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Above: Rendall's Serotine bat (*Neoromicia rendallii*) (ECJS-44/2009) caught in the Chitabi area, Okavango Delta, Botswana.

NOTICE BOARD

Conferences

10th International Mammalogical Congress

To be held at: Mendoza, Argentina, 9-14 August 2009
Further information: http://www.cricyt.edu.ar/imc10

2nd Berlin Bat Meeting: Bat Biology and Infectious Diseases

To be held at: Berlin, Germany, 19– 21 February 2010.
Further information: http://www.izw-berlin.de/

15th International Bat Research Conference

To be held at: Prague, Czech Republic, 23– 27 August 2010.
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All Out
Transvaal Museum
Durban Natural Science Museum

OBSERVATIONS, DISCUSSIONS AND UPDATES

FLYING FOXES (PTEROPODIDAE: *PTEROPUS*) IN THE WESTERN INDIAN OCEAN: A NEW REGIONAL INITIATIVE

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Introduction

The islands of the western Indian Ocean Islands differ in size, language, topography, culture and history but most are home to *Pteropus* flying foxes (MICKLEBURGH *et al.* 1992). These large bats are important seed dispersers and pollinators and contribute important ecosystem servies to oceanic islands (BOLLEN and VAN ELSACKER 2002; ENTWISTLE and CORP 1997; NYHAGEN *et al.* 2005; POWELL and WEHNELT 2003; REASON and TREWHELLA 1994). Seven of the eight species in the region are listed as threatened on the IUCN Red List (Table 1) with most threatened by habitat loss, hunting for food and persecution. A number of different non-governmental organizations, universities and governments are actively engaged in conservation activities to secure wild populations of threatened *Pteropus* bats but there has been limited inter-island communication between the different stakeholders.

The first western Indian Ocean Islands *Pteropus* Workshop was held in Mauritius from 11-14th November 2008. The main objective was to bring together representatives from the different islands to exchange experiences about conserving *Pteropus*, to learn about successful conservation activities, to develop common approaches to shared problems and to investigate possibilities for future collaboration. The workshop was attended by representatives from the islands of Comoros (Anjouan and Mohéli), Madagascar, Mauritius, Pemba, Reunion, Rodrigues, Seychelles and Zanzibar. Participants also included international experts, including the co-Chair of IUCN Chiroptera Specialist Group and the Director of the Lubee Bat Conservancy, and a range of stakeholders from Mauritius.

The main topics of discussion and presentations were:
(i) development of a regional group for *Pteropus*,
(ii) monitoring,
(iii) public communication,
(iv) conflict with fruit growers,
(v) role of environmental education and
(v) future directions.

Regional *Pteropus* Group

Representatives from eight islands were selected following the meeting to act as a focal point for communication and disseminating information between and within islands (Table 2). These individuals will establish networks of interested stakeholders or individuals within their respective islands for inclusion within the regional group. There was also general support for the creation of a website to facilitate the dissemination of news and other information.

Monitoring

Monitoring results were presented for *P. livingstonii, P. rufus, P. niger, P. rodricensis* and *P. voeltzkowi*. *Pteropus* populations on Pemba and Rodrigues have increased notably in recent years and this helped to emphasize the importance of collecting regular monitoring data. Representatives from other islands were encouraged to undertake, or fund, similar monitoring programmes to provide a long-term regional data set. It was decided that a standard methodology for the monitoring *Pteropus* region was not required, nor was even feasible, but it is necessary to tailor the various approved counting techniques (e.g. direct-, patch-, evening dispersal-counts) on a case by case basis and to make sure that the same methods are applied at the same sites on each visit.

Above: Greater Mascarene Flying Fox (*Pteropus niger*)

Public communication

There is a growing need to provide the general public and the media with factual information on *Pteropus* flying foxes. This is particularly important in Mauritius where there is public debate about the damage that *P. niger* inflicts on the commercial litchi crop. With the growing concern of the role that flying foxes play as a disease vector it is possible that this issue will soon enter the public domain in the region. The convincing monitoring data from Rodrigues and

Table 1: Summary of the IUCN Red List conservation status for *Pteropus* species in the western Indian Ocean in 2004 (*1996 status) and 2008 (downloaded from www.redlist.org on 5 March 2009).

Species	2004	2008	Population trend
Aldabra Flying Fox *Pteropus aldabrensis*	CR	VU	Stable
Comoro Flying Fox *Pteropus livingstonii*	CR	EN	Decreasing
Greater Mascarene Flying Fox *Pteropus niger*	VU*	EN	Decreasing
Rodriges Flying Fox *Pteropus rodricensis*	CR	CR	Increasing
Malagasy Flying Fox *Pteropus rufus*	VU	VU	Decreasing
Seychelles Flying Fox *Pteropus seychellensis*	LC	LC	Stable
Pemba Flying Fox *Pteropus voeltzkowi*	VU	VU	Increasing

Table 2: List of the island representatives identified following the workshop

Island	Representative
Pemba (Tanzania)	Said Ali Juma
Mafia (Tanzania)	Hajji Mahingika
Zanzibar (Tanzania)	Bakari Asseid
Mayotte (France)	Michel Charpentier Sarah Caceres
Anjouan & Mohéli (Comoros)	Nassuri Toilibu
Madagascar	Radosoa Andrianaivoarivelo
Mauritius	Vikash Tatayah
Rodrigues (Mauritius)	Andrea Waterstone
Seychelles	*Nature Seychelles*
Réunion (France)	Jean Michel Probst, Marc Salamolard Sarah Caceres

Pemba represent good news for *Pteropus* bats and scientists working on these species should publish their results in the public domain.

Conflict between *Pteropus* bats and people

There was considerable discussion about the current situation in Mauritius where economic damage to litchi crops is blamed on *P. niger.* Participants discussed mitigation measures and ways of assessing the amount of damage caused by other vertebrate species. An opportunity was identified to link research teams in Mauritius and Madagascar because *Pteropus* bats are persecuted on both islands to protect litchi crops.

Environmental education

Representatives from Madagascar, Rodrigues, Pemba and Comoros provided convincing evidence that raising the awareness of people about flying foxes is an important component of conservation programmes on the islands. Pemba and Seychelles had very positive experiences from creating wildlife clubs whilst representatives from Madagascar were hoping to integrate bat-positive messages into the national curriculum. There was wide support for the idea of a regional bat conservation day each year.

Future directions

Research priorities were identified as

(1) using good science to explore the conflict between *Pteropus* bats and commercial fruit growers, preferably under experimental conditions, (
(2) 2) investigating the sustainability of hunting and
(3) (3) studying the feeding ecology and diet of *Pteropus* bats.

Conservation priorities also received wide consensus as

(1) reducing illegal hunting/killing,
(2) reducing the loss of roosting and foraging habitats and
(3) raising awareness about flying foxes.

The recent arrival of *P. niger* in Reunion was identified as unique opportunity to study a small founder population. A follow-up workshop within three or four years was identified as a priority, to include an expanded group of islands (i.e. Mafia, Mayotte and Aldabra), and to address issues such as hunting, disease and feeding ecology.

Acknowledgements

Conservation International funded the workshop and travel costs of most participants. We are grateful to all participants for their enthusiastic participation: S.J. Ali, D. Andriafidison, R. Andriamanana, R. Andrianaivoarivelo, M. Andrianarisata, B. Asseid, L. Bambini, A. Begue, E. Blais, S. Caceres, A. Cheke, D. Derand, A. Dooblall, S.K. Haji, D. Hansen, R.K.B. Jenkins, C. Jones, Y. Mungroo, K. Ombadi, I. Oree, N. Padayatchy, A. Poonyth, J.-M. Probst, P.A. Racey, L. Raffray, K. Ramiah, H. Randrianasolo, S. Robin, M. Salamolard, F.M. Saleh, P. Senior, R.P. Sookhareea, V. Tatayah, N. Toilibou, A. Walsh, A.J. Waterstone

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OBSERVATIONS

Image 10.1

Image 10.2

Image 10.3

Observation #: 10 - Day roost of Rendall's serotine bat (*Pipistrellus rueppellii*)

Submitted by: Richard Randall
Date of observation: 18 May 2009
Locality: Botswana, Okavango, Camp Okavango
GPS: S 19.13360 E 23.10012
Photo's: Richard Randall

Images:
10.1 Individual bat found day roosting in the rolled tent flap.
10.2 Individual bat found day roosting in the rolled tent flap.
10.3 Ear and Tragus of individual bat.
10.4 Bat found in the rolled up tent window.
10.5 Tent window unrolled.
.

Editorial response:
The dorsal grizzeled grey fur colour and the ventral colour of the fur being white is similar to that of the Tomb bat (*Taphazous mauritianus*), which has distinctly white or translucent wings, which is not observed in images 10.1-2. The shape of the ear and tragus of this individual from Botswana also shows that it is not a tomb bat, but definitely one the vesper bats (even without looking at the tail).

Identification as a Rendalls' serotine bat (*Pipistrellus rueppellii*) supported by: Teresa Kearney, Victor Van Cakenberghe and Ernest Seamark.

Image 10.4

Image 10.5

Image 11.1

Image 11.2a

Image 11.2b

Image 11.2c

Observation #: 11 - Unusual bat roost

Submitted by: Dave Hood
Date of observation: 22 January 2009
Locality: South Africa: Eastern Cape Province: Farm Koelfontein
GPS: unknown.
Photo: Dave Hood

Images:
11.1.1 - Picture of the roost site of the individuals below, found roosting behind the can of paint in a workshop.
11.1.2a-e - Various views to show characteristics of Bat 1.
11.1.3a–b - Characteristics of Bat 2.

Email message:

Bat 1 (Images 11.2a-e) was found at the opposite end of the workshop from the fishing bag (ABCN 21: Observation # 12). It was roosting about 2m up behind a can of paint in a corner (Image 11.1). It was with another bat (Bat 2 - Images 11.3a -b) and both looked identical, but Bat 2 was larger and paler than Bat 1.

Are those teeth broken in Bat 2 (Image 11.2c-d)?

The image (11.2d) of Bat2's back shows a large bump - do you know what that could be?

We captured the tick on Bat1 tail (visible in image 11.3b).

Editorial response:
Bat 2 is possibly an adult bat, due to the condition of the teeth, you can see quite clearly (image 11.2c) that these teeth are worn, this is often used as a sign of age, especially when compared to Bat 1 (image 11.3a), who's teeth show no signs of ware. Therefore there is a strong possibility that Bat 1, may be a have been born in this present season. This is also supported by the observation that Bat 2 was larger than Bat 1. But size by its self can be misleading, but by examining the ware of the teeth you can get a better informed view.

The lump on the back of Bat 2 (image 11.2b) could be two things a parasite or a tumor, but this is

Identification as a Vesper bat (Vespertilionidae) supported by: Victor Van Cakenberghe., Teresa Kearney and Ernest Seamark.

Image 11.2d

Image 11.2e

Image 11.3a

Image 11.3b

Image 12.1

Image 12.2

Observation #: 12 - Unusual maternity roost

Submitted by: Dave Hood
Date of observation: 19 January 2009
Locality: South Africa: Eastern Cape Province: Farm Koelfontein
GPS: unknown.
Photo: Dave Hood

Images
12.1 - Fishing bat hanging on the wall, where the maternity roost was found.
12.2 - A look into the fishing bag and the droppings can clearly be seen at the bottom, which testifies that this was being utilized by bats as a roost.
12.3 - The corps of a juvenile bat, that was found at the bottom of the fishing bat.

Image 12.3

Email message:
Here is a pic of the unusual roost in a fishing bag (12.1) and an image of the bat pup (12.3) found in it. It was full of droppings as you can see (12.2). The green thing beneath the roost is an electric fence energizer which emits a regular high pitched squeak and as you can see, there is a grinder nearby.

Editorial response:
Identification as a Vesper bat (Vespertilionidae) supported by: Victor Van Cakenberghe., Teresa Kearney and Ernest Seamark.

NEWLY DESCRIBED SPECIES

Miniopterus griffithsi new species – GOODMAN *et al.* (2009)

GOODMAN *et al.* (2009) described a new species of *Miniopterus* (Long-fingered Bat) from Madagascar. This new species distribution seems to be restricted to the extreme southern Madagascar. The specific name "*griffithsi*" was selected to honor Owen Griffiths, founder of Biodiversity Conservation Madagascar.

References

GOODMAN, S. M., MAMINIRINA, C. P., BRADMAN, H. M., CHRISTIDIS, L. and APPLETON, B. R., 2009. Patterns of morphological and genetic variation in the endemic Malagasy bat *Miniopterus gleni* (Chiroptera: Miniopteridae), with the description of a new species, *M. griffithsi*. *J. Zool. Syst. Evol. Res*.

Miniopterus aelleni new species – GOODMAN *et al.* (2009)

GOODMAN *et al.* (2009) described a new species of *Miniopterus* (Long-fingered Bat) from Madagascar. This new species is known to occur in various portions of lowland northern and western Madagascar. The specific name "*aelleni*" is a patronym for Prof. Villy Aellen (1926-2000) who was a mammalogist at the Muséum d'histoire naturelle de Genève. Prof Aellen devoted much of his professional interests to the study of bats, particularly those of Africa.

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GOODMAN, S. M., MAMINIRINA, C. P., WEYENETH, N., BRADMAN, H. M., CHRISTIDIS, L., RUEDI, M., and APPLETON, B., 2009. The use of molecular and morphological characters to resolve the taxonomic identity of cryptic species: the case of *Miniopterus manavi* (Chiroptera, Miniopteridae). *Zoologica Scripta* **38**: 339-363.

Rhinopoma hadramauticum new species – BENDA *et al.* (2009)

BENDA *et al.* (2009) described a new species of *Rhinopoma* (Mouse-tailed bat) from Yemen. It is only known from a single site at this stage, where there was a population of about 150 individuals. The specific name "*hadramauticum*" refers to Hadramaut, a province and historical territory in the eastern part of Yemen, where the new species was first recorded.

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BENDA, P., REITER, A., AL-JUMAILY, M., NASHER, A. K., and HULVA, P., 2009. A new species of mouse-tailed bat (Chiroptera: Rhinopomatidae: *Rhinopoma*) from Yemen. *Journal of the National Musuem (Prague), Natural Histroy Series* **177**(6): 53-68.

SCIENTIFIC CONTRIBUTIONS

BAT INVENTORY OF THE IVOLOINA FORESTY STATION, ATSINANANA REGION, MADAGASCAR

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Key words: Bats, Inventory, Ivoloina Forestry Station, acoustic, lowlands, Madagascar

In a recent historical sense, mammalogists working on the Malagasy fauna largely neglected bats (PETERSON *et al*., 1995; GOODMAN *et al*., 2008). Given that these animals are now recognized as significant seed disseminators (e.g., BOLLEN and VAN ELSACKER, 2002; ANDRIAFIDISON *et al*., 2006) or important regulators of insect populations (e.g., ANDRIANAIVOARIVELO *et al*., 2006; RAKOTOARIVELO *et al.,* 2007), surveys are needed to refine information on their distribution and natural history. Over the past decade, numerous papers were published on Malagasy bat taxonomy (e.g., GOODMAN and CARDIFF, 2004; GOODMAN *et al*., 2005a, 2007), diet (e.g., RAZAKARIVONY *et al*., 2005; RAJEMISON and GOODMAN, 2007; RAKOTOARIVELO *et al.,* 2007; RAMASINDRAZANA *et al.*, in press), and ecology and conservation (GOODMAN, *et al*., 2005b; RACEY *et al.,* in press). A void still remains regarding knowledge of the bat fauna occurring in lowland eastern Madagascar, where few studies have been conducted (RUSS *et al*., 2001; IFTICENE *et al*., 2005; JENKINS *et al*., 2007). This current paper describes the results of an inventory of the Chiroptera occurring in the Ivoloina Forestry Station.

Materials and Methods

The Ivoloina Forestry Station is located in central-eastern Madagascar, 12 km north of Toamasina (town), and between 18°02'-18°04'S and 49°20'-49°21'E. The elevation of the 282 ha station falls between 10 and 100 m above sea-level. The site is subjected to the permanent action of moisture-laden breezes coming off the Indian Ocean, and the generally nocturnal rainfall has an annual mean of 3055.7 mm (DONQUE, 1972). The mean annual temperature is 24.2°C (data from the Direction de la Météorologie d'Ampandrianomby, Antananarivo). The vegetation is largely dominated by plantations of exotic trees such as *Eucalyptus* spp. (Myrtaceae) and *Pinus* spp. (Pinaceae), marshlands and associated rice paddies, with a small patch of native lowland forest of approximately 1 ha. Indigenous plants such as *Ravenala madagascariensis* (Strelitziaceae) and *Raphia farinifera* (Arecaceae) and the exotic *Psidium cattleianum* (Myrtaceae) are common inside the station.

Three main study sites within the station were:

Site 1 (18°03.419'S, 49°21.660'E, 15 m) characterized by an open lake surrounded by exotic tree plantations, *Typhonodorum lindleyanum* (Araceae), *Ravenala madagascariensis* and *Cinnamomum zelanicum* (Lauraceae);

Site 2 (18°03.421'S, 49°21.546'E, 15 m) constituted by a quasi-natural forest of about 1 ha bisected by a stream and associated cascade. Vegetation is composed largely of *Anthostema madagascariense* and *Uapaca amplifolia* (Euphorbiaceae), *Canarium madagascariense* (Burseraceae), *Spathodea campanulata* (Bignoniaceae) and *Dalbergia madagascariensis* (Fabaceae) (Randriatavy, 2004); and

Site 3 (18°03.537'S, 49°21.612'E, 15 m) is dominated by rice fields surrounded by plantations of *Eucalyptus robusta*, *Pinus* sp. and *Psidium cattleianum*.

Four visits of approximately one month each were made to the station (24-29 April and 9 May to 2 June 2007, 11 November to 9 December 2007, 5 January to 2 February 2008 and 24 April to 24 May 2008). During each visit, different survey techniques were used on alternate nights: capture with different devices at fixed sites and ultrasonic detection with two different census points at Site 1 and Site 3 and a single point at Site 2. This sampling procedure was repeated four times at each of the three main sites. To obtain further information on the locally occurring bat fauna, we attempted to capture bats at nine other sites, which were randomly chosen within the station and presumed to be used by bats as flyways or feeding areas (Appendix 1). Further, interviews were carried out with local people about the presence of bat roosts close to the Ivoloina Forestry Station.

At each of the three principal study sites, bats were captured using 12 m mist net (with 36 mm mesh and 4 shelves) installed across potential flyways. Mist nets were open each night for 6 hours divided in two phases (between 5:30 p.m. and 9:30 p.m. and the second between 3:00 a.m. and 5:00 a.m.) and visited every 15 minutes. At other capture sites, a combination of different mist nets (6 m and 12 m mist net, mesh (respectively) 24 mm and 36 mm, and 4 shelves) were used, and were open for 2 or 3 hours after sunset; at one site the nets were open all night and checked from time to time until dawn. A harp trap measuring 2 x 1.9 m was used at Site 1 and Site 3. Captured bat were identified using the determination keys and descriptions of DORST (1947), PETERSON *et al*. (1995) and BATES *et al*. (2006).

Ultrasonic detection was employed as an additional survey technique to complete species list within the Ivoloina Forestry Station. A bat detector (Pettersson D 240X) connected with a portable Minidisc Recorder (type Sony MZ-N505) was used. Recording periods were of approximately 20 seconds. Echolocation calls heard in heterodyne were manually transformed to time expansion (x 10) mode before being registered. Detection was undertaken between 5:45 p.m. and 8:15 p.m. for the first stage and between 03:45 a.m. and 05:15 a.m. for the second stage. Recorded vocalizations were analyzed using «Bat Sound Pro Software» (Pettersson Elektronik, Sweden). Bat calls were identified, when possible, by comparing measured parameters and structure with the dictionary constructed by RUSS *et al.* (2001). Until a finer level differentiation of Molossidae species is available, we place them under a single generic group (see below).

Results

In total, 22 individuals of five species of insectivorous bats were captured with mist nets at the Ivoloina Forestry Station, consisting of *Myotis goudoti* (A. Smith, 1834), *Pipistrellus raceyi* Bates, Ratrimomanarivo, Harrison and Goodman, 2006, *Myzopoda aurita* Milne-Edwards and Grandidier, 1878, *Hipposideros commersoni* (E. Geoffroy, 1813) and *Chaerephon pumilus* (Cretzschmar, 1826). At least one

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Table 1: Trap success and species richness at each of the principal study sites at Ivoloina Forestry Station and the randomly sampled sites. The sampling effort is expressed as net-meter-hours (NMH) pooled across the different seasons.

Species	Site 1	Site 2	Site 3	Random sites
Sampling effort (NMH)	5760	5760	5760	1263
Myzopodidae				
Myzopoda aurita	8	2	2	1
Vespertilionidae				
Myotis goudoti	0	2	0	2
Pipistrellus raceyi	1	0	0	0
Hipposideridae				
Hipposideros commersoni	0	1	0	1
Molossidae				
Chaerephon pumilus	0	0	0	2
Number of species captured	2	3	1	4
Number of individual captured	9	5	2	6

Table 2: Bat taxa recorded with time-expanded echolocation recordings at each principal study site in the Ivoloina Forestry Station. +/-: the presence or absence of a given taxa, respectively.

Taxa	Site 1	Site 2	Site 3
Myzopodidae			
Myzopoda aurita (39.7-45.4 kHz)	+	-	+
Vespertilionidae			
Pipistrellus /*Eptesicus* spp. (44.1-47.5 kHz)	+	-	+
Myotis goudoti 78.8 kHz	-	+	-
Miniopteridae			
Miniopterus spp. (51-57 kHz)	+	+	-
Molossidae (19.3-35.4 kHz)	+	+	+
Number of taxa detected	4	3	3

specimen per species of captured bats were retained as voucher specimens deposited in the Field Museum of Natural History (SMG field numbers) and in the Département de Biologie Animale, Université d'Antananarivo (RB field numbers). One individual of *Myzopoda aurita* were marked by wing punctures and released but never recaptured.

Myzopoda aurita (Myzopodidae) represented 59.1% of the captures, followed by *Myotis goudoti* (18.2%) and *Pipistrellus raceyi* (4.6%) (Vespertilionidae), *Hipposideros commersoni* (Hipposideridae) (9.1%) and *Chaerephon pumilus* (Molossidae) (9.1%) (Table 1). Two species (*Myzopoda aurita* and *Pipistrellus raceyi*) were captured at Site 1 (open lake); three species (*Myzopoda aurita*, *Myotis goudoti* and *Hipposideros commersoni*) at Site 2 (quasi-natural forest); and one species (*Myzopoda aurita*) at Site 3 (rice field surrounded by exotic plantation). *Pteropus rufus* Tiedemann, 1808 (Pteropodidae) were observed flying over Site 1 and 3; no details are available about the nearest day roost of this species. *Chaerephon pumilus* was captured at a randomly sampled site, where a mist net was placed in an open area next to a building; the second individual of *Hipposideros commersoni* was captured at the same site (Appendix 1). Given that capture rates were notably low within the forestry station, data are not analysed on a seasonal basis. Nevertheless, *Myzopoda aurita* was captured during each visit, and this animal is clearly adapted to living in the degraded habitat of the station.

As a result of interviews with local people, two buildings outside of the Ivoloina Forestry Station were identified as bat day roosts. In both cases, the occupants were *Mops leucostigma* (Allen, 1918) and voucher specimens were saved. The first colony was observed inside the ceiling of a hospital (CSB II, 18°00.706'S, 49°24.238'E, approximately 8 km from the station) and the second colony in the ceiling of a local training centre (49°21.500'E, 18°03.451'S, approximately 3 km from the station).

Five taxa of insectivorous bats were detected from time-expanded echolocation recordings (Table 2). Four taxa -- Molossidae, *Pipistrellus*/*Eptesicus* sp., *Miniopterus* spp., *Myzopoda aurita* -- were found at Site 1; three taxa -- Molossidae, *Myotis goudoti*, *Miniopterus* spp. -- at Site 2; and three taxa -- Molossidae, *Pipistrellus* / *Eptesicus* sp., *Myzopoda aurita* -- at Site 3. A total of 1189 calls were recorded: 95.5% of which were assigned to the Molossidae and 2.4% belongs to the balance of the other families and 2.1% to unidentified taxa.

Discussion

Species diversity in the Ivoloina Forestry Station based on trapping

Although a considerable number of meter-net-hours were accrued at each of the three principal sites, few individuals and only five species of bat were captured in the Ivoloina Forestry Station. With the synanthropic species *Mops leucostigma* obtained outside the forestry station, six species were documented within or in close proximity to the station. Bat species richness in the Ivoloina Forestry Station is similar to the Tampolo Forestry Station, approximately 100 km to the north and composed of 675 ha of degraded littoral forest and marshlands (GOODMAN and RATSIRARSON, 2005), which has six species of Chiroptera (IFTICENE *et al*., 2005, S. M. GOODMAN, pers. comm.). Four species were common to both sites (*Pipistrellus raceyi, Myzopoda aurita, Hipposideros commersoni* and *Mops leucostigma*), *Rousettus madagascariensis* G. Grandidier, 1928 and *Taphozous mauritianus* E. Geoffroy, 1818 were also found at Tampolo Forestry Station. As for Ivoloina, *Mops leucostigma* was captured closed to Tampolo Forestry Station (S. M. GOODMAN, pers. comm.). Although these two localities are the only known sites to have been surveyed in the lowland central eastern portion of the island, this suite of common species is presumed to be characteristic of degraded habitats within this zone.

There may be a relationship between the quality of habitat and the level of capture. *Myotis goudoti* was only captured at Site 2, formed by a quasi-natural forest formation. At the randomly sampled sites, this species was also trapped flying across a trail inside the quasi-natural forest and across another trail surrounded by exotic plantations.

This study provides insight into which bat species occur in an area almost devoid of natural forest vegetation, as the principal plant cover of the station is largely composed of secondary formations of *Ravenala madagascariensis* and *Typhonodorum lindleyanum*, which have been proposed as roosting sites for *Myzopoda aurita* (GÖPFERT and WASSERTHAL, 1995). This might explain why this species was the most frequently captured bat within the forestry station and confirms this species' ability to live in degraded habitats across much of the length of the eastern lowland areas of the island (GOODMAN *et al*., 2007).

The capture of *Pipistrellus raceyi* in the Ivoloina Forestry Station provides an additional locality for this recently described endemic taxa, which was previously recorded in

the eastern portion of the island at Kianjavato (75 km to the south of Ivoloina Forestry Station) and Tampolo Forestry Station (10 km to the north of Ivoloina Forestry Station) (BATES *et al*., 2006).

Species diversity in the Ivoloina Forestry Station based on the acoustic survey

The use of ultrasonic surveys is known to provide further information at a given site on species richness than simple trapping surveys (FLAQUIER *et al*., 2007). The acoustic survey undertaken in the Ivoloina Forestry Station was made at a series of fixed stations, in order to document species richness at the three principal study sites. Five taxa were detected with the ultrasound device in the station, but some recordings remain unidentified because of their poor quality. Some Malagasy species such as *Myotis goudoti* and *Myzopoda aurita* have distinctive echolocation calls and can be identified by analysing time-expanded echolocation recordings made in free flight; however, this is not the case for the majority of Malagasy taxa (RUSS *et al*., 2001). Moreover, no individual of *Miniopterus* was captured in the Ivoloina Forestry Station but the ultrasonic study shows the presence of more than one species in the station. One of them may be a member of the ex-*Miniopterus manavi* group which is paraphyletic (Goodman *et al*., 2009, in press).

RUSS *et al*. (2001) discussed the complexity of the identification of *Eptesicus* and *Pipistrellus* species from recording hand-held animals and consolidated them as *Eptesicus*/*Pipistrellus*. Subsequently, there have been several pipistrelloid bats added to the Malagasy fauna based on morphological studies but information on the echolocation calls of these taxa are lacking (BATES *et al.*, 2006). Hence, herein we follow the combined *Eptesicus*/*Pipistrellus* category of RUSS *et al*. (2001). For *M. aurita,* the echolocation calls are composed of four components with decreasing frequency, which permits it to be distinguished from *Eptesicus*/*Pipistrellus* complex even through these groups fall within the same kHz band frequency (Table 2).

As *Miniopterus* spp. were detected at Site 1 (open lake) and Site 2 (quasi-natural forest), this would indicate their ability to pass or feed closed to marshlands or more cluttered habitat. KOFOKY *et al*. (2007) showed the habitat preference of *M*. "*manavi*" as forest edge and clearing by acoustic survey. Based on current information, it is difficult to identify at the species level low-frequency recording (<35 kHz), such as molossids (JENKINS *et al*., 2007). Associated with an inventory survey in the southerneastern portion of the island, Jenkins *et al.* (2007) segregated three different type of low-frequency echolocation calls, which were assigned to three molossid groups: "molossid sp. 1" (15-19 kHz), "molossid sp. 2" (20-30 kHz), and "molossid sp. 3" (> 30 kHz). For molossids detected in the Ivoloina Forestry Station, the mean peak frequency was 26 kHz. Molossids were the most common bat species recorded during the ultrasonic surveys, but were rarely captured. This is best explained by their ability to exploit open habitat but were difficult to capture because the height that they fly is considerably above the mist-net placement.

In order to establish a dictionary of the echolocation calls of small bats such as *Pipistrellus*, *Eptesicus*, and *Miniopterus*, these species must be recorded and at the very least tissue samples saved for molecular studies, although at this stage in the evolution of the taxonomy of Malagasy bats a voucher specimen would be more appropriate. This aspect was already initiated during this study and continues in the context of other projects to provide a more refined and properly documented dictionary of local bats.

Conclusion

The present study documents the bat fauna of the Ivoloina Forestry Station, and highlights the need to use acoustic methods in parallel with mist netting and harp traps during survey studies on Madagascar. *Myzopoda aurita* was the most frequently captured species at the site, but molossids were overwhelmingly the most commonly detected group during the ultrasound survey. Only trapping at Site 2 and two random sites resulted in the capture of *Myotis goudoti*, a species with a broadband echolocation, characteristic of species in occurring in vegetated zones. The former vast eastern lowland humid forests of the island have been extensively degraded by humans over the past 50 years (HARPER *et al*., 2007) and little of this formation remains, since the bat fauna of this habitat is largely unknown future studies including capture and ultrasonic survey should focus on this remnants of this habitat.

Acknowledgement

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Appendix 1. Coordinates of randomly sampled sites and species captured within the Ivoloina Forestry Station. Codes: 0 = no bat captured, 1 = *Myotis goudoti*, 2 = *Chaerephon pumilus*, 3 = *Hipposideros commersoni*, 4 = *Myzopoda aurita*.

Longitude	Latitude	Habitat setting	Species captured
49°21.857'E	18°03.402'S	Close to the park entrance, *Gluta tourtour* (Anacardiaceae) formations	0
49°21.500'E	18°03.451'S	At the edge of Lake Fulgence	0
49°21.784'E	18°03.623'S	near the Station modèle agricole	0
49°21.681'E	18°03.594'S	Across a trail to the camping site	1
49°21.635'E	18°03.406'S	Closed to Peace Corps building (habitation)	2, 3
49°21.522'E	18°03.374'S	Across a trail in the quasi-natural forest	1
49°21.451'E	18°03.559'S	On the bridge across from Lake Fulgence	0
49°21.431'E	18°03.574'S	Ecotone between exotic plantation and Lake Fulgence	4
49°21.554'E	18°03.376'S	At the ecotone of the quasi-natural forest	0

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RECENT LITERATURE

REPORTS

AFRICAN CHIROPTERA REPORT. 2009. African Chiroptera Project, Pretoria. i - xvi + 2960 pp.

ISSN 1990-6471

The *African Chiroptera Report 2009* is currently most comprehensive in the presentation of information on extant and fossil/extinct African bat and their known synonyms. Species specific information associated with the taxa has also been compiled.

Information that may answer specific requirements of a user, i.e. more information about 46,044 voucher specimens, or specimen collectors, has been drawn from across the database and is presented in separate appendices. The newly introduced appendix 2j provides species and specimens accumulation curves, starting with the first African specimens for which the collection year was recorded back in the 1830s. Common names arranged in alphabetical order together with corresponding scientific names is available in appendix 3e, while 3f has separated the common names and associated taxa by the various languages (Afrikaans, Arabian, Basque…English, Estonian,…Swedish, Yao). 45 published identification keys for African bat species, have, where necessary, been updated to include current names, and are presented in an appendix 5.

A start has also been made, in an appendix 6, to make images available of type specimens. Many of the original descriptions have been made available in an appendix 3g, although due to copyright law issues only those older than 50 years are included in the current report.

The report can be downloaded free of charge from http://www.Africanbats.org/ACR.html

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Appendix 2: Voucher specimens www.africanbats.org/docs/Appendix_2_ACR_2009.pdf [15.9Mb]
Appendix 3: Synonyms www.africanbats.org/docs/Appendix_3_ACR_2009.pdf [1 .76Mb]
Appendix 4: Collector Information www.africanbats.org/docs/Appendix_4_ACR_2009.pdf [4.17Mb]
Appendix 5: Keys from the Literature www.africanbats.org/docs/Appendix_5_ACR_2009.pdf [542kb]
Appendix 6: Images of Type Specimens www.africanbats.org/docs/Appendix_6_ACR_2009.pdf [3.69Mb]
Appendix 7: Summary of Characteristic Information www.africanbats.org/docs/Appendix_7_ACR_2009.pdf [85.5kb]
Appendix 8: Abstracts www.africanbats.org/docs/Appendix_8_ACR_2009.pdf [556kb]

GIS DATA:
In this the 2009 release of the report it was decided to share the voucher specimen data contained in the African Chiroptera Database. This information has been converted to ESRI Shape files, and can be opened in any GIS software application or alternatively the various dbf files can be imported into any database software. Please note that there is no guarantee to the accuracy of the spatial data,

Download all distribution data for taxa - ACR2009_taxa.zipx [1.2Mb]

Download all taxa records for all African countries - ACR2009_country [765kb]

Any mistakes, misrepresentation of data, or omitted publications can be reported to the managing editors of the database (AfricanChiropteraReport@Africanbats.org). This will allow corrections and updates to be made in the next report (July 2010).

The African Chiroptera Report 2009 and the Africanbats.org website has been hosted by Earthcape – www.earthcape.com.

PUBLISHED PAPERS

ANDRIANAIVOARIVELO, A. R., SHORE, G. D., MCGUIRE, S. M., JENKINS, R. K. B., RAMILIJAONA, O., LOUIS JR., E.E, and BRENNEMAN, R. A., 2009. Characterization of 22 microsatellite marker loci in the Madagascar rousette (*Rousettus madagascariensis*). *Conservation Genetics* 10: 1025-1028.

Abstract: Twenty-two nuclear microsatellite loci were isolated from a genomic DNA library derived from Madagascar's Rousettus madagascariensis. Marker characteristics were determined from a single population (37 individuals) from Fort Dauphin (southeastern Madagascar). Sixteen of the 22 loci were within Hardy-Weinberg expectations. These loci are highly informative with polymorphic information content values ranging between 0.757 and 0.916. These loci will provide valuable information for the study of population genetics and gene flow within this species of bats. Due to the dramatic reduction and alteration of their habitat, data generated utilizing this marker suite will potentially provide additional information for the effective long-term management of this near-threatened bat species.

BAKWO, E. M., 2009. Inventaire des chauves souris de la réserve de biospère du Dja, Cameroun. *Le Vespère* (2): 11-20.

Abstract: We report on the results of a bat inventory of the Dja biosphere reserve in southern Cameroon rainforest. In total, we recorded 29 bat species belonging to 16 genus and 8 families. Microchiopteran bats are more diversified (21 species), but less abundant compared to Megachiropteran bats in this reserve. During this survey, a species is recorded for the first time for Cameroon: *Epomops buettikoferi*. This record raises the species total for that country from 71 to 72.

BARRIERE, P., NICOLAS, V., and ODURO, L. K., 2008. Rapid survey of the small mammals of Ajenjua Bepo and Mamang River Forest Reserves, Ghana. MCCULLOUGH, J., HOKE, P., NASKRECKI, P., and OSEI-OWUSU, Y. [Eds]. A Rapid Biological Assessment of the Ajenjua Bepo and Mamang River Forest Reserves, Ghana: 54-57, 89-93.

Abstract: Small mammals (shrews, rodents and bats) were surveyed in the Ajenjua Bepo and Mamang River forest reserves of eastern Ghana. A total of 128 specimens belonging to at least 18 species were recorded including five species of rodent, six species of shrew and seven bat species. Within Ajenjua Bepo, six shrew species were recorded including four forest species. Despite the high degree of disturbance of the secondary forest, three specimens of *Crocidura muricauda* were collected. Only three species of murid rodents were collected, with two forest species (*Malacomys edwardi* and *Praomys tullbergi*). Six pteropodid bat species and a single insectivorous bat species were recorded. Several of these species were forest-dwelling species. Within the Mamang River Forest Reserve, five or six shrew species were collected, the dominant species being the forest-dwelling *Crocidura obscurior*. With a similar trapping effort as at Site 1, a higher number of specimens (39) and species (5) of rodents were recorded within Mamang River. The forest-dwelling *Praomys tullbergi* was dominant. Only four specimens of a single forest-dwelling bat species (*Myonycteris torquata*) were recorded within the forest, most likely a result of weather conditions during surveys. Both species richness and species abundance of the forest shrew and murid rodent species point to a higher conservation potential of Mamang River than Ajenjua Bepo. Mamang River appears to present better conservation value due to 1) its larger size, 2) the absence of plantations within Mamang, and 3) the more structured arboreal vegetation within Mamang probably providing more fruit and leaf litter.

BENDA, P., REITER, A., AL-JUMAILY, M., NASHER, A. K., and HULVA, P., 2009. A new species of mouse-tailed bat (Chiroptera: Rhinopomatidae: *Rhinopoma*) from Yemen. *Journal of the National Musuem (Prague), Natural Histroy Series* 177(6): 53-68.

Abstract: Based on genetic and morphological comparisons, a new species of the mouse-tailed bat, *Rhinopoma hadramauticum* sp. nov., is here described from south-eastern Yemen. The new species remains known only from the type locality, Ash Sheher, coastal Hadramaut.

CARDIFF, S. G., RATRIMOMANARIVO, F. H., REMBERT, G., and GOODMAN, S. M., 2009. Hunting, disturbance and roost persistence of bats in caves at Ankarana, northern Madagascar. *African Journal of Ecology*: e10.

Abstract: Surveys and monitoring of 37 caves in and around the Ankarana Special Reserve, northern Madagascar, yielded evidence of hunting of bats and potential disturbance of bats by miners and tourists, and colony counts for several bat species of potential conservation concern. Colony size decreased by 95% and 14% for a colony of *Hipposideros commersoni* and a colony of *Eidolon dupreanum*, respectively, when recent evidence of hunting occurred at those colonies and those declines are probably attributable to hunting. Evidence of hunting occurred commonly at the roosts of those species and most commonly at the roosts of *Rousettus madagascariensis*. Hunting of pteropodids was associated with high vulnerability of roosts to hunters, little forest buffer between the cave and open savannah and the absence of tombs in the cave. Roost sites of the hunted species persisted for at least several years and this regularity may facilitate hunting. This work supports the ranking of *E. dupreanum*, *R. madagascariensis* and *H. commersoni* as species of conservation concern. Managers should consider the impact of tourist visits on bats and of increasing access to caves for tourism. Conservation efforts for the hunted species should also seek to protect vulnerable and unprotected cave roosts.

CHEKE, A. S., 2009. Not lost but hiding - type material of the endemic Mauritian bat *Mormopterus acetabulosus* (Hermann, 1804) (Chiroptera: Molossidae). *Journal of the National Museum (Prague), Natural History Series* 178(1): 1-3.

Abstract: The recent designation of a neotype for *Mormopterus acetabulosus* is invalid as there is an existing holotype illustration, a pair of drawings used in the original description.

EITING, T. P., and GUNNELL, G. F., 2009. Global completeness of the bat fossil record. *Journal of Mammalian Evolution* 16: 151-173.

Abstract: Bats are unique among mammals in their use of powered flight and their widespread capacity for laryngeal echolocation. Understanding how and when these and other abilities evolved could be improved by examining the bat fossil record. However, the fossil record of bats is commonly believed to be very poor. Quantitative analyses of this record have rarely been attempted, so it has been difficult to gauge just how depauperate the bat fossil record really is. A crucial step in analyzing the quality of the fossil record is to be able to accurately estimate completeness. Measures of completeness of the fossil record have important consequences for our understanding of evolutionary rates and patterns among bats. In this study, we applied previously developed statistical methods of analyzing completeness to the bat fossil record. The main utility of these methods over others used to study completeness is their independence from phylogeny. This phylogenetic-independence is desirable, given the recent state of flux in the higher-level phylogenetic relationships of bats. All known fossil bat genera were tabulated at the geologic stage or sub-epoch level. This binning strategy allowed an estimate of the extinction rate for each bat genus per bin. Extinction rate—together with per-genus estimates of preservation probability and original temporal distributions—was used to calculate completeness. At the genus level, the bat fossil record is estimated to be 12% complete. Within the order, Pteropodidae is missing most of its fossil history, while Rhinolophoidea and Vespertilionoidea are missing the least. These results suggest that 88% of bats that existed never left a fossil record, and that the fossil record of bats is indeed poor. Much of the taxonomic and evolutionary history of bats has yet to be uncovered.

GOGOLEVSKY, K. P., VASSETZKY, N. S., and KRAMEROV, D. A., 2009. 5S rRNA-derived and tRNA-derived SINEs in fruit bats. *Genomics* 93: 494-500.

Abstract: Most short retroposons (SINEs) descend from cellular tRNA of 7SL RNA. Here, four new SINEs were found in megabats (Megachiroptera) but neither in microbats nor in other mammals. Two of them, MEG-RS and MEGRL, descend from another cellular RNA, 5S rRNA; one (MEG-T2) is a tRNA-derived SINE; and MEG-TR is a hybrid tRNA/5S rRNA SINE. Insertion locus analysis suggests that these SINEs were active in the recent fruit bat evolution. Analysis of MEG-RS and MEG-RL in comparison with other few 5S rRNA-derived SINEs demonstrates that the internal RNA polymerase III promoter is their most invariant region, while the secondary structure is more variable. The mechanisms underlying the modular structure of these and other SINEs as well as their variation are discussed. The scenario of evolution of MEG SINEs is proposed.

GOODMAN, S. M., MAMINIRINA, C. P., WEYENETH, N., BRADMAN, H. M., CHRISTIDIS, L., RUEDI, M., and APPLETON, B., 2009. The use of molecular and morphological characters to resolve the taxonomic identity of cryptic species: the case of *Miniopterus manavi* (Chiroptera, Miniopteridae). *Zoologica Scripta* 38: 339-363.

Abstract: Based on recent molecular phylogenetic studies, the Old World bat family Miniopteridae, composed of species in the genus *Miniopterus*, has been shown to contain complex paraphyletic species, many of which are cryptic based on convergent morphological characters. Herein we resolve the phylogenetic relationships and taxonomy of the species complex *M*. *manavi* on Madagascar and in the Comoro Archipelago, where these animals occur in different bioclimatic zones. First using mitochondrial cytochrome*b* sequence data to define clades and then morphology to corroborate the molecular data, including comparisons to type specimens, we demonstrate that animals identified as this taxon are a minimum of three species: *M*. *manavi sensu stricto* occurs in at least the central portion of the Central Highlands; *M*. *griveaudi* has a broad distribution in lowland northern and central western Madagascar and the Comoros (Anjouan and Grande Comore), and *M*. *aelleni* sp. n. has been found in northern and western Madagascar and the Comoros (Anjouan). In each case, these three clades were genetically divergent and monophyletic and the taxa are diagnosable based on different external and craniodental characters. One aspect that helped to define the systematics of this group was isolation of DNA from one of the paratypes of *M. manavi* collected in 1896 and new topotypic material. *Miniopterus manavi* is most closely allied to a recently described species, *M. petersoni*. At several localities, *M*. *griveaudi* and *M*. *aelleni* have been found in strict sympatry, and together with *M. manavi sensu stricto* show considerable convergence in morphological characters, but are not immediate sister taxa. In defining and resolving the systematics of cryptic species, such as miniopterid bats, the process of defining clades with molecular tools, segregating the specimens accordingly, and identifying corroborative morphological characters has been notably efficient.

GOODMAN, S. M., MAMINIRINA, C. P., BRANMAN, H. M., CHRISTIDIS, L., and APPLETON, B. R., 2009. Patterns of morphological and genetic variation in the endemic Malagasy bat *Miniopterus gleni* (Chiroptera: Miniopteridae), with the description of a new species, *M. griffithsi*. *Journal of Zoological Systematics and Evolutionary Research*: 1-12.

Abstract: Over the past decade, major advances have been made concerning the systematics and species diversity of Malagasy bats, largely based on specimens collected during inventories and associated morphological and molecular genetic studies. Herein we describe a new species of endemic bat from southern Madagascar, *Miniopterus griffithsi* sp. n., which is the sister taxa to *Miniopterus gleni*, a taxon described in 1995 (holotype from Sarodrano, just north of the Onilahy River in the southwest). Based on current information, *M. griffithsi* is found in the sub-arid bioclimatic zone, south of the Onilahy River, and *M. gleni* occurs in a variety of different bioclimatic zones, north of the Onilahy River to the northern portion of the island and on the near shore island of Ile Sainte Marie. The realization that *M. griffithsi* was a separate entity was first based on phylogeographic studies of the *M. gleni* complex. Comparisons using 397 bp of mitochondrial cytochrome *b* found a divergence of 1.2% within animals occurring across much of Madagascar north of the Onilahy River, 0.07% in those south of the Onilahy River, and 7.4% in populations separated by this river. Subsequently, morphological characters were identified that supported the specific separation of populations occurring south (*M. griffithsi*) and north of the Onilahy River (*M. gleni*), which include tragus shape, pelage coloration, and skull proportions.

HOFFMANN, M., GRUBB, P., GROVES, C. P., HUTTERER, R., VAN DER STRAETEN, E., SIMMONS, N., and BERGMANS, W., 2009. A synthesis of African and western Indian Ocean Island mammal taxa (Class: Mammalia) described between 1988 and 2008: an update to Allen (1939) and Ansell (1989). *Zootaxa* 2205: 1-36.

Abstract: We provide a synthesis of all mammal taxa described from the African mainland, Madagascar and all surrounding islands in the 20 years since 1988, thereby supplementing the earlier works of G.M. Allen (1939) and W.F.H. Ansell (1989), and bringing the list of African mammals described over the last 250 years current to December 2008. We list 175 new extant taxa, including five new genera, one new subgenus, 138 new species and 31 new subspecies, including remarks, where relevant, on the current systematic position of each taxon. Names of seven species of primates are emended, according to the requirements of the ICZN. The taxonomic group in which the largest number of new taxa has been described is the Primates, with two new genera, 47 new species and 11 new subspecies, while geographically the biggest increase in new species descriptions has been on the island of Madagascar, accounting for roughly half (67) of all new species described in the past 20 years. Nearly half of all new species listed currently are assessed as Data Deficient on the IUCN Red List of Threatened Species (49 of 101 listed species) suggesting further research is urgently needed to help clarify the status of those recently described species.

JONES, G., JACOBS, D. S., KUNZ, T. H., WILLIG, M., and RACEY, P. A., 2009. Carpe noctem: the importance of bats as bioindicators. *Endangered Species Research*: 1-23.

Abstract: The earth is now subject to climate change and habitat deterioration on unprecedented scales. Monitoring climate change and habitat loss alone is insufficient if we are to understand the effects of these factors on complex biological communities. It is therefore important to identify bioindicator taxa that show measurable responses to climate change and habitat loss and that reflect wider-scale impacts on the biota of interest. We argue that bats have enormous potential as bioindicators: they show taxonomic stability, trends in their populations can be monitored, short- and longterm effects on populations can be measured and they are distributed widely around the globe. Because insectivorous bats occupy high trophic levels, they are sensitive to accumulations of pesticides and other toxins, and changes in their abundance may reflect changes in populations of arthropod prey species. Bats provide several ecosystem services, and hence reflect the status of the plant populations on which they feed and pollinate as well as the productivity of insect communities. Bat populations are affected by a wide range of stressors that affect many other taxa. In particular, changes in bat numbers or activity can be related to climate change (including extremes of drought, heat, cold and precipitation, cyclones and sea level rise), deterioration of water quality, agricultural intensification, loss and fragmentation of forests, fatalities at wind turbines, disease, pesticide use and overhunting. There is an urgent need to implement a global network for monitoring bat populations so their role as bioindicators can be used to its full potential.

JUSTE, J., BILGIN, R., MUÑOZ, J., and IBÁÑEZ, C., 2009. Mitochondrial DNA signatures at different spatial scales: from the effects of the Straits of Gibraltar to population structure in the meridonal serotine bat (*Eptesicus isabellinus*). *Heredity*: 1-10.

Abstract: The meridional serotine bat *Eptesicus isabellinus* is found in North Africa and the Iberian Peninsula. We analyzed the genetic structure of *E. isabellinus* at two different geographic scales to reveal the historical and ecological patterns that have shaped its populations. The role of the Straits of Gibraltar as an isolating barrier between African and Iberian populations is evaluated and the degree of genetic structure and female-mediated gene flow was assessed at a local scale between neighboring colonies. Populations of *E. isabellinus* from Iberia and northern Morocco show little genetic divergence and share mtDNA haplotypes, indicating that the Straits of Gibraltar are neither an impediment to dispersal nor a cause of genetic differentiation. Our results also suggest that *E. isabellinus* may have dispersed from western Andalusia into northern Morocco after the last glacial period. At a smaller geographic scale, the colonies studied showed high variation in genetic variability and structure, indicating that no female-mediated gene flow is present. This pattern is consistent with a described pattern of independent endemic viral circulation of the bat rabies virus EBLV-1, which was found when studying rabies dynamics in the same serotine bat colonies.

KITYO, R. M., KERBIS PETERHANS, J. C., HUHNDORF, M. H., and HUTTERER, R., 2009. New additions and noteworthy records of the bat (Mammalia: Chiroptera) fauna of Uganda, Rwanda, and the Democratic Republic of Congo. *Bonner zoologische Monographiens* 55: 127-140.

Abstract: New records are reported for five species of bats from Central Africa. Two genera (*Laephotis* and *Casinycteris*) and a large member of *Kerivoula* (? *cuprosa*) are recorded from Uganda for the first time but the specific identification of the later taxon is problematic. *Nycteris grandis* and *Kerivoula* c.f. *cuprosa* are reported from Rwanda for the first time. The number of known specimens of the rare Afrotropical bat, *Casinycteris argynnis* is nearly tripled. The second and third records of *Taphozous perforatus* confirm its presence in Uganda.

KYNDT, T., ASSOGBADJO, A. E., HARDY, O. J., GLELE KAKAD, R., SINSIN, B., VAN DAMME, P., and GHEYSEN, G., 2009. Spatial genetic structuring of baobab (*Adansonia digitata*, Malvaceae) in the traditional agroforestry systems of West Africa. *Am. J. Bot.* 96(5): 950-957.

Abstract: This study evaluates the spatial genetic structure of baobab (*Adansonia digitata*) populations from West African agroforestry systems at different geographical scales using AFLP fingerprints. Eleven populations from four countries (Benin, Ghana, Burkina Faso, and Senegal) had comparable levels of genetic diversity, although the two populations in the extreme west (Senegal) had less diversity. Pairwise FST ranged from 0.02 to 0.28 and increased with geographic distance, even at a regional scale. Gene pools detected by Bayesian clustering seem to be a byproduct of the isolation-by-distance pattern rather than representing actual discrete entities. The organization of genetic diversity appears to result essentially from spatially restricted gene flow, with some influences of human seed exchange. Despite the potential for relatively long-distance pollen and seed dispersal by bats within populations, statistically significant spatial genetic structuring within populations (SGS) was detected and gave a mean indirect estimate of neighborhood size of ca. 45. This study demonstrated that relatively high levels of genetic structuring are present in baobab at both large and within-population level, which was unexpected in regard to its

dispersal by bats and the influence of human exchange of seeds. Implications of these results for the conservation of baobab populations are discussed.

MICKLEBURGH, S. P., WAYLEN, K., and RACEY, P. A., 2009. Bats as bushmeat: A global review. *Oryx* 43 (2): 217-234.

Abstract: A questionnaire survey and literature review revealed the extent of hunting of bats for bushmeat in the Old World tropics. High levels of offtake were reported throughout Asia, the Pacific islands and some Western Indian Ocean islands, where fruit bats of the genus *Pteropus* are eaten extensively. Most hunting in Africa was reported in western states and the largest fruit bat *Eidolon helvum* was preferred. Insectivorous bats are also eaten, particularly *Tadarida* in Asia. Hunting is both for local consumption and commercial, sometimes involving cross-border transactions. The high levels of hunting reported and the low reproductive rate of bats indicate there are likely to be severe negative effects on bat populations, and declines of several species are documented. Although there has been only one reported attempt to manage offtake, this indicates that it is possible and apparently successful. Furthermore, voluntary controls on hunting have halted declines in bat numbers. There have been several initiatives to reduce hunting pressure and conserve threatened bat species, mainly on islands that, when sustained, have been successful. More education projects and community-based conservation initiatives should be encouraged together with further attempts at sustainable harvesting in situations where disease risk has been evaluated.

O'BRIEN, J., MARIANI, C., OLSON, L., RUSELL, A. L., SAY, L., YODER, A. D., and HAYDEN, T. J., 2009. Multiple colonisations of the western Indian Ocean by *Pteropus* fruit bats (Megachiroptera: Pteropodidae): The furthest islands were colonised first. *Phylog. Evol.* 51(2): 294-303.

Abstract: We investigate the genetic relationships between purported island species of *Pteropus* fruit bat (Megachiroptera) from the western Indian Ocean islands using mitochondrial DNA sequencing in order to infer the pattern of colonisation of this biogeographic region. Most significantly, our genetic data questions the current taxonomic assignment based on morphology of many of the island species and subspecies, suggesting instead that many of the western Indian Ocean islands harbour 'races' of *P. giganteus* from mainland India. Our results strongly argue against a single colonisation event from mainland Asia. Evidence is presented for three colonisation events; the first to the western-most extremity of their range (Comoros and Pemba Island), the second to Rodrigues Island; and a third giving rise to the remaining extant island taxa, the latter two events occurring relatively recently and rapidly.

RAKOTOARIVELO, A. A., RALISATA, M., RAVOAHANGIMALALA, O. R., RAKOTOMALALA, M. R., RACEY, P. A., and JENKINS, R. K. B., 2009. The food habits of a Malagasy Giant: *Hipposideros commersoni* (E. Geoffroy, 1813). *African Journal of Ecology* 47: 283-288.

Abstract: *Hipposideros commersoni* is a large microchiropteran bat endemic to Madagascar. We analysed fragments of its prey from faeces and from underneath feeding perches to describe its diet from four sites. Diet was similar across sites and Coleoptera was the main prey item by percentage volume (75%), followed by Hemiptera (13%). Carabidae and Scarabidae were the most frequent coleopterans found in the diet. Direct observations (n = 3) were made of bats flying short distances from perches along forest trails to prey on Cicadidae (c. 20 mm in length) located on tree trunks. There were differences in the composition of faecal samples collected form netted bats and pellets collected under feeding perches, with the latter consisting of more Blattoptera (Blattellidae 'cockroaches'). *Hipposideros commersoni* appears to have a unique foraging behaviour and diet among Malagasy microchiropterans and its preference for certain Coleoptera and other large invertebrates may account for reported seasonal variation in body fattening and activity.

RATRIMOMANARIVO, F. H., GOODMAN, S. M., TAYLOR, P. J., MELSON, B., and LAMB, J., 2009. Morphological and genetic variation in *Mormopterus jugularis* (Chiroptera: Molossidae) in different bioclimatic regions of Madagascar with natural history notes. *Mammalia* 73: 110-129.

Abstract: We investigated patterns of morphological and genetic variation in *Mormopterus jugularis*, an endemic Malagasy Molossidae. On the basis of external and cranio-dental measurements taken from adult specimens, the following conclusions can be drawn: there is notable sexual dimorphism, males being larger than females and there is no clear pattern of variation associated with bioclimatic, latitudinal or altitudinal zonation. DNA sequence analyses were based on 1078 nucleotides of the mt cytochrome *b* (cyt *b*) gene (n=20) and 351 nucleotides of the 5' hypervariable region of the D-loop (n=50). A high haplotype diversity within *M. jugularis* (cyt *b*=0.995, D-loop=1.00) was combined with an absence of genetic structure. Analysis of molecular variance showed no significant grouping of haplotypes with latitude, longitude or altitude. D-loop diversity and neutrality analyses indicate that the Malagasy samples form a single population, which has been expanding for between 120,884 and 230,588 years. According to the MaxEnt potential distribution model, *M. jugularis* is predicted to occur ubiquitously across most of southern and central Madagascar, accounting for the observed genetic and morphological homogeneity of populations; observed specimen records north of 18°S occur in unsuitable habitats and may have arisen from recent expansion into synanthropic roosts. This species has a broad geographic distribution across much of Madagascar, encompassing the elevational range from 70 to 1750 m. The vast majority of known roosting sites are in human built structures, which are often shared with different species of Molossidae.

RATRIMOMANARIVO, F. H., GOODMAN, S. M., STANLEY, W. T., NAIDOO, T., TAYLOR, P. J., and LAMB, J., 2009. Geographic and phylogeographic variation in *Chaerephon leucogaster* (Chiroptera: Molossidae) of Madagascar and the western Indian Ocean islands of Mayotte and Pemba. *Acta Chiropterologica* 11(1): 25-52.

Abstract: We examine patterns of morphological and genetic variation in *Chaerephon leucogaster* (family Molossidae) on Madagascar, Mayotte in the Comoros Archipelago, and the offshore Tanzanian island of Pemba. Five external, 10 cranial, and eight dental measurements of animals from different Malagasy populations (grouped according to bioclimatic regions) show differences in the degree of sexual dimorphism and size variation. Further, the population on Mayotte is largely identical in size to those from western Madagascar, and animals from Pemba are notably larger than those from Madagascar and Mayotte. Cytochrome *b* genetic distances across samples from these islands were low (maximum 0.0035) and animals from Pemba and Mayotte shared cytochrome *b* haplotypes with Malagasy bats. D-loop data showed some concordance between haplotype distribution, geographical position (latitude and island), and the bioclimatic zones. Animals from Pemba and Mayotte formed a unique D-loop haplotype, which was a minimum of six mutational steps different from Malagasy haplotypes. Within

Madagascar, certain haplotypes were exclusive to the north (13ºS latitude band) and arid southwest (22º and 23ºS latitudes) regions. In general, there was no clear concordance between variation in haplotype distribution, latitude, altitude or gender. Where concordance occurred, the genetic distances involved were not sufficiently high to warrant the definition of new taxonomic units. Hence, based on current genetic information, patterns of morphological variation of the Madagascar populations and differences between Pemba and Mayotte/Madagascar are best explained as inter-population variation and may be adaptive, associated with different climatic regimes and associated ecological variables.

SMITH, J. D. L., and GREGORY, T. R., 2009. The genome sizes of megabats (Chiroptera: Pteropodidae) are remarkably constrained. *Biology Letters* 5: 347-351.

Abstract: It has long been recognized that bats and birds contain less DNA in their genomes than their non-flying relatives. It has been suggested that this relates to the high metabolic demands of powered flight, a notion that is supported by the fact that pterosaurs also appear to have exhibited small genomes. Given the long-standing interest in this question, it is surprising thatalmost no data have been presented regarding genome size diversity among megabats (family Pteropodidae). The present study provides genome size estimates for 43 species of megabats in an effort to fill this gap and to test the hypothesis that all bats, and not just microbats, possess small genomes. Intriguingly, megabats appear to be even more constrained in terms of genome size than the members of other bat families.

TAYLOR, P. J., LAMB, J., REDDY, D., NAIDOO, T., RATRIMOMANARIVO, F., and GOODMAN, S. M., 2009. Cryptic lineages of little free-tailed bats *Chaerephon pumilus* (Chiroptera: Molossidae) from southern Africa and the western Indian Ocean islands. *African Zoology* 44(1): 55-70.

Abstract: We investigate mitochondrial DNA and craniometric variation in southern African and Malagasy populations of the small and morphologically variable, house-roosting molossid bat, *Chaerephon pumilus* in relation to Malagasy populations of the related, smaller-sized species, *C. leucogaster.* Both cytochrome *b* and D-loop sequences show *C. leucogaster* to be nested within *C. pumilus sensu lato,* with Malagasy *C. pumilus* forming a sister group to African *C. pumilus* and Malagasy *C. leucogaster.* Four distinct D-loop clades are found in southern African populations, all of which occur sympatrically in the greater Durban area of KwaZulu-Natal Province, whilst two of the Durban clades also characterize 1) northern KwaZulu-Natal and low-lying (<600 m) areas of Swaziland, and 2) 'inland' populations comprising the Kruger National Park and higher-lying (>600 m) areas of Swaziland. Clades from low-lying areas show evidence of historical demographic expansion around 3300-13 000 years ago (KwaZulu-Natal coastal clade, Clade A1) to 14 700-60 000 years ago (Durban clade, Clade B1), whilst the inland clade (Clade B2a) was demographically more stable. The origin of these clades can be explained by sea level and vegetation changes hypothesized to follow the Last Glacial Maximum (LGM) after 18 000 years ago. Sympatric clades are shown to differ significantly in the proportional width of the braincase, and ongoing work will test evidence for acoustic and other morphological differences between them.

VAN DER MERWE, M., and STIRNEMANN, R. L., 2009. Group composition and social events of the bannana bat, *Neoromicia nanus*, in Mpumalanga, South Africa. *South African Journal of Wildlife Research* 39(1): 48-56.

Abstract: The social structure of banana bats (*Neoromicia nanus*) was studied in relation to reproductive events over an annual cycle in banana plantations in Mpumalanga Province, South Africa. Banana plantations were visited at monthly periods over a year, and social group composition was investigated. Group composition varied considerably over the annual cycle, and was linked to reproductive status. Mixed-sex groups began to form during February, lasted until October, and were most frequent during mid winter (July). During the lactation period (Oct-Jan), females formed maternity colonies composed of lactating females and Juveniles. Three kinds of leaf tubes were identified according to the size of the opening: small (0-20 mm), medium-sized (21-115 mm) and large (115 mm-unfolded leaf). Bats occupied mainly medium-sized leaf tubes. Average daily temperatures were high, even during the winter period (Jun-Aug), with humidity in the leaf tubes >80% throughout the year. Although high humidity may play a role during hibernation to restrict dehydration, low ambient temperatures are important to sufficiently lower their body temperatures in order to lower metabolic rate and thus reduces energy requirements.

YEBOAH, S., 2007. Reproductive pattern of some megachiropteran bats in Ghana. *Ghana Journal of Science* 47: 117-122.

Abstract: Surveys of megachiropteran bats (fruit bats) were carried out in two forest reserves and some areas outside the reserves in the Eastern Region of Ghana. The studies were undertaken during three seasons of the year: end of the major rainy season (July/August), end of the minor rainy season (November/December), and end of the major dry season (March/ April). Ten of Ghana's 13 species of fruit bats were recorded in the area; the commonest species was *Epomops franqueti*. The highest number of bats was caught towards the end of the major dry season, mainly due to the abundance of nutritious seeds of *Cedrella odorata* in the area during this time of the year, and also due to new recruitments into the population. The population was lowest at the end of the major rainy season. The larger fruit bats (*Epomophorus gambianus*, *Epomops franqueti*, *Myonicteris leptodon* and *Rousettus aegyptiacus*) have two breeding seasons: the major one in July/August and a minor one in March /April. With the smaller sized bats (*Micropteropus pussilus* and *Scotonycteris zenkeri*) there are also two breeding seasons but the major one occurs in November/ December and the minor one in April. The Ghanaian megachiropteran bats are capable of producing two litters in a year.

ZHAO, H., ROSSITER, S., TEELING, E. C., LI, C., COTTON, J. A., and ZHANG, S., 2009. The evolution of color vision in nocturnal mammals. *PNAS* 106(22): 8980-8985.

Abstract: Nonfunctional visual genes are usually associated with species that inhabit poor light environments (aquatic/ subterranean/nocturnal), and these genes are believed to have lost function through relaxed selection acting on the visual system. Indeed, the visual system is so adaptive that the reconstruction of intact ancestral opsin genes has been used to reject nocturnality in ancestral primates. To test these assertions, we examined the functionality of the short and medium- to long-wavelength opsin genes in a group of mammals that are supremely adapted to a nocturnal niche: the bats. We sequenced the visual cone opsin genes in 33 species of bat with diverse sensory ecologies and reconstructed their evolutionary history spanning 65 million years. We found that, whereas the long-wave opsin gene was conserved in all species, the short-wave opsin gene has undergone dramatic divergence among lineages. The occurrence of gene defects in the short-wave opsin gene leading to loss of function was found to directly coincide with the origin of high-duty-cycle

echolocation and changes in roosting ecology in some lineages. Our findings indicate that both opsin genes have been under purifying selection in the majority bats despite a long history of nocturnality. However, when spectacular losses do occur, these result from an evolutionary sensory modality tradeoff, most likely driven by subtle shifts in ecological specialization rather than a nocturnal lifestyle. Our results suggest that UV color vision plays a considerably more important role in nocturnal mammalian sensory ecology than previously appreciated and highlight the caveat of inferring light environments from visual opsins and vice versa.

Call for contributions

African Bat Conservation News publishes brief notes concerning the biology of bats, new geographical distributions (preferably at least 100 km from the nearest previously published record), sparsely annotated species lists resulting from local surveys including roost counts and echolocation and sonograms of bat species occurring on the African continent and adjacent regions, including the Arabian peninsula, Madagascar, and other surrounding islands in the Indian and Atlantic oceans.

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