Mabu Forest expedition 10th to 22nd September 2022- Scientific Report

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Contents

Executive Summary

This report provides the final results of the scientific expedition to Mount Mabu, 10th to 22nd September 2022, funded through the Biofund and Rainforest Trust grants to help provide further evidence base towards creating a new protected area for Mount Mabu.

This was the first scientific expedition under the second phase of the Mount Mabu Conservation Project (MMCP) initiative and it focused on studying certain taxonomic groups such as small mammals, freshwater fish, bush-crickets, and butterflies. The expedition returned to the easterly forest camp as used by previous expeditions and surveyed this part of the forest. The small mammals, freshwater fauna, and bush crickets represent gaps in the zoological survey which needed to be surveyed to complete the record for in the eastern part of Mabu forest, thus building on the previous work of biodiversity survey. It is hoped that subsequent expeditions will now focus on the southern, central, western, and northern areas of Mabu forest, all of which are yet to be visited and surveyed by biologists, and should contain further discoveries of species new to science.

Small mammals were previous only sampled opportunistically in the eastern area of Mabu forest, and they represent a gap in the biodiversity survey work, this expedition aimed to survey this taxonomic group more intensely and systematically. Similarly the freshwater fish were only opportunistically surveyed in the past and therefore a more systematic survey was required for this taxonomic group. The bush-crickets, or Katydids, have never been surveyed at Mabu. Butterflies have been a focus of biodiversity survey since the first visit in 2005. Since this time members of the African Butterfly Research Institute (ABRI) have visited the eastern part of the forest on numerous occasions to study an collect butterflies.

In order to survey the small mammals a recognised expert was engaged. This was Professor Ara Monadjem from the University of Eswatini. Professor Ara Monadjem has worked extensively across Mozambique on small mammal and bats, is author of the books 'Rodents of Sub-Saharan Africa' and 'Bats of Southern and Central Africa', and has been on previous expeditions organised by J. Bayliss. He also works regularly at Gorongosa National Park as part of their research team. He was supported by Dr Ana Gledis (ANAC, Mozambique) and his assistant Dr Mnqobi Mamba (University of Eswatini). This team led on the small mammal work and were supported by field staff from the University of Zambezia. The freshwater fish fauna were surveyed by Dr Erica Tovela from the Museu de História Natural in Maputo also supported by field staff from the University of Zambezia. The bush-crickets, or Katydids, were surveyed by Dr Poitr Nebraski from Gorongosa National Park. The butterflies were opportunistically collected by Professor J. Bayliss to build on previous butterfly survey work.

New species records for Mabu forest and species new to science were discovered as a result of this expedition, adding to database of biological discovery from previous expeditions and further raising the importance of Mabu forest. Notably the small mammal list was added to and revised accordingly through the expert input of Professor Ara Monadjem. As a result of this expedition an additional 5 species of bat were added to the known bat species list for Mabu (Annex 1). Further to this two

additional species of rodent were also added to the list and the identification of the shrews (*Crocidura* sp.) were further analysed as they represent a complex of species. *Crocidura cf denti* species has also been captured at Mt Sokoni in northern Mozambique (identified as *Crocidura cf hildegardeae*) and may refer to a new species. The clade VIII of the *C. olivieri* complex and is currently being described as a new species endemic to the highlands of northern Mozambique and southern Malawi and will hopefully represent a regional (ecoregion) endemic to these mountains. There were no new species discovered amongst the freshwater fauna (fish or crabs) however for the first time the freshwater fish were identified and represent 5 species which we can add to the overall species list. There were no new butterflies collected which was to be expected as this p[art of the forest has been collected and studied for almost 20 years in the butterfly fauna. However additional species of some rare butterflies which require further analysis were collected. For the first time the Katydids (bush crickets) were collected and at least one, and probably two, species new to science were collected and await description.

Suggested citation:

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Figure 1. View from the old managers house on the tea estate, the base for every expedition since 2005, with excellent views of Mt Mabu.

Figure 2. Image of the team departing from the old managers house to the forest base camp.

Field Schedule

Dates

10th - Mocuba / Nampula
11th - Tea Estate - old managers house
12th - Forest Base camp
13th - Forest Base camp
14th - Forest Base camp / Summit camp
15th - Forest Base camp
16th - Forest Base camp / River crossing camp
17th - Forest Base camp
18th - Forest Base camp / Summit camp
19th - Forest Base camp / Summit camp
20th - Forest Base camp
21st - Mocuba / Nampula
22nd - Mocuba / Nampula

Mabu Expedition Team September 2022

Figure 3. Expedition field team at the main forest base camp (easterly forest edge).

Mabu Expedition 2022 Team

Julian Bayliss (UK) – Expedition/Science Coordinator and Lepidoptera
Ara Maonadjem (University of Eswatini) - small mammal
Mnqobi Mamba (University of Eswatini) - small mammals
Erica Tovela (Museu de História Natural, Mozambique) - freshwater
Ana Gledis da Conceição Miranda da Conceição (ANAC Mozambique) - small mammals
Noé Hofiço (UniZambezi Mozambique) - small mammals and freshwater
Fernando Macia (UniZambezi Mozambique) - small mammals and freshwater
Piotr Naskrecki (Gorongosa, Mozambique) - small mammals and Orthoptera
Tara Massad (Gorongosa, Mozambique) - small mammals and freshwater
Christophe Bernier (France) - Camp manager/photography
Luciano Mariano (WWF, Mozambique) - logistics
Jose Monteiro (R-GCRN, Mozambique) – RT Coordinator
Antonio Serra (WWF, Mozambique) – Biofund Coordinator
Daniel Maula (RADEZA, Mozambique) – Community Coordinator

Small mammals and Bats

Background Small mammals and Bats

Despite the increasing number of recent scientific surveys, the mammals of Mozambique remain poorly known (Monadjem et al., 2010, 2015; Neves, Mathias, & Bastos-Silveira, 2018), and this is particularly true of high-elevation, montane areas. Mt Mabu, in northern Mozambique, is one of the most important sites in Mozambique for forest biodiversity, with a high level of endemism (Bayliss et al., 2014). In response to this, more than a dozen field surveys have been conducted at Mt Mabu over the past two decades. Although some bats, rodents and shrews have been collected at Mabu forest (by J. Bayliss, L. Sabao, M. Curran, & M. Kopp), this has been opportunistic in nature, and no dedicated small mammal survey has ever been conducted. During these previous opportunistic surveys, a total of 12 species of bats, four species of rodent, and three species of shrew have been collected at Mt Mabu (Bayliss et al., 2014). The September 2022 expedition was the first intensive survey of the small mammals (including bats) in the eastern forests and grasslands of Mt Mabu.

To achieve the best results a small mammal expert (Professor Ara Monadjem) was engaged. Professor Ara Monadjem, from the University of Eswatini, has worked extensively across Mozambique on small mammal and bats, and has been on previous expeditions organised by J.Bayliss. He also works regularly at Gorongosa NP as part of their research team. He was supported by Dr Ana Gledis da Conceição Miranda da Conceição (ANAC, Mozambique) and his assistant Dr Mnqobi Mamba (University of Eswatini). This team led on the small mammal work in collaboration with staff from the Uni Zambezia, Dr. Noé Hofiço and Fernando Macia, to assist them in the field with the small mammal sampling work.

Methods Small mammals and Bats

A 10-day survey of the mammals of Mt Mabu, Mozambique, was conducted from the 11th to the 21st of September 2022. The base camp was situated in mid-elevation forest ca. 1,000 m above sea level, in a valley below the highest point in the region at around 1,720 m (Figure 4). This extensive forest covers ca. 7800 ha, of which only the extreme eastern portion was surveyed (Figure 4). Above 1,600 m above sea level, the forest gave way to a small patch of high elevation grassland.

The focus of the mammal team was on capturing small mammals of the orders Chiroptera (bats), Rodentia (rodents), and Eulipotyphla (shrews), using a variety of standard methods such as Sherman live traps, pitfall traps, and mist nets. Larger mammals were recorded incidentally through direct observation of the animal, its spoor or faeces and other signs.

Figure 4. Location of the pitfall traps and the bat nets used on this expedition to sample the small mammals.

Small mammals are notoriously difficult to identify in the field, and hence voucher specimens were taken, which will be split between the Maputo Natural History Museum and the Eswatini National Museum of Natural History in Eswatini. Liver and lung tissue samples were taken from these specimens, while ear clippings were taken from released individuals; all these tissue samples were stored in 99% ethanol. All specimens of rodents, shrews, and bats were closely examined once their crania were extracted and cleaned for morphometric analysis. Molecular analyses was also conducted post-field.

Results Small mammals and Bats

A total of at least 21 species of small mammals and bats were recorded in mid- and high-elevation habitats of Mt Mabu including 12 species of bats, 6 species of rodents, and 3 species of shrew (Annex 1). The low number of species belies the fact that these include new records for the region or are records of species with restricted ranges. Although large mammals were not a focus of this survey, they were recorded incidentally and opportunistically. The following six species of large mammals were either seen or heard or recorded from their signs (such as faeces): *Cercopithecus albogularis*, *Pronolagus cf. randensis*, *Rhynchocyon cirnei*, *Procavia capensis*, *Dendrohyrax arboreus*, and *Paragalago cf. granti*.

At least one species of small mammal from Mt Mabu is threatened and one is near-threatened (see Annex 1). However, several of the species on this list may represent new taxa (represented by cf. before the species name), and these should therefore be considered as not evaluated (some of which could potentially be considered threatened).

Most of the rodent species (as currently recognized) recorded at Mt Mabu have relatively restricted distributions, although two of them are abundant in appropriate forested habitat (*Lophuromys machangui* and *Montemys delectorum*). The latter species is a close endemic, being restricted to northern Mozambique and the extreme south of Malawi (Bryja et al., 2014). The Otomys specimen is probably part of the *O. angoniensis* complex, and its taxonomy is unresolved. A similar specimen was also captured at Mt Soconi on a separate expedition in 2018 and these two may represent the same species. Whether Beamys represents one or two species is still under debate. If *B. major* is shown to be distinct from *B. hindei*, then this species would be restricted to northern Mozambique and southern Malawi. The Mus and Aethomys specimens will need to await additional analyses before an identification is possible.

The shrew *Crocidura olivieri* is an abundant and widespread species across Africa. However, it would appear that it is a species complex, and the Mt Mabu population may be a close endemic to the forested mountains of northern Mozambique and Mt Mulanje in Malawi (Jacquet et al., 2015). *Crocidura luna* occurs widely in mid-elevation forests in the region. A single specimen of an unidentified species was collected, which has been tentatively assigned as *Crocidura cf. hildegardeae*. This is a species complex that has yet to be resolved taxonomically. However, there are indications that the populations in Mozambique and southern Malawi may be distinct genetically.

Of the 12 bat species recorded during this survey (Annex 1), at least five are widespread and relatively abundant species. Of note was the capture of *Rhinolophous mabuensis* (Figure 5), an endemic species discovered in 2009 (by J. Bayliss) and caught for the second time only at Mabu on this expedition. There are in total 16 species of bat recorded from Mt Mabu (this survey plus previous surveys) Annex 1.

Figure 5. *Rhinolophous mabuensis* – an endemic species discovered in 2009 and caught for the second time only at Mabu on this expedition.

Several other species of *Rhinolophous* were also caught which may prove interesting, as well as the colourful *Myotis welwitschia* (Figure 6).

Figure 6a&b. Images of *Myotis welwitschia*.

Also caught was the fruit bat *Myonycteris* which is represented by an endemic taxon *M. angolensis goliath* (Figure 7) that is restricted to central Mozambique and the neighbouring highlands of eastern Zimbabwe (Monadjem et al., 2020); whether the Mt Mabu specimens refer to this taxon is not yet clear.

Figure 7. Dr Mnqobi Mamba holding a *Myonycteris cf. goliath*.

Discussion Small mammals and Bats

For future small mammal surveys the type of traps and numbers of traps deployed is important. For example, this expedition used a small harp trap (supplied by Ara Monadjem), the dimensions of which were probably inappropriately small for the vegetation structure at Mt Mabu. A large, 3-bank Austbat Harp trap is highly recommended for such a forested site. Indeed, it has recently been demonstrated that bat diversity in African forests have been severely under-represented because of the lack of harp traps (Tanshi et al., 2022). A canopy mist net system is probably also essential and should be a priority.

Although trap success was relatively high (approximately 15%) in the Sherman traps, these were dominated by just two species: *Montemys delectorum* and *Lophuromys machangui*. This may have prevented or dissuaded other rodent species from entering the traps. Hence, increasing the number of Sherman traps should be considered for further surveys. Finally, surveys during different seasons should be considered, since some species may be absent (e.g. due to migration or hibernation) during some seasons.

Freshwater Sampling

Background Freshwater Sampling

The freshwater fish from the streams around the main easterly forest base camp have previously been collected by Bill Branch and Werner Conrade in 2009. However, as yet they remain unidentified and the location of these specimens remains unclear although they are known to be have been collected from the water courses close to the easterly forest camp. Therefore it was important to re-survey the aquatic fauna engaging a freshwater expert, Dr Erica Tovela from the Museu de História Natural in Maputo, to undertake the survey (Figure 8a&b).

Figure 8 a&b. Dr Erica Tovela from the Museu de História Natural in Maputo and Fernando Masi UniZambezia examining freshwater samples at the forest base camp.

Methods Freshwater Sampling

Mountain streams were systematically sampled between 13th to 20th September 2022. Several rivers and streams in the near vicinity to the easterly forest base camp were sampled for aquatic diversity (Figure 9). The samples collected included crab specimens, tissue samples from fish for DNA analysis, whole fish specimen for morphology, and water samples for a complete eDNA analysis.

The fins and muscles of the fish samples were analysed for formal identification through DNA barcoding. These specimens were analysed and processed in the Natural History Museum(MHN), Maputo, and were sequenced thereafter in the Macrogen reference laboratory for formal and final identifications (Figure 10). The specimens are part of the collection at the Natural History Museum Maputo (MHNM).

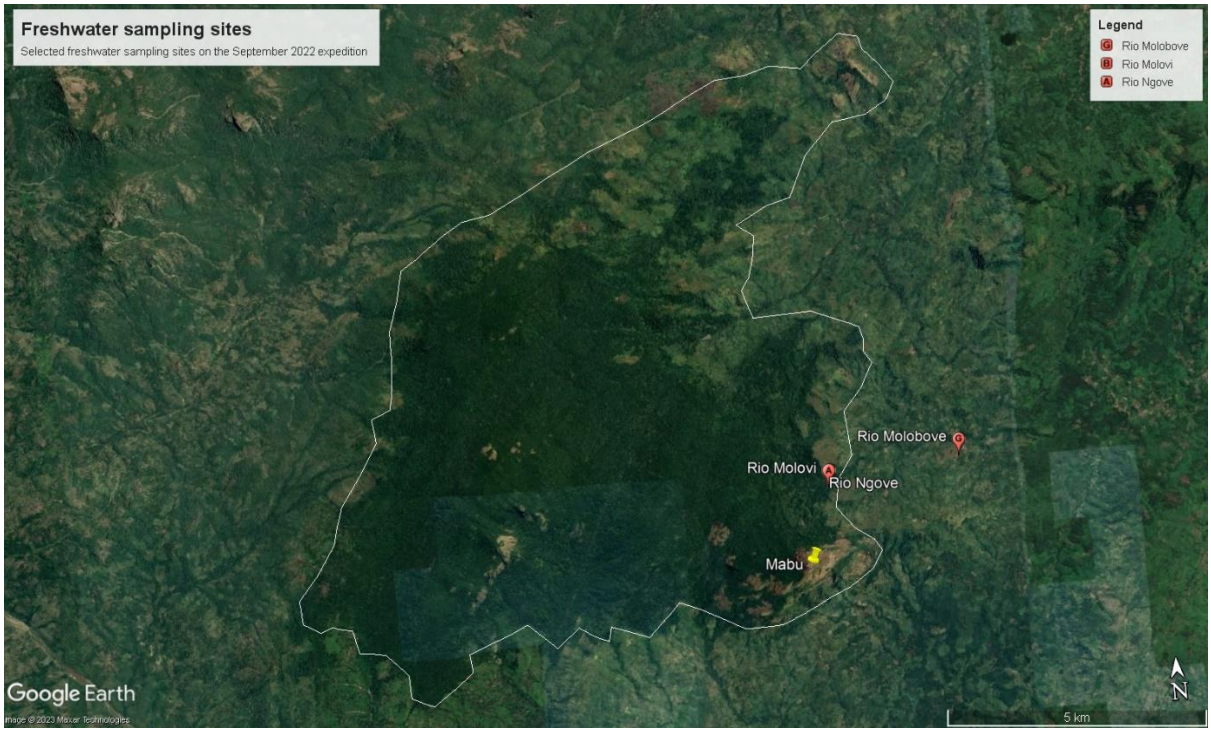

Figure 9. Location of selected freshwater sampling sites on the September 2022 expedition.

Results Freshwater Sampling

The specimens were identified by Dr Erica Tovela and Dr Roger Bills as belonging to the following families: the crabs were identified as Potamonautidae (Maritimonautes) and the five fish families namely Cyprinidae, Cichlidae, Danionidae, Amphiliidae and Mochokidae. See Annex 2 for final Geo-located identifications.

A total of eight species of fish were collected and identified plus 1 species of freshwater crab. Amongst the Amphiliidae there were three species identified, these were *Amphilius cf laticaudatus*, *Amphilius uranoscopus*, and *Zaireichtys rotudinceps*. Amongst the Cyprinidae there were two species identified, these were *Enteromius trimaculatus* and *Enteromius cf viviparus*. Amongst the Mockokidae there was one species identified, this was *Chiloglanis neumanni*. Amongst the Cichlidae there was one species identified, this was *Oreochromis placidus*. And amongst the Danionidae there was one species identified, this was *Opsaridium zambezensis*. The species of freshwater crab found at the main forest base camp was identified previously as *Maritimonautes choloensis* (Daniels pers comm.). The Amphilius DNA sequences will be uploaded to the BOLD open access databases which holds genetic sequences for future references.

Figure 10a,b,&c. Freshwater fish samples collected from the surrounding streams close to the forest base camp.

Discussion Freshwater Sampling

The species found upstream correspond to those described in similar places in northern Mozambique such as Mts Chiperone and Lico, representing a relatively low diversity. Further downstream it was expected that biodiversity would be greater, which was not the case. Downstream species are relatively larger species, and it is necessary to use more specific gear. The existence of larger species was observed during sampling, but they were not captured due to a lack of appropriate equipment for this size of species. More specific and selective equipment is required for future sampling of larger size species.

As this is a supposedly isolated area, it would be interesting to carry out a phylogenetic analysis with similar species from other places to assess the degree of dispersion or similarity of these local populations. The use of electrofishing for sampling downstream might be appropriate as it is more precise and effective. Sampling during different seasons will identify diversity and abundance.

Another aspect to consider is the study of existing populations on Mts Lico, Chiperone and Mabu, in order to be able to understand the level of similarity and dispersion at the genetic level because despite being separated by distance these species can share a common ancestor or may be indicative of some genetic variability within this family.

A possible local community livelihood intervention could be the use of small cages to do aquaculture within the river instead of having to dig ponds for fish farming instead.

Butterflies

Background Butterflies

Butterflies have been surveyed intensively on many previous visits (>10) to Mabu forest, and in particular the easterly side of the forest, by members of the African Butterfly Research Institute (ABRI) since the first visit by J. Bayliss in 2005. Therefore butterflies were not a main focus of the September 2022 scientific expedition as they have been sampled many times before in this part of the forest. However, J. Bayliss was actively searching for additional species of butterfly to add to the known Mabu species list.

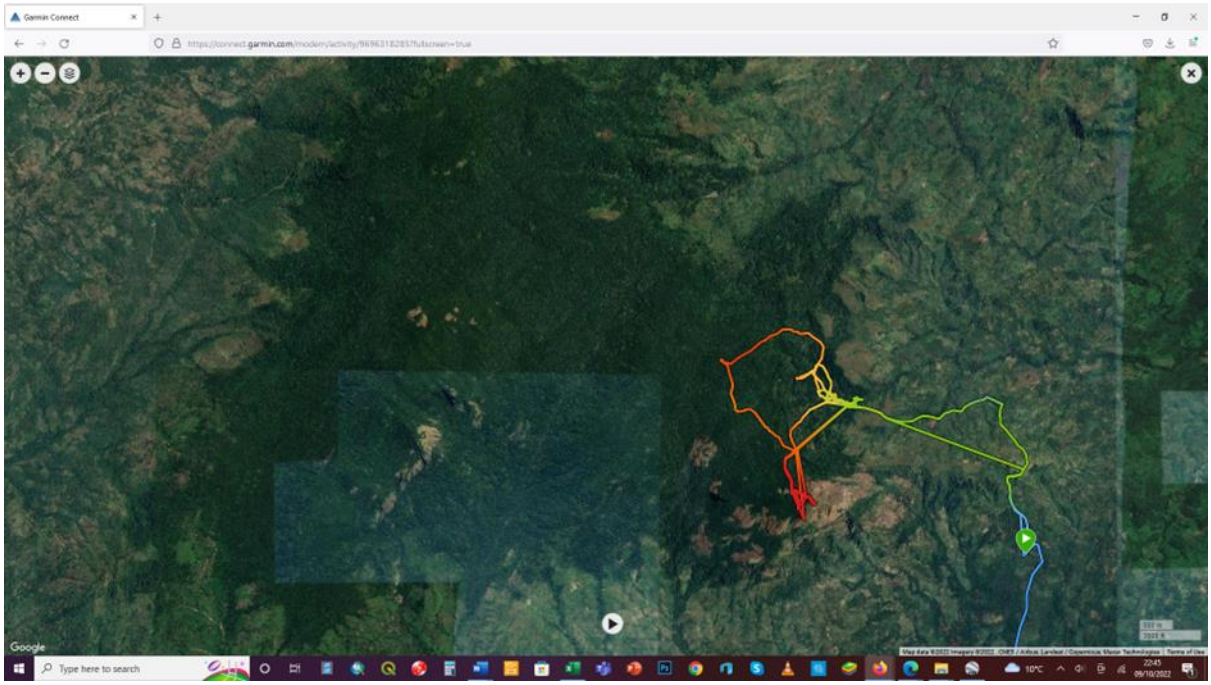

Figure 10. GPS route (JB) of the area of forest sampled during this expedition to the eastern part of the forest.

Methods Butterflies

Butterfly diversity was assessed opportunistically over the course of the expedition due to the limited time. Primarily, butterflies were collected opportunistically using hand held nets of different sizes. A range of habitats were sampled at different times of the day to sample as broadly as possible the butterfly fauna. Based on the knowledge of the previous years of butterfly study at Mabu forest additional new species to science (and thus endemic species) are most likely to be found amongst the Satyridae, Lycaenidae, and Hesperridae hence the focus of survey on this expedition. Identification of the species was determined by the African Butterfly Research Institute (ABRI) based in Nairobi.

Results Butterflies

During this expedition several butterfly groups were deliberately targeted for further study. These were namely species of Satyridae, Lycaenidae, and Hesperridae as they are suspected to be those families in which species new to science may yet occur at Mabu forest. For example the Bicylcus butterflies of the Satyridae were a particular focus (Figure 11). Further specimens of these groups of butterfly were studied and will add to the existing database of Mt Mabu through the African Butterfly Research Centre (ABRI) in Nairobi. ABRI houses the world's largest African butterfly database. The current Mabu butterfly species list is 201 species of which there are at least 6 known described endemic species and subspecies of butterflies (Sáfián et al 2022; Richardson, 2020; Bayliss et al 2019; Bayliss et al, 2018; Bayliss et al, 2016; Van Velzen et al 2016) and several more awaiting description. It is expected that as new areas of the forest are surveyed in the west, north, south, and central areas of the forest possible new species of butterfly will be further discovered.

Figure 11a&b. Different species of Bicyclus butterfly found in Mabu forest, and catching butterflies on the summit of Mt Mabu.

Discussion Butterflies

As the butterflies have been surveyed many times now in the easterly area of Mabu forest the next steps are visiting and surveying the remaining part of the forest which are yet to be visited by biologists. Currently only 20% in the easterly part of the forest has been biologically surveyed, and 80% of the forest remains surveyed. This represents the west, north, south, and central areas of the forest. We simple do not know what is there, and this particularly applies to the butterfly fauna. This group has yielded many endemic species new to science at this site and it is expected that there are still new species to be found at Mabu forest. Sampling these areas at different times of the year (and in different seasons) is also recommended as there will be seasonal emergence and difference species flying at different times of the year. A series of scientific expeditions is required to complete the survey of the butterfly fauna.

Katydids– Bush Crickets

Background Katydids

The Katydids (Bush Crickets), previously been known as "long-horned grasshoppers", have never been studied before at Mt Mabu, and several species new to science are expected with continued study. They are normally nocturnal in habit and many species exhibit mimicry and camouflage, often resembling leaves in their colour and shape.

Methods Katydids

The Katydids (Bush Crickets) were opportunistically collected by Dr Piotr Naskrecki (Gorongosa, Mozambique) while he was also assisting with the small mammal survey. Sampling was undertaken opportunistically through visual observation and the use of the hand net of different sizes. A range of habitats were sampled at different times of the day to sample a selection of habitats as broadly as possible.

Results Katydids

Results suggest at least two species new to science. These are of the Ovonotus sp. nov and Paragryllodes cf kenyanus. The descriptions of these new Katydid species to science from Mt Mabu will be described by Dr Piotr Naskrecki in the near future. Also discovered by Dr Piotr Naskrecki was a new species of cricket, Paragryllodes sp. nov. (Phalangopsidae).

Figure 12. Image of the potentially new species of Katydid, belonging to Ovonotus sp. nov. (Tettigoniidae: Meconematinae).

Discussion Katydids

The new katydid is an Ovonotus sp. nov. (Tettigoniidae: Meconematinae), with the closest relatives currently found on Mt. Gorongosa and Chimanimani Mountains, thus demonstrating links to the southwest within this group and Mt Mabu, although further research is required of the other mountains in northern Mozambique (and southern Malawi) to clarify this status for Katydids. As this group have never been studied before at Mt Mabu it is expected that further research will yield even more species new to science within this group. It is therefore recommended that Katydids are studies and sampled on future scientific expeditions.

As with all other taxonomic groups at Mt Mabu there is a need to study these at the areas previously not visited by biologists before. Notably the north, south, central, and western areas of the forest. This should form part of the series of scientific expeditions to clarify the biological status of this part of the forest.

Conclusions

- This was the first scientific expedition funded through the Biofund and Rainforest Trust grants to help gather sufficient scientific evidence to support the creation of a new protected area of the forest at Mount Mabu.

- This current survey expanded our knowledge of the small mammals, aquatic diversity, Katydids, and butterflies found at Mt Mabu.

- This expedition focused on the easterly part of the forest, and mostly at mid-elevations, completing the biological gaps of previous expeditions to this part of the forest. Large parts of the forest (~80%) remain unexplored scientifically. Subsequent expeditions should now focus on the southern, central, western, and northern areas of Mabu forest as the easterly area has now been surveyed in detail.

- In particular the small mammal diversity has proven to harbour a distinct species assemblage quite different from those inhabiting the woodlands and savannas around the base of the mountain. As such, these species are essentially confined to the wet forest. Since at least some of these species are regional endemics, this means that Mt Mabu is vitally important to the longer-term persistence of small mammal biodiversity in northern Mozambique.

- Potential new discoveries within the freshwater fauna remain high and further exploration should result in species new to science particularly within the *Amphilius* group.

- Previous butterfly surveys of the easterly part of Mabu forest have already resulted in about 10 species and sub-species new to science, including some which still await formal description. It is probable that more species new to science will be discovered with further biological survey of other parts of the forest.

- The first opportunistic survey of Katydids (Bush crickets) of the easterly part of Mabu forest has, not surprisingly, resulted in at least one species new to science and possibly two. These are currently being described by Dr Piotr Naskrecki (Gorongosa, Mozambique).

Recommendations

Science Recommendations

1. Future scientific expeditions should now focus on the southern, central, western, and northern areas of the forest, preferably in the wet and dry seasons. A full biodiversity survey is required in these areas of the forest. The results of which will help guide the management planning process through an adaptive management approach.

2. All altitude and habitat types should be surveyed from Low (>500m), Medium (900-1400m), to High-elevation (> 1,400 m) forests, and in the grasslands and rocky areas at the summit(s) (> 1,600m). This will provide a comprehensive assessment of the biodiversity at Mabu forest.

3. For bats and small mammals another priority must be the search for bat roosting sites, such as caves and rocky overhangs as well as pitfall trapping, boreal and arboreal Sherman traps, and river and stream crossings.

4. Other studies besides biodiversity surveys should be included as part of the scientific expeditions such as those relating to ecosystem services, especially hydrology, carbon, and nature-based tourism assessments (Bayliss et al 2014).

5. There is a need for the project to procure good quality equipment to be used on such expeditions. This equipment falls into two categories camping (good quality tents of different sizes, cooking equipment and utensils, strong camping chairs, gas bottles, lights, tarpaulins, heavy duty jerry cans, short wave radios, medical kit), and science equipment – details below.

6. Examples of the science equipment that is required to be procured are camera traps (e.g. Browning), Bats nets (various lengths), Harp traps, GPS (Garmin 66 range), Sherman live traps (x100), drones (1x Mavic 3 and 1x Mavic 2 Enterprise Advanced), bridge camera for canopy work (e.g. Sony RX IV), butterfly nets, recording equipment.

7. An automated weather station situated on the summit of Mt Mabu might also be a good idea to record climatic fluctuations.

8. A project website is also now required to document the activities of the project (past and present).

9. A research and project base is urgently required to help guide field activities and to provide a base from which visiting researchers and scientists can work from, and also for nature-based tourists.

10. Research links now need to be established between national and international academic institutions to promote Mabu as a research base for students and future research. A series of permanent sampling plots should be established managed through the UniZambezia in collaboration with national and international scientists.

Logistical Recommendations

1. A project field base is now desperately needed. The Old Managers house which has served very well for this purpose since 2015, the base of approximately 15 expeditions, is still perfect. The project should offer to buy this building off Mozambique Holdings and renovate it. It is still cost (and time) effective as there is no need for an architect or any planning permission as the basic structure and plan already exists. If the project desires an 'office' building this could be built separately and the Old Managers House would still serve as visitor accommodation and a base camp. Such a building would look visually impressive on any website attracting nature-based tourism and has excellent views of Mt Mabu.

2. There is now Movitel coverage at the old managers house base camp and also at the forest base camp. This was not the case a few years ago. However, we cannot reply on having suitable mobile phone coverage throughout the forest when working there, and therefore a set of suitable short-wave radios should also be procured for field work. We can look into suitable models to procure which will work in forest environments. These are particularly important for emergencies.

3. Any expedition needs to have an evacuation plan in the case of an emergency. It is essential that we know where to take someone in the case of an accident and how to communicate with a contact at base camp. As such a vehicle needs to be stationed as close as possible to an extraction point throughout the whole of expedition. This may involve a driver camping next to his vehicle while the expedition is undertaken. The risks are real and may include snake bite, severe injury through stepping on a gin trap, or through infection (sepsis) and disease (malaria). It would be a good idea to include a tropical doctor as part of the expedition team. We also need to know which local hospitals are able to treat various ailments such as snake bit (Mocuba and Quelimane?), phone numbers of the hospitals to warn them we are coming with a patient, and approximately how long it would take to take them there. Maybe the project can obtain this information before the next expedition?

4. The project needs to identify mechanisms through which it can engage international expertise contractually to help develop and promote the project on the international stage (such as website design). The issue of facilitating Forex payments needs to be discussed with Biofund and RT.

References

Bayliss, J., Brattström, O., Bampton, I. & Collins, S.C. 2019. A new species of Leptomyrina Butler, 1998 (Lepidoptera: Lycaenidae) from Mts Mecula, Namuli, Inago, Nallume and Mabu in Northern Mozambique. Metamorphosis 30(1): 19–24. https://dx.doi.org/10.4314/met.v30i1.1

Bayliss, J., Congdon, T.C.E. & Collins, S.C. 2018. A new subspecies of Papilio (Princeps) pelodurus Butler, 1896 (Lepidoptera: Papilionidae: Papilioninae) from several mountains in northern Mozambique. Metamorphosis 29: 132–136. https://dx.doi.org/10.4314/met.v29i1.20

Bayliss, J.L., Collins, S.C. & Congdon, T.C.E. 2016. A new species of Iolaus Hübner subgenus Epamera Druce (Lepidoptera: Lycaenidae: Theclinae) from Mts Namuli and Mabu, Northern Mozambique. Metamorphosis 27: 21–28.

Bayliss J, Timberlake J, Branch W, Bruessow C, Collins S, Congdon C, Curran M, De Sousa C, Dowsett R, Dowsett-Lemaire F, Fishpool L, Harris T, Herrmann E, Georgiadis S, Kopp M, Liggitt B, Monadjem A, Patel H, Ribeiro D, Spottiswoode C, Taylor P, Willcock S & Smith P. 2014. The discovery, biodiversity and conservation of Mabu forest - the largest medium-altitude rainforest in southern Africa. Oryx 48: 177–185. https://doi.org/10.1017/S0030605313000720

Bayliss J., Schaafsma M., Balmford A., Burgess N.D., Green J.M.H., Madoffe S.S., Okayasu S., Peh K S-H., Platts P.J., D.W. Yu (2014). The Current and Future Value of Nature-based Tourism in the Eastern Arc Mountains of Tanzania. Ecosystem Services 8 (2014) 75–83: http://dx.doi.org/10.1016/j.ecoser.2014.02.006

Bryja J, Mikula O, Patzenhauerová H, Oguge NO, Šumbera R & Verheyen E. 2014. The role of dispersal and vicariance in the Pleistocene history of an East African mountain rodent, *Praomys delectorum*. Journal of Biogeography 41: 196–208.

Chakona, A., Kadye, W. T., Bere, T., Mazungula, D. N., & Vreven, E. (2018). Evidence of hidden diversity and taxonomic conflicts in five stream fishes from the Eastern Zimbabwe Highlands freshwater ecoregion. ZooKeys, (768), 69-95. https://doi.org/10.3897/zookeys.768.21944

IUCN. 2019. The IUCN Red List of Threatened Species. Version 2015.4.

Jacquet F, Denys C, Verheyen E, Bryja J, Hutterer R, Kerbis Peterhans JC, Stanley WT, Goodman SM, Couloux A, Colyn M & Nicolas V. 2015. Phylogeography and evolutionary history of the Crocidura olivieri complex (Mammalia, Soricomorpha): from a forest origin to broad ecological expansion across Africa Phylogenetics and phylogeography. BMC Evolutionary Biology 15:71.

Mairal, M., Sanmartín, I., Herrero, A. et al. Geographic barriers and Pleistocene climate change shaped patterns of genetic variation in the Eastern Afromontane biodiversity hotspot. Sci Rep 7, 45749 (2017). https://doi.org/10.1038/srep45749

Monadjem A, Taylor PJ, Cotterill FPD & Schoeman MC. 2010. Bats of southern and central Africa: A biogeographic and taxonomic synthesis. Johannesburg: University of the Witwatersrand Press.

Monadjem A, Taylor PJ, Denys C & Cotterill FPD. 2015. Rodents of sub-Saharan Africa: a biogeographic and taxonomic synthesis. Berlin: De Gruyter.

Monadjem A, Taylor PJ, Cotterill FPD & Schoeman MC. 2020. Bats of southern and central Africa: a biogeographic and taxonomic synthesis. Johannesburg: Wits University Press.

Neves IQ, Mathias ML & Bastos-Silveira C. 2018. The terrestrial mammals of Mozambique: integrating dispersed biodiversity data. Bothalia 48(1): a2330.

Richardson, I.D. 2020. Revision of the genus Neptis Fabricius, 1807 (Lepidoptera: Nymphalidae) in the Afrotropical Region, Part 3: A new species from Mt Mabu, Moçambique: Metamorphosis 31(1): 132–138. https://dx.doi.org/10.4314/met.v31i1.23.

Sáfián, S., Bayliss, J., & Congdon, T. Colin E., 2022. Description of four IolausHübner, 1819 species in the subgenus PhiliolausStempffer & Bennett, 1958 from East Africa, assigned to the proposed I. maritimus species group (Lepidoptera, Lycaenidae, Theclinae), Zootaxa 5099 (1), pp. 46-64 : 55-60. https://doi.org/10.5281/zenodo.6037890

Van Velzen, R., Collins, S.C., Brattström, O. & Congdon, T.C.E. 2016. Description of a new species of Cymothoe Hübner, 1819 from northern Mozambique (Lepidoptera: Nymphalidae: Limenitidinae). Metamorphosis 27: 34–41.

Tanshi I, Obitte BC, Monadjem A, Rossiter SJ, Fisher-Phelps M & Kingston T. 2022. Multiple dimensions of biodiversity in paleotropical hotspots reveal comparable bat diversity. Biotropica 54: 1205–1216.

Annex 1. Mammal for Mabu list as a result of the expedition

This short annex reports the final identifications of the bats, rodents and shrews collected on the Mt Mabu expedition 11-21 September 2022. These identifications are based on a combination of characters including external pelage, skull shape, dental characteristics, acoustic records, and molecular genetics. We also include species of bats, rodents, and shrews previously reported from Mt Mabu by Bayliss et al. (2014).

Table 1: List of 16 bat species recorded from Mt Mabu, of which 12 were recorded on this survey

Family	**Genus**	**Species**	**This study**	**Bayliss et al. (2014)**
Pteropodidae	*Epomophorus*	*wahlbergi*	No	Yes
	Myonycteris	*goliath*	Yes	No
	Rousettus	*aegyptiacus*	Yes	Yes
Rhinolophidae	*Rhinolophus*	*blasii*	Yes	Yes
	Rhinolophus	cf *clivosus*	Yes	Yes
	Rhinolophus	cf *darlingi*	Yes	No
	Rhinolophus	*lobatus*	Yes	Yes (as *landeri*)
	Rhinolophus	*mabuensis*	Yes	Yes
Hipposideridae	*Hipposideros*	*ruber*	No	Yes
Miniopteridae	*Miniopterus*	cf *inflatus*	Yes	Yes
	Miniopterus	*wilsoni*	Yes	Yes (as cf *fraterculus*)
Vespertilionidae	*Afronycteris*	*nana*	Yes*	No
	Kerivoula	cf *phalaena*	No	Yes
	Myotis	*welwitschii*	Yes	No
	Myotis	*tricolor*	No	Yes
	Pipistrellus	*hesperidus*	Yes	No

*Recorded by echolocation call only

Table 2: List of 8 rodent species recorded from Mt Mabu, of which 6 were recorded on this survey

Family	**Genus**	**Species**	**This study**	**Bayliss et al. (2014)**
Sciuridae	*Heliosciurus*	*mutabilis*	No	Yes (sighting only)
Muridae	*Grammomys*	*cometes*	Yes	No
	Grammomys	*dolichurus*	No	Yes
	Lophuromys	*machangui*	Yes	Yes (as *aquilus*)
	Montemys	*delectorum*	Yes	Yes (as *Praomys*)
	Mus	*triton*	Yes	Yes
	Otomys	cf *angoniensis*	Yes	No
Nesomyidae	*Beamys*	*hindei*	Yes	Yes (as *major*)

Table 3: List of 3 shrew species recorded from Mt Mabu, all of which were recorded on this survey

Family	**Genus**	**Species**	**This study**	**Bayliss et al. (2014)**
Soricidae	*Crocidura*	cf *denti**	Yes	No
	Crocidura	*luna*	Yes	Yes
	Crocidura	cf *olivieri***	Yes	Yes

*This species has also been captured at Mt Soconi (as *Crocidura* cf *hildegardeae*) and may refer to a new species

**This represents clade VIII of the *C. olivieri* complex and is currently being described as a new species endemic to the highlands of northern Mozambique and southern Malawi

Annex 2. Freshwater samples collected and location

Date	Family	Specie	Nr specimens	Locality	River	Coordinates	
13/09/2022	Amphiliidae	*Amphilius cf laticaudatus*	13	Nangaze	Rio Ngove	16.28637S	36.40085E
	Amphiliidae	*Amphilius uranoscopus*	16	Nangaze			
	Amphiliidae	*Zaireichtys rotudinceps*	5	Nangaze	Rio Molovi	16.28618S	36.40104E
	Potamonautidae	*Potamonautes cf licoensis*	2	Nangaze			
				Nangaze	Rio Mugwe		
14/09/2022	Amphiliidae	*Amphilius cf laticaudatus*	13	Nangaze	Rio Mugwe		
	Amphiliidae	*Amphilius uranoscopus*	21	Nangaze			
	Amphiliidae	*Zaireichtys rotundiceps*	3	Nangaze			
				Nangaze			
15/09/2022	Amphiliidae	*Amphilius laticaudatus*	11	Nangaze	Rio Mwanagaga		
	Amphiliidae	*Amphilius uranoscopus*	15	Nangaze			
	Amphiliidae	*Zaireichtys rotundiceps*	6	Nangaze			
				Nangaze			
16/0/2022	Potamonautidae	*Potamonautes cf licoensis*	5	Nangaze	Rio Matavine		
	Amphiliidae	*Amphilius uranoscopus*	35	Nangaze			
				Nangaze			
20/09/2022	Amphiliidae	*Zaireichtys rotudinceps*	3	Limbwe	Rio Molobove	16.283083°	36.426067°
	Cyprinidae	*Enteromius trimaculatus*	4	Limbwe	Rio Molobove		
	Cyprinidae	*Enteromius cf viviparus*	5	Limbwe	Rio Molobove		
	Mockokidae	*Chiloglanis neumanni*	1	Limbwe	Rio Molobove		
	Cichlidae	*Oreochromis placidus*	2	Limbwe	Rio Mulave		
	Danionidae	*Opsaridium zambezensis*	1	Limbwe	Rio Mulave		

Annex 3. A selection of images of field work from the expedition

- photographs taken by Christophe Bernier