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New record, ranging behaviour, vocalization and food of the Madagascar Red Owl *Tyto soumagnei*

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The rare Madagascar Red Owl *Tyto soumagnei* was captured, radio tagged and released for study in October 1994. It ranged within an area of 210 ha from October to December 1994, and 50% of the locations were along forest edge and newly created tavies, 36% in rice fields and 14% in cultivated tavies. Nine diurnal roost sites were documented in small ravines among secondary vegetation and bananas (*Masu* sp.). The owl used dense canopy-covered roosts that averaged 3.7 m above the ground and were extremely close to tavies, averaging 9.8 m. The 17 regurgitated pellets collected contained 27 individual vertebrates representing native small mammals of the families Tenrecidae and Muridae. The owl's vocalization was similar to that of the Barn Owl *Tyto alba*. This new record on Masoala Peninsula at sea level substantially extends the species potential range in Madagascar, and our observations of behaviour and habitat use contradict previous descriptions of the species as a primary forest obligate.

The Madagascar Red Owl *Tyto soumagnei* is considered to be one of the rarest endemic bird species in Madagascar (Langrand 1990) and one of the most endangered owls of the world (Clark *et al.* 1978, Langrand & Meyburg 1984). Until recently, it was known from only eight museum specimens (Halleux & Goodman 1994) collected before 1935, a reliable sighting in 1973 of a bird near Analamazaotra (King 1979) and the discovery of a captive individual near Réserve Spéciale d'Anjanaharibe-Sud and Reserve Naturelle Intégrale de Marojejy in northeastern Madagascar (Halleux & Goodman 1994). All these records came from forests above 900 m (King 1979, Langrand 1990, Halleux & Goodman 1994).

On 22 February 1994, a Madagascar Red Owl was discovered near sea level on the Masoala Peninsula 2 km east of the village of Ambanizana (15°37'S, 49°58'E) by two local villagers. The men responded to The Peregrine Fund's nest reward program by taking us to the site where the owl was roosting by day. The identity of the owl was verified by R.T. from Langrand (1990), and photographs were taken for documentation. Later, O. Langrand (pers. comm.) confirmed the identification from the photos. In October 1994, R.T. returned to the same site and located a Madagascar Red Owl perched 20 m away from the earlier sighting in February. This individual was trapped, radio tagged and released for study on 9 October 1994 in an attempt to learn more about its habitat preferences, food habits and ranging behaviour and to assist in developing a conservation plan for this rare species.

STUDY AREA AND METHODS

The roost site where the Madagascar Red Owl was trapped was 2 m above mean sea level. The owl was perched 10 m above the ground over a riverine slough that fluctuated from tidal influences. The slough substrate consisted of mud and was bordered by Giant Bamboo *Ochlandra capitata* and other native vegetation. At the slough's southern edge, mixed primary forest and tavies (deforestation from slash-and-burn farming for subsistence and commercial agriculture) began. To the east and west of the slough were rice paddies, and a large river ran to the north. The slough was crossed daily by local people travelling to and from Ambanizana. On the hilly slopes to the south, tavies were worked for the production of cloves, sugar cane, ginger, vanilla and bananas and for cattle pastures. The habitat within the owl's home range was a mixture of intact primary forest, secondary vegetation, a large river, tavies and rice paddies.

The bird was trapped at a roost site with the use of a net attached to a long bamboo pole. It was measured (nearest 1.0 mm), weighed (nearest 1.0 g, Pesoala 500-g spring scale), ringed and fitted with a backpack-mounted radio transmitter (Holohil Systems Ltd, Canada). We waited 1 day to allow the owl to adjust to the harness and began radio tracking on 10 October. The bird was followed through the night (18.30–05.00 h), and its position was recorded usually once or twice each night with a global positioning system (GPS, Ensign, Trimble Navigation). Vocalizations were recorded with a Sony Walkman W6M, with the use of a Sennheiser MZA 14 P48U studio microphone, and sona-

Table 1. *Roost type, use and habitat variables measured at nine Madagascar Red Owl roost sites*

Roost number	Roost tree type	Frequency of use		Roost tree diameter (cm)	Roost tree height (m)	Diameter at roost height (cm)	Roost height (m)	Slope (°)	Aspect (°)	Canopy coverage (%)	Distance to human habitation (m)	Distance to tavy (m)	Altitude (m)
		%	*n*										
1	*Masu* sp.	11	3	65	4	3	3.0	40	130	94	300	3	2
2	Palm	18	5	50	10	10	3.5	20	330	95	50	10	35
3	Vine	43	12	35	4	10	4.0	30	70	79	50	5	30
4	Palm	11	3	85	12	3	5.0	35	305	89	150	5	5
5	*Rhus taratana*	4	1	45	5	4	4.5	35	225	74	150	12	10
6	*Masu* sp.	4	1	35	5	15	2.0	50	120	81	300	10	150
7	*Dimoerpha* sp.	4	1	25	10	3	4.0	10	240	85	500	20	170
8	*Masu* sp.	4	1	30	5	10	4.0	30	310	70	300	20	2
9	*Masu* sp.	4	1	35	6	15	3.0	35	130	90	300	3	2
Mean				45	6.7	8	3.7	31.7	172	84	233	9.8	45
s.d.				19	3.0	5	0.9	11.4		8.7	146	6.6	66.5

grams were produced with the use of MacSpeech Lab 2.0 computer software. Home range area estimations were made with the program Ranges IV (Kenward 1990).

Regurgitated pellets found below three roost sites were dissected dry (Marti 1987, Sabo & Laybourne 1994). Fur was separated from bones, dentary bones were paired to give a count of the minimum number of individuals and reference skeletal collections from the Vertebrate Paleontology Department of the University of Antananarivo were used to identify species.

The habitat characteristics measured at each roost site were the tree species (if known), roost tree height and diameter at breast height, roost height and tree diameter at roost height, ground slope and aspect at roost tree, canopy coverage taken below the roost site by densiometer, distance to the nearest human habitation and tavy and roost site altitude.

RESULTS

Measurements and description

The Madagascar Red Owl in this study weighed 323 g, had a body-length of 275 mm, unflattened wing-length of 209 mm, tail-length of 100 mm, tarsus-length of 56.6 mm and width of 6.0 mm and beak-length from the cere of 11.6 mm. The eye colour was sooty black, cere colour flesh, beak pale grey and feet smoke grey. The owl was growing new feathers at primary P7 of 10 counted from inside to outside. Of the 12 tail feathers, five were one-third grown.

Ranging behaviour

The Madagascar Red Owl was located 22 times at night from 10 October to 27 November. The maximum convex polygon home range for this bird was 210 ha, which includes all roost sites. Fifty percent (n = 11) of the 22 locations were in forest edge/tavy habitat, 36% (n = 8) in rice paddies (dry and flooded) and 14% (n = 3) in large tavies. The owl was never radio located in the mature forest stands. Generally, the owl would return to its day roost by 04.30 h in the morning (sunrise was at about 05.00 h).

Roost sites

The Madagascar Red Owl was located on 28 days at nine different diurnal roosts. All roost sites were located in ravines and were characterized by degraded primary and secondary vegetation, typically in densely vegetated forest edge. Roost 3, a vine, was used most often (Table 1). Bananas represented four of the nine diurnal roost trees (see Fig. 1). Although roost sites were usually near the top of the tree, they were low, averaging 3.7 m above ground, on steep inclines, below dense canopies averaging 84% canopy coverage, situated near human habitation and an average of 10 m from tavies (Table 1).

Frequently, we discovered this individual on its diurnal roost, resting with a large leaf positioned umbrellalike overhead and touching the owl. Occasionally, the owl was squeezed between several large leaves and had to squirm out of its diurnal roost prior to the evening exit. Large leaves may offer protection from the frequent precipitation that occurs in this area. The precipitation records at Andranobe Field Station, 7 km south of the study area, show ranges from 6000 mm to 6600 mm annually (Borge & Watson 1993 and pers. obs. 1994). Weather may influence selection of diurnal roost sites by this individual. Using roost 3 as the centre of this owl's range, six roosts were from 20 m to 100 m away, and two roosts were 400 m and 1800 m distant.

Figure 1. Madagascar Red Owl at a roost site.

Food habits

Seventeen regurgitated pellets were found intact below the roosts. All pellets contained small native mammals from two families, Tenrecidae and Muridae. A minimum of 27 individuals were identified as follows: Shrewlike Tenrecs *Microgale talazaci* (n = 6), *Microgale* sp. (n = 1), small rodents *Eliurus webbi* (n = 11) and *Eliurus minor* (n = 4), unidentified fossorial insectivores, possibly Rice Tenrecs *Oryzorictes* sp. (n = 4), and the Black Rat *Rattus rattus* (n = 1).

Vocalization

One vocalization type, a screech, was heard and recorded for the Madagascar Red Owl during this study (Fig. 2). The screech was approximately 1.5 s long. It maintained a level frequency until it slightly decreased at the end of the call. During October and November, the owl usually called one or two times just as it left the roost, when it flew again after leaving the roost area and sometimes in the night in response to a second Madagascar Red Owl in the vicinity. In December, the owl ceased calling as it left its roost. The calls

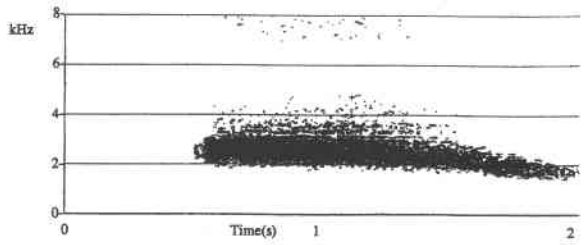

Figure 2. Narrow band spectogram of the screech call of the Madagascar Red Owl.

sounded similar to the eerie screech of the Barn Owl *Tyto alba* but were more vigorous.

DISCUSSION

All previous records of the Madagascar Red Owl were at altitudes above 900 m. This study provides the first record for this species at sea level, which extends its known altitudinal distribution substantially. It is also the most eastern location for this species and again extends its potential distribution throughout the Masoala Peninsula forest block.

The Madagascar Red Owl has been reported to occupy strictly undisturbed rain forests (Langrand 1990). Our radio-tagged bird ranged and hunted over human-altered habitat: rice paddies, tavies, clove groves and edges of intact forests. We have subsequently detected Madagascar Red Owls in other disturbed habitat sites. For example, during October 1995, R.T. heard two different Madagascar Red Owls calling over tavies on the east side of the Masoala Peninsula at Antafononona (15°25′S, 50°11′E) and Voakoanaoina (15°46′S, 50°13′E), 25 km and 35 km east of the study area, respectively. Hunting along edges of intact forests and along fencelines in rice fields is similar to the behaviour observed in Barn Owls in Scotland (Voous 1988, Taylor 1994), where perches offered by forest edge trees and fencelines were thought to be important.

We believe the bird from this study was a female because its measurements are comparable to those of a slightly emaciated adult female that died in captivity weighing 245 g (Halleux & Goodman 1994; Table 2). At present, the other bird associated with this radio-tagged bird has not been trapped. The morphological measurements of this owl—relatively long wings, long legs and short tail—are similar to those of some Barn Owl subspecies that are adapted for hunting over open areas, grasslands and patchy, scrublike habitats (Taylor 1994) and are consistent with our observation that the species foraged over open ground.

The Madagascar Red Owl has been reported to eat mostly frogs (Langrand 1990, Halleux & Goodman 1994), but we found no remains of frogs in regurgitated pellets. The diet of Barn Owls found in eastern rain forests of Madagascar consisted mainly of small introduced rodents *Mus* and *Rattus* by frequency and biomass (Goodman *et al.* 1993). Our analysis of Madagascar Red Owl pellets showed a diet almost

Table 2. *Measurements of two male and one known female Madagascar Red Owl compared with the Madagascar Red Owl from this study*

Museum[a] and number	Locality	Sex	Wing-length (mm)	Tail-length (mm)	Tarsus-length (mm)
AMNH 458989	Forêt de Lakato	Male	222 (flattened)	93	53.8
MNHN 1932.3795	Analamazaotra	Male	215 (flattened)	93	54.3
FMNH 363792	Andapa	Female	190 (worn)	97	58.7
This study	Ambanizana	Female?	209 (normal)	100	56.6

[a] AMNH = American Museum of Natural History (New York), MNHN = Museum National d'Histoire Naturelle (Paris), FMNH = Field Museum of Natural History (Chicago).

exclusively of small native mammals. *Eliurus minor* and *E. webbi* (weight range = 35–103 g) have been reported to prefer heavily forested areas and to be burrowers (Grzimek 1975). *Microgale talazaci* (weight range = 39–61 g) is a surface forager, active by day and night, which prefers dense vegetation and uses extensive tunnel systems, as well as regular runways on the surface (Eisenberg & Gould 1970, Nowak 1991). At the Réserve Spéciale d'Analamazaotra (Périnet), an eastern rain forest of Madagascar that lies at 1000 m, *Eliurus* spp. were trapped more frequently in undisturbed primary forest, while *M. talazaci* was abundant in disturbed forests (Stephenson 1993). Although the behaviour of these prey species suggests that they are forest dependent, our observations of Madagascar Red Owl foraging behaviour indicate that they were captured along forest edges in fragments of primary and secondary forest and other human-modified habitats.

The vocalization of the Madagascar Red Owl has been reported to be a *wac-wac-wac* and a single, explosive call (Burton 1973) and *wok-wok-wok* (Langrand 1990). We heard and recorded only what may be described as an explosive call, a high, eerie, screech call similar to that of the Barn Owl.

The information we collected during this study is contradictory to previous accounts of the Madagascar Red Owl's normal habitat and foraging behaviour and suggests the owl is not a strict forest-obligate species as previously believed. Since the Madagascar Red Owl and the Barn Owl appear to have similar behaviour, calls and habits and occupy similar habitat types, we suspect that observers may have confused the two species, especially where they are sympatric. More research is needed to determine the distribution and status of these species and to what extent their diets, behaviour and habitats overlap. Future surveys of the Madagascar Red Owl should not search exclusively inside intact undisturbed forests but also along forest edge habitat, and great care will be needed to distinguish the two species in the wild.

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