Biodiversity Assessment Survey (BAS):

Herpetological Surveys of Poorly Studied Sites in the South East African Montane Archipelago

2020 - 2024

4 FORESTS

by Ruben Foquet, Tim Brammer, Paulo Manjor, Fernando Macia and Matthias De Beenhouwer

Biodiversity Assessment Survey (BAS) 1: Herpetological surveys of poorly studied sites in the South East African Montane Archipelago, 2024.

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Rhampholeon sp. nov. (Mt. Namaroana) by Ruben Foquet

Biodiversity Assessment Surveys (BAS) are designed to study specific taxonomic groups from carefully selected regions that are considered understudied. Expeditions typically target areas that can be assumed threatened and/or of high biodiversity value, where there is an urgent need for more information on the occurring biodiversity. Generally, BAS are once-off studies, and the results are presented in a survey report which aims to make this information publicly available online, in a relatively short time frame, for anybody to use. The reports must be seen as dynamic, and will be updated as new information on identifications from the survey and from observations in the area becomes available, and as the slower peer-review process for publications is completed. More information can be found at https://4forests.eu/.

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TABLE OF CONTENTS

EXPEDITION FACT SHEET

Locations
Malawi
Ruo Gorge: 15°57'15.4"S 35°39'24.9"E
Chisongeli: 15°59'51.9"S 35°43'51.1"E
Mchese: 15°49'05.7"S 35°42'50.6"E
Thyolo: 16°04'54.6"S 35°03'13.7"E
Ruo Valley: 16° 2' 1.7"S 35° 38' 54.1"E

Mozambique
Marata (Namaroana): 15°53'56.8"S 36°46'39.8"E
Mancuni: 15°00'02.0"S 37°11'38.4"E
Inago: 15°08'46.3"S 37°27'20.5"E
Mabu: 16°16'59.4"S 36°21'18.4"E

Dates
Malawi
10th Nov – 18th Dec 2020
4th Nov – 18th Nov 2023
15th Jan – 17th Jan 2024
3rd Feb – 15th Feb 2024

Mozambique
5th May – 18th May 2024
28th May – 12th June 2024

Expedition Members – Expertise
Tim Brammer – 4Forests – Reptiles
Matthias De Beenhouwer – 4Forests – Project leader and Mohamed bin Zayed Species Conservation Fund grantee
Ruben Foquet – 4Forests – Amphibians
Fernando Macia – Universidade Zambeze – expedition preparations
Paulo Manjor – Universidade Zambeze – fieldwork support

Permits
- A research permit to work in Malawi (Ref. N° NCST/RTT/1/20) was obtained from the National Commission for Science and Technology.
- Permissions to work in Mozambican sites (except for Mabu) were obtained through the Universidade Zambeze and the respective District administrations (Namarroi District, Zambezi Province and Malema District, Nampula Province).
- Permissions to work in Mabu, Mozambique, were coordinated by the PROMOVE project partners.
- Export permit for DNA samples and voucher specimens is being processed through the Museu De História Natural de Maputo, Mozambique, at the time of writing.

Cooperation
This expedition was made possible with help of:
- Forest Research Institute of Malawi (FRIM), Zomba, Malawi
- Wildlife and Environmental Society of Malawi (WESM), Mulanje, Malawi

- World Wildlife Fund (WWF), Promove project, Mozambique
- Rede para Gestão Comunitária de Recursos Naturais (ReGeCom), Promove project, Mozambique
- Museu De História Natural de Maputo, Mozambique

Acknowledgements

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(PT) Agradecemos ao Fundo de Conservação de Espécies Mohamed bin Zayed (Project 220528576 e Project 192522840), nomeadamente para a exploração dos locais Mulanje, Marata, Mancuni e Inago e ao programa PROMOVE Biodiversidade no âmbito do Biofund (para a expedição a Mabu), pelo apoio financeiro a este projeto. Agradecemos ao Dr. Julian Bayliss por nos ter convidado a participar na expedição a Mabu como herpetólogos. Estamos em dívida para com o Dr. Harith Farooq por nos ter convencido nas primeiras conversas a visitar as áreas montanhosas menos conhecidas nas províncias da Zambézia e Nampula. Estamos gratos à equipa da Universidade Zambeze, Dr. Magalhães Amade Miguel e Dr. Rafael Muchanga por facilitarem a colaboração e as cartas de apoio. A Erica Helena Tovela de Museu de História Natural de Maputo é reconhecida peloss seus conselhos e orientações sobre os procedimentos de permissão. Acima de tudo, agradecemos a todas as autoridades locais pela permissão e aos guias e carregadores locais por nos apoiarem no trabalho de campo, incluindo mas não limitado a Dionísio Rico Agostinho, Santos Berasone, Mouzinho Duarte (Marata); Banana, Leonel, Eugenio (Mancuni); Agostinho Pistola Mahonha, Alberto Jorge Jackson, Atelino Jackson Shiboro (Inago); Zeferino (Mabu). Gostaríamos também de agradecer ao Dr. Werner Conradie do Museu de Port Elizabeth por partilhar o seu vasto conhecimento e experiência no que diz respeito à herpetofauna da região.

ABSTRACT

Summary:

(EN) A team of herpetologists surveyed the evergreen forests of Mount Mulanje and Mchese in southern Malawi, and the evergreen forests of Mount Namaroana in the Marata range, Mount Mancuni, Mount Inago and Mount Mabu in Mozambique with a specific objective to explore and collect data on the herpetological diversity of the inselbergs in the South East African Montane Archipelago. A total of 55 species of Reptiles and 37 species of Amphibians were observed of which eight are likely to be new to science. A special focus was placed on collecting population data for the Near-Threatened Mabu Pygmy Chameleon (*Rhampholeon maspictus*) and the Critically Endangered Mount Inago Pygmy Chameleon (*Rhampholeon bruessoworum*). This report highlights data from these herpetological surveys as well as from the first ever population studies for these two Pygmy Chameleon species.

Resumo:

(PT) Uma equipa de herpetologistas estudou as florestas sempre verdes do Monte Mulanje e Mchese no sul do Malawi e as florestas sempre verdes do Monte Namaroana na cordilheira de Marata, Monte Mancuni, Monte Inago e Monte Mabu em Moçambique, numa tentativa de explorar a diversidade herpetológica dos inselbergs no Arquipélago Montano do Sudeste Africano. Foi observado um total de 55 espécies de répteis e 37 espécies de anfíbios, das quais oito são provavelmente novas para a ciência. O foco foi colocado nas densidades das espécies do camaleão-pigmeu de Mabu (*Rhampholeon maspictus*), quase ameaçado, e do camaleão-pigmeu do Monte Inago (*Rhampholeon bruessoworum*), criticamente ameaçado. A equipa apresenta dados das primeiras estimativas populacionais para estas duas espécies.

INTRODUCTION

(EN) In March 2024, the 'South East Africa Montane Archipelago' (SEAMA) was proposed as a distinct ecoregion of global biological importance (Bayliss et al. 2024). Biological surveys of ancient inselbergs in southern Malawi and northern Mozambique led to the discovery and description of many species new to science and overlapping centres of endemism across multiple taxa. 22 reptile and 11 amphibian species were reported to be strictly endemic to the SEAMA. Of the Mozambican sites listed in this ecoregion proposal, the most comprehensively surveyed sites were Mt. Mabu, Mt. Namuli, and Mt. Lico. The proposal also listed nine others that had never been scientifically surveyed (Bayliss et al. 2024). This report aims at bridging part of the gap, by discussing the results of the first herpetological surveys from two of these sites (Mt. Marata and Mt. Mancuni in Mozambique), whilst also adding findings to better known sites (Mt. Mulanje and Mt. Mchese in Malawi and Mt. Inago and Mt. Mabu in Mozambique).

While the SEAMA is recognized as an important and distinct ecoregion, it was also highlighted that this is probably one of the most threatened ecoregions in the world (Bayliss et al. 2024). Therefore, unravelling the unique biodiversity in this region is urgent. Most sites are threatened by montane forest loss through slash and burn shifting agricultural practices, along with charcoal production. Within the area defined for the SEAMA ecoregion, approximately 18% of primary humid forest above 800 m.a.s.l. was lost between the years 2000 and 2022. More generally, rates of montane forest loss in Mozambique, averaging close to 30% and sometimes above 40% since 2000, are among the highest in tropical Africa. The majority of SEAMA sites within Mozambique lack meaningful national protection, as currently only Mt. Ribáuè (which includes Serra Mpàluwé) is a gazetted Forest Reserve. That said, formal protection would have been unlikely to change much, considering that Mt. Ribáuè experiences one of the highest deforestation rates within SEAMA.

Across the border in Malawi, Mount Mulanje and Mount Mchese receive formal protection as a Forest Reserve since 1927 and have even been enlisted as a Biosphere Reserve in 2000. However, in recent decades, rampant deforestation and uncontrolled fires have taken their toll, degrading the evergreen forests (Bayliss et al. 2007; Bayliss et al. 2024). Several small lowland rainforest patches remain well protected within tea estate lands, and hence the team focused on an investigation of forest remnants to map out populations of species within these fragmented patches that are either range restricted and/or of specific conservation concern.

Due to the high level of endemism found in reptiles and amphibians in the SEAMA ecoregion, the high forest dependence of these species and the relatively little surveys undertaken, we focused our research on these taxonomic groups. We paid particular attention to the chameleons of the genus *Rhampholeon* as they are a strict forest endemic and offer a unique opportunity to collect quantitative data that can provide valuable insights to the type and the health of the remaining forest patches.

The Mount Inago Pygmy Chameleon

The Mount Inago Pygmy Chameleon (*Rhampholeon bruessoworum*) is of particular interest. It is endemic to Mozambique as it is likely to only occur on Mount Inago, also known as Serra Inago, located in Nampula Province, 50 km north-east of Mount Namuli. Much of the mid-altitude moist forest and riverine forest on Mount Inago has been cleared for cultivation, leaving the remaining forests fragmented. This species is a forest specialist and as such is not expected to move between fragmented forest areas. Given the intense pressure on the habitat and the assumed loss of ecological function of the remaining forest fragments, the possibility that the species may have already gone extinct was assumed as likely (Tolley al. 2019). There are currently no species-specific conservation measures in place. As such, a survey determining the extent of the remaining forest fragments and

the population density of this species is important to determine future conservation strategies (ZSL). To allow for species-comparisons, the team conducted a similar survey on the Mount Mabu Pygmy Chameleon (*Rhampholeon maspictus*) in the intact Mabu mid-altitude forests.

(PT) Em Março de 2024, o "Arquipélago Montano da África do Sudeste" (SEAMA) foi proposto como uma eco-região distinta de importância biológica global. Os estudos biológicos de antigos inselbergs no sul do Malawi e no norte de Moçambique levaram à descoberta e descrição de muitas espécies novas para a ciência e à sobreposição de centros de endemismo em vários taxa. 22 espécies de répteis e 11 espécies de anfíbios foram reportadas como sendo estritamente endémicas da SEAMA. Dos sítios moçambicanos listados nesta proposta de ecoregião, os sítios mais exaustivamente estudados foram o Monte Mabu, o Monte Namuli e o Monte Lico. A proposta também listava nove outros que nunca tinham sido objeto de um levantamento científico. Este relatório tem como objectivo colmatar parte da lacuna, discutindo os resultados dos primeiros levantamentos herpetológicos de dois destes locais (Monte Marata e Monte Mancuni), ao mesmo tempo que acrescenta descobertas de locais mais conhecidos (Monte Inago, Monte Mabu e Monte Mulanje).

É urgente realçar a biodiversidade única, uma vez que a maioria dos sítios está ameaçada pela perda de florestas montanhosas através de práticas agrícolas itinerantes de corte e queima, juntamente com a produção de carvão vegetal. Dentro da área definida para a ecoregião SEAMA, aproximadamente 18% da floresta húmida primária acima de 800 m.a.s.l. foi perdida entre os anos 2000 e 2022. De uma forma mais geral, as taxas de perda de floresta montanhosa em Moçambique, é de cerca de 30% desde 2000, e estão entre as mais elevadas da África tropical. A maioria dos sítios do SEAMA em Moçambique carecem de protecção nacional significativa, uma vez que, actualmente, apenas o Monte Ribáuè (que inclui a Serra Mpàluwé) é uma Reserva Florestal.

Do outro lado da fronteira, no Malawi, o Monte Mulanje recebeu proteção oficial como Reserva Florestal e está mesmo inscrito como Reserva da Biosfera. No entanto, a desflorestação desenfreada e os incêndios descontrolados têm tido o seu impacto nos últimos anos, degradando as florestas sempre verdes (Bayliss et al. 2007). Várias pequenas manchas de floresta tropical de planície permanecem bem protegidas dentro das terras das propriedades de chá e, por isso, a equipa concentrou-se numa investigação dos remanescentes florestais para mapear as populações de espécies que podem estar mais ameaçadas dentro da Reserva Florestal formalmente protegida, mas em declínio.

O Camaleão-pigmeu do Monte Inago

O Camaleão-pigmeu do Monte Inago *(Rhampholeon bruessoworum*) é de particular interesse. É endémico de Moçambique, mas é provável que só ocorra no Monte Inago, também conhecido como Serra Inago, localizado na Província de Nampula, 50 km a nordeste do Monte Namuli. Grande parte da floresta húmida de altitude média e da floresta ribeirinha no Monte Inago foi limpa para cultivo, deixando as florestas remanescentes fragmentadas. Esta espécie é especialista em florestas e, como tal, não se espera que se desloque entre áreas florestais fragmentadas. Dada a intensa pressão sobre o habitat e a presumível perda de função ecológica dos fragmentos florestais remanescentes, é muito possível que a espécie já tenha sido extinta. Actualmente, não existem medidas de conservação específicas para a espécie. Como tal, um estudo que determine a extensão dos fragmentos florestais remanescentes e a densidade populacional desta espécie é importante para a criação de futuras estratégias de conservação. Para permitir comparações entre espécies, a equipa realizou um estudo semelhante sobre o camaleão-pigmeu do Monte Mabu (*Rhampholeon maspictus*) nas florestas intactas de média altitude de Mabu.

OBJECTIVES

Mount Inago Pygmy Chameleon

- Assess distribution, density and population size of species.
- Develop Species Action Plan (SAP).
- Share results/lessons locally, nationally and internationally.
- Conduct a similar survey on a related species in a less degraded forest context, to allow for comparisons (*Rhampholeon maspictus*).

Others

- Produce follow-up herpetological inventories of Mt. Mulanje and Mt. Mchese, including the privately owned tea estate remnant lowland forests.
- Produce a first herpetological inventory of Mt. Marata and Mt. Mancuni.
- Produce a herpetological inventory of the interior forests of Mt. Mabu mountain.

METHODOLOGY

Research Sites and Logistics

SEAMA Core Sites

For this survey, six core sites in the SEAMA were visited following Bayliss et al. (2024) (Fig. 1).

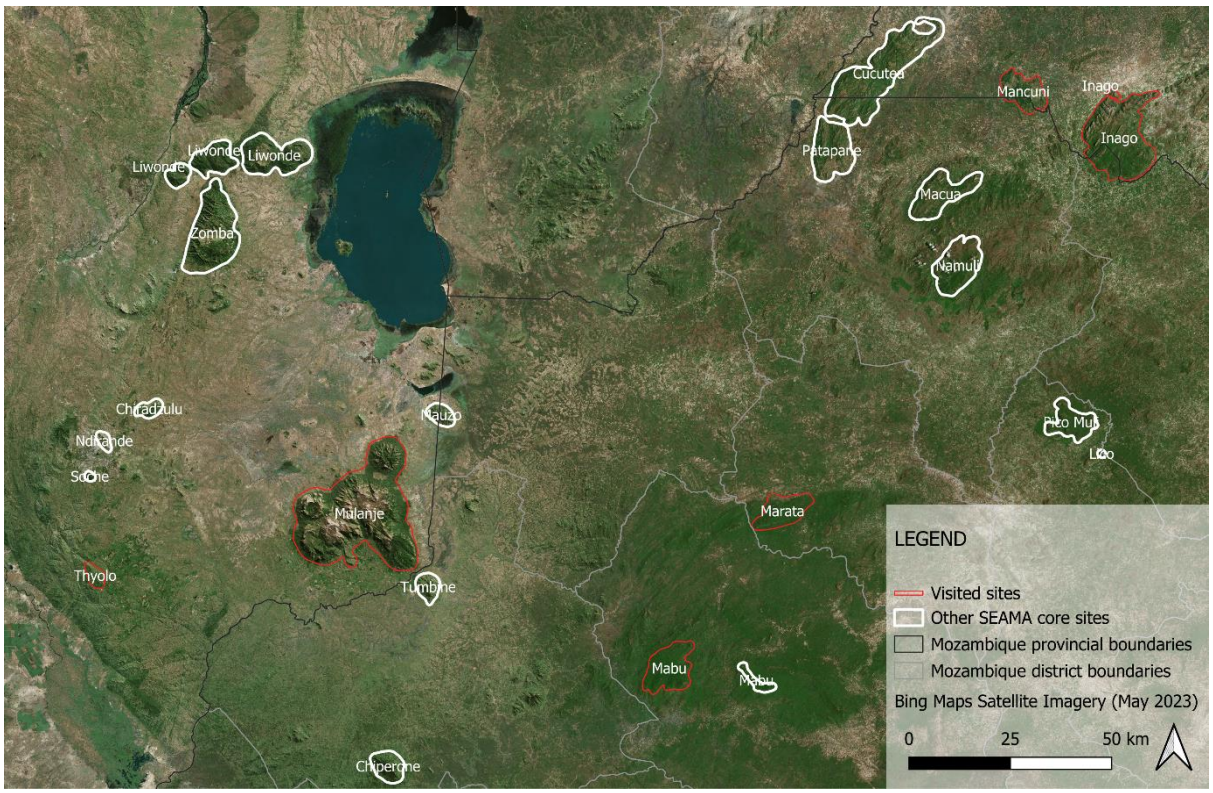

Fig. 1. SEAMA core sites (Bayliss et al. 2024), with sites visited during this Biodiversity Assessment Survey indicated in red.

Study Sites

Of the identified core sites, Mt. Mulanje (including Mchese Mountain) and Thyolo mountain are located in Malawi. Both are relatively well biologically surveyed; the relative survey effort as reported by Bayliss et al. (2024) was rated the highest for Mount Mulanje and Mchese out of all SEAMA core sites. Broadley (2001) presented a checklist for the herpetofauna of Mulanje Mountain, recording 33 anurans and 56 reptiles (25 lizards and 31 snakes). This checklist, however, was not based on further surveys, but rather simply updated the taxonomy of Steven's (1974) earlier collections. An updated assessment of the diversity and conservation status of reptiles and amphibians in the Mulanje region was conducted at the end of the summer rainy season and reported on in 2005 (Branch & Cunningham, 2005). Within the Mount Mulanje area, we identified the following four study sites for targeted surveying (see Fig. 2 and 3):

1) Ruo Gorge: Mount Mulanje: positioned on the southern slopes of Mount Mulanje, the Ruo Gorge forest consists mainly of mid-altitude rainforest at 950–1500 m.a.s.l. Our survey efforts were focused along and around existing trails leading up towards the plateau through the gorge.
2) Chisongeli Forest: Mount Mulanje: the largest single block of rainforest in the country, Chisongeli on the south-eastern slopes previously extended from 900 to 1800 m.a.s.l. in a continuum and still measured 4,000 ha in 1974. It was almost totally destroyed in the 1980s, as local tea-estate workers (deprived of land by the tea estates) and refugees from the civil war in Mozambique cleared the forest for subsistence agriculture.
3) Mchese mountain: Mchese mountain is relatively inaccessible as it does not have an upland plateau and is characterised by deep, almost inaccessible gorges, separated by narrow precipitous spurs. The Mchese area makes up around 7500 ha of the Mulanje Mountain Forest Reserve. Although adjacent to the well-studied Mt. Mulanje, Mchese is rarely visited by biologists (apart from botanical expeditions in 2008 under a Darwin Initiative grant). Not much is known on its biodiversity or on its conservation values. Moist forests are found on the upper slopes. The extent of the moist forest on Mt. Mchese is estimated to be around 1000 ha (Timberlake et al. 2009), significantly larger than was previously thought and uplifting Mt. Mchese to equal significance in terms of montane forest extent to the main Mulanje massif. Timberlake et al. reported in 2009 that the montane forest on the upper slopes remained in a good state, probably owing to the steepness of the terrain. There was no evidence of significant change in extent over the previous 40 years.
4) Ruo valley: The Ruo valley lies beneath the southern slopes of Mount Mulanje, outside of the Forest Reserve delineations. It is nestled in the hollow of the crescent-shaped mountain. Moisture blowing in from the Southeast frequently gets trapped against this mountain face and as a result the valley sees significant amounts of rainfall every year (e.g. at Mimosa Tea Research Station, located 5 km from the mountain and 650 m.as.l. and indicated with letter A in Figure 3, the average annual rainfall is 1626 mm). In the early 20th century the forests of the valley were replaced by tea plantations. These plantations still stand today. Small patches of riverine forest and lowland rainforest remain. They stand at altitudes ranging from approx. 600 - 900 m.a.s.l.

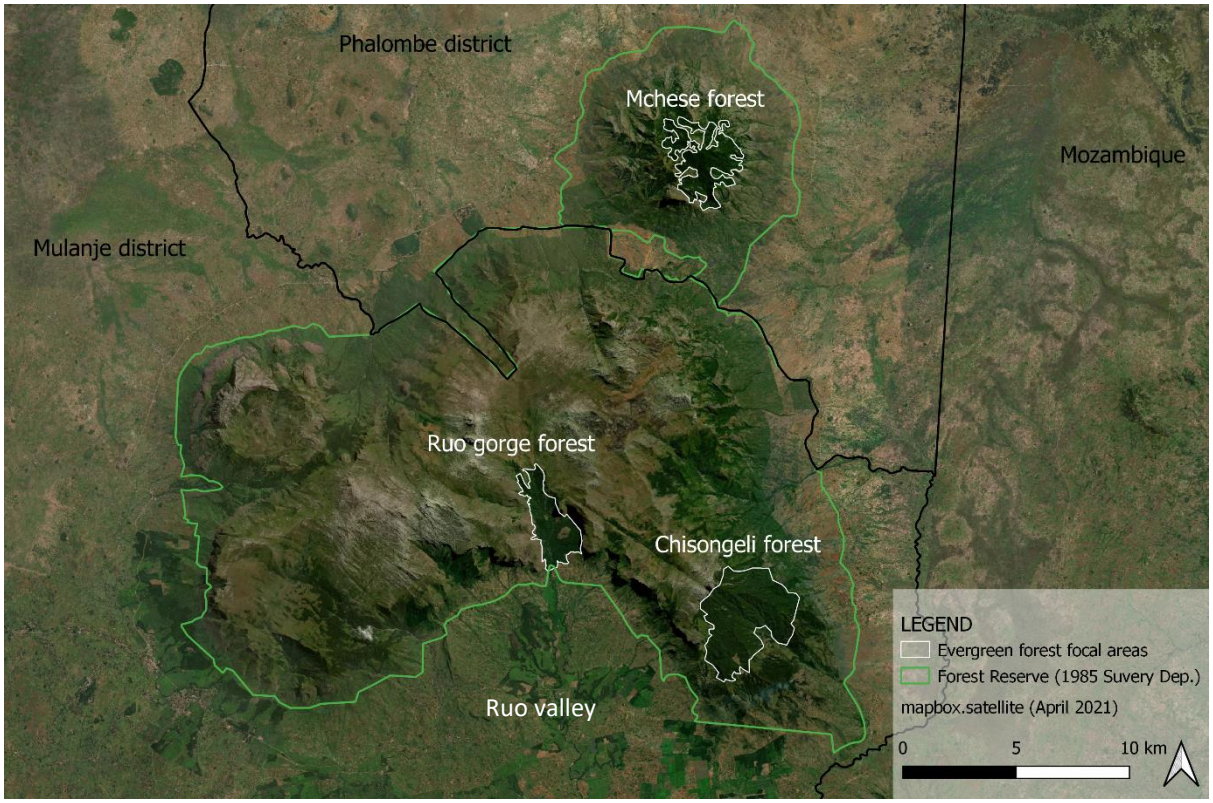

Fig 2. Mount Mulanje and Mount Mchese in Malawi, with focal areas Ruo Gorge, Chisongeli and Mchese

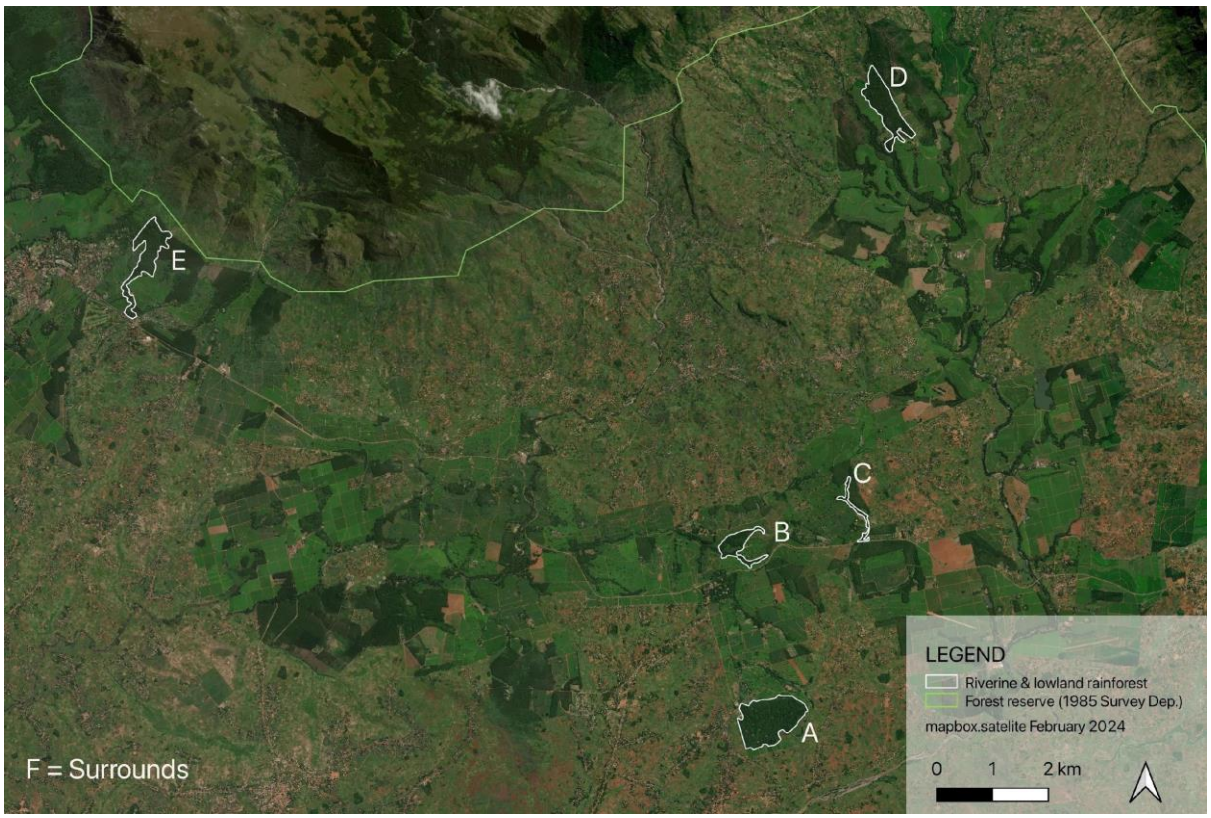

Fig. 3: Ruo valley showing selected Riverine and Lowland rainforest patches visited during the four weeks of herpetological surveying.

The last site in Malawi concerned Thyolo Mountain:

5) Thyolo mountain: Thyolo Mountain used to support a single block of mid-altitude rainforest ca. 6 km in length along the north–south aligned ridge. From 1955 to 1980, the total area of forest decreased from approx. 1500 to 1000 ha. Since 1995–1996, the remaining area has been seriously encroached upon for subsistence agriculture. Currently, a forest patch no more than 35 ha remains at approx. 1180 m.a.s.l.. The patch is located on private tea estate grounds (Satemwa) and was the focus of our rapid assessment.

In Mozambique, four core sites were identified for surveying, listed below. All trails and tracks explored are visualised and can be viewed in the appendix of this document (see Annex Fig. 1, 2, 3 and 4 in the appendix). The gpx/kml files are available upon request.

1) Marata – Namaraona mountain: Marata has not been scientifically surveyed according to Bayliss et al. (2024), and was hence identified for further investigation, being located in between Mount Namuli and Mount Mabu. Within the Marata range, we identified high ground and fair forest cover in a part of the range that was not included within the boundaries of the SEAMA as proposed by Bayliss et al. (2024). The name given to this peak by the neighbouring community is Monte Namaroana. It reaches approximately 1600 m.a.s.l. with forest remnants found at elevations between 1300 and 1500 m.a.s.l. The combined forest extent is about 115 ha. Our survey area was centred around a clearing near the summit of the mountain. A path had to be cut through thick bush in order to reach the place. Mt. Namaroana is located within Namarroi District, in Zambezia Province.
2) Mancuni: Mancuni mountain is another non-surveyed site within the SEAMA. It is located in close proximity to Mount Inago (8 kilometres westwards) and with forest at altitudes between 1600 and 1700 m.a.s.l. The evergreen forest covers an approximate area of 180 ha. Mancuni mountain is located within Malema District, in Nampula Province.
3) Inago: Inago mountain is, from a herpetology perspective, one of the more scientifically studied inselbergs among the SEAMA sites, having been visited in 2018 by a team of herpetologists from South Africa (Tolley and Conradie in prep.). Its summit reaches a height of 1769 m.a.s.l. and the remaining primary forest fragments cover an area of approximately 427 ha (43% decrease compared to the year 2000). Mount Inago hosts the focus species of our research, the Mount Inago Pygmy Chameleon, and was hence included in our surveys. Inago mountain is located within Malema District, in Nampula Province.
4) Mabu: Mabu mountain is biologically well surveyed, starting in 2005 as part of a Kew-led project funded through the UK's Darwin Initiative, followed by a large expedition under the same project in 2008 with more brief visits in 2009 and 2010 (see Bayliss et al. 2014). Covering an estimated area of 7880 ha, with around 5270 ha of this at medium altitude (1000–1400 m), the forests on Mt. Mabu are some of the most extensive of this type in southern Africa. The summit reaches an altitude of 1650m and the forest covers about 7000 ha, characterized by well-developed and little-disturbed moist forest. Mabu mountain is located within Lugela District, in Zambezia Province.

Schedule

The data presented in this study was collected over the course of two field seasons in Malawi: a two-month survey from the 11th of November to the 18th of December 2020, a two-week survey from the 4th of November to the 18th of November, 2023, a two-day survey from the 15th of January to the 17th of January, 2024 and a subsequent two-week survey from the 3rd of February to the 15th of February 2024. For Mozambique, the team worked on the project from the end of April till mid-June 2024, with field visit dates as indicated below.

2020 - Malawi
Ruo Gorge: 12th Nov – 17th Nov and 21st Nov – 22nd Nov
Mount Mulanje Plateau: 18th Nov – 20th Nov
Chisongeli forest: 23rd Nov – 29th Nov, 3rd Dec – 4th Dec and 15th - 17th Dec
Thyolo mountain: 30th Nov – 1st Dec
Mchese mountain: 11th Dec – 13th Dec

2023/2024 - Malawi
Ruo valley: 4th Nov 2023 – 18th Nov
Ruo valley 15th Jan – 17th Jan
Ruo valley: 3rd Feb – 15th Feb

2024 - Mozambique
Marata (Namaroana): 5th – 8th May
Mancuni: 10th May – 12th May
Inago: 13th May – 16th May
Mabu: 29th May – 11th June

Acquiring Permissions
To facilitate future research, we share our experiences in gaining the necessary permissions to conduct research at these sites.

Permissions in Malawi
A research permit (Ref. N° NCST/RTT/1/20) was obtained from the National Commission for Science and Technology, obtained in partnership with the Wildlife and Environmental Society of Malawi (WESM).

Permissions in Mozambique
Acquiring permissions from the following authorities to conduct our work proved essential and in-person meetings facilitated the process significantly. Through the outlined process, we enabled community buy-in into the research visits, and ensured that we debriefed the relevant structures after the fieldwork. Note that separate permissions need to be acquired to collect specimens.

1. A 'Credençial' from a National Entity (e.g. University or Museum), accrediting you to visit each research site. We obtained one for each District.
2. Approval stamp on the 'Credençial' from the relevant District Commissioner for each District. Offices open at 07:00AM and close at 15:00PM on weekdays only.
3. Approval stamp from the Deputy at the relevant 'Posto Local' (Municipality). It is essential to identify in advance within which municipality the study site is located.
4. Verbal approval from 'Regulo' (King) and/or 'Reina' (Queen), who are in charge of an area roughly 10km x 10km.
5. Verbal approval from 'Secretario' (Community Leader), who is in charge of roughly 30 households.
6. Verbal approval from 'Chefe da Zona' (Chief), who is in charge of roughly 10 households.

Pygmy chameleon density survey methodology

To estimate the population density of pygmy chameleons, various methods could be used including a distance sampling approach or a plot approach. We opted for the plot approach. Density estimates were carried out in Mabu focused on the Mount Mabu Pygmy Chameleon and in Inago focused on the Mount Inago Pygmy Chameleon. Plots were placed randomly in the forest. Each plot was visited once,

at night. All chameleons were counted in each plot by meticulously scanning the whole plot with two observers (always the same avoiding observer bias), slowly moving up and down in a systematic manner through the plot.

Plot size
Based on an earlier density assessment by the same authors on the Chapman's Pygmy chameleon (*Rhampholeon chapmanorum*) in the Malawi hills (De Beenhouwer et al. in prep.), it was suggested to downscale the plot size from 400 m^2 to 100 m^2 to allow for more plots to be sampled within a limited time whilst maintaining accuracy. Each plot was square and measured 10 by 10 metres on Mt. Inago and 20 by 20 metres in size on Mt. Mabu. The choice of plot size (20 versus 10 metre) was adjusted based on, among others, the chameleon density; lower densities required larger plot sizes to remain relevant. If conducted by two observers, the size is limited by the upward limit since observation accuracy is expected to decrease with larger plots, as the attention span of each observer decreases.

Plot parameters
For each plot, the following categorical parameters were recorded:

- Slope (No incline, Slight incline, Steep incline)
- Habitat type (Riverine, Forest Interior)
- Undergrowth density (Very open, Open, Medium, Very dense)
- Leaf litter (Very little, Little, Medium, Thick), with four readings of leaf litter depth, one for each plot corner point

Fauna parameters
For each individual pygmy chameleon detected, the following parameters were recorded: snout vent length and sex (if possible). For Mount Mabu, all other reptiles and amphibians encountered within the plots were also identified and counted.

Herpetological survey methodology

To explore the herpetology of the SEAMA sites more broadly beyond pygmy chameleons, both day-time and nocturnal opportunistic sampling took place, to provide an overview of species encountered. Amphibians and reptiles were looked for using different methods. In each of the sites, we performed visual encounter surveys during the night, focusing on forest edge, forest streams and forest interior, mostly within primary forests. Further visual and acoustic searches were carried out opportunistically during the day. These mostly were carried out in the morning and late afternoon to increase our chances of recording diurnal and crepuscular species. The surveys were aimed at providing baseline semi-quantitative data on species occurrences across the focal habitats. Amphibians were handled using nitrile gloves, and where appropriate, sampling bags were not reused between individuals and localities to prevent the transmission of pathogens. All specimens listed in the account below were photographed, GPS coordinates were taken and digital records are available on the online platform iNaturalist.

Where DNA or voucher samples were collected, the following methods were used. DNA samples, consisting of tail and toe clips, were stored in 99% ethanol immediately after extraction. Reptile vouchers were euthanized by means of orally administered 20% benzocaine gel. Amphibians were euthanized by topical application of 20% benzocaine gel to the ventrum. Vouchers were fixed by means of injecting all fleshy parts with 99% ethanol using a hypodermic syringe and then submerging the entire specimen in 99% ethanol. Vouchers of amphibians were transferred to a 70% ethanol and 30% distilled water solution after 24 - 48 hrs depending on the size of the specimen. We await analysis for which results will be added to this report on a running basis.

RESULTS

Pygmy chameleon's densities

Mt. Inago Pygmy Chameleon

Between the 13th and the 15th of June 2024, *Rhampholeon* counts were recorded from 14 plots, covering an area of 100 m^2 each. These plots collectively contained 16 Mount Inago Pygmy Chameleons. The plots were located in two isolated forest fragments, one defined as being riverine and one being a remnant of forest interior. The data collected during this study can be viewed in Table 1 below. A detailed study and population estimate based on this data in conjunction with that of the Mt. Mabu Pygmy Chameleon will be published (De Beenhouwer et al. in prep.).

Table 1: plot parameters for all 14 plots from Mount Inago, indicating the number of Inago Pygmy Chameleons encountered.

Plot	Date	Location	Altitude	Slope	Undergrowth	Nr pygmies
1	13/05/2024	15.144900° S 37.455978° E	1434m	Steep incline	Medium dense	1
2	13/05/2024	15.145062° S 37.455767° E	1436m	Slight incline	Dense	1
3	13/05/2024	15.144812° S 37.455267° E	1452m	Slight incline	Open	0
4	14/05/2024	15.142808° S 37.450813° E	1504m	Slight incline	Open - Medium	3
5	14/05/2024	15.143225° S 37.450875° E	1498m	No incline	Medium	0
6	14/05/2024	15.143735° S 37.451057° E	1499m	No incline	Dense	1
7	15/05/2024	15.142503° S 37.458705° E	1423m	Steep incline	Open - Medium	0
8	15/05/2024	15.142712° S 37.458676° E	1419m	Steep incline	Dense	0
9	15/05/2024	15.142660° S 37.458242° E	1427m	Steep incline	Medium	0
10	15/05/2024	15.142435° S 37.457683° E	1444m	Slight incline	Medium	1
11	15/05/2024	15.142292° S 37.457957° E	1439m	Slight incline	Medium	5
12	15/05/2024	15.142398° S 37.458127° E	1434m	Steep incline	Open	2
13	15/05/2024	15.142835° S 37.458752° E	1416m	Slight incline	Open	1
14	15/05/2024	15.143263° S 37.459060° E	1404m	Slight incline	Medium	1

Mt. Mabu Pygmy Chameleon

Between the 1st and the 10th of June 2024, 21 plots of each 400 m^2 were established, where a total of 38 Mount Mabu Pygmy Chameleons were discovered (Fig. 37 in the appendix). Here a slightly different approach was followed. Due to the wide altitudinal range on which suitable forest can still be found, the team intentionally defined seven altitude intervals spanning 100m each. Within each of these intervals, three plots were chosen at random. The intervals spanned from 900 up until 1600 m.a.s.l. All plots were located within the main major forest block that constitutes the core of Mount Mabu. Results correlating altitude and number of chameleons per plot are visualised in Figure 4. Higher numbers were encountered for the 900-1000 altitude interval and 1000-1100 altitude interval, with a gradual decreasing abundance towards the higher altitudes. Although no chameleons were encountered in the plots above 1500 m.a.s.l., presence within this altitude interval was confirmed opportunistically, albeit at low density.

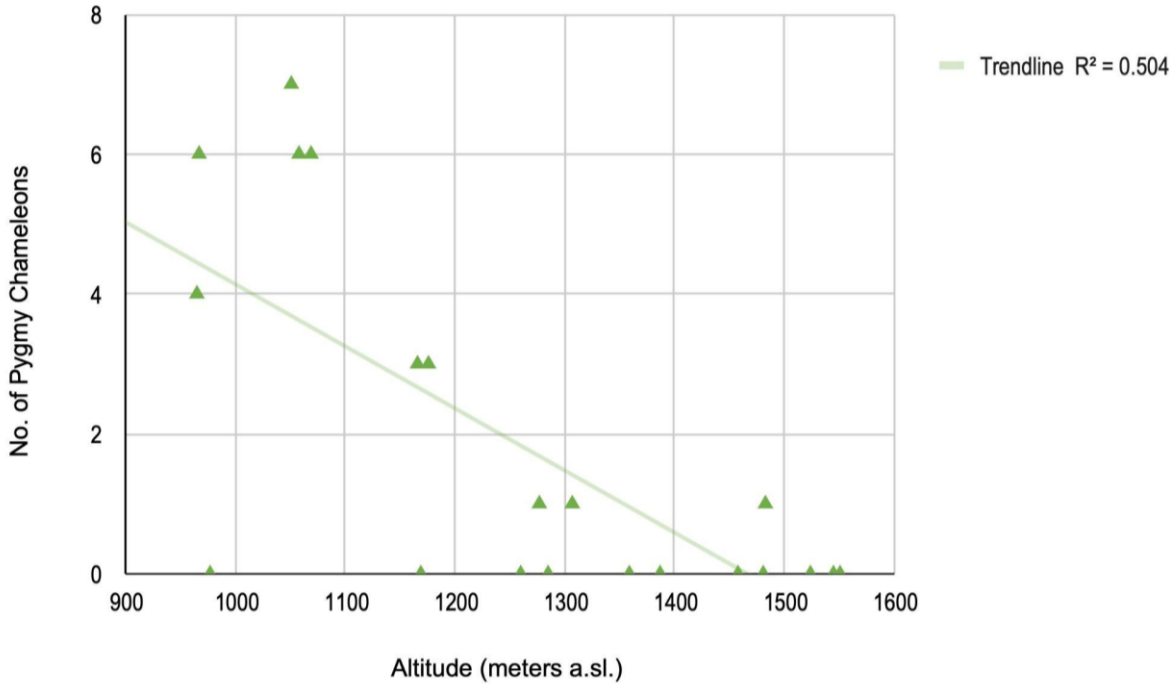

Fig. 4: scatter plot indicating the number of encountered Mount Mabu Pygmy Chameleons per plot of 20 by 20 meters across the altitudinal range of 900 to 1600 meters above sea level, in Mount Mabu, Mozambique.

Herpetofauna

For each location visited, a full species list, containing all species observed during our field visits, is presented. Under notable observations, reptile and amphibian species of conservation concern (IUCN red-listed species) are discussed. Specimens that present a potentially new species, a considerable range extension and/or species to which we contribute new insights on their natural history, are equally listed and elaborated on below.

Mount Mulanje

We provide an overview of species encountered opportunistically in 2020 as well as those recorded during approximately four weeks of targeted surveying in 2023 and 2024 (Annex Table 3 in the appendix). This includes all observations from Mount Mchese, Ruo gorge (see Figure 5), Ruo valley and Chisongeli forest.

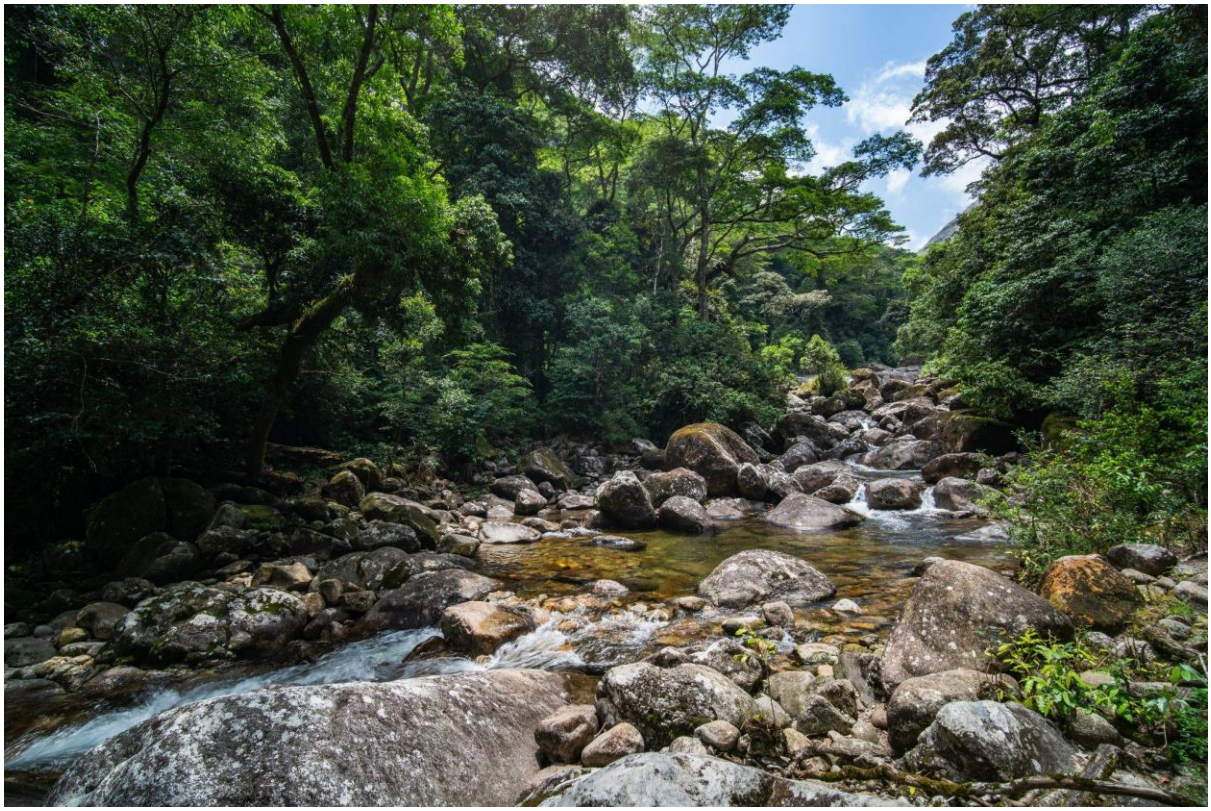

Fig. 5: The Ruo river and surrounding Afromontane forest in the Ruo Gorge. ©TB

Notable reptile observations (Mt Mulanje)

Mulanje Cross-barred Tree Snake (*Dispadoboa flavida flavida* - Least Concern)
In October 2023, on three different occasions, the rarely seen Mulanje Cross-barred Tree Snake (*Dispadoboa flavida flavida*) (Fig. 6) was observed in a small riverine patch in the Ruo Valley at 650 m.a.s.l. (recorded on iNaturalist). Few records exist of this subspecies.

King Dwarf Gecko (*Lygodactylus rex* – Near Threatened)
Several specimens were photographed throughout the sampling period, both within the Evergreen forest edge, as on top of the mountain plateau of Mount Mulanje and Mount Mchese.

Mulanje Chameleon (*Nadzikambia mlanjensis* - Endangered)
The Mulanje Chameleon is fairly common in evergreen forests on top of the Mulanje plateau as well as in forests on the lower down slopes. Contrary to the distribution map on the IUCN Red List (visited on 8/4/2024), several individuals were also observed in four out of five of the visited Ruo valley remnant lowland forests, at altitudes between 630 m.a.s.l and 670 m.a.s.l.. This contradicts the statement "In recent times, the chameleon has only been recorded between 1100 m up to ca. 1900 m (Lichenya hut)". Additional interesting observations were that of two Mulanje Chameleons laying eggs in self-dug holes in the middle of a narrow footpath in the Ruo gorge (November 2020, and November 2023).

Mulanje Flat-headed Pygmy Chameleon (*Rhampholeon platyceps* – Endangered)
This species was found to be common within its habitat. Contrary to the Mulanje Chameleon, no individuals were found in the lower lying evergreen forests of the Ruo Valley, indicating that the species might be more sensitive to altitudinal limits.

Zomba Pygmy Chameleons (*Rieppeleon brachyurus* - Least Concern)

Populations of Zomba Pygmy Chameleons (Fig. 7) were discovered in some of the lowland forest patches on the tea estates (available on iNaturalist), representing range extensions. Due to habitat loss, the future of this species in the ecoregion is uncertain.

Fig. 6: Mulanje Cross-barred Tree Snake ©TB

Fig. 7: Zomba Pygmy Chameleon ©TB

Notable amphibian observations (Mt Mulanje)

Lujeri squeaker *(Arthroleptis sp. nov. / cf. xenodactyloides)*
A further observation worth noting was that of small frogs in the Ruo valley belonging to the *Arthroleptis* genus and most closely resembling the Dwarf Squeaker (*Arthroleptis xenodactyloides* - Least Concern*)* (Fig. 10). We noted consistent differences in coloration; plain reddish brown above and lacking the diagnostic hourglass pattern with red coloration on the inside of the limbs, as well as unique vocalisation. Moreover, first finger was clearly shorter than second finger (available on iNaturalist). Nonetheless, DNA samples would have to be obtained to confirm the status of these individuals.

Ruo River Screeching Frog (*Arthroleptis francei* - Vulnerable)
A fairly common occurrence on the moist forest floor within evergreen forests on the Mulanje slopes and the riverine valley forests on the plateau.

Spiny-throated Reed Frog (*Hyperolius spinigularis* - Vulnerable)
A breeding population of approximately 50 individuals of the vulnerable *Hyperolius spinigularis* (Fig. 8 & 9) was encountered in low gallery forest at the edge of a wetland at an altitude of around 1610 m.a.s.l. in Chisongeli forest (Observation available on iNaturalist). Vocalisation by males was recorded for the first time. (Foquet et al. in prep.)

Mongrel Frog (*Nothophryne broadleyi* - Endangered)
Moreover, on two occasions, vocalising Mongrel Frogs (Fig. 11) were observed next to a clutch of large eggs under rocks on a seepage (Observation available on iNaturalist). Assuming that the two vocalising frogs were males, this may indicate that males guard egg laying sites to which females come to deposit their eggs. Little is known about the breeding behaviour of this secretive species.

Fig. 8: Male Spiny-throated Reed Frog with eggs ©RF

Fig. 9: Spiny-throated Reed Frog amplexus ©RF

Fig. 10: Dwarf Squeaker aka Lujeri squeaker ©TB

Fig. 11: Mongrel Frog with eggs ©RF

Threats and conservation implications

Mulanje Mountain Forest Reserve has never been managed effectively and has been in a steady state of decline since its conception. However, recent decennia have seen destruction and especially deforestation accelerate. Additionally, Cyclone Freddy in early March 2023 and a 44% currency devaluation in November 2023, caused general economic desperation. This coupled with a lack of effective law enforcement coerced illegal logging groups into the Ruo Gorge (Fig. 12). The damage done to the forest is immense and the entire evergreen Ruo gorge forest and Chisongeli is rapidly being destroyed. If the current situation persists these forests will completely disappear within the next few years. Chisongeli Forest has also been severely impacted by Cyclone Freddy. At the time of our study in 2020, Chisongeli forest appeared to be in relatively good condition, with human presence limited to the main footpaths and only hardwoods targeted for logging. However, recent aerial imagery shows that the forest has been ravaged by landslides (Fig. 13). This is most likely exacerbated due to the increase in deforestation pressures, as hardwoods and other valuable timbers are removed from the forest. The increase in pressure is amongst others caused by the unsustainable logging of Mulanje cedar (*Widdringtonia whytei,* critically endangered*)* which is now threatened by extinction. The loss of this income stream as well as the increased demand for timber due to mismanagement of (government) plantations has caused loggers to target alternative sources of timber such as *Podocarpus milanjianus* and *Newtonia buchananii*, further eroding the resilience of the natural forest against deforestation drivers such as fire and extreme weather events.

While conservation efforts have been receiving significant funding for decades due to the unique biodiversity that needs protection, these are clearly failing when compared to other forest reserves in the country that have received way less funding. Current conservation measures by the Forestry Department and the Mount Mulanje Conservation Trust (MMCT), alongside smaller short-term projects, are unsuccessful at curbing the negative trend in the evergreen forest of Mulanje, illustrated

by the ongoing rampant deforestation of first the Chisongeli and, as we speak, the Ruo Gorge forest. While MMCT remains adamant that a delegated mandate is an imminent solution, this has now been halted without significant progress since at least 2018 (Pers. Comm.). The Forest Landscape Restoration organisation WeForest, at the time of writing, only focuses on the protection of miombo woodlands through co-management and hence the future of forest-dependent endemic species on Mount Mulanje is bleak. The remnant populations of *Nadzikambia mlanjensis* in the tea-estate owned lowland forest patches are hence crucial for the survival of this species. It is important that tea estates become aware of their unique biodiversity and uphold their commitments under potential sustainability labels like Rainforest Alliance, UTZ and Fairtrade. This includes Lujeri Tea Estates and Eastern Produce Malawi Tea Estates. Since tea is not (yet) listed under the EU Deforestation Regulation, conservation depends on voluntary commitments linked to sustainability labels.

Fig. 12: Illegal logging in the Ruo Gorge ©RF

Fig. 13: Chisongeli forest after Cyclone Freddy ©RF

Mount Namaroana (Marata)

This was the first ever scientific expedition to this mountain and thus our findings represent the first species list for the area. As expected, Mt. Namaroana was found to have similar herpetofauna to the other inselbergs in the area (full overview in Annex Table 4 in the appendix). Trees were quite stunted in the forest (Fig. 14). The conditions during our survey were not optimal and mist covered the mountain every night, making it difficult to scan the tree tops for *Nadzikambia* chameleons and other arboreal species.

Fig. 14: Forest stream in the interior of the Afromontane Forest at Mt. Namaroana ©TB

Notable reptile observations (Mount Namaroana)

Lygodactylus sp. nov. or *cf. rex/regulos*

Also notable was a Dwarf Gecko of the genus *Lygodactylus* (Fig. 15) that was found on a tree at the forest edge near our camp at approximately 1508 m.a.s.l. This may also represent a new species as it is part of the *Lygodactylus rex/regulos* complex which is to be split into multiple species (Tolley and Conradie in prep.). Further DNA analysis will be needed to clarify the taxonomic status of this gecko (records on iNaturalist).

Rhampholeon sp. nov.

A possible new Pygmy Chameleon of the genus *Rhampholeon* was discovered (records on iNaturalist) (Fig. 16). Dozens of individuals were encountered during three nights of surveying in the Afromontane forest patches. They most frequently exhibited rusty reddish-brown coloration. 60 specimens were measured and it was found that adults rarely exceed 50mm in snout to vent length with a maximum length of 53mm recorded. This is much smaller than its counterparts *Rhampholeon maspictus* (occurring roughly 60 km to the south) and *Rhampholeon bruessoworum* (occurring 110 km to the northeast) (Annex Table 2 in the appendix). Further DNA analysis will be needed to clarify the taxonomic status of these chameleons within the genus.

Fig. 15: Potentially undescribed Dwarf Gecko ©RF

Fig. 16: Potentially undescribed Pygmy Chameleon ©TB

Notable amphibian observations (Mount Namaroana)

Arthroleptis aff. francei

Of note are our records of *Arthroleptis aff. francei* (available on iNaturalist) from the same mountain. Until now, this species complex was only known to occur on Mt. Mulanje, Mt. Mabu, Mt. Namuli and Mt. Socone (Bittencourt-Silva 2020 and Conradie et al. 2016). These records represent an important link between the populations on Mt. Mabu and Mt. Namuli.

Threats and conservation implications

Mt Namaroana, like many of the other SEAMA core sites, was used as a safe haven by refugees during the Civil War in the 1980s. During this time people settled on the mountain and cleared large tracts of forest to plant crops on which they depended for survival. Still today, forest clearings, choked by vines and dotted with charred tree stumps characterise a large part of the landscape (Fig. 17). These areas appear to be prone to fire damage which in turn hinders the regeneration of the forest. The mountain is also considered a hunting ground, indicated by our observations of multiple traps during surveys. Although the agricultural activities in the evergreen forest have ceased, the forest does not appear to be in a state of natural recovery. Moreover, slash-and-burn shifting agriculture is rapidly approaching from the slopes lower down the mountain.

If the Pygmy chameleon turns out to be a distinct species, Mount Namaroana would gain significantly in conservation importance. In any case, we do strongly recommend the expansion of the SEAMA delineation to include Mount Namaroana and surrounding woodlands (approx. 1500 ha) to the Marata core site (Fig. 18).

Fig. 17: Charred stumps and vines in a forest clearing on Mt. Namaroana ©TB

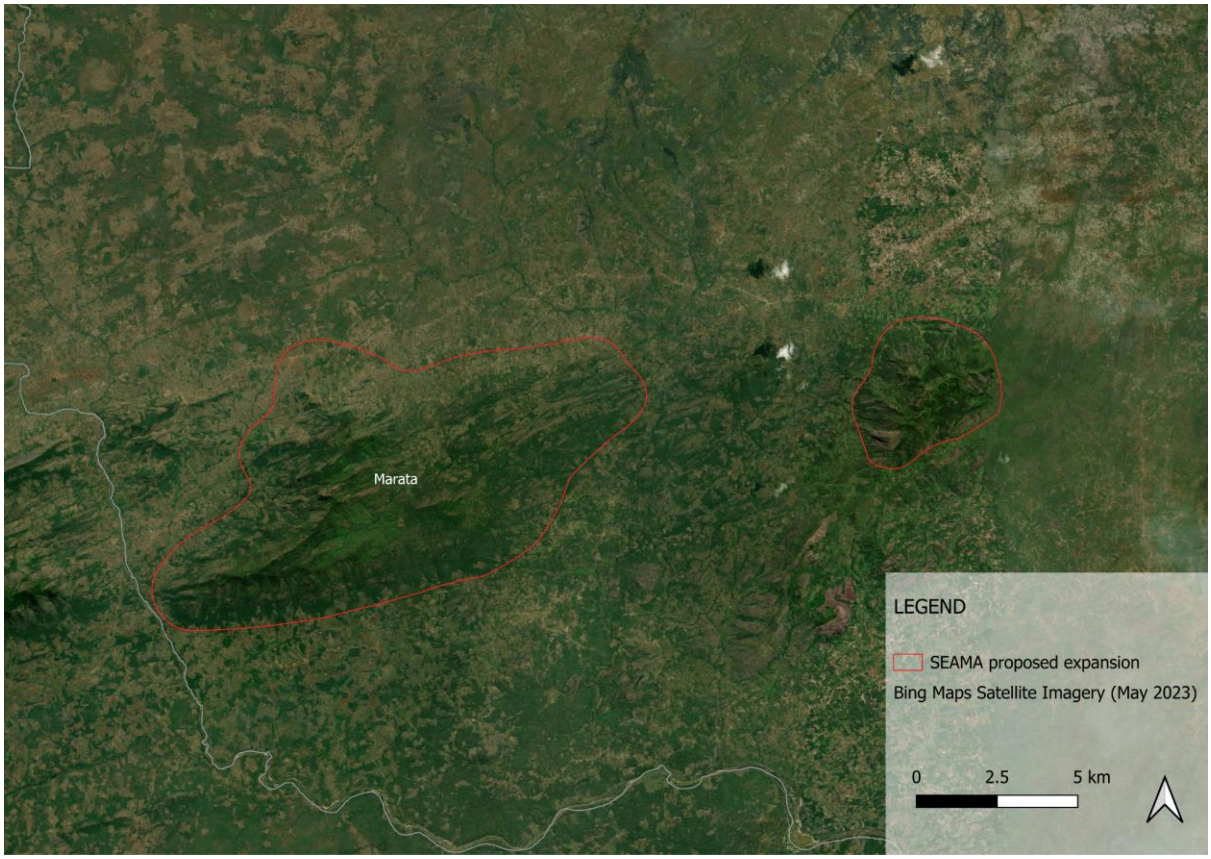

Fig. 18: proposed expansion of Marata core site of the SEAMA. An extra site delineating 1500 hectares containing Mount Namaroana is added.

Mount Mancuni

The forests on Mancuni appeared much drier (Fig. 19) and hence are substantially different to that of the other, wetter mountains visited. The undergrowth is denser with a thick layer of dry leaf litter. Large trees forming a closed canopy are scarce and instead, large vines form densely woven mats overhead. This, in conjunction with the large number of thickly vegetated clearings makes traversing the forest difficult, necessitating the use of a machete. It is likely that Mt. Mancuni is located in the rain shadow of Mt. Inago and thus receives significantly less rain, especially in dry season, which is a determining factor for the unique biodiversity of these mountains in the SEAMA. We did not encounter the usual assemblage of herpetofauna, yet several interesting finds were recorded (full overview in Annex Table 4 in the appendix).

Fig. 19: Forest interior at the Northwestern edge of Mt. Mancuni plateau ©TB

Notable reptile observations (Mount Mancuni)

Lygodactylus sp. nov. or *cf. rex/regulos*

A further possible new species of *Lygodactylus* (Fig. 20) was discovered on the base of a tree within a patch of Afromontane forest at an altitude of about 1530 m.a.s.l.. Similarly to the specimen from Mt. Namaroana, it too is most likely part of the *Lygodactylus rex/regulos* complex. Other, new *Lygodactylus* specimens have been collected in the Afromontane forests of nearby Mt. Inago (Tolley and Conradie in prep.). DNA analysis will help provide an identification for this specimen (available on iNaturalist).

Notable amphibian observations (Mount Mancuni)

Mongrel frog (*Notophryne sp. nov*.)

A possible new species of *Nothophryne* was found (Fig. 21). The individual was found under a large rock, located under the shade of a small tree on a slightly inclined section of granite seepage (available on iNaturalist). The altitude was approximately 1660 m.a.s.l. The individual was collected, since Mancuni mountain has not previously been visited by herpetologists, and Mount Inago contains its own endemic species *Nothophryne inagoensis* (Conradie et al. 2018). Further DNA analysis will elucidate the taxonomy of the specimen.

Fig. 20: Undescribed Dwarf Gecko ©TB

Fig. 21: Undescribed Mongrel Frog ©RF

Threats and conservation implications

No evidence of logging or clearing was observed on the top of Mt. Mancuni, however, the miombo woodlands on the lower slopes have been mostly deforested. The main threat to the evergreen forest appears to be recurrent wildfires. Charred logs and stumps were visible even in the forest interior. Local communities use the forest as hunting grounds, targeting Blue Monkeys, Red Rock Hare and other small mammals, potentially beyond sustainability levels.

Notwithstanding its close proximity to Mount Inago, Mount Mancuni harbours less typical SEAMA reptile and amphibian species; we did not record, among others, *Arthroleptis aff. francei*, *Rhampholeon* and *Nadzikambia* species, and we hypothesise that the microclimate is different from other SEAMA sites. Further meteorological and vegetation surveys would clarify which environmental parameters do indeed differ. Based on this brief herpetological survey, we do not consider Mancuni a core priority area for conservation, relative to its neighbouring Mount Inago.

Mount Inago

The South-eastern side of the mountain, containing the largest remaining forest patches (Fig. 22), was our target area. As hypothesised, these patches proved to be optimal habitat for the target species *Rhampholeon bruessoworum* (Critically Endangered). The target area rose from 1360 m.a.s.l. to about 1520 m.a.s.l.. The forest is fragmented and patches are separated from each other as a result of current and historical slash and burn farming activities. The herpetofauna has been previously assessed (Tolley and Conradie in prep.). During our visit we made additional new discoveries of which the most noteworthy are listed below (full overview in Annex Table 4 in the appendix).

Fig. 22: Forest stream in one of the last remaining forest patches on Mt. Inago ©TB

Notable reptile observations (Mount Inago)

Mulanje Water Snake *(Lycodonomorphus mlanjensis* – Least Concern)
Noteworthy is the presence of *Lycodonomorphus mlanjensis* (Fig. 23) at high altitudes. Four large specimens were observed actively swimming in forest streams late at night. The records are from both forest and riverine patches at altitudes of 1409 m.a.s.l. and 1497 m.a.s.l.. The snakes were identified on the basis of having 21 scale rows at midbody and the presence of a dark median line on the subcaudals. DNA analysis will be used to confirm this identification as the genus is currently being revised based on genetics (Conradie in prep) (available on iNaturalist). These records represent a range extension for the species (Brammer et al. in prep).

Forest Chameleon (*Nadzikambia sp. nov*.)
The team encountered four chameleons of the genus *Nadzikambia*. The *Nadzikambia sp. nov*. (Fig. 24) is known from previous surveys (Tolley, 2018) and a new species description is imminent (Tolley and Conradie in prep.). The chameleons were discovered at altitudes of approximately 1430 m.a.s.l. Three individuals were observed on the edge of a man-made clearing, the fourth in the forest interior. All individuals were perched high up in the canopy (available on iNaturalist). Species description is urgent, as the population is under sever threat, and highly likely to be listed as Critically Endangered.

Mount Inago Pygmy Chameleon (*Rhampholeon bruessoworum* – Critically Endangered)
As the target species on the MBZ grant, specific attention was paid to the densities of this species, within riverine forest and forest interior. 31 specimens were measured (Annex Table 2 in the appendix).

Fig. 23: Mulanje Water Snake ©TB

Fig. 24: Undescribed Forest Chameleon ©RF

Notable amphibian observations (Mount Inago)

Arthroleptis aff. francei

Several specimens of *Arthroleptis aff. francei* (available on iNaturalist) were encountered on the forest floor. This species complex was only known to occur on Mt. Mulanje, Mt. Mabu, Mt. Namuli and Mt. Socone (Bittencourt-Silva 2020 and Conradie et al. 2016). Our records confirm their presence on the mountain as previously recorded (Tolley and Conradie in prep.).

Rainfrog *(Breviceps sp. nov.)*

An undescribed, male, *Breviceps sp. nov.* (Fig. 25) was located under a small rock, in an evergreen forest patch, close to a forest stream (available on iNaturalist). The altitude was 1418 m.a.s.l.. The individual was collected as only one female specimen had been collected so far (Tolley and Conradie in prep.). A species description is imminent.

Spiny-throated Reed Frog (*Hyperolius cf. spinigularis* - Vulnerable)

Another Anuran observation worth noting was that of a *Hyperolius cf. spinigularis* (Fig. 26). The specimen was found on a wild ginger plant in a patch of riverine forest at an altitude of approximately 1497 m.a.s.l (available on iNaturalist). This species was first discovered in the Ruo Valley of Mt. Mulanje (Stevens 1971) and has since also been recorded from Mt. Namuli (Loader 2015) in the SEAMA ecoregion. Our observation represents the first known record of this species from Mt. Inago. The species, like many of the other SEAMA endemics, is likely to have speciated on each of the major mountains. It is thus likely that this find also represents an undescribed species (Tolley and Conradie in prep.). DNA analysis will confirm its taxonomic status.

Fig. 25: Undescribed Rain Frog ©RF

Fig. 26: Spiny-throated Reed Frog ©TB

Threats and conservation implications

Like other SEAMA core sites, refugees settled on the mountain in the 1980s, clearing large tracts of forest (Fig. 27) in order to plant their crops in the fertile soils. Similar to Mt. Namuli, some of these refugees have remained there to this day. Slash and burn agriculture continues and the forest shrinks every year as fires continue to further degrade the forest edges. There were also signs of logging in the forest patches. Hunting is also practised in the forests and we found multiple snares and were warned of gin traps.

The local authorities, upon being informed of the existing threats, were surprised and eager to find a sustainable solution to these problems in an effort to better protect their unique fauna and flora. A partner organisation looking to make a difference would almost certainly be welcomed in the area. The description of the new species is urgent, as the degradation of Mount Inago threatens their survival and we consider it imperative that the new species descriptions are used as conservation vehicles to channel attention and funding to Mount Inago.

Fig. 27: Vast tracts of forest cleared for slash and burn agriculture on Mt. Inago ©RF

Mount Mabu

As part of an international team of scientists, we headed into the centre of this forest (Fig. 28), as opposed to previous expeditions that have always focused on the Eastern side. The 7000 hectares of Afromontane forest form the largest rainforest in Southern Africa. The Mabu peak reaches a height of 1650 m.a.s.l.. Activity levels of the herpetofauna were low during the first ten days, due to dry and cold weather. In the last two days the rainforest was drenched by a heavy downpour that did not make surveying any easier. Although our efforts were focused on gathering data for a population estimate of *Rhampholeon maspictus,* we did also come across herpetofauna that is worth noting (full overview in Annex Table 4 in the appendix).

Fig. 28: Forest interior at ca. 1300m a.s.l near the centre of Mt. Mabu ©TB

Notable reptile observations (Mount Mabu)

Mt. Mabu Bush Vipers (*Atheris mabuensis* - Endangered*)*
Two very dark, almost patternless Mt. Mabu Bush Vipers (Fig. 29) were observed at an approximate altitude of 1300 m.a.s.l.. Local hunters who knew the species by name, claimed that it was also present at our survey sites located between 1500 m.as.l. and 1600 m.a.s.l.. Previously, on Mt. Mabu, this species was only recorded from the lower lying forest at 1000 m.a.s.l.. (Branch & Bayliss 2009). These records increase the altitudinal range for the species on Mt. Mabu by 200 m. The species has also been recorded from Mt. Namuli where a single specimen was found at an altitude of 1550 m.a.s.l.. At the time of that publication, it was thought that the presence of this species at such high altitudes was due to the destruction of the low lying forests of Mt. Namuli which might have forced the species to migrate higher up. Our findings suggest that this is most likely still part of the species natural habitat and suggests that the species might cover a wider altitudinal range than previously assumed (record available on iNaturalist).

Montane Tree Snakes (*Dipsadoboa montisilva* - Near Threatened)
Two Montane Tree Snakes (Fig. 30) were observed. One was found dead; it appeared to have been killed by an animal (available on iNaturalist) and a second was found foraging at night on the forest floor in one of the sampling plots prior to heavy rain (available on iNaturalist). The altitudes at which they were found were respectively 1300 m.a.s.l. and 1146 m.a.s.l.. The second specimen was the largest of the two, measuring 901 mm from snout to vent and 1181 mm in total length. This is a new length record for the species, measuring 97 mm longer than the previous longest recorded specimen which measured 1084 mm in total length (Branch et al. 2019).

Mount Mabu chameleon (*Nadzikambia baylissi* – Near Threatened)
Several individuals were found at night, whilst scanning the mid-canopy of the evergreen forest.

Mount Mabu Pygmy Chameleon (*Rhampholeon maspictus* – Near Threatened)

A systematic population density estimate was conducted through plot counts on this species, across the altitudinal range of the evergreen forest on Mount Mabu. The species was encountered across the altitudinal range, yet with differing densities (see Figure 4).

Fig. 29: Mt. Mabu Bush Viper, juvenile ©TB

Fig. 30: Montane Tree Snake ©RF

Notable amphibian observations (Mount Mabu)

Arthroleptis aff. francei
Several specimens of *Arthroleptis aff. francei* were encountered on the forest floor. This species complex was already known from Mt. Mabu, hence our records confirm their presence on the mountain.

Spiny-throated Reed Frog (*Hyperolius cf. spinigularis* - Vulnerable)
We note that colleagues including Dr. Julian Bayliss observed and photographed *Hyperolius cf. spinigularis* in the centre of Mount Mabu in December 2023, in preparation of the June 2024 expedition. We did not encounter this species, underlining the limitations of dry season sampling.

Threats and conservation implications

Mt. Mabu is one of the few SEAMA core sites which still has pristine rainforest that is relatively untouched by people (at least from a vegetation perspective). Although the lower slopes are under severe pressure by subsistence farmers, the higher elevation forest remains in good condition. Logging does not occur in the forest. However, hunting is a considerable threat as hundreds of hunters use the forest as their hunting grounds. Duiker, Bush Pig, Blue Monkeys and other small mammals are targeted (see Fig 31). Large mammals, such as buffalo, were hunted to extinction during the civil war in the 1980s. Gin traps are scattered across the forest and therefore, leaving trails to survey forest interiors away from the main trails, is extremely dangerous.

The ongoing projects supported by the BioFund and Rainforest Trust facilitated the application for a Community Conservation Area, which would increase the formal protection status and hence increase the chances of survival of the unique species. No longer-term funding has been secured yet and hence the next years will clarify whether and how the proposed management plan will be implemented.

Fig. 31: Gin trap with deceased Duiker covered in Driver Ants from Mt. Mabu ©TB

Mount Socone

The team also attempted to visit Mount Socone, in Ile District, which was visited by herpetologists in May 2018 (see Bittencourt et al. 2020). After obtaining permissions from Ile District and the Posto Administrativo at municipality level, the local communities granted us permission to ascend the mountain. However, the tea company Chai Socone under Sonil Lda (a private company) indicated to have the mandate across the whole 10.000 hectares of land including the mountain tops (Muli and Malacaci). To be granted permission to enter, we were therefore requested to submit a research proposal to their headquarters in Nampula, a process which was initiated but never approved. Deforestation on the mountain is rife, yet the company representative claimed that they take forest protection on their land very seriously. With regards to future conservation, this would imply that community-based protection is out of the question, and supply chain levers have to be pulled to increase the companies' environmental responsibility. We recommend future explorers to first verify the estate boundaries and enter in dialogue with the offtakers of the Socone Chai tea, as well as with the tea estate itself.

CONCLUSION

(EN) The herpetofauna of the SEAMA is still largely unknown. Our findings confirm that many of the SEAMA core sites remain poorly explored. Most sites have only been visited once, if at all, by herpetologists. We also conducted a first survey of Mount Namaroana, and based on our findings recommend its inclusion in the SEAMA ecoregion, illustrating further exploration of both recognized and new sites in the SEAMA can render valuable new biodiversity data. Our survey efforts have further uncovered some of the ecoregion's secrets. Below is a summary of the most noteworthy discoveries:

- New breeding behaviours observed in *Hyperolius spinigularis* and *Nothophryne broadleyi* on Mt. Mulanje
- A possible new species of *Arthroleptis aff. xenodactyloides* from the Ruo Valley
- Two likely undescribed *Lygodactylus,* one from Mt. Mancuni and one from Mt. Namaroana.
- A likely undescribed species of *Rhampholeon* from Mt. Namaroana
- A possibly undescribed species of *Nothophryne* from Mt. Mancuni
- A possibly undescribed *Hyperolius aff. spinigularis* from Mt. Inago
- The first ever recorded male *Breviceps* of an undescribed species from Mt. Inago
- Observations of undescribed *Nadzikambia sp. nov.* (Tolley and Conradie in prep.) from Mt. Inago
- A new record of *Lycodonomorphus mlanjensis* from Mt. Inago
- New altitudinal records for *Atheris mabuensis* on Mt. Mabu
- New length record for *Dipsadoboa montisilva* on Mt. Mabu

Further clarity on species identifications will be unveiled after DNA analysis. During our exploration we also gathered the following ecological quantitative data:

- Population data for the Critically Endangered *Rhampholeon bruessoworum*
- Population data for the Near-Threatened *Rhampholeon maspictus*

The alarming rates of habitat destruction stress the urgency of such research. We are hopeful that the work conducted on Mount Mabu will be taken further into a long-term (not project-based) commitment, ensuring community structures are capable of coordinating and enforcing bylaws once the legal status of Community Conservation Area becomes officialized by the government. Mount Mabu clearly remains the beacon of this newly established ecoregion, as it is undoubtedly the largest and most pristine of all SEAMA forest islands. While deforestation is omnipresent, we encourage conservationists to initiate conservation work on Mount Inago as soon as possible, because of the high number of endemic species and their continued presence in the remaining forest fragments.

We also show that biodiversity assessments and taxonomic work is easily coupled with the collection of ecological quantitative data. We encourage future research across the region, and especially the sites that remain unstudied.

(PT) A herpetofauna do SEAMA ainda é bastante desconhecida. O nosso trabalho de investigação revelou alguns dos segredos da ecoregião. Segue-se um resumo das descobertas mais notáveis:

- Novos comportamentos de reprodução observados em *Hyperolius spinigularis* e *Nothophryne broadleyi* no Monte Mulanje
- Uma possível nova espécie de *Arthroleptis aff. xenodactyloides* do Vale do Ruo
- Dois *Lygodactylus* provavelmente não descritos, um do Monte Mancuni e outro do Monte Namaroana.

- Uma espécie provavelmente não descrita de *Rhampholeon* do Monte Namaroana
- Uma espécie possivelmente não descrita de *Nothophryne* do Monte Mancuni
- Uma espécie possivelmente não descrita de *Hyperolius aff. spinigularis* do Monte Inago
- O primeiro registo de um *Breviceps* macho de uma espécie não descrita do Monte Inago
- Observações de *Nadzikambia* sp. nov. não descrita (Tolley e Conradie em prep.) do Monte Inago
- Um novo registo de *Lycodonomorphus mlanjensis* do Monte Inago
- Novos registos altitudinais para *Atheris mabuensis* no Monte Mabu
- Novo registo de comprimento para *Dipsadoboa montisilva* no Monte Mabu.

A identificação das espécies será esclarecida após a análise do ADN. Durante a nossa exploração, recolhemos também os seguintes dados ecológicos quantitativos:

- Dados populacionais do *Rhampholeon bruessoworum*, criticamente em perigo de extinção
- Dados populacionais de *Rhampholeon maspictu*s quase ameaçado

As nossas descobertas confirmam que a maioria dos principais sítios do SEAMA ainda estão pouco explorados. A maioria dos sítios só foi visitada uma vez, se é que o foi, por apenas herpetólogos. Recomendamos a inclusão do Monte Namaroana na ecoregião do SEAMA, ilustrando que uma maior exploração de sítios reconhecidos e novos no SEAMA pode produzir novos dados valiosos sobre a biodiversidade.

As taxas alarmantes de destruição do habitat realçam a urgência de tal investigação. Do ponto de vista das prioridades de conservação, encorajamos os conservacionistas a iniciarem os trabalhos de conservação no Monte Inago o mais rapidamente possível, uma vez que, as espécies endémicas ainda estão presentes nos fragmentos de floresta remanescentes. O trabalho realizado no Monte Mabu precisa de ser levado mais longe, num compromisso a longo prazo (não baseado em projectos), assegurando que as estruturas comunitárias são capazes de coordenar e fazer cumprir os estatutos, uma vez obtido o estatuto de Área de Conservação Comunitária. O Monte Mabu é, sem dúvida, a maior e mais prístina de todas as ilhas florestais do SEAMA.

Mostramos também que as avaliações da biodiversidade e o trabalho taxonómico podem ser facilmente associados à recolha de dados ecológicos quantitativos. Incentivamos a investigação futura.

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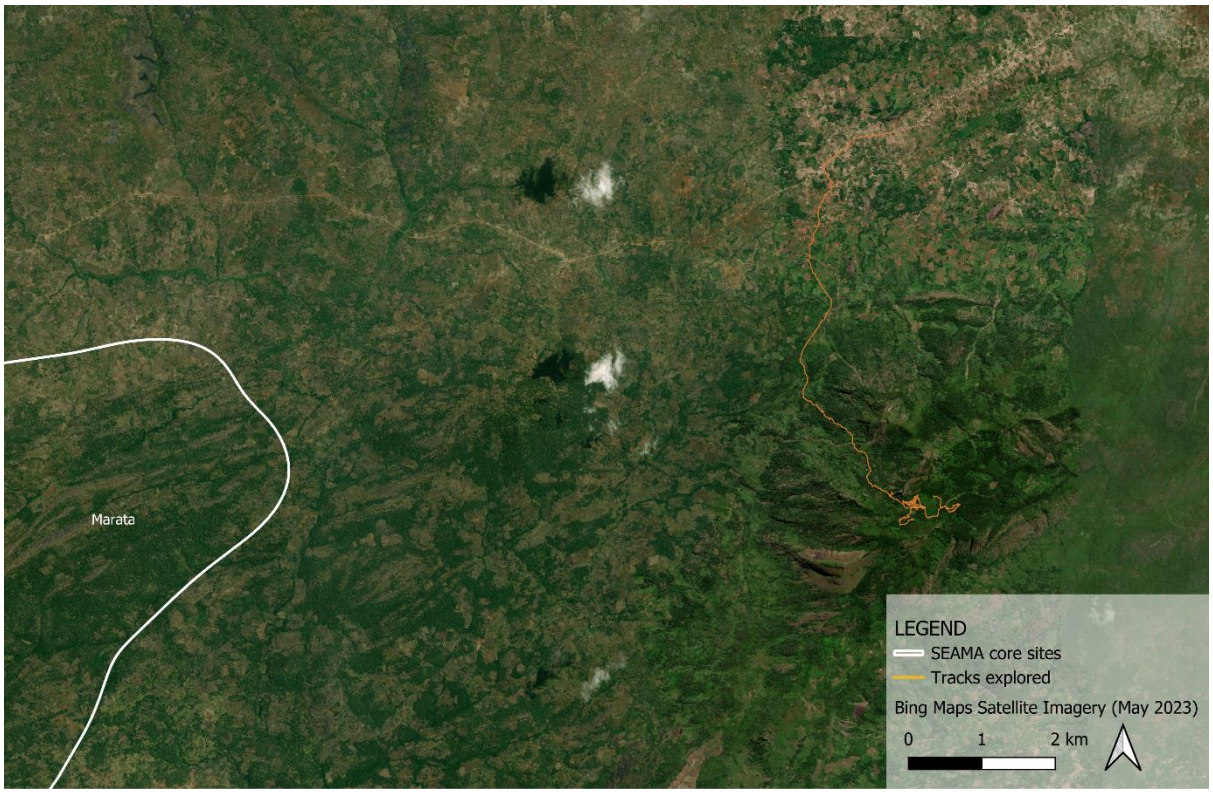
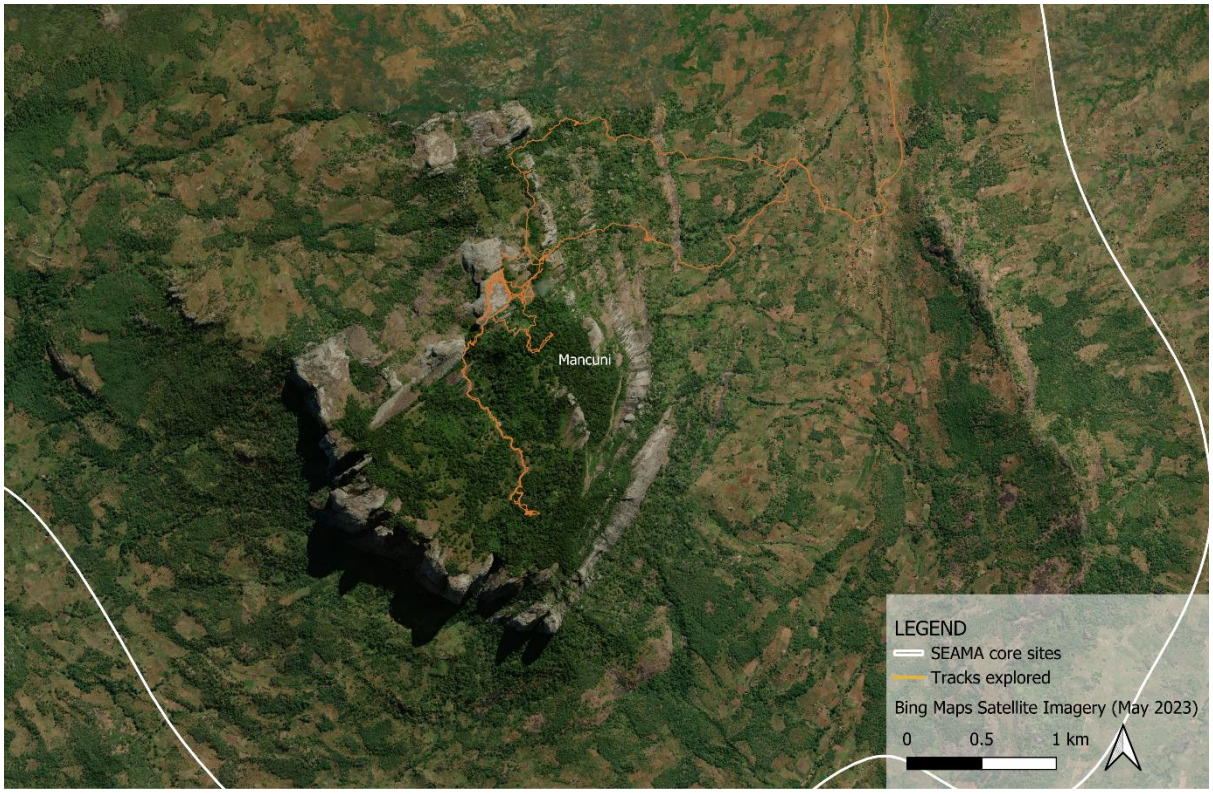
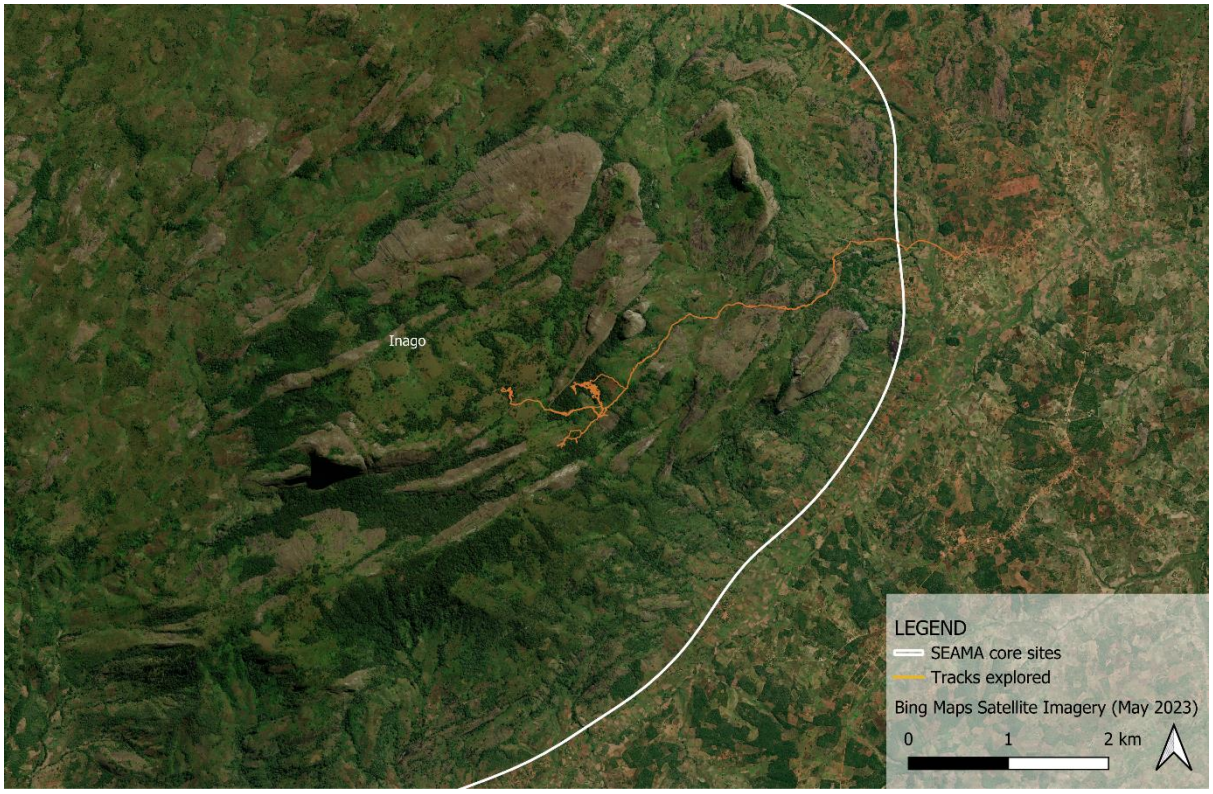
APPENDIX



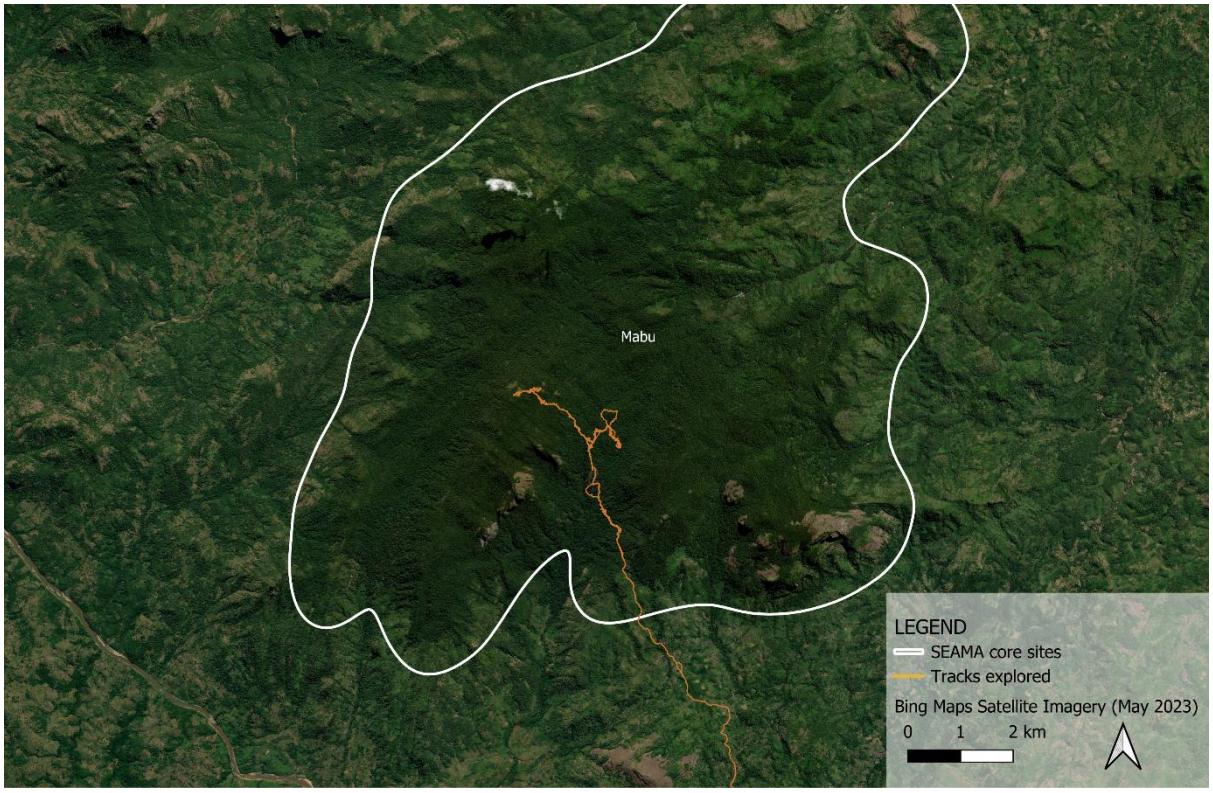
Annex Fig. 1: Eastern section of Marata core site in the SEAMA, indicating the tracks explored on Mount Namaroana, outside the core area.



Annex Fig. 2: Mancuni core site in the SEAMA, indicating the tracks explored.



Annex Fig. 3: Inago core site in the SEAMA, indicating the tracks explored.



Annex Fig. 4: Mabu core site in the SEAMA, indicating the tracks explored.

Annex Table 1: plot parameters for all 21 plots located in Mount Mabu, indicating the number of Mount Mabu pygmy chameleons encountered per plot of 20 by 20 metres. a.l.l.d. stands for average leaf litter depth (cm). All plots were located within the forest interior.

Plot	Date	Location	Altitude	Slope	Undergrowth	Leaf litter	a.l.l.d.	Nr pygmies
1	01/06/2024	16.282091° S 36.358592° E	1285m	Slight incline	Medium dense	Very little	1.3	0
2	02/06/2024	16.282328° S 36.358480° E	1277m	Slight incline	Very dense	Little	1.3	1
3	02/06/2024	16.282777° S 36.358912° E	1260m	Slight incline	Very open	Medium	2.8	0
4	03/06/2024	16.282957° S 36.354743° E	1307m	Slight incline	Medium dense	Medium	1.8	1
5	03/06/2024	16.281370° S 36.352957° E	1359m	Slight incline	Medium dense	Medium	4.9	0
6	03/06/2024	16.280856° S 36.352150° E	1387m	Slight incline	Medium dense	Medium	3.0	0
7	04/06/2024	16.274297° S 36.344870° E	1551m	Slight incline	Medium dense	Thick	3.3	0
8	04/06/2024	16.274598° S 36.344295° E	1545m	Slight incline	Medium dense	Medium	4.4	0
9	04/06/2024	16.274966° S 36.344028° E	1524m	Slight incline	Very open	Medium	2.3	0
10	05/06/2024	16.276815° S 36.346248° E	1481m	Slight incline	Medium dense	Medium	2.8	0
11	05/06/2024	16.276592° S 36.346693° E	1483m	Slight incline	Medium dense	Medium	3.1	1
12	05/06/2024	16.276952° S 36.347058° E	1458m	Slight incline	Medium dense	Medium	3.0	0
13	07/06/2024	16.283858° S 36.360120° E	1176m	Steep incline	Very dense	Little	4.0	3
14	07/06/2024	16.283967° S 36.360216° E	1166m	Steep incline	Very dense	Little	1.5	3
15	07/06/2024	16.284392° S 36.359832° E	1169m	Steep incline	Very dense	Little	1.8	0
16	09/06/2024	16.295691° S 36.357345° E	967m	Steep incline	Very dense	Medium	3.5	6
17	09/06/2024	16.295562° S 36.357551° E	977m	Slight incline	Very dense	Medium	2.6	0
18	09/06/2024	16.295873° S 36.357485° E	965m	Slight incline	Very dense	Thick	5.8	4
19	10/06/2024	16.298561° S 36.360202° E	1051m	Steep incline	Very dense	Little	2.4	7
20	10/06/2024	16.298783° S 36.360199° E	1058m	Steep incline	Very dense	Very little	1.0	6
21	10/06/2024	16.299188° S 36.359754° E	1069m	Steep incline	Very dense	Medium	5.8	6

Annex Table 2: data obtained from snout to vent lengths (SVL) of *Rhampholeon "namaroana"*, *Rhampholeon maspictus* and *Rhampholeon bruessoworum*

	R. "namaroana"	***R. maspictus***	***R. bruessoworum***
Median SVL:	30 mm	48 mm	41 mm
Min SVL:	20 mm	18 mm	20 mm
Max SVL:	53 mm	75 mm	60 mm
Mean SVL:	32.98 mm	44.26 mm	39.61 mm
Standard deviation:	11.18	14.63	13.48
Number of Samples:	60	69	31

Annex Table 3: Herpetofauna species recorded during the expedition in Malawi. Presence is denoted by an x mark, except for Ruo Valley, where letters are used for which Map 2 provides a key.

#	English name	Latin	IUCN (blank = LC)	Ruo Gorge	Chisongeli	Mchese	Thyolo	Mulanje plateau	Mulanje boma and surrounds	Ruo Valley
1	Zambezi Blind Snake	*Afrotyphlops dinga*								F
2	Slender Blind Snake	*Afrotyphlops obtusus*								F
3	Kirk's Rock Agama	*Agama kirkii*				x				
4	Mozambique Agama	*Agama mossambica*								C
5	Bibron's Burrowing Asp	*Atractaspis bibronii*								C, F
6	Brown House Snake	*Boaedon capensis*								A, C, F
7	Snouted Night Adder	*Causus defilippii*								F
8	Flap-necked Chameleon	*Chamaeleo dilepis*								A, B, C, F
9	Red-Lipped Snake	*Crotaphopeltis hotamboeia*					x		x	B, C, F
10	Eastern Green Mamba	*Dendroaspis angusticeps*		x						
11	Mulanje Cross-barred Tree Snake	*Dipsadoboa flavida flavida*								B
12	Northern Boomslang	*Dispholidus typus viridis*								F
13	Shire Slug Eater	*Duberria shirana*						x		
14	Boulenger's Garter Snake	*Elapsoidea boulengeri*								F
15	Yellow-throated Plated Lizard	*Gerrhosaurus flavigularis*								B
16	Tropical House Gecko	*Hemidactylus mabouia*								F
17	Saw-tailed Gliding Lizard	*Holaspis laevis*								F
18	Cape File Snake	*Limaformosa capensis*								F
19	Cape Wolf Snake	*Lycophidion capense*								C, F
20	Malawi Dwarf Gecko	*Lygodactulys bonsi*						x		
21	Common Dwarf Gecko	*Lygodactylus capensis*					x			
22	King Dwarf Gecko	*Lygodactylus rex*	NT	x		x			x	E
22	Longtail Limbless Skink	*Melanoseps ater*					x			
23	Mulanje Chameleon	*Nadzikambia mlanjensis*	EN	x	x					B, C, D, E
24	Forest Marsh Snake	*Natriciteres sylvatica*							x	C
25	Western Green Snake	*Philothamnus angolensis*								A, C, F

26	Green Water Snake	*Philothamnus hoplogaster*		x						A, B, C, D, F
27	Spotted Bush Snake	*Philothamnus semivariegatus*								C, F
28	Mitchell's Flat Lizard	*Platysaurus mitchelli*		x						
29	East African Shovel-snout	*Prosymna stuhlmanni*								F
30	Mulanje Flat-headed Pygmy Chameleon	*Rhampholeon platyceps*	EN	x	x	x				
31	Zomba Pigmy Chameleon	*Rieppeleon brachyurus*								A, B, C, F
32	Eastern Vine Snake	*Thelotornis mossambicanus*								A, B, C, F
33	Boulenger's Skink	*Trachylepis boulengeri*								C, F
34	Speckle-lipped Skink	*Trachylepis maculilabris*								C, F
35	Mulanje Skink	*Trachylepis mlanjensis*						x		
1	Short-legged Spiny Reed Frog	*Afrixalus brachycnemis*							x	
2	Delicate Spiny Reed Frog	*Afrixalus delicatus*								B, C, F
3	Fornasini's Spiny Reed Frog	*Afrixalus fornasini*								F
4	Common River Frog	*Amietia delalandii*		x	x				x	A, B, C
5	Darling's White-lipped Frog	*Amnirana darlingi*								B, C
6	Ruo River Screeching Frog	*Arthroleptis francei*	VU	x	x	x				
7	Common Squeaker	*Arthroleptis stenodactylus*				x	x		x	F
8	Dwarf Squeaker	*Arthroleptis xenodactyloides*		x		x			x	F
9	Mozambique Rain Frog	*Breviceps mossambicus*								A
10	Marbled Snout-burrower	*Hemisus marmoratus*								C
11	Red-Legged Wot-wot	*Hylambates maculatus*								B, F
13	Marginated Reed Frog	*Hyperolius marginatus*								B, C
14	Painted Reed Frog	*Hyperolius marmoratus*								C
15	Water Lily Reed Frog	*Hyperolius pusillus*								B, F
16	Spiny-throated Reed Frog	*Hyperolius spinigularis*	VU		x					B
17	Mainland Reed Frog	*Hyperolius substriatus*			x					B, C
18	Tinker Reed Frog	*Hyperolius tuberilinguis*								B, C, F
19	Senegal Running Frog	*Kassina senegalensis*			x					F

20	Broadley's Tree Frog	*Leptopelis broadleyi*								B, C
21	Mozambique Tree Frog	*Leptopelis mossambicus*							x	B
23	Eastern Puddle Frog	*Phrynobatrachus acridoides*							x	
24	Natal Puddle Frog	*Phrynobatrachus natalensis*							x	
25	Anchieta's Ridged Frog	*Ptychadena anchietae*								A
26	Sharp-nosed Ridged Frog	*Ptychadena oxyrhynchus*							x	
27	Small Ridged Frog	*Ptychadena taenioscelis*							x	C
28	Guttural Toad	*Sclerophrys gutturalis*							x	F

Annex Table 4: Herpetofauna species recorded during the expedition in Mozambique. Presence is denoted by an x mark.

#	English name	Latin	IUCN (blank = LC)	Marata	Mancuni	Inago	Mabu	Other Locations
1		*Agaminae*						x
2	Common Purple-glossed Snake	*Amblyodipsas polylepis*						x
3	Mount Mabu Forest Viper	*Atheris mabuensis*	EN				x	
4	Puff Adder	*Bitis arietans*						x
5	Cape House Snake	*Boaedon capensis*		x				
6	Flap-necked Chameleon	*Chamaeleo dilepis*			x			x
7	East African Egg-eater	*Dasypeltis medici*						x
8	Montane Forest Tree Snake	*Dipsadoboa montisilva*	NT				x	
9	Boomslang	*Dispholidus typus*		x				
10	House Gecko	*Hemidactylus sp.*			x	x		x
11	Tropical House Gecko	*Hemidactylus mabouia*						x
12	Flathead Leaf-toed Gecko	*Hemidactylus platycephalus*					x	
13	Mlanje White-bellied Water-Snake	*Lycodonomorphus mlanjensis*				x		
14	Dwarf Gecko	*Lygodactylus cf. rex/regulos*	?	x	x			
15	Black Limbless Skink	*Melanoseps ater*				x		
16	Mount Mabu chameleon	*Nadzikambia baylissi*	NT				x	
17	Mount Inago Chameleon	*Nadzikambia sp. nov.*	?			x		
18	Green Water Snake	*Philothamnus hoplogaster*					x	x
19	Spotted Flat Lizard	*Platysaurus maculatus*			x	x		x
20	Olive Grass Snake	*Psammophis mossambicus*						x

21	Eastern Stripe-bellied Sand Snake	*Psammophis orientalis*				x		
22	Mount Inago Pygmy Chameleon	*Rhampholeon bruessoworum*	CR			x		
23	Mount Mabu Pygmy Chameleon	*Rhampholeon maspictus*	NT				x	
24	Pygmy Chameleon	*Rhampholeon sp. "namaroana"*	?	x				
25	Eastern Vine Snake	*Thelotornis mossambicanus*						x
26	Rainbow Skink	*Trachylepis margaritifera*					x	x
27	African Striped Skink	*Trachylepis striata*						x
28	Eastern Variable Skink	*Trachylepis varia*		x			x	
1	Delalande's River Frog	*Amietia delalandii*			x	x	x	
2	Ruo River Screeching Frog	*Arthroleptis cf. francei*	VU	x		x	x	
3	Common Squeaker	*Arthroleptis stenodactylus*		x	x			x
4	Dwarf Squeaker	*Arthroleptis xenodactyloides*		x	x	x	x	x
5	Mozambique Rain Frog	*Breviceps mossambicus*		x				
6	Forest Rain Frog	*Breviceps sp. nov.*	?			x		
7	Spiny-throated Reed Frog	*Hyperolius cf. spinigularis*	VU			x		
8	Mainland Reed Frog	*Hyperolius substriatus*		x		x	x	
9	Bocage's Tree frog	*Leptopelis bocagii*						x
10	Yellow-spotted Tree Frog	*Leptopelis flavomaculatus*				x	x	
11	Mongrel Frog	*Nothophryne sp. "mancuni"*	EN		x			
12	Ridged Frogs	*Ptychadena spp.*			x	x		x
13	Anchieta's Ridged Frog	*Ptychadena anchietae*			x	x		
14	Spotted-throated Ridged Frog	*Ptychadena taenioscelis*				x		
15	Toad	*Sclerophrys sp.*						x
16	Flat-backed Toad	*Sclerophrys pusilla*						x
17	Mount Meru Stream Frog	*Strongylopus cf. merumontanus*					x	
18	African Clawed Frog	*Xenopus laevis*				x		