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## The food habits of the Madagascar Long-eared Owl *Asio madagascariensis* in southeastern Madagascar

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**Abstract.** A collection of regurgitated pellets and food remains was found below an occupied roost of the Madagascar Long-eared Owl *Asio madagascariensis* in southeastern Madagascar. The owls are taking a wide variety of prey including insects, frogs (*Boophis*), geckos (*Uroplatus*), birds (*Eurystomus*, *Hypsipetes*), bats (large *Hipposideros*), rodents (*Eliurus* spp., *Rattus*), and lemurs (*Microcebus*). This is the first quantitative information on the food habits of this owl species.

**Key words.** Aves, Strigiformes, *Asio madagascariensis*, food choice, Madagascar.

### Introduction

The Madagascar Long-eared Owl *Asio madagascariensis* is a widespread inhabitant of the eastern humid forest of Madagascar from sea-level to 1800 m (Rand 1936, Dee 1986). Delacour (1932) considered it rare, but this species may be overlooked due to its reclusive habits and consequently more common than currently realized. Little published information is available on the natural history of this species. The only known reference to its diet is Rand's (1936) statement that "three stomachs [were] examined [and] all contained remains of small mammals." It is for this reason that the analysis of food remains found below a Madagascar Long-eared Owl roost is of interest.

### Study Area and Methods

From September 1989 to January 1990 we took part in a faunal survey of southeastern Madagascar. Between 26 and 30 December 1989 we worked in the Bezavona Forest, 7.5 km NNW of Tolagnaro (Fort Dauphin), 1.5 km NE of Nahampoana, 24°58'S, 46°58'E, approximately 75 m above sea-level. The Bezavona Forest is located at the southern end of the Vohimena range of the Anosyenne Mountain chain and the vegetation is typical of lower montane forest of the area (Paulian et al. 1973). On 27 December, while walking on a trail in the forest, SMG noted two Crested Drongos (*Dicrurus forficatus*), a Coral-billed Nuthatch Vanga (*Hypositta corallirostris*) and a Madagascar Bulbul (*Hypsipetes madagascariensis*) that were scolding two *Asio madagascariensis* roosting in a tree about 10 m above the forest floor.

The owls' perch was directly below the fronds of a large palm tree, which afforded them protection from the rain. Underneath the roost, on vegetation and the ground, was some white wash. Pellet remains, most of which had been dissolved, were found below the roost. In order to recover bone and other food remains, the ground within 5 m radius from the roost's center was partially cleared and excavated to a depth of about 5 cm. The site was revisited each day to collect fresh pellets until our departure on the 30th. During this period the two owls were always present during day light-hours.

### Results

About 250 bones were recovered from the regurgitated remains on the ground below the roost. No partially eaten carcass was found at the site, and thus it would appear that the owls do not dismantle their prey at the roost. Paired elements of any taxon were separated and the largest number of elements from either the right or left side was considered the minimum number of individuals (MNI). The pellets were composed of the following:

#### Class Insecta

##### Order Orthoptera

unidentified taxa (taxon) — two ovipositors (MNI = 2)

##### Order Odonata

unidentified taxon — wing and head (MNI = 1)

#### Class Amphibia

##### Family Rhacophoridae

*Boophis* cf. *madagascariensis* — ilia, presacral vertebrae, radioulna, femur and tibiafibula (MNI = 2)

#### Class Reptilia

##### Family Gekkonidae

*Uroplatus* cf. *sikorae* — maxillary, premaxillary, dentary, pelvic girdle and humerus (MNI = 2)

#### Class Aves

##### Order Coraciiformes

*Eurystomus glaucurus* — manubrial portion of sternum, carpometacarpus, coracoid, tarsometatarsus, and proximal portion of scapula (MNI = 1)

##### Order Passeriformes

*Hypsipetes madagascariensis* — carpometacarpus and proximal half of ulna (MNI = 1)

#### Class Mammalia

##### Order Chiroptera

*Hipposideros commersoni* — mostly intact skull (MNI = 1)

##### Order Rodentia

*Eliurus myoxinus webbi* — various cranial pieces and fragments (MNI = 6)

*Eliurus minor* — various cranial pieces and fragments (MNI = 3)

*Rattus rattus* — various cranial pieces and fragments (MNI = 6)

##### Order Primates

*Microcebus rufus* — set of matching mandibles, portion of maxilla with cheek teeth, three right and one left humeri, pair ulnae, and one left tibia (MNI = 3)

The roost was about  $\frac{3}{4}$  km ground distance and 40 m altitudinal distance from the lower limit of the forest, below which were small villages, agricultural plots, and fallow fields. The forest condition in the vicinity of the owl roost was in a mixed state. Sections remained intact, particularly on the higher slopes, while other portions had been completely deforested. About  $\frac{1}{4}$  km from the roost was a cleared patch of about one hectare planted with cassava. The forest still contained a number of bird species characteristic of intact eastern humid forest: *Mesitornis unicolor*,

Table 1: Vertebrate remains identified from *Asio madagascariensis* food remains.

	MNI <sup>1</sup>	% total individuals	average mass in grams (n) <sup>2</sup>	% total biomass
Amphibians				
<i>Boophis cf. madagascariensis</i>	2	8	17.5 (5)	2.0
Reptiles				
<i>Uroplatus cf. sikorae</i>	2	8	29 (1)	3.3
Birds				
<i>Eurystomus glaucurus</i>	1	4	147 (3)	8.0
<i>Hypsipetes madagascariensis</i>	<u>1</u>	<u>4</u>	<u>47 (20)</u>	<u>2.7</u>
Σ birds	2	8	94.5	10.7
Mammals				
<i>Hipposideros commersoni</i>	1	4	49 (2)	2.8
<i>Eliurus myoxinus</i>	6	24	82.3 (25)	27.9
<i>Eliurus minor</i>	3	12	33.8 (23)	5.7
<i>Rattus rattus</i>	6	24	109.5 (8)	37.1
<i>Microcebus cf. rufus</i>	<u>3</u>	<u>12</u>	<u>~63</u>	<u>10.7</u>
Σ mammals	19	76	78.4	84.2
Σ all vertebrates	25		70.9	

<sup>1</sup> MNI = Minimum number of individuals.  
<sup>2</sup> All masses are tabulated from our own unpublished data with the exception of *Eurystomus* (Benson et al. 1976) and *Microcebus* (Petter et al. 1977).

*Coa caerulea*, *C. reynaudii*, *Mystacornis crossleyi* and *Calicalicus madagascariensis*. Both *Eurystomus* and *Hypsipetes*, the birds recovered from the food remains, are locally common in the Bezavona Forest. Other raptors noted within 2 km of the roost include: *Buteo brachypterus*, *Accipiter francesii*, *Falco newtoni*, and *Otus rutilus*.

The only large species of *Boophis* recorded in the Bezavona Forest was *madagascariensis*, and the bones recovered from the owl food remains closely match those of this frog. Two species of *Uroplatus* geckos have been recorded in the Anosyenne Mountain chain and nearby moist littoral forest, *U. fimbriatus* and *U. sikorae*. Only *sikorae* was collected at Bezavona, and the size of the mandibles fits well with the adult size of this species. *U. fimbriatus* is almost twice as large as *sikorae* (Bauer & Russel 1989). *Boophis madagascariensis* and *Uroplatus sikorae* represent the largest nocturnal arboreal frog and gecko collected at Bezavona.

The two species of *Eliurus* identified from the remains are typical inhabitants of the eastern forests of Madagascar. Both species are nocturnal and scansorial in habits and forage both on the ground and in the lower vegetation strata of the forest. *E. minor* is characteristic of montane wet forest habitats below about 2000 m. *E. myoxinus webbi* is common in moist littoral forests and montane forests below 800 m. Both species coexist with introduced *Rattus* in disturbed and natural forest fragments throughout southeastern Madagascar. *Hipposideros commersoni* was found during the survey in lowland moist forest, where it was captured in mist nets set over or near streams under a closed forest canopy.

Martin (1973) found *Microcebus rufus* inhabiting the lowland montane forest in the general vicinity of the owl roost and *M. murinus* in the littoral forest a few km

away. Thus, it is presumed that the lemur bones recovered from the owl food remains are referable to *M. rufus*. We found this strictly nocturnal lemur to be locally common in the Bezavona Forest. These bone remains are apparently the first documented case of predation on *Microcebus* by a bird of prey.

### Discussion

There are two other known records of *Asio madagascariensis* in southeastern Madagascar. An undated specimen collected in the Tolagnaro (Fort Dauphin) area is housed in the British Museum (Natural History), Tring (reg. no. 1891.10.22.1). A single individual was observed on 18 and 19 October 1989 in moist littoral forest about 1.5 km NW of Manafiafy (St. Luce), 24°47'S, 47°12'E (pers. obs.).

*Asio madagascariensis* is regarded by some authorities as an allospecies of *A. otus* (e. g. Mayr & Short 1970). The latter species is widely distributed across the Holarctic and also has breeding populations, which are variously treated as subspecifically or specifically distinct, on the Canary Islands, in the Ethiopian Highlands, and mountainous areas of central and east Africa. The food habits of some of these populations have been investigated.

Marti (1976) summarized several dietary studies of North American *A. otus*. Of the total of 23,888 prey items identified, small mammals made up on average 98.2 % & 98.3 % and birds 1.7 % & 1.7 % of the total prey and biomass taken (respectively). Czarnecki (1956) tabulated diet information of this species from central Europe and of 122,000 prey items identified, small mammals made up 91.8 % and birds 8.1 %.

Dietary analyses from the African breeding populations of long-eared owls are not as detailed as those from the Holarctic. A collection of pellets of *A. (otus) abyssinicus* from the Mendeb-Araenna Mountains of south-central Ethiopia was analyzed by Yalden (1973). Only mammal bones were recovered from the remains. Carillo et al. (1989) summarized diet differences of the endemic *A. o. canariensis* on several Canary Islands. They found some variation in diet on the various islands and in different habitats, but in all cases mammals (introduced *Mus* and *Rattus*) constituted at least 92.8 % and birds up to 5.9 % of the biomass taken by this owl.

Of the minimum 25 individual prey items identified from the *A. madagascariensis* pellets, 19 (76 %) were mammals, 2 (8 %) birds, 2 (8 %) reptiles and 2 (8 %) amphibians (Table 1). The total represented biomass of these four groups of animals was 84.2 %, 10.7 %, 3.3 % and 2.2 %, respectively. The most commonly hunted prey species were *Rattus rattus* and *Eliurus myoxinus webbi*, each representing 24 % of the total individuals taken and 37.1 % and 27.9 % of the total biomass. The largest prey was *Eurystomus glaucurus* (147 g), followed by *Rattus rattus* (109.5 g). The smallest identified vertebrate prey were *Boophis* (17.9 g) and *Uroplatus* (29 g).

The overall average mass of vertebrate prey was 70.9 g, for mammals 78.4 g and birds 94.5 g. This is similar to the average mammalian prey mass of 84 g calculated for *A. abyssinicus* (Yalden 1973), but nearly twice as heavy as the average mammalian prey mass of 37.0 and 32.2 g taken by *A. otus* in North America and Europe (respectively) (Marti 1976). These owls geographically vary in size: the wing of four female *A. abyssinicus* average 356.5 mm, one female *A. madagascariensis* measures 284 mm, and 12 female mid-European *A. otus* average 296 mm (Benson et al. 1976, Fry et al.

1988, specimens in British Museum [Natural History] and Field Museum of Natural History). Body size of these owls is a poor predictor of the size of prey selected by the different populations. *A. madagascariensis* and *A. abyssinicus* take proportionally heavier prey than Holarctic *A. otus*. Moreover, *A. madagascariensis* is only about 80 % the size of *A. abyssinicus* but is catching prey of nearly comparable mass. The masses of the different prey species taken by *A. madagascariensis* ranged from 17.5 to 142 g and by *A. abyssinicus* from 13 to 200 g (Yalden 1973).

On the basis of the material analyzed herein, *A. madagascariensis* living in the southern portion of the eastern humid forest of Madagascar are feeding predominantly on small mammals, namely bats, rodents and lemurs. Birds, reptiles, amphibians and insects made up a small proportion of the diet.

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#### Zusammenfassung

Es wird über das Beutespektrum der Madagaskar-Waldohreule in Südost-Madagaskar berichtet. Säuger bildeten 76 % der Gesamtzahl von Beuteresten, am häufigsten waren *Hipposideros commersoni*, *Eliurus myoxinus*, *Eliurus minor*, *Rattus rattus* und *Microcebus* cf. *rufus*. Vögel bildeten 8 % der Gesamtzahl von Beuteresten. Die zwei Ratten *Eliurus myoxinus* und *Rattus* machten 27.9 % beziehungsweise 37.1 % der Gesamtmasse an Wirbeltieren aus.

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