Notes and records

Activity patterns and abundance of microchiropteran bats at a cave roost in south-west Madagascar

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Introduction

Madagascar has at least 28 species of Chiroptera, of which 50% are endemic (Peterson, Eger & Mitchell, 1995). Few studies have been carried out on Malagasy Microchiroptera (Goodman, 1999), which makes it difficult to establish conservation priorities and actions for this group. A preliminary survey of a cave in south-west Madagascar in November 2001 revealed three species from the subfamily of Old World leaf-nosed bats, Hipposiderinae: *Triaenops rufus* (Milne-Edwards 1881), *Triaenops furculus* (Trouessart 1906) and *Hipposideros commersoni* (E. Geoffroy 1813) (Emmett, Fanning & Olsson, 2003). Little is known about the ranges of Malagasy Hipposiderinae, their population sizes or their ecology (Peterson et al., 1995; IUCN, 2002). We planned to assess the populations of these three species, study their nocturnal activity and reassess their conservation status.

Materials and methods

Study area

The site is located in the Toliara region of south-west Madagascar in an area locally known as the Sept Lacs. The area has an altitudinal range of 40–240 m and the predominant habitats are dry spiny forest on the limestone plateau, with gallery forest along the rivers and wetlands. There is agricultural land on the floodplains and plateau. The climate is semi-arid with an average annual rainfall of 400 mm, over 85% of which falls between December and March. Average maximum temperatures vary from 26 to 36°C (Du Puy & Moat, 1996).

Research was conducted around a pothole on the limestone plateau in an area of dry spiny forest (23°30’29.1”S, 44°09’46.3”E) at an altitude of 150 m. The pothole was about 3 m across, and opened into a large cave system.

Methods

We conducted a mark–recapture study over eight nights between 15–18 and 28–31 August 2002. Two harp traps (each measuring 1 m²) and two mist nets (12 m long, 2.6 m high) were set up at suitable positions across flight paths around the hole into the cave, and were in place from 18.00 hours until about 06.00 hours. The harp traps were active for 12 h each night, and the mist nets for 5 h, totalling 192 and 80 h, respectively.

For all captures, we recorded: date, time, species and sex. We marked the bats during the first six nights of trapping by trimming the fur on their shoulders.

We used the bias-adjusted Lincoln–Petersen estimator:

\[ N = \frac{(n_1 + 1)(n_2 + 1)}{m_2 + 1} - 1, \]

using the ratio of marked to unmarked individuals caught during the final two nights to estimate total population sizes (Wilson et al., 1996). Here, \(N\) is the population size, \(n_1\) is the marked individuals in the first sample, \(n_2\) is the caught individuals in the second sample and \(m_2\) is the recaptured individuals in the second sample. We assumed that marked individuals mixed well with unmarked individuals, and had the same likelihood of being caught.

Standard error (SE) for population estimates were calculated using the following equation (Fowler & Cohen, 1990):

\[ SE = \sqrt{\frac{n^2 \times N(N - r)}{r^3}}, \]

where \(n\) is the marked individuals in the first sample, \(N\) is the caught individuals in the second sample and \(r\) is the recaptures in the second sample.

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To test for homogeneity between samples, the chi-square equation (Fowler & Cohen, 1990) was used:

\[ \chi^2 = \frac{(O - E)^2}{E} \]

where \( O \) is the observed frequency and \( E \) is the expected frequency.

**Results**

We marked 4425 (4688 total captures) individuals of two species – *T. rufus* and *T. furculus*; no *H. commersoni* were caught. The sex ratios were similar; 47% of *T. rufus* and 48% of *T. furculus* were males.

**Activity patterns**

At dusk (about 18.00 hours), the bats emerged from the roost. After 21.00 hours, the numbers of returning bats (based on the direction, they entered the mist nets) began to increase. Between 00.00 hours and 01.00 hours activity augmented, followed by low activity until about 05.00 hours, when the remaining bats returned.

There were highly significant differences in activity patterns of male and female *T. furculus* \((\chi^2 = 147, P < 0.01)\) throughout the night. Males returned much earlier than females, many of which returned just before dawn. A similar trend was observed for *T. rufus* (Fig. 1).

**Population size and conservation**

We estimated the roost to contain 41,021 (SE = 4851) individuals of *T. rufus* \((n_1 = 2496, n_2 = 1149, m_2 = 69)\) and 10,058 (SE = 2895) of *T. furculus* \((n_1 = 645, n_2 = 217, m_2 = 13)\). These are very large, previously unknown populations of endemic species.

**Discussion**

Our survey was conducted in the dry season, prior to the mating period for these species (Cumming & Bernard, 1997). In similar habitats in east Africa, prey availability is limiting at this time (Fenton & Thomas, 1980), so female bats feed longer to collect enough prey items to maintain or increase their fat deposits prior to reproduction. Research into seasonal activity, fat levels and faecal contents of male and female *Triaenops* may explain the activity patterns we observed.

Female *H. commersoni* are known to migrate to areas with better food availability during the dry season prior to the breeding season, while males remain within the roost (Churchill, Draper & Marais, 1997; Cotterill & Fergusson, 1999). This may explain why we did not capture or observe *H. commersoni*.

Local villagers occasionally capture bats for food, and tourists visit the site. However, the remote location and inaccessibility of the cave reduces the impact of visitors, and compared with many cave roosts in Madagascar, disturbance is minimal (R. Jenkins, pers. comm.).

According to the IUCN (2002) Red List, *T. furculus* is vulnerable due to predicted population decline through habitat loss, and *T. rufus* is data deficient, so the identification and protection of their roosts are priorities (Hutson, Mickleburgh & Racey, 2001). *Triaenops furculus* may be more widespread and abundant than previously assumed.

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Fig 1 Summary of the nocturnal activity pattern of *Triaenops furculus* (a) and *T. rufus* (b) based on bat captures over an eight-night period.
but habitat loss could justify its IUCN status. Habitats across south-west Madagascar are threatened through clearance of forest and drainage of wetlands (Myers et al., 2000; Seddon et al., 2000). However, the ecology of these endemic Triaenops species is poorly understood, so effects of habitat loss are not yet known. Research should assess the abundance and habitat use of these Triaenops species and reassess their conservation status.

Registers of cave roosts are an important step towards developing national and international management plans for bat conservation (Mickleburgh, Hutson & Racey, 2002). The roost we studied should be monitored, with appropriate conservation activities implemented if necessary.

Acknowledgements

Thanks to the Society for Environmental Exploration (SEE) and Institut Halieutique et des Sciences Marines (IHSM) for field support; Direction des Eaux et Forêts for research permits; and Steven Goodman and Richard Jenkins for comments. Fieldwork was conducted by Frontier-Madagascar, a collaboration of SEE and IHSM.

References


(Manuscript accepted 29 July 2005)

doi: 10.1111/j.1365-2028.2006.00661.x