ~75 days, but two clutches had to be involved since the owlets could not have been from eggs incubated beginning mid-February. There were no eggs or eggshell fragments when I was first able to examine the nest post-branching/post-fledging on 25 June, when the young were roosting away from the nest and my visit no longer elicited a response from the adults.

While I have referred throughout to "the" female, it is not certain that there was only one adult female. It is also not certain when the first 2012 clutch failed, but the day off the eggs on 12 March, 26 days after initiation of incubation, likely would have killed any embryos. In captivity, a raptor of similar size, the Peregrine Falcon (*Falco peregrinus*), can be induced to double clutch only if eggs are removed early in the incubation of the first clutch (Platt et al. 2007), which suggests that one of the pair of these owls was replaced. It is possible that the female mobbed on 11 March was evicted by a second female as early as the intervening night, which could explain the day of no incubation. I heard no challenging or returned female hooting, though. Replacement could have occurred during my absence 13–29 March. Still, the intense mobbing the day before the apparent abandonment of the first clutch, which was part of almost daily raven mobbing of the owls every breeding season, is possibly more than coincidental. A female that prolonged incubation one year might have had the behavioral flexibility to double clutch the succeeding year.

This note, Eagle Environmental Publication 2, is the result of an unfunded, opportunistic, but scientifically motivated inquiry that serendipitously occurred where it could not be ignored. Neighbors L. and C. Williams documented incubation during my absences. I thank B. W. Smith for the many positive suggestions that greatly improved the original draft and concepts of this manuscript. Referee comments by J. L. Lincer, P. H. Bloom, and D. D. Gibson clarified thoughts and theories, particularly on possible explanations of the double clutch in 2012 and successful fledging of the second clutch.

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