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Notes on the diet of the Barn Owl (Aves: Tytonidae: *Tyto alba*) from Zohin'Andavaka, Beahitse, extreme southwestern Madagascar

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Introduction

A number of papers have been published on the diet of Barn Owls (*Tyto alba*) on Madagascar based on the analysis of regurgitated pellets. Samples for these studies were obtained in different ecosystems on the island, including gallery forest in spiny bush (Goodman & Langrand, 1993; Goodman *et al*., 1993; Rasoma & Goodman, 2007), edge of limestone plateau in spiny bush (Goodman & Langrand, 1993), limestone area of dry deciduous forest (Goodman & Owens, 2006), open habitats adjacent to areas of eastern humid forest (Goodman & Langrand, 1993; Goodman *et al*., 1993; Goodman & Thorstom, 1998), and near urban areas in the Central Highlands (Goodman & Langrand, 1993). However, no quantified information has been available on the food habits of this raptor from southwestern inland areas of the spiny bush away from riverine habitats; herein we present such an analysis from a site near Beahitse. Further, this is a region that little data is available on local small mammal communities and the food remains provide interesting insights in this regard.

Materials and Methods

The Barn Owl roost site was located near the entrance of a cave known as Zohin'Andavaka, southwest of the village of Beombe (=Beomby), to the west of Beahitse, 24º20.155'S, 44º6.739'E, approximately 400 m above sea-level. The habitat surrounding the site was noted as dry with degraded euphorb forest and scattered tall baobabs growing on limestone with thin red top soils. The pellets were collected on 14 November 2007.

The bone remains were removed from pellets and identified using the comparative osteology collections at the Field Museum of Natural History, Chicago. Age classes for mammals are based on the ossification of the basisphenoid suture and molar eruption patterns: juveniles – suture non-fused and distal molars non-erupted and adults – suture fused and

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cheek teeth fully erupted. The Minimum Number of Individuals (MNI) per taxon was tallied for mammals by cranial-maxillary counts based on the number of unique bilateral elements. The *Microcebus* remains were identified to species using characters outlined by Rasoloarison *et al*. (2000). Invertebrate remains were uncommon in the pellets and are not figured in the analysis.

Results

The total MNI of prey items identified from the pellets was 107, for a total prey biomass of 2780 g. A considerable number of different prey types were identified from the pellets, comprising three classes of vertebrates – Reptilia, Aves, and Mammalia (Table 1). The only reptile remains identified were cranial and mandibular fragments referable to a large gecko, most likely *Blaesodactylus sakalava.* In contrast, 11 taxa of birds were recovered from the pellets, including two species of non-passerines and nine species of passerines. The mammal remains were almost as diverse as birds, with seven different species, two of which are introduced to Madagascar, and consisting of tenrecs, shrews, bats, primates, and rodents. Amongst these different classes of animals, the MNIs for birds and mammals were similar (47.6% and 46.7%, respectively) and by biomass birds were slightly more important than mammals (57.3% and 32.9%, respectively). Either by MNI or by biomass, no single taxon represents a disproportionate percentage of the total recovered from the pellets. On the basis of the MNI, the three most common prey types were *Geogale aurita* (15.9%), *Foudia madagascariensis* (13.1%), and *Mus gentilulus* (12.2%). For biomass, the three most important prey taxa were *Dicrurus forficatus* (16.9%), *Eurystomus glaucurus* (16.0%), and *Microcebus griseorufus* (11.3%).

Discussion

While the pellets from Zohin'Andavaka were collected in mid-November 2007, two aspects help provide inference into the season that at least a portion of the remains was deposited. Amongst the birds identified were individuals of *Eurystomus glaucurus*, a species that breeds on Madagascar and migrates during the austral winter, May to September, to Africa (Langrand, 1995). Hence, at least a portion of the prey remains had to be consumed during that period. Further, immediately adjacent to the site the pellets were collected was an unhatched egg of a Barn Owl. This sedentary species is known to breed on Madagascar between the months of April to July (Langrand, 1995), which largely coincides with the period *Eurystomus* can be found on the island. It cannot be excluded that a portion of the pellets were deposited outside of these periods and during the austral winter.

Several other studies have been published on the dietary regime of the Barn Owl in southwestern Madagascar, but in most cases, the samples came from zones of gallery forest (Goodman & Langrand, 1993; Goodman *et al*., 1993; Rasoma & Goodman, 2007). While largely the same taxonomic groups are represented in the prey remains reported on in these various studies, the proportions are notably different. One of the more striking differences at the Zohin'Andavaka site is the complete lack of amphibians in the diet of this owl. In contrast, at a site near Sept Lacs, along the Onilahy River, amphibians represented 22.6% of the MNI and 6.6% of the biomass during the rainy season; these figures dropped to 10.2% and 3.1% (respectively) during the dry season (Rasoma & Goodman, 2007). Further, at Ambinda, just outside the Réserve Spéciale de Beza Mahafaly and in gallery forest, amphibians represented 48.0% by MNI and 14.8% by biomass of the prey consumed by the Barn Owl (Goodman *et al*., 1993).

In both the Rasoma & Goodman (2007) and Goodman *et al*. (1993) studies, birds represented less than 5% by MNI and less than 8% by biomass, as compared to nearly or more than 50% for these parameters in the current study. For mammals, the MNI is almost comparable between these three studies, but the biomass is notably lower in the Zohin'Andavaka sample. Most striking in this regard is the importance of introduced mammals in the diet of Barn Owls in southwestern Madagascar. At Sept Lacs the two non-native genera (*Mus* and *Rattus*) represent during the rainy season 82.0% by MNI and 84.7% by biomass of mammalian prey consumed by this raptor and during the dry season 61.0% and 68.0% (respectively); at Beza Mahafaly 78.0% and 69.3% (respectively); and at Zohin'Andavaka 30.0% and 32.2% (respectively). Hence, it is clear that in areas of gallery forest the prevalence of introduced mammals in the diet of the Barn Owl is notably higher than in areas of dry spiny bush. Whether this is a function of the relative densities of these introduced mammals associated with water availability, human perturbation of the environment or some other factors needs to be further investigated.

The forested areas around Beombe, in the general vicinity of the site the owl pellets were collected, have

Table 1. Prey remains identified from *Tyto alba* pellets collected near Beahitse, southwestern Madagascar. Non-native species are identified with an asterisk. Unless otherwise noted all individuals are adult. Mass data for taxa identified from the pellets were obtained from Raselimanana (unpubl.) for reptiles; Ravokatra *et al*. (2003) for birds; and Goodman *et al*. (2003), Ratrimomanarivo *et al*. (2007), and Goodman (unpubl.) for mammals. Total MNI =107 and calculated biomass for all prey remains was 2780 g.

Taxa	Mass (g)	MNI	% total individuals	% total biomass
Reptilia				
Large gecko	45	6	5.6	9.7
Total Reptilia		6	5.6	9.7
Aves				
Family Columbidae				
Oena capensis	37.7	2	1.9	2.7
Family Coraciidae				
Eurystomus glaucurus	148.6	3	2.8	16.0
Family Bernieridae				
Thamnornis chloropetoides	14.3	1	0.9	0.5
Family Turdidae				
Copsychus albospecularis	23.6	2	1.9	1.0
Sylvidae				
Nesillas lantzii	17.5	4	3.7	2.5
Cisticola cherina	9.6	4	3.7	1.4
Neomixis cf. *tenella*	7.0	2	1.9	0.5
Family Vangidae				
Leptopterus chabert	19.6	1	0.9	0.7
Family Dicruridae				
Dicrurus forficatus	47.1	10	9.3	16.9
Family Ploceidae				
Ploceus sakalava	23.8	8	7.5	6.8
Foudia madagascariensis	16.3	14	13.1	8.2
Total Aves		51	47.6	57.2
Mammalia				
Family Tenrecidae				
Geogale aurita	7.0	17	15.9	4.3
Family Soricidae				
Suncus madagascariensis	1.7	7	6.5	0.4
Family Molossidae				
Mops midas	42.8	1	0.9	1.5
Family Cheirogaleidae				
Microcebus griseorufus	63.0	5	4.7	11.3
Family Muridae				
*Mus gentilulus**	11.5	13	12.2	5.4
*Rattus rattus**				
Sub-adult	45.4	1	0.9	1.6
Adult	109.9	1	0.9	4.0
Family Nesomyidae				
Macrotarsomys bastardi	24.5	5	4.7	4.4
Total Mammalia		50	46.7	32.9

our knowledge not been the subjects of a vertebrate inventory. Hence, the species identified from the Barn Owl prey remains represent new distributional records for several taxa. The closest known localities that have been the subject of multi-disciplinary vertebrate inventories include the PN de Tsimanampetsotsa (50-100 m), Antabore (24°23.9'S, 43°50.8'E, 20-80 m), and Tongaenoro (24°44.2'S, 44°01.8'E, 120 m) (Goodman *et al*., 2002; Goodman & Wilmé, 2008). In all cases, these sites are at the foot of the western limit of the Mahafaly Plateau at a maximum elevation of 120 m, which is different than the Zohin'Andavaka site in the inland spiny bush and at elevations approaching 400 m. For the reptiles and birds identified from the pellets, there is no notable area and these data range-extension. In contrast, there are a few mammal taxa that were previously unknown from this immediate area and these data help to fill

in certain gaps in their geographic ranges (*Geogale aurita, Mops midas, Microcebus griseorufus,* and *Macrotarsomys bastardi*).

Prey remains found in Barn Owl pellets have been cited as an excellent means to examine the distribution of small mammals in a given area, as this predator randomly selects its prey falling within a certain size range (Andrews, 1990; Yom Tov & Wool, 1997). In recent years, several discoveries have been made with regards to small mammals in southwestern Madagascar. A large species of *Macrotarsomys*, *M. petteri*, was described based on a single specimen from the Mikea Forest (Goodman & Soarimalala, 2005). Soon thereafter, subfossils of this same species were identified from the Andrahomana Cave, to the west of Tolagnaro (Goodman *et al.,* 2006), some 450 southeast km from the site the holotype was collected. Further, from the same cave a new species of shrew tenrec, *Microgale macpheei,* was named (Goodman *et al.,* 2007). In both of these cases, the question remains, given that considerable areas of southwestern Madagascar had not been inventoried for small mammals, if remnant populations of these taxa occurred in this poorly known quadrant of the island. Given that both of these recently named animals fall within the size range of prey taken by Barn Owls and that they were not identified from the Zohin'Andavaka pellet remains, this would indicate that they probably do not exist in the immediate region of the site.

The Barn Owl prey remains identified from Zohin'Andavaka are the first to be analyzed from completely dry areas of inland and upland spiny desert of southwestern Madagascar. A comparison to other sites in the region in or near close proximity to gallery forest indicates that this owl has a plastic dietary regime. It is able to adapt to the availability of different prey animals associated with differences in local habitats, both as a function of seasonality and possibly human disturbance.

Acknowledgements

We are grateful to Olivier Langrand for his comments on an earlier version of this paper.

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