



Use of native animals by local communities in Madagascar

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ABSTRACT

Madagascar is a biodiversity hotspot, yet its wildlife is under immense threat from habitat loss and other anthropogenic pressures. To tackle this, Madagascar has implemented new environmental legislation, including rapid expansion of the protected area network. Many new protected areas permit sustainable extraction of natural resources by local communities, but little is known about how and why local people use biodiversity, particularly animal wildlife. We conducted a rapid appraisal of animal use by 236 households across Madagascar's rural Moramanga district to explore which wild faunal species are used by local people and for what purpose. Our results document a wide range of uses attributed to familiar wildlife groups, including lemurs, tenrecs, birds, geckos, chameleons, frogs and invertebrates. Uses include food, trade, medicine, and pest control among others. We conclude that conservation decisions concerning sustainable use in relation to livelihoods require an understanding of both the diversity of species used and the diversity of uses of species by local communities.

1. Introduction

Biodiversity is threatened by human actions such as habitat loss and overharvesting, coupled with climate change. This is particularly so in Madagascar, a global conservation priority due to its unparalleled species richness and endemism [Brooks et al., 2006], facing unprecedented levels of threat due mostly to habitat loss [Jones et al., 2019]. The human population of Madagascar is largely rural and heavily dependent on natural resources [Randrianarivony et al., 2016, Poudyal et al., 2018], so reconciling conservation and development remains a challenge.

In the last two decades Madagascar has been subject to a range of conservation efforts, including rewriting key environmental legislation and expanding its protected area system [Gardner et al., 2018]. Fifty three percent of the total area under protection is now within IUCN category V and VI in which local communities are permitted to sustainably extract some natural resources [Gardner et al., 2018]. Despite numerous initiatives supported by international donors to increase incentives for forest conservation in Madagascar [Neudert, Ganzhorn, and Waetzold, 2017], deforestation rates remain high (globalforestwatch.org).

The government of Madagascar's objectives for the expanded protected area network include promoting sustainable use of biodiver-

sity for poverty alleviation and development, alongside conservation [Gardner et al., 2013]. However, since most extractive uses are detrimental to biodiversity and compromise conservation goals unless carefully managed [Gardner, 2009], an understanding of why and how communities use natural resources is essential if managers are to design strategies that will allow local communities to meet their needs while maintaining biodiversity. This applies particularly to animals, as many species are vulnerable to the direct impacts of harvesting in addition to other pressures.

Studies exploring how local communities use and interact with wild fauna in Madagascar are largely focussed on subsistence (e.g. [Golden et al., 2014, Borgerson et al., 2022]) and collection of reptiles, amphibians and lemurs for trade [Reuter et al., 2016, Robinson et al., 2018, Robinson et al., 2018]. However, by focussing on particular forms of animal use, research may be overlooking other important values attributed to local wildlife that may prove important in terms of development and creation of incentives for conservation management, as well as initiatives to support local livelihoods. The aim of this study was to explore the different ways in which local people in rural Madagascar use wild animals, and in doing so enhance our understanding of human-wildlife inter-relationships.

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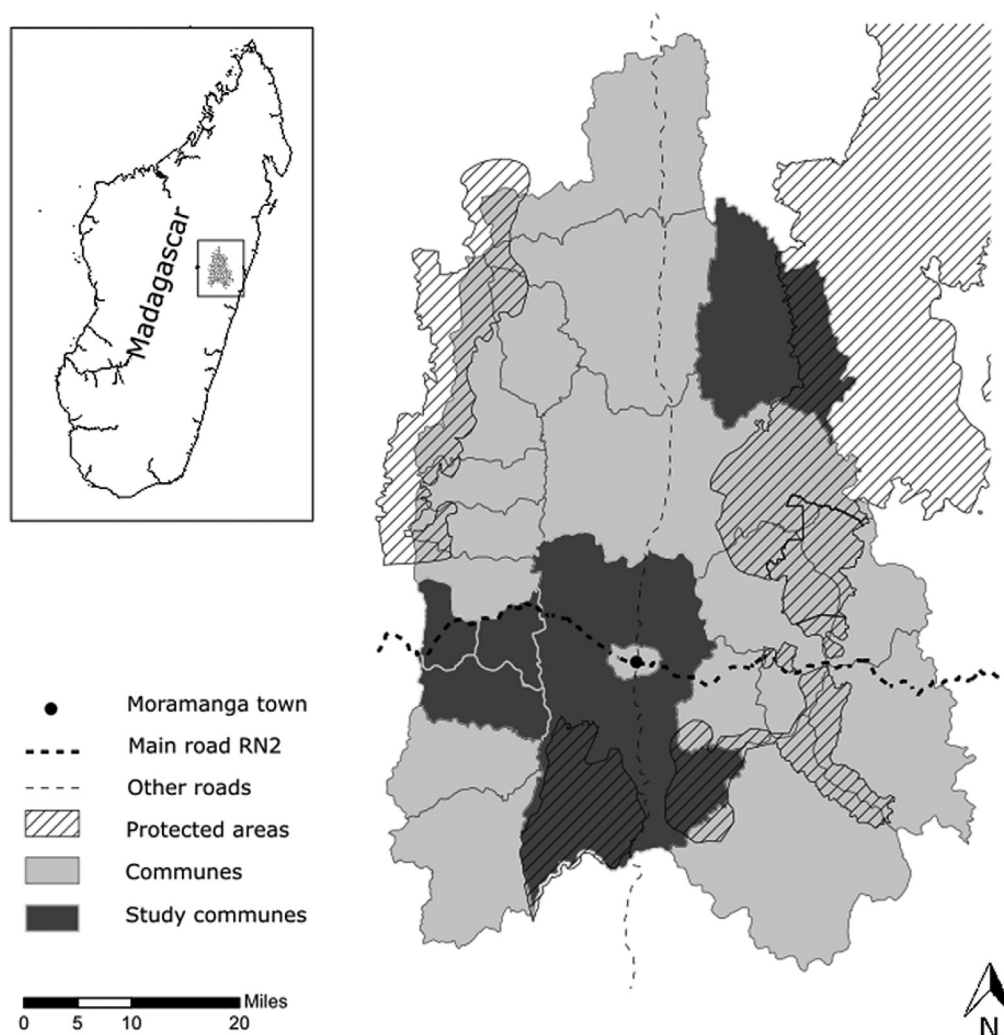


Fig. 1. Location of study communes within Moramanga district. Inset: position of Moramanga district in Madagascar, following [Robinson et al., 2018].

2. Methods

Moramanga district lies in eastern Madagascar within a belt of mid-altitude humid forest, and has a largely rural population engaged primarily in agriculture and livestock rearing [Robinson et al., 2018]. The district is subdivided into communes, each representing a collection of villages (Fig. 1). Data were collected as part of a larger project exploring local people's livelihoods as well as use and trade of different animal groups. Therefore we targeted villages where wildlife collectors were resident, as detailed in Robinson et al. [Robinson et al., 2018]. Two to four villages (depending on village size) were selected from each of five rural communes, aiming to sample ~60 households per commune. Thirty percent of households per village were interviewed, with a maximum of 30 and minimum of 10 per village. Village households were mapped with assistance from guides, and whilst walking in a zig-zag pattern, every *n*th household was surveyed according to village size. If the household head was unavailable, the interviewer returned when they were available. A household was defined as all persons who normally live together and eat from the same cooking pot/kitchen.

Questionnaire and photo prompts were piloted in February 2014 and refined prior to fieldwork (March to July 2014). A total of 236 questionnaires were completed across 16 villages (averaging 33% of households surveyed per village). Respondents were asked whether there were any 'uses' concerning each of several familiar animal groups (yes, no,

don't know), including: chameleons, geckos, frogs, invertebrates, birds, lemurs and tenrecs. We showed respondents photographs to ensure that animal groupings were understood. When a respondent answered 'yes', we asked what those animal groups were used for, and recorded any further information volunteered. All interviews took place in the local dialect of the Malagasy language. Based on reported answers, 'uses' were coded into the following categories: food, trade, medicine, pets, animal food (e.g., food for pigs), pest control (e.g., catching insects in plantations), honey, fishing bait and 'other'.

3. Results

When asked if the animal groups had any 'uses', over 90% of respondents reported 'yes' for tenrecs and a large proportion (>65%) reported 'yes' for birds (Table 1). Around 50% of respondents also reported 'yes' for lemurs and frogs, with lower rates (~22–36%) reported for other animal groups.

Of all the use categories, 'food' was the most frequently mentioned, particularly for tenrecs (90% of respondents stated tenrecs were used for food), birds (mentioned by 59% of respondents) and lemurs (42%), but all other groups except for geckos and chameleons were also noted as being used for food (Fig. 2). 'Trade' was the second most frequently reported use with all animal groups mentioned, especially chameleons (21%) and geckos (20%) but invertebrates (16%), frogs (16%), snakes (12%), and lemurs (11%) were also mentioned, with tenrecs (7%) and

Table 1

Respondents' percent agreement scores (with *n* numbers in brackets) to the question: "Are there any uses for this animal group?" Percent scores over 50% in bold.

Use (N=236)	chameleons	geckos	snakes	frogs	invertebrates	Birds	lemurs	tenrecs
Yes	26.7% (63)	22.5% (53)	23.3% (55)	48.7% (115)	35.6% (84)	65.3% (154)	50.8% (120)	91.1% (215)
No	36.0% (85)	46.6% (110)	49.2% (116)	31.8% (75)	43.6% (103)	21.2% (50)	34.3% (81)	5.5% (13)
Don't know	37.3% (88)	30.9% (73)	27.5% (65)	19.5% (46)	20.8% (49)	13.6% (32)	14.8% (35)	3.4% (8)

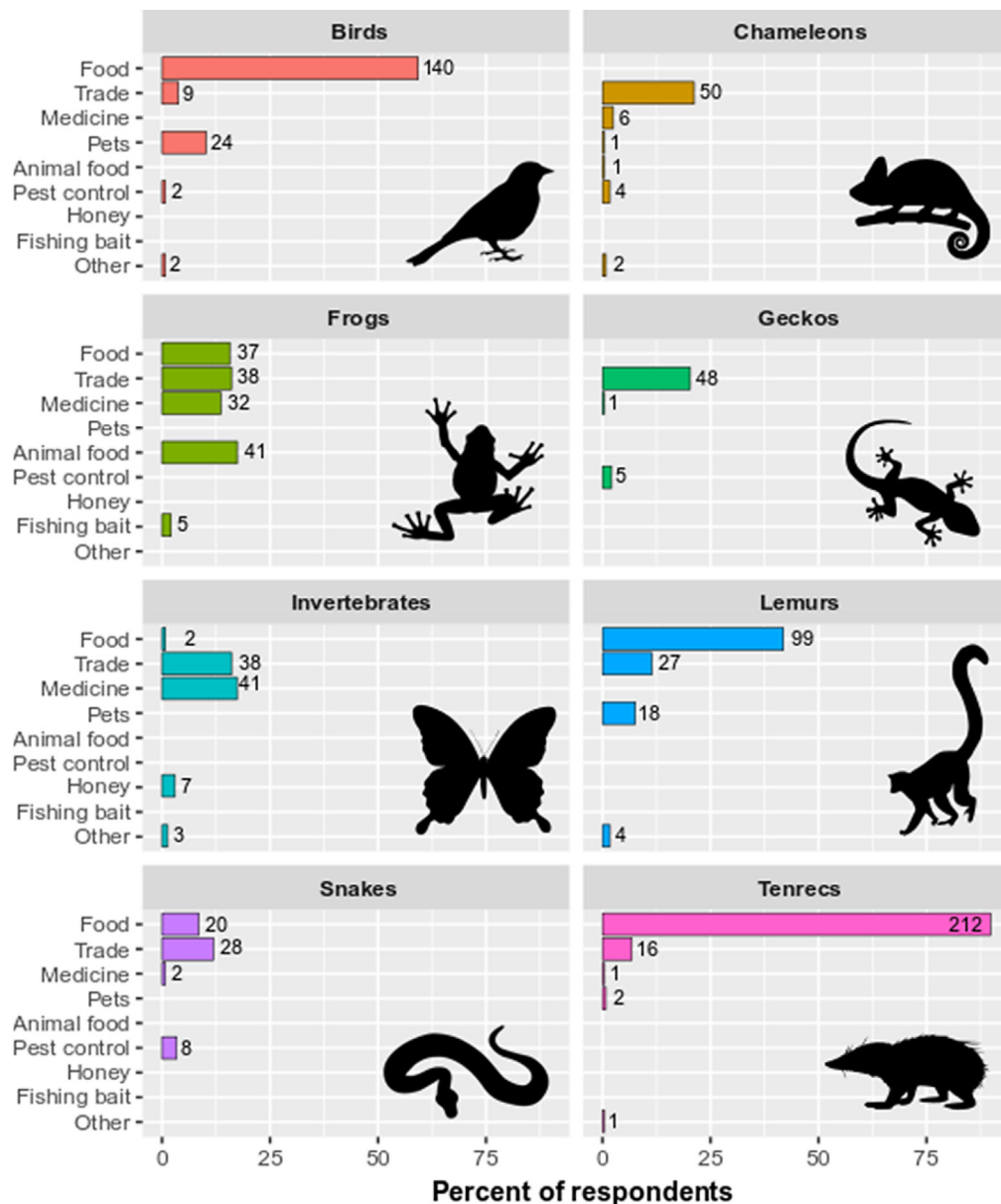


Fig. 2. Percent of all respondents (N=236) indicating uses for each of the different animal groups. The 'other' category included tourism (lemurs, n=1; tenrecs, n=1), ornaments (invertebrates, n=2), children's games (chameleons, n=2; birds, n=2), ecosystem function (lemurs, n=1 "good for tree plantation" [seed dispersal]; worms, n=1, "good for soil"), telling time (lemurs - *Indri indri*, n=1) and clothing (n=1, "hat made from the lemurs skin").

birds (4%) stated in lower proportions. Medicine was the third most frequently mentioned use, with invertebrates (17%) and frogs (14%) being by far the most frequently reported. Scorpions were often referred to for use as medicine including for tooth problems, and frogs most recognised as medicine for asthma and coughs, with undernourishment, and tooth problems also mentioned. Chameleons (3%, n=6) were also used for medicine including for skin diseases, child convulsions and nosebleeds. Two people stated snakes (including snake bile) were used medicinally

and one person stated that geckos (*Uroplatus*) were used as medicine for breastfeeding mothers.

Frogs (which are collected in rice fields) were commonly used for pig, poultry and duck feed (17% of respondents mentioned this). Birds (10%), mainly vasa parrot and sometimes doves, and lemurs (8%) were identified for use as pets (locally), whilst two people mentioned tenrecs and one mentioned chameleons. A number of respondents identified snakes (n=8), geckos (n=5), chameleons (n=4) and birds (n=2)

for their roles in pest control. Respondents commented that snakes and owls catch rats, and geckos and chameleons eat insects, including flies, mosquitos and cockroaches. One person said that they take chameleons to their pumpkin plantation to eat insects. Some participants (n=7) identified invertebrates (bees) for making honey, and five stated frogs were used for fishing bait.

4. Discussion

Our results demonstrate that a wide range of uses are attributed to wild faunal species in rural eastern Madagascar, expanding our understanding of human-wildlife inter-relations. This research helps improve our understanding of local uses and potential importance of wild animals in the context of future conservation and development programs.

It is clear that tenrecs in particular, as well as lemurs and birds, are important and widely recognised food sources for people in rural communities, as reported elsewhere (e.g. [Jenkins et al., 2011]), but frogs, snakes and to a lesser extent invertebrates were also consumed. Whilst amphibian and invertebrate consumption is reported in the literature [Jenkins et al., 2009, Van Itterbeeck et al., 2019], there are few records relating to snake consumption in Madagascar. Trade was the most prominent use reported for geckos, chameleons and snakes (also see [Robinson et al., 2018, Robinson et al., 2018]) but tenrecs and lemurs were also indicated for their use in trade, which may relate to local bushmeat, pet trade and supply of tourism operations. Tenrecs are also known to be exported, although this is poorly documented. Birds and lemurs were most recognised locally as 'pets', and several animal groups were noted by a small proportion of respondents for their use in local medicine and ecosystem services, particularly pest control. Estimates relating to ecosystem services may be under-represented as we did not specifically ask people to consider indirect use, but some people offered this information. Interestingly, frogs had a wide range of uses, with animal feed and medicine being as widely recognised as human food and trade.

Further research may cover a more extensive range of animal groups, differentiate between different types of use (e.g. direct, indirect), and explore techniques such as the Use-Value Index [Albuquerque et al., 2006], applied predominantly within ethnobotanical research to quantify uses and relative cultural importance of species and demonstrate their utility to local people. This may advance understanding of how wild animal use may help or hinder conservation efforts in the area, but also support food security and human livelihoods.

5. Conclusion

Here, we highlight the varied ways in which local people reported that wild animals can be used, including the value services that biodiversity provides. We document a wide range of uses of wildlife groups, including lemurs, tenrecs, birds, geckos, chameleons, frogs and invertebrates, and uses including food, trade, medicine, and pest control. Our study provides an understanding of human interactions with animals in a biodiversity hotspot, and can help to design and refine conservation initiatives. Given that many new protected areas in Madagascar permit sustainable extraction of natural resources by rural communities, we conclude that involving local resource users in conservation efforts and decision making will play a big part in ensuring a positive future for Madagascar's unique biodiversity.

6. Ethical standards

Ethical approval was granted by the University of Kent. The research was discussed with commune and village leaders prior to data collection.

Respondents were informed that taking part in the survey was voluntary and they could stop at any time and consent was recorded via a tick box on the questionnaire.

Declaration of Competing Interest

None.

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