

Feeding ecology of Javan Hawk-eagle *Spizaetus bartelsi* during the nestling period

Dewi M. Prawiradilaga, Nils Rov, Jan Ove Gjershaug, Hapsoro and
Adam Supriatna

ABSTRACT

The Javan Hawk-eagle is one of the least known raptors in the world, an endangered and endemic bird of prey of Indonesia. Its distribution is limited to forest on the island of Java. The decline in its population has prompted concerns about the availability of prey species. The Javan Hawk-eagle is a medium-sized eagle with a total length of 60-70 cm, with females slightly larger than males. Its feeding behaviour and diet have been studied by observations and analyses of regurgitated pellets and prey remains. In West Java, this species preys upon a wide range of animals including small and medium-sized mammals, birds and reptiles. In our study, the most common prey species were squirrels (Sciuridae), treeshrews (Tupaidae), rodents (Muridae) and bats (Chiroptera). During the nestling period, both parents brought prey to the nest, the male more often in the morning and the female more often in the afternoon. The estimated total number of prey brought to the nest during the nestling period ranged between 109 and 116 animals.

INTRODUCTION

The Javan Hawk-eagle (*Spizaetus bartelsi* Stresemann, 1924) is one of the least known raptors in the world and endemic to Java island, Indonesia. Its distribution is confined to rain forest. In the last few decades, its population has been considered to decline and now it is classified as an endangered species according to current IUCN threat categories (Collar *et al.* 1994).

Many factors may be implicated in the decline of the Javan Hawk-eagle population, including loss of prey and habitat and illegal trapping by people. The role of prey-supply in the declining population is still obscure, because the diet of the Javan Hawk-eagle is poorly documented. Casual observations indicate that domestic chickens (*Gallus* sp.), a large fruit bat (*Cynopterus* sp.), stink badger (*Mydaus javensis*) (Bartels 1924; Becking 1989), squirrels (Linsley in Sozer and Nijman 1995), lizards (van Balen 1991), snakes and medium-sized mammals (Sozer and Nijman 1995) are eaten. In this paper, we present recent information gained on the diet and feeding behaviour, and estimate the total number of prey items taken during the nestling period.

STUDY AREA AND METHODS

Information was gathered by analysing regurgitated pellets and prey remains, by interviewing local people and by field observations.

Study area

General observations on feeding behaviour to identify prey species were conducted during nest surveys at G. Halimun (6°50' S and 106° 32' E), G. Salak (6°43' S and 106°42' E) and Cibulao, Puncak (6°42' S and 106°59' E).

Pellet collections and analysis

Twelve samples of regurgitated pellets and prey remains were collected from under roosting tree at Cibulao, Puncak and from inside the nest at G. Salak. In the laboratory, samples were sometimes washed with water to remove dirt and then dried for analysis. Prey items were identified by comparison with museum collections, in consultation with the staff.

Feeding observations and analysis

Feeding activities were recorded during intensive nest observations on a pair of breeding Javan Hawk-eagles with their single young at G. Salak between August and October 1997. The pair members were sexed by individual recognition based on plumage differences and size, the female being larger than the male. Data were analysed in one hour intervals. A chi square test was used to examine whether the number of prey brought to the nest in the morning was the same as in the afternoon and a univariate ANOVA test was applied to see if the parents brought prey at mainly different times.

In order to estimate prey consumption, we recorded the rate at which various prey species were delivered to the eaglet. The nest was watched for 37 days, for a total of 276 hours.

RESULTS

Prey species

Small to medium-sized mammals, birds, snakes and lizards were identified either from prey remains, observations or interviews (Table1). Small mammals, in particular squirrels (Sciuridae), tree shrews (Tupaidae), rodents (Muridae) and bats (Chiroptera), were most commonly taken. Because during observations squirrels and treeshrews were often difficult to tell apart, they were lumped in the analysis. Predation pattern

Both male and female parents often came to the nest with prey. If the prey could not be eaten in one meal, they left the remains in the nest. When feeding the eaglet, both parents seemed to feed the oldest prey first.

Prey were often brought to the nest between 06.00 and 12.00 hours and between 14.00 and 16.00 hours (Figure 1), but at a greater frequency in the morning than in the afternoon ($\chi^2 = 13.12$; $df = 1$; $p < 0.001$). The male brought prey more often in the morning and female more often in the afternoon ($F = 6.3$; $df = 1$; $p = 0.02$) (Table2).

Table 1. Prey of Javan Hawk Eagle *Spizaetus bartelsi*

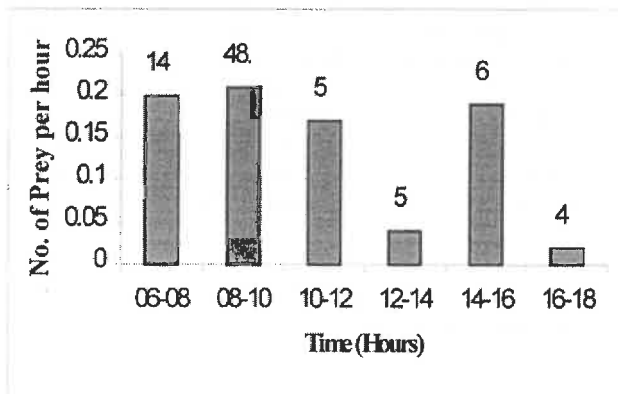
Method codes: 1 = field observation

2 = identified prey remains from nest or perching site

3 = information from local people

Species	No. of observations	Method
Mammals		
Common Treeshrew (<i>Tupaia glis</i>)	3	1
Ebony Monkey (<i>Trachypithecus auratus</i>), young	1	3
Flying lemur (<i>Cynocephalus variegatus</i>)	1	3
Diadem Roundleaf Bat (<i>Hipposideros diadema</i>)	2	1
Fruitbat (<i>Cynopterus</i> sp.)	1	1
Bat (<i>Chiroptera</i>)	6	1
Black Giant Squirrel (<i>Ratufa bicolor</i>)	1	1
Black-banded Squirrel (<i>Callosciurus nigrovittatus</i>)	1	2
Plantain Squirrel (<i>Callosciurus notatus</i>)	1	1
Squirrel (<i>Callosciurus</i> sp.)	5	1 & 2
Squirrel or Treeshrew	24	1
Rat (<i>Rattus</i> sp.)	2	2
Small rodent (<i>Muridae</i>)	6	1
Total mammals	54	
Birds		
Domestic Chicken (<i>Gallus gallus</i>)	2	3
Barred Button-quail (<i>Turnix suscitator</i>)	1	2
Emerald Dove (<i>Chalcophaps indica</i>)	2	2
Dove (<i>Streptopelia</i> sp.)	1	2
Javan Frogmouth (<i>Batrachostomus javensis</i>)	1	2
Unidentified bird (Aves)	1	1
Total birds	8	
Snakes (Reptilia)	1	3
Lizards (Reptilia)	1	3
Total reptiles	2	

Figure 1. Estimated number of prey brought to the nest per hour during nestling period. Numbers above bars depict total observation hours.



Estimate of total number of prey items during the nestling period

Prey were delivered to the nest during 13.4% of the nest watches. Most prey taken were small mammals (Table 1). Assuming (1) that each watch when prey was brought to the nest represented a predation event, (2) that predation largely involved small mammals, (3) that there were 12 hours of feeding during a day, and (4) that the nestling period ranged from 68 to 72 days, then each pair of Javan Hawk-eagles would kill about 109 to 116 individual small mammals to raise their single chick. The total prey killed is likely to have been much greater, because this figure took insufficient account of prey consumed by the parents.

Table 2. Number of prey brought to the nest during observations (n=276 hours)

Sex	Time	
	Morning (Before 12 noon)	Afternoon (After 12 noon)
Male	16	5
Female	6	10
Total	22	15

DISCUSSION

The diet of the Javan Hawk-eagle we studied consisted of a wide variety of animals, including mammals, birds and reptiles (Table 1). Evidently, the species was an opportunist predator. However, small to medium-sized mammals, especially squirrels and treeshrews, were often taken. Such species are arboreal and live on low to high branches in primary, as well as in secondary, forests (PPA 1978). At the nest watched, the male brought prey more often in the mornings and the female in the afternoons (Table 2), but further study on sexed individuals is necessary to see whether this behaviour is general.

It seems that the Javan Hawk-eagle took birds less often than the Changeable Hawk-eagle *Spizaetus cirrhatus*, but otherwise their diets are fairly similar (Hoogerwerf 1949).

ACKNOWLEDGEMENTS

We proudly acknowledge that this study was carried out as a part of an environmental cooperation between Indonesia and Norway. We are grateful to the Indonesian Institute of Sciences (LIPI) for giving research permits to the Norwegian researchers, the State Ministry for Environment (LH) for fruitful cooperation and the Directorate General of Forest Protection and Nature Conservation (PHPA)-Ministry of Forestry and Perum Perhutani for permission to work in the study areas. We thank BirdLife International-Indonesia Programme, Harry, Mulyadi, Bob, Arbi, Dwi (Telapak members), Usep Suparman, Eddy, Mulyadi, Bapa Dili (CIBA members), local people at G. Salak, especially Pak Ocen, Pak Otang, Pak Onyon, G. Halimun and especially Pak Kokon for their help during field work, and M.H. Sinaga (Museum Zoologicum Bogoriense-LIPI) for valuable assistance during identification of mammalian prey species. The first author is grateful to the Norwegian Institute for Nature Research (NINA) for providing funds to attend the 5th World Conference on Birds of Prey and Owls.

REFERENCES

- BARTELS, M. 1924. Waarnemingen omtrent *Spizaetus cirrhatus limnaetus* Hors. en *Spizaetus nipalensis kelaarti* Legge op Java. *Jaarber. Club. Ned. Vogelk.* 14: 11-21.
- BECKING, J.H. 1989. *Henry Jacob Victor Sody (1892-1959). His Life & Work*. Leiden: E.J. Brill. Netherlands.
- COLLAR, N.J., M.J. CROSBY & A.J. STTAERSFIELD 1994. *Birds to watch 2: The world list of threatened birds*. *BirdLife Conservation Series* No. 4. BirdLife International, Cambridge.
- DIREKTORAT PERLINDUNGAN DAN PENGAWETAN ALAM (PPA), DIT.JEN. KEHUTANAN 1978. *Mamalia di Indonesia*. Pedoman Inventarisasi Satwa. Bogor.
- HOogerWERF, A. 1949. *De avifauna van Tjibodas en omgeving (Java)*. Koninklijke Plantetuin van Indonesie, Buitenzorg.

SOZER, R. & V. NIJMAN. 1995. Behavioural ecology, distribution and conservation of the Javan Hawk-eagle *Spizaetus bartelsi* Stresemann, 1924. Verslagen en Technische Gegeven No. 62. University of Amsterdam. The Netherlands.

VAN BALEN, S. 1991. The Java Hawk eagle *Spizaetus bartelsi*: WWGBP project report No. 1, March 1990. WWGBP Birds of Prey Bulletin 4: 33-40.

Dewi M. Prawiradilaga
R & D Centre for Biology-LIPI
Flora and Fauna International
Indonesia Programme
P.O. Box 230, Bogor 16002
Indonesia

Nils Rov and Jan Ove Gjershaug
NINA.NIKU
Tungasletta 2
7005 Trondheim
Norway

Hapsoro
Telapak Indonesia
Jalan Sempur Kaler No. 16
Bogor 16154
Indonesia

Adam Supriatna
KPB CIBA, Kotak Pos 66
Sindanglaya
Cianjur 43253
Indonesia

