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PARENTAL CARE AT A RED-TAILED HAWK NEST TENDED BY THREE ADULTS[1]

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Key words: Red-tailed Hawk; Buteo jamaicensis; *breeding biology; helpers; brooding behavior.*

Although the presence of more than two adults simultaneously tending the same nest has been reported for several species of raptors (Newton 1979), quantitative descriptions of nest attendance in these instances are scant. Wiley (1975) reported the first case of three adult Red-tailed Hawks (*Buteo jamaicensis*) tending a nest. We report a second case of three adults at a Red-tailed Hawk nest, and we compare nest attendance patterns at this nest with those at a nest tended by two adults.

Two Red-tailed Hawk nests, one tended by three adults (Nest 1) and the other by two adults (Nest 2) were studied in Dane County, Wisconsin. Both nests were on white oaks (*Quercus alba*) approximately 14 m from the ground and had similar canopy cover. The nests were located on adjacent territories in small (1.0-ha) woodlots surrounded by pastures. Inter-nest distance was 0.9 km. Habitat composition and human activity surrounding the nests were similar.

We first visited the nests on 19 May 1984. Nestlings were aged by measuring the length of the fourth primary (Petersen and Thompson 1977). Nest 1 had one three-week-old young and was defended by three adults, whereas Nest 2 had two two-week-old young and was defended by two adults. During each of four subsequent visits to Nest 1 (20, 23, 27, and 29 May), three adults simultaneously defended the nest by calling and flying to within 50 m of the person at the nest. During a visit to Nest 1 on the evening of 20 May, we saw one adult roosting at the nest while the other two roosted within 30 m of the nest.

The trio consisted of one male (distinguished by his smaller size and aerial displays) and two females. Female A had a complete set of primaries whereas Female B was missing primary No. 6 from the right wing. These differences allowed us to recognize each individual in flight. On 27 May all three birds attending Nest 1 soared together above the nest for over one hour. With prey in his talons, the male approached both females and performed undulating flight displays. We never observed overt aggressive interactions among the three birds. We did not observe the trio during pre-laying or incubation periods when copulations occurred; therefore we did not know the original clutch size at the nest and whether the extra female was a nonreproductive "helper" or a second mate in a polygynous bond.

On 29 May we removed one nestling from Nest 2 and exchanged it for the nestling at Nest 1. The nestling from Nest 1 was fostered into a third Red-tailed Hawk nest that had originally contained only one young. These exchanges resulted in Nest 1 and Nest 2 each having a single young of comparable age. On the day of the exchange we also placed an automatic time-lapse camera at each nest. We allowed three days for the birds to adjust to their new brood size, and we then monitored each nest for a minimum of 12 hr each day, between 0530 and 2100 on 1, 2, 5, and 6 June. Photographs were taken at 30-sec intervals. Observations ended on 7 June when we removed the cameras.

Differences in size and age of broods and in habitat variables, weather, and temporal factors can obscure comparisons of the effect of helping behavior at different nests (Brown 1978, Rabenold 1984). Habitat, weather, and temporal factors were similar between the two nests in this study due to their location, geographic proximity, and our concurrent monitoring. Our brood manipulation controlled for size and age of broods. Presumably, nest attendance patterns were mostly influenced by the number of adults tending the nest and by individual differences among these adults.

We inspected 11,811 photographs taken during four days of time-lapse photography at both nests, tallied the number of photographs in which adults were at the nests, and recorded whether they were feeding or brooding. From these photographs we then calculated the amount of time spent at the nest and the amount spent brooding. We could distinguish between the two females at Nest 1 by differences in throat coloration, but for almost 40% of the visits we were unable to identify the individual at the nest. Identification of prey items could not be made from the photographs.

Both females at Nest 1 defended the nest and fed, brooded, and preened the nestling. When defending, Female A consistently called more often and approached closer (10 m) to the person at the nest than did Female B (30 to 40 m). The male called less frequently and did not approach us as closely (>40 m) as either female. During one visit

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both females fed the young at the same time. The male visited the nest but was not observed feeding the young.

Unlike the nests studied by Wiley (1975), the rates of prey delivery were very similar between Nest 1 and Nest 2 during our four days of observation. The three adults tending Nest 1 made 23 visits to the nest and fed the nestling on 12 of those visits. The two adults at Nest 2 made 25 visits to their nest and fed the nestling on 14 of those visits. Adults at Nest 1 spent a total of 750 min at the nest (187.5 min/day) and those at Nest 2 spent 645 min (161.2 min/day). Adults at Nest 1 brooded the nestling eight times, and those at Nest 2 brooded the nestling five times. Preening of the young occurred during most brooding bouts. Although the number of brooding bouts were similar between the two nests, adults at Nest 2 spent 84% less time (51 min, 12.6 min/day) brooding than was spent by those at Nest 1 (365 min, 91.1 min/day). During a severe rainstorm on 6 June, the nestling at Nest 1 was brooded continuously for 79 min whereas the nestling at Nest 2 was brooded for only 5 min. Because we only observed one nest of each type and the sample of days was small, statistical tests are meaningless. However, the large difference in brooding time is substantial and might be attributed to the presence of the second female. We were unable to find studies that quantified the effect of "helpers" or of the number of mates in polygamous species on brooding, shading, or preening behavior.

Although the incidence of more than two adults at Red-tailed Hawk nests is undoubtedly rare, it may be more common than previously thought. It is difficult to detect more than two adults at a nest during short visits unless all adults defend together or unless prolonged observations of behavior are being made. Mader (1975) found a positive correlation between the number of times he visited Harris's Hawk (*Parabuteo unicinctus*) nests and the number of adults tending the nests. We discovered the three adults at Nest 1 during a detailed study on Red-tailed Hawk nest-defense behavior. After its discovery, Nest 1 was visited twice by other biologists who failed to detect that three adults were defending the nest. In a study of nest-defense behavior in the United States and Canada, in which "extra" adults would have been detected if they were present, only one out of 105 Red-tailed Hawk nests had three adults defending (R. L. Knight et al., unpubl. data). More detailed observations of nest-defense behavior at raptor nests might increase the incidence of records of "helpers" or polygamous bonds.

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RESPONSES OF BREEDING CLIFF SWALLOWS TO NIDICOLOUS PARASITE INFESTATIONS[1]

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Key words: Cliff Swallow; nidicolous parasites; nest desertions; colony abandonment; nesting response to parasite eradication.

Cavity- and burrow-nesting swallows are often plagued by vast numbers of bedbugs (*Cimicidae*), ticks (*Acarina*), and fleas (*Ceratophyllus*) swarming in the lining and walls of their nests (Knight 1908, Forbush 1929, Rothschild and Clay 1952, Loye and Hopla 1983). The principal direct victims of these parasites are the nestlings (Moss and Camin 1970). Equally and perhaps more important for the species, however, may be that infestations can induce mass colony desertions (Foster 1968) or prevent the repeated use of otherwise favorable colony sites. Stoner (1936) was aware of these effects in the Bank Swallow (*Riparia riparia*), noting that colony sites were rarely reoccupied in successive years unless between-season erosion or excavation had sloughed off the old earth surface to create clean, parasite-free faces for fresh burrowing activities. Storer (1927) came to a similar conclusion for the Cliff Swallow (*Hirundo pyrrhonota*) after observing that a colony of long standing in a creek bed apparently depended for its annual occupancy on the regular flushing by spring floods of the rock surface on which it was built. Buss (1942) demonstrated that the usually shifting pattern of site selection in Wisconsin Cliff Swallow colonies could be stabilized, when he documented the history of a colony on a barn near Deerfield, Wisconsin, that had been "managed" by systematically scraping off the old nests each fall. With this treatment, plus a campaign of House Sparrow

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