

Monastic *Myzopoda*: the foraging and roosting ecology of a sexually segregated Malagasy endemic bat

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Abstract

We studied the social organization, use of foraging habitat, roost switching and diet of the sucker-footed bat *Myzopoda aurita* in south-eastern Madagascar. All 138 bats caught were males, 18 of which were selected for radio-tracking. The areas individual bats used for foraging varied between 7 and 108 ha (100% minimum convex polygon). Bats foraged close the roost for the first hour after emergence, then travelled up to 1.8 km away. Compositional analysis revealed that they selected coffee plantations, degraded humid forest and wooded grassland more than any other habitats. All 133 roosts located consisted of the partially unfurled leaves of *Ravenala madagascariensis* and housed between nine and 51 individuals. Bats changed roosts every 1–5 days. Their diet comprised mainly of Lepidoptera and Coleoptera. No ectoparasites were observed. *Myzopoda aurita* is one of the few mammals endemic to Madagascar that uses disturbed patches of vegetation and is not therefore threatened by deforestation, although it may be affected by loss of roosts for building materials. The search for females continues.

Introduction

Madagascar is a critical priority for international conservation efforts, based on levels of endemism, species diversity and human threat (Groombridge & Jenkins, 2002; Goodman & Benstead, 2005). Madagascar is also unique in that one-third of its 39 bat species have been described in the last decade, although little is known of their ecology (Racey, Goodman & Jenkins, 2009). In particular, their habitat requirements are poorly known and such information is important for conservation managers seeking to establish priorities.

The chiropteran family Myzopodidae is endemic to Madagascar and was previously thought to be monospecific and rare, represented by *Myzopoda aurita* (Hutson, Mickleburgh & Racey, 2001) generally recorded from single individuals caught in eastern humid forests (Schliemann & Goodman, 2003). A second species, *Myzopoda schliemanni* was recently identified from the central western lowlands (Goodman, Rakotondraparany & Kofoky, 2006), and its diet determined (Rajemison & Goodman, 2007).

Hutson *et al.* (2001) considered *M. aurita* to be a species of special conservation concern, largely because of its

perceived rarity and because so little was known about its distribution. It was classified as Vulnerable in the 2000 IUCN Red List of Threatened Species but is now known to be more abundant and has been reclassified as of Least Concern (IUCN, 2008).

Little is known about the ecology of *M. aurita* although on the basis of a single observation by H. Hoogstraal of its roosting in the partially unfurled central leaf of the Traveler's tree *Ravenala madagascariensis* (Family Strelitziaceae), such a roosting association has long been inferred (Schliemann & Goodman, 2003). The presence of adhesive pads on the elbows and wrists of *Myzopoda*, a character unique among Old World bats but shared with four neotropical species of the Thyropteridae, aids roosting on the smooth leaves of *R. madagascariensis* (Riskin & Fenton, 2001; Riskin & Racey, 2010).

The discovery of a site in eastern Madagascar where *M. aurita* can reliably be caught (G. K. Creighton, L. Emmons & J. Ryan, unpubl. data, in Schliemann & Goodman, 2003) led to this study, the first on the ecology of the species. Our aim was to investigate its foraging and roosting ecology and social organization.

Methods

Study area

Myzopoda aurita was studied in and around the coffee research station operated by the Malagasy agricultural extension agency FOFIFA (Foibe Fikarohana ampiarina amin'ny Fampanandrosoana ny eny Ambanivohitra) at Kianjavato (21°22'S, 47°52'E; 35–250 m a.s.l.), a town of about 1000 people situated in the valley of the Fotobohitra river. The most important crops in the valley are bananas, rice and coffee. Although the hilltops are covered with humid forest, much of the valley has been cleared and the hillsides are dominated by dense stands of *R. madagascariensis* and bamboo (Family Poaceae) (Goodman *et al.*, 2006). *Ravenala madagascariensis* is a pioneer plant endemic to Madagascar, which grows to a height of 10–20 m with leaves 2–3 m long. The latter are banana-like, with two ranks fanning outward either side of the palm-like trunk. There is no dry season in the southeast but the rainfall is lower from August to December. The mean annual rainfall is 189 mm and the

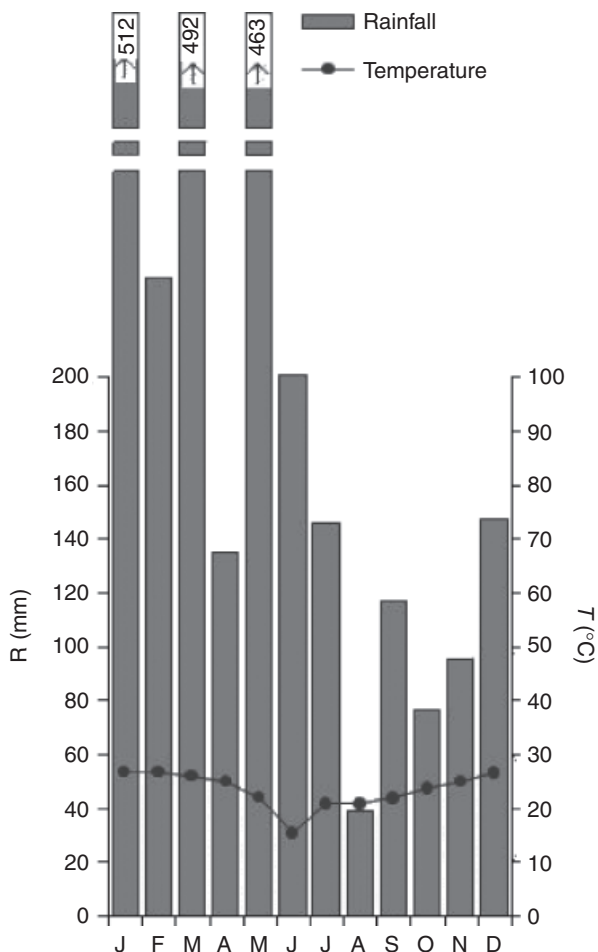


Figure 1 Mean monthly temperature ($^{\circ}\text{C}$) and rainfall (mm) at Kianjavato as recorded at the nearest weather station (Mananjary) from 2003–2004.

mean temperature is 23°C (Fig. 1). The study areas considered for habitat selection were defined as minimum convex polygons (MCP; Harris *et al.*, 1990; Kenward, 2001). Habitat data were supplemented by a field survey and digitized onto ArcView GIS 3.2 (Fig. 2).

Field surveys revealed the following habitat types:

1. Coffee plantation: mainly coffee bushes (*Mascarocoffea* sp., *Arabusta* sp., and *Canephora* sp.), with *R. madagascariensis* and other large trees.
2. Degraded lowland humid forest: consisting mainly of *R. madagascariensis*, a few large trees and bamboo.
3. Intact humid forest: little evidence of tree felling, fire and invasion by *R. madagascariensis*.
4. Wooded grassland: includes open sites, with grass, some bamboo and fruit trees (litchis, mangoes).
5. Rice paddy: occurs throughout the valley.
6. Banana field: either as a monoculture or combined with coffee.
7. Habitation: the small town of Kianjavato.

Mist netting

Myzopoda aurita was captured with mist nets set from ground level to a height of 3.5–4 m across vehicle tracks in the FOFIFA station and in the valley 8 km to the east and to the west of Kianjavato. Five mist nets, three 6 m and two 9 m (36 mm mesh), were set at dusk until 21:00 h on 21 nights during four field trips: October–November 2007 (five nights), February–March 2008 (five nights), July–August 2008 (five nights) and October–November 2008 (six nights). On three nights during the last two visits, nets were left in place all night. We recorded age, sex, morphological measurements and reproductive state of the captured bats. External genitalia were examined for indications of reproductive condition. Bats with unfused phalangeal epiphyses were regarded as juveniles. The fur and wing membranes were inspected for ectoparasites (Anthony, 1988; Racey, 2009). Adult bats were marked with colored plastic forearm bands, and the wings of juveniles were tattooed to identify recaptures.

Radio tracking

Radio tags (model LB-2; Holohil Systems, Carp, ON, Canada) with frequency range 173.000–173.499 MHz were glued to the shaved interscapular area of 20 adult bats, using Torbot Bonding Cement (Torbot Group, Inc., Cranston, RI, USA) (Table 1). Transmitters weighed 0.48 g and <5% of bats' body mass, and had an expected battery life of 12 days. Bats fitted with transmitters were adults and not tracked until the following night (Bonaccorso *et al.*, 2002). Signals from the transmitters were monitored with two Telonics TR-4 (Telonics Inc., Mesa, AZ, USA) receivers and three-element Yagi antennae to pinpoint locations (Uda & Mushiako, 1954; Kenward, 2001). Each night, one bat was tracked by walking to determine the home range of the species. Individual bats were tracked from dusk to 21:00 h,

to establish foraging areas and all night to additionally locate the roost sites used at the end of foraging.

Night fixes were determined by triangulation (Kenward, 2001): two teams, in continuous contact using hand-held

FM-radios, simultaneously recorded information on the position and direction of the bats every 5 min (Bontadina, Schofield & Naef-Daenzer, 2002). Bearings were taken with a handheld compass to the nearest degree (Bernard &

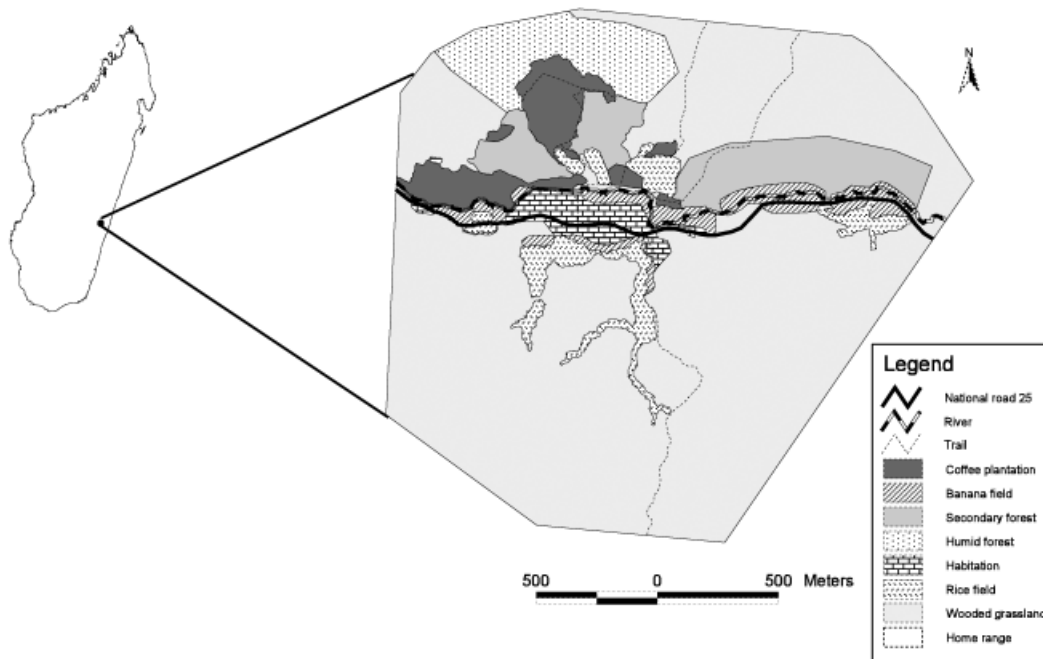


Figure 2 The habitat composition of the study site at Kianjavato. The study area is delimited by the minimum convex polygon enclosing all locations, roosts and capture sites of the bats followed during the entire study.

Table 1 Details of radio-tracked *Myzopoda aurita* in Kianjavato during four field surveys in 2007–2008

Period	ID	Weight (g)	Date captured	Number of days	Number of fixes	MCP (ha)	Number of roosts	Roosts in core area (%)
October–November 2007	AM443	10.5	22/10/07	5	122	86.2	14	93
	AM24	9.5	24/10/07	5	159	22.74	12	0
	AM164	10.0	25/10/07	3	54	17.78	10	0
	AM380	9.0	26/10/07	6	117	45.67	10	10
February–March 2008	AM63	9.5	22/02/08	6	136	8.78	14	3
	AM422	9.5	22/02/08	4	102	9.79	13	77
	AM332	9.5	03/03/08	5	90	100.43	5	0
	AM103	10.0	12/03/08	5	136	14.76	10	20
	AM233	9.5	20/03/08	5	115	11.73	4	0
July–August 2008	AM495	9.5	05/07/08	4	133	35.29	7	29
	AM501	9.5	05/07/08	4	144	24.51	8	0
	AM182	10.0	14/07/08	5	97	23.35	0 ^a	0 ^a
	AM242	10.0	20/07/08	5	111	21.59	7	100
	AM181	9.5	24/07/08	3	127	4.36	0 ^a	0 ^a
October–November 2008	AM202	10.0	01/11/08	5	94	65.24	9	0
	AM101	10.0	01/11/08	4	66	107.76	3	0
	AM161	9.6	06/11/08	4	64	103.7	3	0
	AM471	9.4	06/11/08	4	86	63.47	8	0

^aRoost not located.

AM, adult male.

Fenton, 2003) and locations were plotted on a map using MAP SOURCE software (Version 6.0, Garmin, Olathe, KS, USA). The precision of the fixes was estimated using the location error method (Zimmerman & Powell, 1995): the linear distances between actual and estimated locations of the roost were measured in the study site during the day.

Home-range analyses were conducted in ArcView 3.2® (Environmental Systems Research Institute, Redlands, CA, USA, <http://www.esri.com>), with the Animal Movement extension (Hooge & Eichenlaub, 1997). The home range was defined by all positions, including roost sites and night fixes, as the MCP (100% MCP). The maximum foraging distance was determined as the distance between the roost site and the furthest fix for each tracking session (Bontadina *et al.*, 2002). The core area is defined as the part of the range where most activity is concentrated (Wray, Cresswell & Rogers, 1992).

Habitat selection was determined by compositional analysis (Aebischer, Robertson & Kenward, 1993). Use and availability of habitats was compared in two stages. First, an individual's foraging range selection was examined, and then habitat use within that foraging range. All foraging fixes for each bat were delimited by MCPs and a map of the study area showing the fixes was generated with ArcView GIS 3.2. The percentage habitat composition within each MCP was then calculated (Smith & Racey, 2008). Habitat preferences within the range of the population studied and within each individual range were analyzed by compositional analysis (Aebischer *et al.*, 1993) on the EXCEL macro COMPOS ANALYSIS version 6.2 plus (Smith, 2005).

Roosting associations

Roosts were located using the homing-in method (White & Garrott, 1990; Russo, Jones & Migliozzi, 2002): the observer followed the strongest signal until the bat was located inside the roost. Attempts were made to estimate how many bats were present using binoculars and cameras.

On five occasions, a temporary platform was constructed around the tree and a large sack was dropped over the distal end of the partially unfurled central leaf of *R. madagascariensis* with bats inside. The sack was closed and the stem cut.

Insects

Available prey was assessed with a malaise trap set in the foraging area at dusk until 06:00 h on 18 nights. Insect catches were preserved in 70% alcohol and subsequently sorted to family by reference to keys (Scholtz & Holm, 1985; Delvare & Aberlenc, 1989; Chinery, 1993; Shiel *et al.*, 1997; McGavin & Lewington, 2001).

Fecal analysis

Diet was determined by fecal analysis. Captured bats were removed from the net and individually placed in cloth bags

for at least 1 h during which faeces were voided. Fecal pellets were preserved in 70% alcohol and insect fragments later identified to order using a binocular microscope by referring to trapped insects and keys. The average percentage volume of each order in the total sample was estimated according to Whitaker, McCracken & Siemers (2009).

Results

Bat captures

A total of 138 *M. aurita* was captured on 24 nights of mist netting (5.7 ± 4.8 SD individuals per night), involving 36 net metre hours (2×9 and 3×6 m) each night during the four fieldwork sessions, and all were males (72 adults and 26 juveniles, plus 40 recaptures). Bats were captured at a height of 1.5–2.5 m from the ground.

There were no significant differences in body mass and forearm measurements of the bats caught from October to November between 2007 and 2008 (ANOVA body mass: $F_{1,77} = 0.05$, $P = 0.82$; forearm: $F_{1,76} = 0.23$, $P = 0.64$) and data from these periods were pooled in further analyses.

Body mass of adult males differed significantly between seasons (ANOVA $F_{2,104} = 4.87$, $P = 0.0095$) and the bats were significantly heavier in July–August compared with October–November (Fisher's PLSD $P = 0.031$). There was no seasonal difference in the mean length of adult male forearms (ANOVA $F_{2,104} = 1.64$, $P = 0.19$) which varied between 46.1 mm and 50.2 mm (mean = 48.2 SE ± 0.08).

Juvenile males were caught only during February–March and October–November and there were no significant differences in body weight and forearm measurements between these periods (ANOVA body mass: $F_{1,27} = 0.08$, $P = 0.77$; forearm: $F_{1,27} = 1.38$, $P = 0.25$), but adult males were significantly heavier than juveniles (ANOVA body mass: $F_{1,114} = 4.96$, $P = 0.03$) (Fig. 3).

The testes of males ($n = 83$) examined during October–November appeared larger than at other times, although seasonal variation was not pronounced.

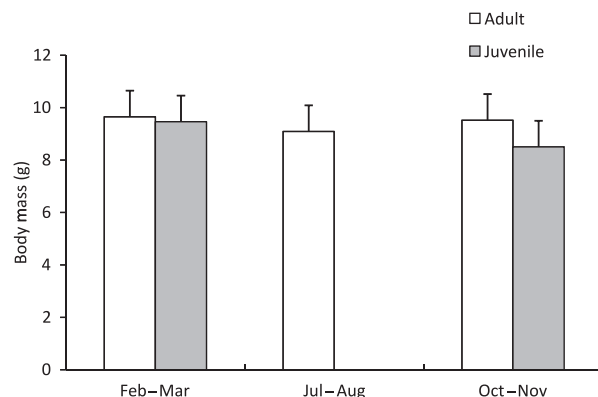


Figure 3 Comparison of the body mass of *Myzopoda aurita* captured in Kianjavato during four fieldwork sessions.

Home range

A total of 1957 fixes was accumulated from 18 radio-tagged bats during tracking sessions that lasted between one and six nights (Table 1). Two of the tagged bats were not located in the study area. The home range of an individual is defined when the plot of the area of the home range versus the number of fixes had reached an asymptote, as for example with 30 locations for AM443 and 60 locations for AM471 (Fig. 4).

Foraging ranges determined by the MCP method were between 4 and 108 ha (Fig. 5). The total area used by the 18 *M. aurita* at Kianjavato was 389 ha and comprised 70% wooded grassland, 8% degraded forest, 6% humid forest, 5% coffee plantations, 4% rice paddy, 4% banana plantations, and 3% habitation.

Initially bats foraged close to the roost for the first hour after emergence, then moved further afield and returned after 03:00 h (Fig. 6). The average maximum distance travelled from the roost on one night ($n = 18$) was 862 m and the furthest recorded was 1.8 km.

Foraging habitat

Comparison between habitat composition of individual foraging range MCPs and study area MCPs showed that *M. aurita* did not select foraging areas at random (compositional analysis, $\lambda = 0.3394$, $\chi^2_6 = 19.4516$, $P < 0.01$, randomization $P = 0.0140$) so habitat rankings were determined. The simplified rank order was established (from 6 to 0; Table 2a): Coffee plantation \ggg Degraded humid forest $>$ Rice paddy $>$ Intact humid forest $>$ Wooded grassland $>$ Banana fields $>$ Habitation (\ggg denotes a significant difference between adjacent habitat types). The ranking matrix (Table 2a) showed that the most preferred habitat was the coffee plantation followed by degraded humid forest and this was significantly preferred to wooded grassland, banana fields and habitation.

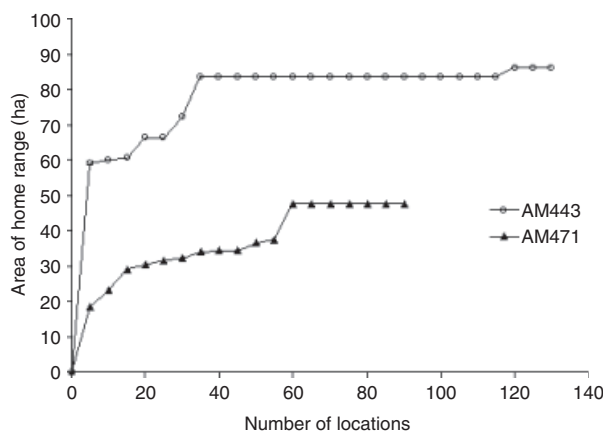


Figure 4 Cumulative area of home range with the number of locations of two individuals of *Myzopoda aurita*.

The second comparison revealed that the bats use of the seven habitats, based on time, differed significantly from the composition of habitats within their MCP foraging ranges (compositional analysis, $\lambda = 0.4685$, $\chi^2_6 = 13.6498$, $P < 0.05$, randomization $P = 0.0120$). A ranking matrix (from 6 to 0; Table 2b) ordered the habitat types in sequence from most to least selected as follows: Wooded grassland $>$ Coffee plantation $>$ Intact humid forest $>$ Degraded humid forest $>$ Banana field $>$ Rice paddy $>$ Habitation (where a habitat preceding a ' $>$ ' symbol was preferred to that immediately following the symbol). Wooded grassland and coffee plantation, the two highest ranked habitats, were preferred over habitation and rice paddy, the two lowest ranked habitats (Table 2b).

Wooded grassland represents 70% of the study area and bat spent most time there. However the number of fixes (used in the estimation of home range) in this habitat was less than in coffee plantation, degraded humid forest, rice paddy and intact humid forest.

Roosting habits

We found 133 roosts for 18 radio-tagged bats (Table 1), 70% by the close approach method and 30% by triangulation.

All the identified roosts were in partially unfurled leaves of *R. madagascariensis*, 55 of which were located in coffee plantations, 31 in degraded forest, six in humid forest and one in wooded grassland. Bat switched roosts after a mean of 1.4 ± 0.76 days (\pm SD, range 1–5 days, $n = 133$) when the leaf completely unfurls. The mean numbers of *M. aurita* caught inside five unfurled leaves was (\pm SD) 19.8 ± 17.7 (range 9–51 individuals per roost, $n = 5$).

Diet

Analysis of fecal pellets revealed seven orders of insects and 80% of the diet was comprised of 79% Lepidoptera and 12.5% Coleoptera (Fig. 7a). There was significant variation of the proportions of these orders in the diet between seasons (Kruskal–Wallis, $P = 0.05$ for Lepidoptera, and $P = 0.01$ for Coleoptera).

The total number of insects trapped in February–March was higher than in any other fieldwork session. Eight orders were identified from the traps (Fig. 7b), and the majority (75%) were Diptera and Lepidoptera. During winter (July–August), the number of insects captured decreased.

Ectoparasites

No ectoparasites were observed on any *M. aurita*.

Discussion

Two extraordinary facts have emerged from this study: the absence of females from the study area and ectoparasites from the bats.

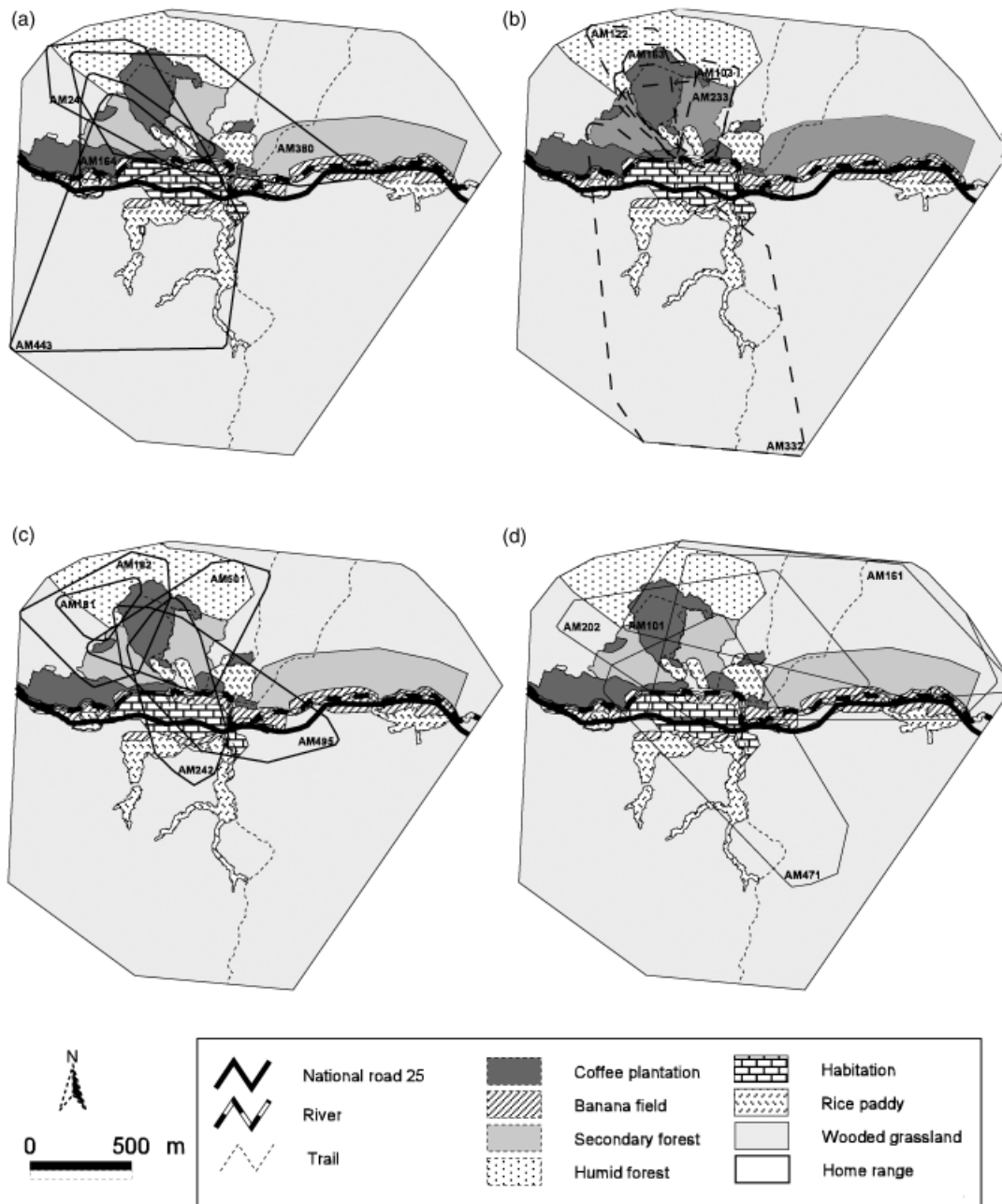


Figure 5 Individual home range (minimum convex polygons) of 18 *Myzopoda aurita* tracked in (a) October–November 2007, (b) February–March 2008, (c) July–August 2008 and (d) October–November 2008. Letters correspond to the bats in Table 1. The study area is delimited by minimum convex polygons enclosing all locations, roosts and capture sites of the bats followed during the entire study.

Sexual segregation

Sexual segregation of roosting insectivorous bats commonly occurs during pregnancy and lactation but is less common in foraging areas. However, several studies (Russo, 2002; Encarnação *et al.*, 2005; Senior, Butlin & Altringham, 2005) have reported that male Daubenton’s bat *Myotis daubentonii* are found at higher altitudes than females and relate this to resource quality. Barclay (1991) reported that >90% of the

little brown bats *Myotis lucifugus* caught during summer on the eastern slopes of the Rocky Mountains in Canada, which are characterized by low ambient temperatures and insect abundance, were males and suggested that such areas cannot support the higher reproductive energy demands of females.

However, Kianjavato is at low altitude and insects were abundant. The fact that juveniles with unfused epiphyses were found in the study area suggests that juvenile males leave their mothers after weaning and join adult males. No

females were however caught when mist nets were deployed 8 km upriver and downriver from Kianjavato, at sites with abundant *R. madagascariensis*. Future research will extend the search for females.

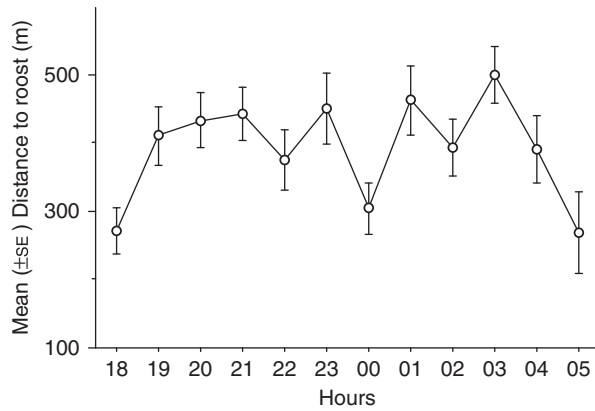


Figure 6 Mean distances of *Myzopoda aurita* from the roost sites to the foraging areas at Kianjavato.

Ectoparasites

The total absence of ectoparasites on the bats is most likely a consequence of their roosting habits, since the smooth surface of the *R. madagascariensis* leaves cannot harbor arthropods. Timm (1987) noted that bats may escape parasitism by using less permanent, more exposed, or marginally suitable roosting structures. The roost switching of *M. aurita* appears to be driven by the unfurling of the *R. madagascariensis* leaf, and may help to reduce parasite loads (Lewis, 1995; Reckardt & Kerth, 2005), but cannot alone account for their total absence, since species which switch roosts frequently (e.g. *Myotis nattereri*, Smith & Racey, 2008) retain an appreciable ectoparasite burden.

Roost switching

Our results are similar to those of Yasui *et al.* (2004) who observed that *Myotis ikkonikovi* changed roosts every 1 or 2 days, and roosts tended to be close to one another. Other studies confirm that species occupying less permanent roosts, such as developing leaves, have low roost fidelity (Kunz & Lumsden, 2003; Willis & Brigham, 2004; Chaverii

Table 2a Ranking matrix for *Myzopoda aurita* based on comparing proportions of habitats occurring within 18 individual range minimum convex polygons and the study area

	Banana field	Habitation	Coffee plantation	Degraded humid forest	Rice paddy	Intact humid forest	Wooded grassland	Rank
Banana field		+	---	---	---	-	-	1
Habitation	-		---	---	-	-	-	0
Coffee plantation	+++	+++		+++	+++	+++	+++	6
Degraded humid forest	+++	+++	---		+	+	+++	5
Rice paddy	+++	+	---	-		+	+	4
Intact humid forest	+	+	---	-	-		+	3
Wooded grassland	+	+	---	---	-	-		2

The signs show whether the habitat category placed in the corresponding row was more (+) or less (-) important than the corresponding column of the matrix. A triple sign (+++ or ---) indicates a significant ($P < 0.05$) difference between the two habitat categories. One sign (+ or -) shows a non-significant trend. Relative importance of the different habitat categories (Rank) was determined by the number of + and +++ signs occurring in rows. Habitats were ranked according to their importance from zero (least important) to six (most important).

Table 2b Ranking matrix for *Myzopoda aurita* based on comparing percentage of time bats spent in each habitat with the percentage of habitats occurring within 18 individual range minimum convex polygons

	Banana field	Habitation	Coffee plantation	Degraded forest	Rice paddy	Humid forest	Wooded grassland	Rank
Banana field		+	-	-	+	-	-	2
Habitation	-		---	-	-	-	---	0
Coffee plantation	+	+++		+	+++	+	-	5
Degraded humid forest	+	+	-		+	-	-	3
Rice paddy	-	+	---	-		-	---	1
Intact humid forest	+	+	-	+	+		-	4
Wooded grassland	+	+++	+	+	+++	+		6

The signs show whether the habitat category placed in the corresponding row was more (+) or less (-) important than the corresponding column of the matrix. A triple sign (+++ or ---) indicates a significant ($P < 0.05$) difference between the two habitat categories. One sign (+ or -) shows a non-significant trend. Relative importance of the different habitat categories (Rank) was determined by the number of + and +++ signs occurring in rows. Habitats were ranked according to their importance from zero (least important) to six (most important).

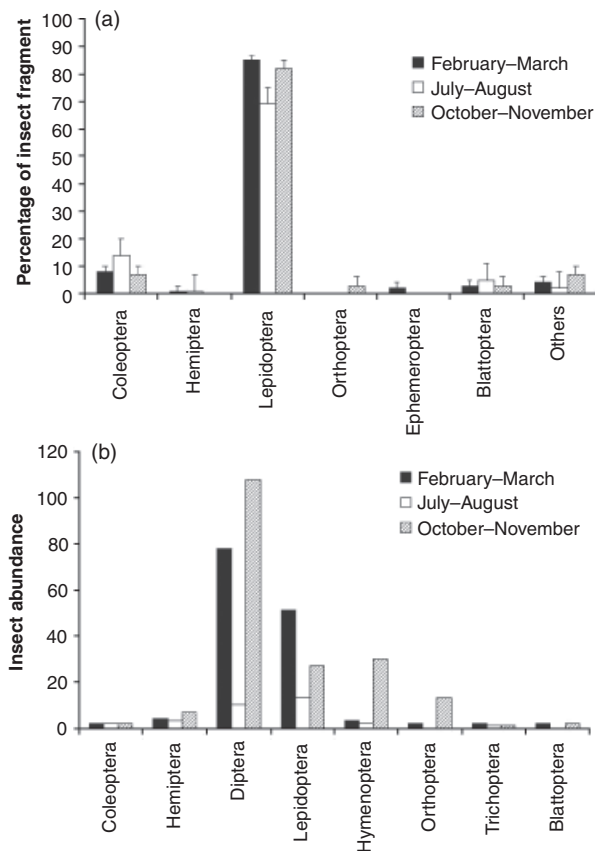


Figure 7 (a) Percentage volume of insects identified in *Myzopoda aurita* faeces collected at Kianjavato. (b) Mean insect abundance during the four fieldwork sessions at Kianjavato.

& Kunz, 2006). Roost switching, however, may help prevent detection of roost sites by predators (Winkelmann, Bonaccorso & Strickler, 2000).

Home range

The total home range of *M. aurita* (body mass 8–10.5 g) is 389 ha, is similar to the 368 ha recorded for *Rhinolophus hipposideros* which is a similar sized insectivorous bat (5–7.5 g) (Bontadina *et al.*, 2002), but smaller than the 1000 ha recorded for *Chalinolobus tuberculatus* (9.3–10.5 g) (O'Donnell, 2001).

The furthest distance between roost and foraging sites was 1.8 km. Bonaccorso *et al.* (2002) confirmed that bat species which live in small groups, particularly in tropical forests, often roost within 2 km of their foraging areas and incur minimal time and energy costs for commuting.

Foraging habitat

Myzopoda aurita make extensive use of degraded forests characterized by abundant *R. madagascariensis* or coffee plantations. Schliemann & Goodman (2003) stated that this species also appears to forage over marshland and in

degraded habitats. The majority of *M. aurita* caught in eastern Madagascar were within or close to stands of *R. madagascariensis* (Goodman *et al.*, 2006), but some were inside littoral forest (Goodman, 1999; Jenkins *et al.*, 2007).

Schliemann & Goodman (2003) noted that *M. aurita* is probably one of the few endemic mammals that has benefited from anthropogenic habitat modifications in eastern Madagascar.

Roosting associations

We found day roosts only in partially unfurled *R. madagascariensis* leaves. The presence of pads on the wrist and ankles of *M. aurita* suggests that they are used to attach the animal to the smooth leaf surfaces, or for climbing up the leaves (Goodman *et al.*, 2006). Like *Thyroptera*, *Myzopoda* has evolved adhesive discs. In *Thyroptera* these operate as suction pads to grip the smooth leaves of *Heliconia* (Family Musaceae) and *Calathea* (Family Marantaceae) (Riskin & Fenton, 2001), which are used as day roosts in degraded forest (Vonhof & Fenton, 2004). However in *M. aurita*, the pads make use of a different mechanism – wet adhesion (Riskin & Racey, 2010).

Diet

Our result shows that *M. aurita* feed largely on Lepidoptera, as well as Coleoptera. Göpfert & Wasserthal (1995) noted, from fecal pellet analysis that this species fed on small moths. The second species of *Myzopoda*, *M. schliemanni* also feeds extensively on Lepidoptera, as well as Blattaria, and to a much smaller extent on Hymenoptera and Coleoptera (Rajemison & Goodman, 2007).

Conservation status

The mean number of bats caught during each night's mist netting at Kianjavato was 5.7 (range 0–15) and bats were caught on every netting night. This refutes the suggestion that this species is rare (Hutson *et al.*, 2001) and can be explained by the abundance of *R. madagascariensis* in the study area. Göpfert & Wasserthal (1995) and Goodman *et al.* (2006) confirm that *M. aurita* was captured within or close to stands of *R. madagascariensis*.

In the IUCN assessment of the conservation status of insectivorous bats in Madagascar, Jenkins *et al.* (2008) considered *M. aurita* to be a species of Least Concern, because of its wide distribution and apparent use of disturbed habitats. As with other bat species in Madagascar (molossid, *Scotophilus*, *Neoromicia* and *Pipistrellus*), *M. aurita* appears to be able to survive in degraded forest and anthropogenic habitats (Schliemann & Goodman, 2003; Russell *et al.*, 2008), although it may be affected by loss of roosts for building materials. The only threat to the species in our study area is the use of *R. madagascariensis* leaves for thatching village houses, although if *Myzopoda* was found during the harvesting of *R. madagascariensis* they were reportedly killed for human consumption.

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Supporting information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. *Myzopoda* monastique: Ecologie des gites et des modes d'alimentation de la chauve-souris endémique Malgache sexuellement isolée.

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