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THE NESTING AND FEEDING BEHAVIOR OF THE ORNATE HAWK-EAGLE NEAR MANAUS, BRAZIL[1]

BERT C. KLEIN
Department of Zoology, University of Florida, Gainesville, FL 32611

LEE H. HARPER
Department of Biological Sciences, State University of New York, Albany, NY 12211

RICHARD O. BIERREGAARD
World Wildlife Fund-U.S., 1255 23rd St. N.W., Washington, DC 20037

GEORGE V. N. POWELL
National Audubon Society Research Department, 115 Indian Mound Trail, Tavernier, FL 33070

Key words: Ornate Hawk-Eagle; Spizaetus ornatus; *Amazonia; feeding behavior; nesting.*

The Ornate Hawk-Eagle (*Spizeatus ornatus*), found over most of tropical Central and South America, is typically a bird of dense forest (Brown and Amadon 1968). Nests are difficult to observe in high tropical forests. Little has been reported on its biology other than casual observations by Slud (Brown and Amadon 1968) and Lyon and Kuhnigk (1985). Our study provides information on nest activity from copulation and nest building to 318 days after hatching.

STUDY AREA AND METHODS

A large stick nest was found in virgin forest 70 km north of Manaus, Brazil (2°25″S, 59°50″W, see Bierregaard 1984 for general habitat description). We initiated observations in June 1983 when adult Ornate Hawk-Eagles were found on and around the nest. Intensive observations were made from 21 September to 28 November 1983. During this time we recorded 173 hr of observations on the adults and 77 on the nestling. From 28 November 1983 until 27 July 1984 brief daily to bi-weekly observations were recorded. An observation platform constructed 19 m high in a tree and 72 m from the nest across a clearing allowed an unobstructed view of the nest.

The sex of the adults was distinguished by size differences and individual molting patterns. We assumed

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TABLE 1. *Spizaetus ornatus* prey species identified from bones in the nest and prey observed delivered to the nest.

	Individuals	Percent of total
Reptiles		
Unidentified snake*	1	
Unidentified lizard (Teiidae)	1	
Total reptiles	2	4.1
Birds		
Tinamus sp. (*major* or *guttatus*)	6	
Crypturellus sp. (*variegatus* or *soui*)	4	
Crypturellus variegatus	1	
Ara macao	1	
Ara sp. (probably *manilata*)	1	
Ramphastos vitellinus	1	
Penelope sp. (probably *marail*)	2	
Penelope sp. (probably *jacuacu*)	10	
Ortalis motmot	1	
Smaller birds	4	
Total birds	31	63.5
Mammals		
Opossums* (*Didelphis marsupialis, Metachirus nudicaudatus*)	2	
Dasyproctidae (*Myoprocta* sp. or *Dasyprocta* sp.)	12	
Myoprocta sp.	1	
Coendu sp.	1	
Total mammals	16	32.7
Grand total	49	

* Indicates records based on observations of the eagles with prey not represented in skeletal material taken from nest.

that the larger bird found consistently on or close to the nest was the female.

On 12 May 1983, 19 to 26 days after fledging, the juvenile was captured with a bal-chatri trap (Berger and Hamerstrom 1962) baited with a live chicken. A 12-g transmitter was mounted on the eagle's central tail rectrice.

Seven months after fledging, the nest tree was cut down in the ranch's attempt to create more cattle pasture. The nest was measured and prey remains removed for identification.

RESULTS AND DISCUSSION

NEST SITE

The nest site was in a small ravine next to a stream 1 to 2 m wide. From rim to rim, the nest was 1.7 m in diameter and located 37 m high in the main fork of an emergent 46-m tall *Hymenaea* sp. (Leguminosae) tree. The tree's diameter at breast height was 1 m. The canopy was 11 m in diameter at nest level with branches of 25 cm, 18 cm, and 15 cm in diameter supporting the nest.

PREY SPECIES

Remains of 45 prey items were collected in the nest (Table 1). Scott Robinson (pers. comm.) has recorded the Ornate Hawk-Eagle taking two squirrel monkeys (*Saimiri sciureus*), a Saddle-backed Tamarin (*Saguinus fuscicollis*), two spiny woodrats (*Proecomys* sp.), and three Purple Gallinules (*Porphyrula martinica*) in Manu Park, Peru.

ADULT BEHAVIOR

On the morning of 24 June, the eagles copulated on the nest. We later projected, based on observations of the nestling and an estimated incubation time of 40 days (Brown 1977), that the eggs were laid in the beginning of August. The occurrence of copulations in June indicates the species has a long period of courtship prior to egg laying.

After hatching, whenever the adult male approached the nest area, it vocalized. The female reciprocated by calling from on or near the nest. The calling bouts usually lasted from 2 to 8 min before the female flew to receive prey from the male. The male was observed on the nest only once for a few seconds before the female aggressively chased it off. In contrast, the male Crested Eagle (*Morphnus guianensis*) studied by Bierregaard (1984) always delivered prey to the nest during 4 weeks of observation and was never aggressively chased away by the female.

Throughout the nesting cycle, the female broke branches from trees within 100 to 200 m of the nest and added them to the nest. Prey remains were routinely removed from the nest at least 2 to 4 times daily and taken to a "dump," a conspicuous perch 50 m from the nest where the bones were dropped to the forest floor.

On two occasions Blue-and-yellow Macaws (*Ara ararauna*) and Greater Yellow-headed Vultures (*Cathartes melambrotus*) passed within 25 m of the nest while both the nestling and adult female were on the nest. The adult called briefly as the vultures passed but did not leave the nest. The eagles showed no response to the macaws or to the presence of a crew of chain sawyers felling the forest within 38 m of the nest.

JUVENILE BEHAVIOR AND DEVELOPMENT

Based on the size of the nestling when we began observations, we estimated that it hatched 2 to 4 days earlier, between 17 and 19 September. At this time, the young was all downy and barely able to lift its head from the floor of the nest. At 36 days it began to peck at prey carcasses between feedings by the adult female. Wing and tail feathers began to appear at about 37 days. The nestling was able to tear some food off prey in the nest without parental help by 54 days. Between 35 and 57 days the time spent feeding increased 14%. It started climbing on branches outside the nest by 71 days and fledged between 83 to 90 days after hatching (for discussion we assume fledging at 87 days after hatching).

The juvenile was captured 23 days after fledging. It had a wing length of 370 mm, a tail length of 350 mm, and a tarsus of 110 mm. Based on these measurements it was assumed to be a female (Bierregaard 1978, Weick 1980).

Between 23 and 76 days after fledging, we located the juvenile with radio telemetry 73 times on 41 days (transmitter's battery went dead at 54 days). The ju-

venile was never found more than 170 m from the nest. Over 90% of the observations were within 100 m of the nest. On 27 July, 225 days after fledging, we observed a food transfer from an adult hawk-eagle to the juvenile within 100 m of the nest. Before the transfer the adult and juvenile called repeatedly 160 m apart for 36 min. The juvenile then left its perch and flew to the adult, grabbed the prey item from its talons without landing and continued to a nearby perch. It continued to exchange calls with the adult for 2 min. These observations indicate that the juvenile hawk-eagle was partially dependent on parental feeding 312 days after hatching when the study was concluded. This supports Brown's (1977) generalization that tropical raptors have a long parental dependency period compared to similar sized temperate raptors.

If we assume that Ornate Hawk-Eagles have an incubation period of at least 40 days, they will require well over a year for courtship, nesting, and raising one young to independence. At most, this species may produce one nestling every other year. Such low productivity may make the species sensitive to habitat destruction or hunting pressure.

We appreciated the help of Susan Renner and Antonio Cabral in identifying the nest tree. Antonio Cabral also helped with the construction of the observation platform. Fernando C. Novaes, Jose Maria Cardosa da Silva, and Maria de Fatima Lima identified the prey remains from the nest using reference material at the Museu Goeldi in Belem, Brazil. Rocelino Marajo dos Reis and Luis Raimundo helped with many of the ordeals of living in a remote field site. Scott Robinson provided unpublished data on prey species. The manuscript benefited from conversations with Jay Malcolm and John Eisenberg. This study was supported by the World Wildlife Fund-US, the Instituto Nacional de Pesquisa da Amazonia (INPA), and the Instituto Brasileiro de Desenvoivimento Florestal (IBDF), and represents publication number 32 in the Minimum Critical Size of Ecosystems Project (Dinamica Biologica de Fragmentos Florestais) technical series.

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A CASE OF COMMUNAL NESTING IN THE EUROPEAN STARLING[1]

PHILIP C. STOUFFER, LINDA C. ROMAGNANO, MICHAEL P. LOMBARDO,[2]
ANN S. HOFFENBERG, AND HARRY W. POWER
Department of Biological Sciences, Rutgers University, Nelson Biological Laboratory, P.O. Box 1059, Piscataway, NJ 08854

Key words: Communal nesting; hole-nesting species; European Starling; Sturnus vulgaris; *parentage; polygyny; electrophoresis; nest-site competition.*

The most common type of avian communal breeding system involves helpers at the nest, in which one or more nonreproductive conspecifics help to raise the brood of a single breeding pair (e.g., Skutch 1961, Brown 1978, Emlen 1978). A less common system involves two or more females and one or more males contributing gametes to a single brood that they raise cooperatively (Koenig and Pitelka 1981). The latter phenomenon is well known in Groove-billed Anis (*Crotophaga sulcirostris*; Vehrencamp 1978) and Acorn Woodpeckers (*Melanerpes formicivorus*; Koenig and Pitelka 1979). In other species, in which nonreproductive helpers are common, a minority of nests contain the clutches of more than one female (Zahavi 1974, Rowley 1978, Lawton and Lawton 1985). Few other cases of communal laying and subsequent cooperation in parental care have been reported (Bellrose 1943, Hawksley and McCormack 1951, Brackbill 1952, Frith

[1] Received 25 February 1987. Final acceptance 27 August 1987.

[2] Present address: Museum of Zoology and Michigan Society of Fellows, University of Michigan, Ann Arbor, MI 48109.