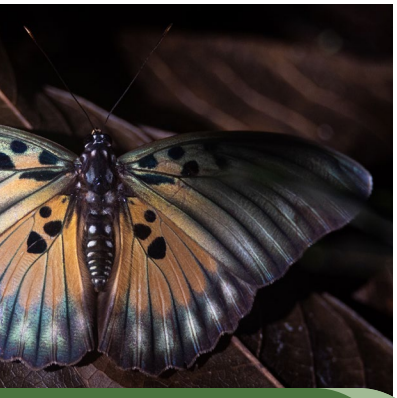
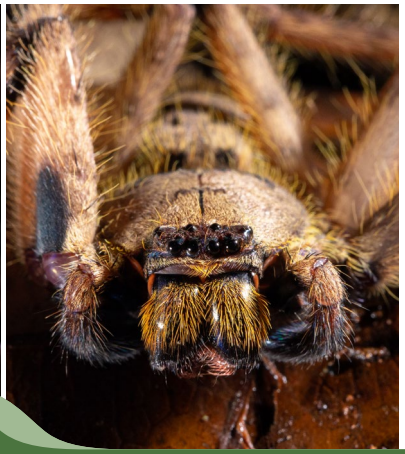
Biodiversity Express Survey

Salonga National Park

DRC

DECEMBER 2022





BINCO

Biodiversity Inventory for Conservation

BES 11.1

Biodiversity Express Survey (BES) 11.1
The Salonga NP Expedition, DRC, December 2022
Biodiversity Inventory for Conservation (BINCO)
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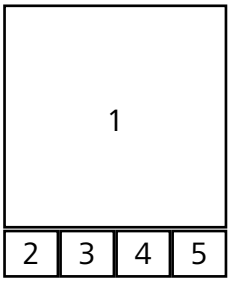

Cover pictures
1. Aerial image of the Luilaka River, bordering the southern part of Salonga NP
2. Edwards' Forester (*Euphaedra edwardsii*)
3. Huntsman spider (Family Sparassidae)
4. White-bellied Kingfisher (*Corythornis leucogaster*)
5. Reed frogs (*Hyperolius* sp.) in copula

All five images by Michiel van Noppen

Biodiversity Express Surveys (BES) are concise, focused studies aimed at capturing the biodiversity of specifically chosen regions. These expeditions often target areas that are either not well-studied or are under threat and where there is a pressing need for updated information on the local fauna and flora. The findings from these surveys are compiled into an Express Report (ER), which is then made available online for public access and use at www.binco.eu. The teams conducting these surveys are typically composed of a select group of international experts and local scientists. The content of the express reports is dynamic and they are periodically updated to include new identifications and information that becomes available over time.

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EXPEDITION FACT SHEET

Location

Three sites in the target project area (Salonga NP, DRC) were visited (WGS84):

1. WWF Station Monkoto, 370 masl (S 1.744083°, E 20.687250°).
2. "Highland camp", terra firma dry forest, 494 masl (S 2.287722°, E 21.021389°).
3. "Lowland camp", marsh forest, 375 masl (S 1.666111°, E 20.532722°).

Time in the field

27 November – 15 December (19 days)

Expedition Members

Jamie, Gabriel, Dr.	Ornithologist (UK)
Jocque, Merlijn, Dr.	Expedition leader (Belgium)
Jones, Samuel, Dr.	Ornithologist (UK)
Mbende, Menard	Co-expedition leader (DRC)
Mertens, Jan	Entomologist (Belgium)
Mpongo Iyomi, Dieux Merci	Camp & logistics manager (DRC)
Nunes, Miguel	Evolutionary Biologist (Portugal)
Onga, Christian	Stagiair, (DRC)
Pett, Brogan	Arachnologist (UK)
van Noppen, Michiel	Wildlife Photographer (Netherlands)

Permits

Export permit for biological samples issued to BINCO by the Ministère de l'environnement et développement durable, secrétariat général à l'environnement et développement durable, le secrétaire général, Kinshasa, 25 November 2022, N° 026/ANCCB-RDC/SG-EDD/BTB/10/2022.

Financial and logistical support:

ACKNOWLEDGEMENTS

"nous sommes ensemble"

We would like to thank Pierre Kafando, Alfred Yoko, Susy Meta Thsimanga, Lucien Gédéon, Luis Arranz, Julva Lisandela Ngongo, Julia Bayer, Terence Fuh, Terrence Ekanje and William Crosmary for the opportunity to collaborate in the ongoing WWF projects in DRC and help conserve some of the truly unique ecosystems and its wildlife on this planet. The current expedition was made possible by the help of a long list of people, to which we owe our most sincere thanks. These include; Pauwel de Wachter, Martin Kabaluapa, Jennifer Hacking, Nima Raghunathan, Guy Kayembe, and many more. Thank you to Jos Snoeks (KMMA), Maarten van Steenbergen (RBINS) and Rudy Jocque (KMMA) for pre-expedition support and advice and loaning sampling gear (fishing nets and Winkler traps). Also thank you to RAVON for support with fishing equipment. We thank Fifi Mukanda, Jean Mutamba, Arsene Yenamau and the whole WWF team in Kinshasa, DRC for their tireless 24/7 help to support the work in the field and the preparations in Kinshasa. For the help with logistics in Monkoto, we thank Pitshu Ngoy and Omer Mahungu. We also extend our thanks to the many people that guided us through these forests as guides and porters and with whom we spend nice moments in the forest. For the fieldwork in the first site, the highland camp, we thank Mane Boney Luafa, Arnaud Kongama Loola, Romain Bopembe Bombilo, Christian Mpetshi Ongo, Aubin Mbenga Ndjoli, Pierre Yolama Lokatsha, Pascal Nacky, Romy Lipanze, Serge Lisingi, Puro Baluka Nicoy. For the people that joined us on the second site we also thank David Mpidi, Artistic Babili, Landricky Ndjoli, Jose Eleku, Bolamba Jado, Bompete Rache, Sango Boutoilokoli. A final thank you goes to our partners for their ongoing support to chase our dreams and spend time in the field. This project was made possible with the financial contribution of WWF DRC.

SUMMARY

Salonga National Park is positioned in the central Congo Basin, covering a vast area in excess of 3.5 million ha of lowland Guinea-Congolian rainforest. Gazetted as a National Park in 1970 and a world heritage site in 1984, it comprises the largest rainforest reserve in Africa, and second largest in the world. It is one of the few nationally protected areas that harbours the endemic Bonobo, alongside other iconic species such as Congo Peacock and Forest Elephant. Despite the lofty status of Salonga, few primary data on its biodiversity exist.

To address this critical knowledge gap, the principal aim of this project was to undertake a multiple taxa biodiversity assessment, with special attention to biological communities that have received relatively little attention. These data provide baseline surveys to further the knowledge and ecological monitoring of biodiversity in Salonga, while also aiming to draw attention to the biodiversity of the park at a global stage through international collaboration and research exposure. We undertook fieldwork at three study sites in Salonga from 25 November – 15 December 2022, collecting standardised data on birds, amphibians, reptiles, fish and selected invertebrate groups (spiders, ants, butterflies, hawkmoths, dragonflies, ground beetles and various other groups).

Within the temporal and spatial constraints of our surveys, we were able to document substantial insights into the biodiversity of the park. Collectively, we recorded 160 species of birds, 32 species of herpetofauna, 32 fish and over 400 species of invertebrates. Our findings include several species of conservation concern on the IUCN RedList such as Grey Parrot (Endangered), Congo Peacock (Near Threatened), Crowned Eagle (Near Threatened) and Forest Hinge-back Tortoise (Data Deficient). We discovered new species of virtually any taxonomic group studied including a shrew, frog, fish, spiders, ant, dragonfly, bugs and many more are expected as the material is studied in more detail. For selected groups where quantitative surveying was possible, species accumulation curves did not typically asymptote, indicating that greater time in the field would yield more species discoveries. We also identified several range extensions of varying significance including Barred Long-tailed Cuckoo (identification pending confirmation) which would be the first record for the Guinea-Congo Basin biome. In addition, we also obtained ecological information and documented sounds and images for several species for the first time in the field.

This biodiversity express survey revealed high species diversity and richness considering the short sampling time. The large number of new species to science reflects how poorly studied this region is, and also how much more is likely to be present. More and more long-term studies across a broader spread of floral and faunal groups are required to better understand the biodiversity of Salonga.

Undertaking biological research in Salonga is a considerable challenge and requires a wide range of expertise (taxonomy, ecology, social, geology, etc.) that is likely to only be efficiently provided through a concerted effort to reinforce international research collaboration in the long run. We thus hope that this field work will contribute to this momentum, and we extend a warm invite to collaborate on studying and conserving this truly unique, and largely intact lowland rainforest region.

RÉSUMÉ

Le parc national de la Salonga est situé dans le bassin central du Congo, couvrant une vaste zone de plus de 3,5 millions d'hectares de forêt pluviale guinéo-congolaise de basse altitude. Classé parc national en 1970 et site du patrimoine mondial en 1984, il comprend la plus grande réserve de forêt tropicale d'Afrique et la deuxième au monde. C'est l'une des rares aires protégées au niveau national qui abrite le bonobo endémique, ainsi que d'autres espèces emblématiques telles que le paon du Congo et l'éléphant de forêt. Malgré le statut élevé de la Salonga, peu de données primaires sur sa biodiversité existent. Pour combler cette lacune critique dans les connaissances, l'objectif principal de ce projet était d'entreprendre un suivi de la biodiversité de plusieurs taxons. Une attention particulière a été consacrée aux communautés biologiques qui ont reçu relativement peu d'attention (comme les invertébrés, etc.). Ces données fournissent des enquêtes de base pour approfondir les connaissances de la biodiversité dans la Salonga. Nous visons également à attirer l'attention sur la biodiversité du parc à l'échelle nationale et mondiale grâce à une collaboration de recherche.

Nous avons entrepris des suivis à trois sites d'étude à Salonga du 25 novembre au 15 décembre 2022, en collectant des données standardisées sur les oiseaux, les amphibiens, les reptiles, les poissons et certains groupes d'invertébrés (araignées, fourmis, papillons, papillons de nuit, libellules, coléoptères et divers autres groupes). Dans les limites temporelles et spatiales de nos suivis, nous avons pu documenter des informations substantielles sur la biodiversité du parc Salonga. Collectivement, nous avons recensé 160 espèces d'oiseaux, 32 espèces d'herpétofaune, 32 poissons et au moins 400 espèces d'invertébrés. Nos découvertes incluent plusieurs espèces sur la liste rouge de l'UICN, telles que le Perroquet Gris (en voie de disparition), le Paon du Congo (quasi menacé), l'Aigle Couronné (quasi menacé) et la Cinixys Rongée (données insuffisantes). Nous avons découvert de nouvelles espèces dans pratiquement tous les groupes taxonomiques étudiés, y compris une musaraigne, une grenouille, un poisson, des araignées, des fourmis, une libellule, deux hémiptères et bien d'autres encore, dont on s'attend à en découvrir davantage à mesure que le matériel sera étudié de manière plus détaillée. Pour les groupes sélectionnés où une étude quantitative était possible, les courbes d'accumulation d'espèces n'étaient généralement pas asymptotes, ce qui indique qu'un plus grand temps passé sur le terrain entraînerait davantage de découvertes d'espèces. Nous avons également identifié plusieurs extensions de distributions d'importance, y compris le coucou montagnard (identification en attente de confirmation) qui serait le premier enregistrement pour le biome du bassin Guinée-Congo. De plus, nous avons également obtenu des informations écologiques et documenté des sons et des images pour plusieurs espèces pour la première fois sur le terrain.

Cette enquête express sur la biodiversité a révélé une grande diversité et richesse d'espèces compte tenu de la courte durée d'échantillonnage. Le grand nombre de nouvelles espèces pour la science reflète à quel point cette région est mal étudiée, et aussi à quel point il est probable qu'il y ait davantage. Des études supplémentaires et à long terme portant sur un éventail plus large de groupes floraux et fauniques sont nécessaires pour mieux comprendre la biodiversité de la Salonga. Entreprendre des recherches biologiques dans la Salonga est un défi considérable et nécessite un large éventail d'expertises (taxonomie, écologie, social, géologie, etc.) qui ne seront probablement fournies efficacement que par un effort concerté pour renforcer la collaboration internationale en matière de recherche à long terme. Nous espérons donc que ce travail de terrain contribuera à cet élan, et nous invitons tout le monde chaleureusement à collaborer à l'étude et à la conservation de cette région de forêt tropicale de basse altitude vraiment unique et en grande partie intacte.

1 Introduction

The Congo Basin, also called "la cuvette centrale", is a vast plain stretching from the northeast of the Republic of the Congo to the northwest of the Democratic Republic of the Congo that corresponds to the north-central part of the Congo River watershed (Tshonda 2016). The Congo River makes a large loop flowing north, west and then south where it receives its main tributary, the Oubangui. Afterwards it leaves the central basin by crossing the Crystal Mountains at Kinshasa which separate the central basin from the Atlantic Ocean. The Congo Basin is geologically a sedimentary region bounded by granite massifs to the west (Gabon), south (Kasaï) and east (Kivu) (Tshonda 2016). Elevation across the region is less than 1000 m, with the average across the Congo Basin of 400 m (Goldammer & De Ronde 2004).

The forests of the Congo Basin are the green heart of the African continent. They are part of a vast tropical forest belt that ranges from the gulf of Guinea in west Africa to the Albertine Rift on the eastern border of DRC. These forests consists of a mosaic of drier upland and wetter lowland forest intersected by rivers of varying sizes, bais, and areas of more open secondary grassland, woodland and "farmbush" created by human cultivation (Goldammer & De Ronde 2004). Based on floristic and environmental characteristics four main Guineo-Congolian forest types are recognised (White 1983). The dominant forests at the heart of the Congo Basin are mixed moist semi-evergreen forests that occur throughout the region except in the wettest and driest extremes. The mixed moist semi-evergreen forest is interspersed with swamp forest and riparian forest throughout the region wherever conditions are suitable. Swamp and riparian forests appear similar to the rainforests, but the main canopy is irregular and relatively open.

The Congo Basin was not always covered by forest. Climatic conditions over the past million years have shifted substantially, and ice age cycles (Fredoux 1994) have triggered sharp oscillations in forest and savannah coverage (Jolly et al. 1998). During the driest periods, the forest shrunk to small refuges. These former refugia are now thought to contain particularly high levels of endemism and species richness (Diamond & Hamilton 1980). Some studies indicate areas of these forests act as "museums" and are conserving ancient diversity (Murienne et al. 2013). Beginning about 5,000 years ago, the climate became drier and forests contracted. Loss of tropical forest and concurrent invasion by savanna woodland habitats culminated around 2,500 years ago when the central part of the Congo may have been savanna woodland (Maley & Brenac 1998). From around 2,000 years ago a wetter climatic period allowed forest to re-expand into many savanna areas, and there is evidence from parts of West and Central Africa that forest expansion might still continue to this day (Maley & Brenac 1998). Most probably large parts of the current extensive forest cover are therefore "only" 2000 years old and they were recolonised from refuge areas with a more stable climate. Due to this waxing and waning of forest cover, the Congo Basin was described as an "evolutionary whirlpool" (Kingdon 1989). During drier periods as the savannah extended refuges for forest species, it also served as springboards for speciation and forest-savannah interactions influencing speciation events. Two spectacular examples of this process are that of Okapi *Okapia johnstoni* Sclater, 1901, the DRC's endemic forest giraffe, and Congo Peafowl *Afropavo congensis* (Chapin 1936), a relict taxon whose evolutionary origins are linked to those of Asian peafowls.

Salonga National Park (www.salonga.org)

Salonga National Park (SNP) was established as the "Parc National de Monkoto" in 1956 and initially encompassed approximately what is now the park's northern block. It was officially designated as a national park in 1970 with its current boundaries and was recognized as a UNESCO World Heritage Site in 1984. Spanning approximately 3.6 million hectares, Salonga NP is the largest rainforest protected area in Africa and the second largest globally. It is a key part of the expansive Salonga-Lukenie-Sankuru landscape, accounting for about one-third of this area.

The park is characterized by two distinct, lung-shaped 'lobes' – the northern block, covering 1.7 million hectares, and the southern block, encompassing 1.9 million hectares. These blocks are separated by a corridor of around 45 kilometers surrounding the Luilaka River. The park's boundaries are primarily defined by major rivers in the region and span across parts of three major drainage basins: the Congo Basin (covering the north block and the northern area of the southern block), the Maï-Ndombe Lake (indirectly through the central southern block), and the Kasaï River Basin (in the extreme south of the southern block).

Salonga National Park is predominantly covered by swamp, riverine, and terra firma forests, with smaller expanses of savanna in its extreme southern areas. The park experiences a typical equatorial climate, characterized by hot and humid conditions. Rainfall is almost a constant feature throughout the year, with fewer than 30 days annually recording rainfall below 20 mm. There is a marginally drier period from June to August. The human population density within the park is very low, and it extends across four administrative regions: Equateur, Bandundu, Kasaï Oriental, and Kasaï Occidental. For a more comprehensive overview of the park's infrastructure and key statistics, detailed information is available online in the world heritage sites datasheets.

Figure 1. Aerial view of the village of Monkoto, located in the corridor between the North and South parts of Salonga NP. (Photo by Michiel van Noppen)

Figure 2. The Salonga NP 2022 Expedition team. Last row from left to right: Romain Bopembe Bombilo, Jean ci, Gabriel Jamie, Christian Mpetshi Ongo, Mane Boney Luafa and Michiel Van Noppen. Second row from left to right: Puro Baluka Nicoy, Arnaud Kongama Loola, Miguel Nunes, Dieux Merci Mpongo Iyomi, Brogan Pett, Sam Jones and Jan Mertens, Third row from left to right: Aubin Mbenga and Merlijn Jocque. (Photo by Michiel van Noppen)

Biodiversity knowledge in Salonga NP & Research

Despite the global status of Salonga NP, surprisingly little primary biodiversity data are available. A major barrier to the accruement of biological data for the park following the early years after its gazettement was in both its geographic remoteness (prior to the clearing of airstrips at key posts, access was a 1500 km journey by river), and then the civil war and heavily armed poaching gangs (van Krukelsven et al. 2000). Indeed, even after the park was declared a world heritage site (1984), d'Huart (1988) emphasised that effectively nothing was known of the fauna of the park, a situation that largely remained stagnant until the turn of the millenia (e.g. van Krunkelsven et al. 2000). Prior to this period the only biological observations from Salonga concerned an unpublished bird survey in 1991 (Cruickshank & Gautier, undated), and observations of Bonobos and other large mammals (primates and predators) in the north of the park/northern borders in the late 80s/early 90s (Meder 1988; Maisels et al. 1994a, 1994b). Pervasive security issues more or less paralysed all research (and much logistical) activity in the park throughout this period (e.g. Alers et al. 1992; Fotso 1996).

Following the stabilisation of the security of the region, research activity in Salonga increased also in concert with better logistical access following the clearing of airstrips at key posts such as Monkoto. From the early 2000s, most research activity in Salonga has focused on bonobos (e.g. Van Krunkelsven et al. 2009; Inogwabini 2015), elephants (Blake et al. 2007) and other large mammals (e.g. Bessone et al. 2019). Some information is available on specific studies on birds (Péron & Crochet 2009; Mulotwa et al. 2010), fish (Inogwabini et al. 2005; Iyaba & Stiassny 2013) and some botanical surveys (Inogwabini 2006). Within these groups some new taxa have also been recently described (e.g. Bernt & Stiassni 2022). While some invertebrate collections have been made (such as butterflies and moths; Bessone et al. 2018), little detailed information is available, with almost nothing known from numerous taxonomic groups. A full summary of biological research activity was recently published in Vande weghe & Vande weghe (2018), but in general, little outside of specific studies, or on large mammals is published in internationally accessible journals or databases. At the time of writing, the only inventories published in peer-reviewed international literature (complete or otherwise) of species from Salonga are of fish (Inogwabini 2005; Iyaba & Stiassny 2013), mammals (van Krunkselven et al. 2000, Inagwabini 2006) and plants (Inagwabini 2006).

Conservation & threats

Beginning in 2015, Salonga National Park entered a co-management phase under the joint supervision of the Institut Congolais pour la Conservation de la Nature (ICCN) and the World Wide Fund for Nature (WWF). In October 2021, this collaboration was further strengthened with the signing of a new Partnership Agreement, focusing on fostering community-centered conservation efforts within the park. For a detailed account of Salonga's management history and various development initiatives, we refer to the overview in Vande weghe & Vande weghe (2018).

A significant and ongoing threat to the biodiversity of Salonga National Park is poaching. Since the park's establishment, the illegal hunting of elephants for ivory has been a persistent challenge, as documented by the 'Monitoring the Illegal Killing of Elephants project' in SNP. The elephant and hippopotamus populations have reportedly been decimated following the park's initial gazettement (van Krunkelsven et al. 2000). However, poaching in the area is not limited to these larger animals; smaller species are also targeted in these illicit activities.

Currently, large-scale commercial activities such as logging, petroleum extraction, and agro-industrial operations are largely absent in the area, likely due to its challenging accessibility. The site's extreme remoteness, being accessible only via river or air travel to small airstrips in Monkoto, Anda, and Mundja, presents significant logistical hurdles. These difficulties not only pose challenges for local transportation, research, and tourism but have also deterred the establishment of major commercial ventures. Additionally, the impact of poaching is presumably lessened, as such activities often correlate with ease of access to the forest and the ability to transport and sell hunted animals in markets. Meanwhile, the population in Monkoto and the surrounding villages near Salonga National Park is experiencing rapid growth.

The vast and largely intact forested ecosystems of Salonga National Park have garnered significant international interest. This has led to major continuous funding for conservation and development efforts, primarily from the European Union and the United States. Initially, Salonga National Park

was a focal area in the European Union-funded Central African Forest Ecosystems Programme (ECOFAC), a conservation initiative that began in 1993 and remained active for 30 years. Recently, this funding approach transitioned to NaturAfrica (EU, 2021) the European Union's new flagship conservation program. NaturAfrica is an integral part of the European Green Deal strategy focusing on global investments in the sustainable management of international biodiversity and ecosystems. Within this framework, Salonga National Park continues to be a priority zone.

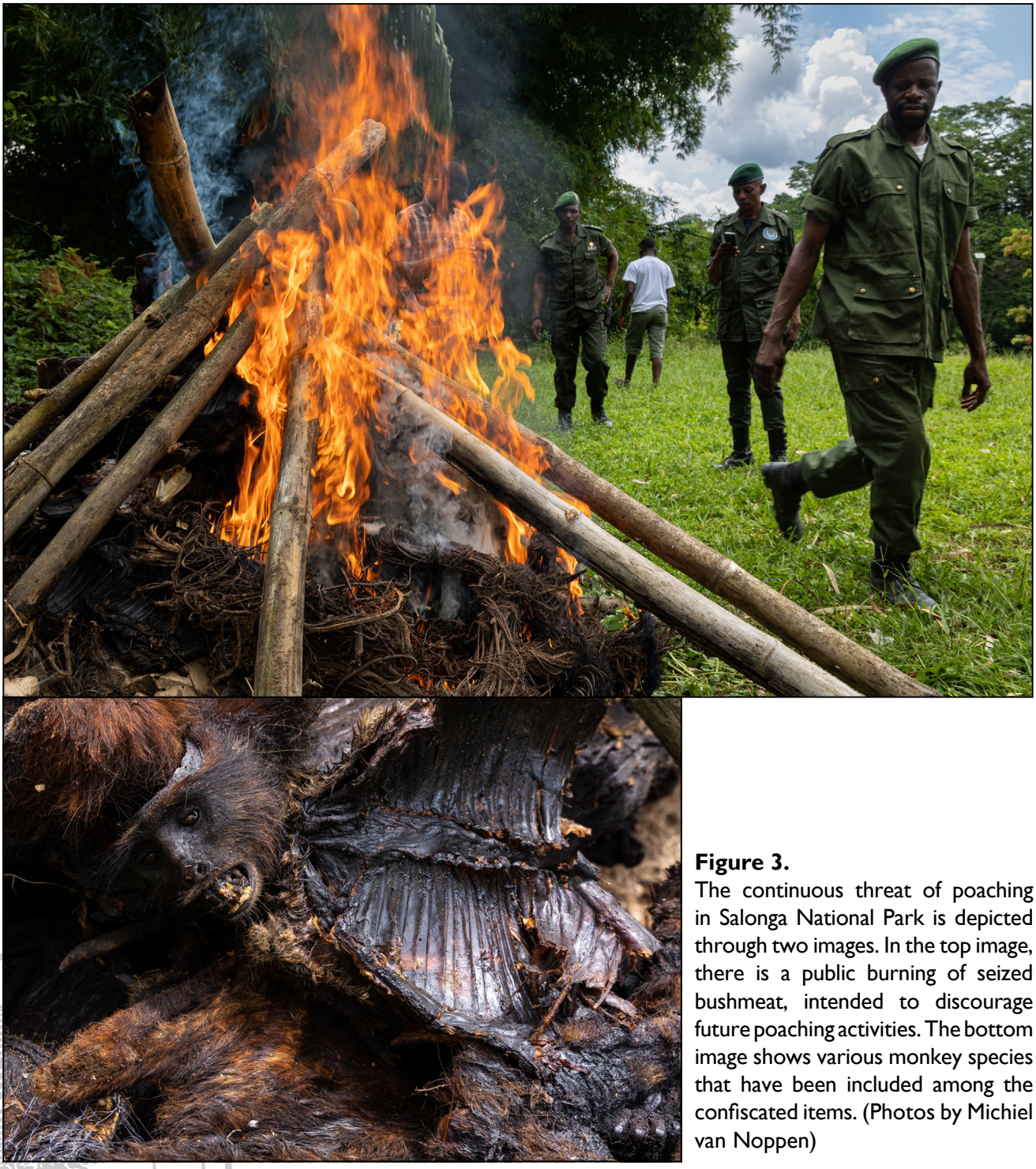

Figure 3.
The continuous threat of poaching in Salonga National Park is depicted through two images. In the top image, there is a public burning of seized bushmeat, intended to discourage future poaching activities. The bottom image shows various monkey species that have been included among the confiscated items. (Photos by Michiel van Noppen)

The Congo Basin Forest Partnership (CBFP) was launched by former United States Secretary of State, Colin Powell, and the Central African Heads of State at the 2002 World Summit on Sustainable Development in Johannesburg as a response to the United Nations General Assembly (Resolution 54/214) which urged the international community to support efforts towards conservation and sustainable management of Congo Basin forests (Yaoundé Declaration, 1999). The CBFP allows member organisations to cooperate on a voluntary basis and does not have a formal institutional structure. A set of informal structures are set in place to enable and stimulate dialogue, collaboration and exchanges, to promote biodiversity conservation and sustainable management of forest ecosystems, combat climate change and reduce poverty of Congo Basin forests.

Salonga NP as part of the Salonga-Lukenie-Sankuru landscape was identified in the USAID funded Central Africa Regional Programme for the Environment (CARPE) as a priority zone for conservation. CARPE is a long-term initiative of the United States Government to promote sustainable forest management, biodiversity conservation, and climate change mitigation in the Congo Basin through increased local, national, and regional natural resource management capacity. The first phase of CARPE was from 1997 to 2002.

Observatoire Satellital Des Forêts D'Afrique Centrale (OSFAC) identified the Salonga NP landscape together with the Maiko Landscape as the two regions with the highest fauna biodiversity value (OSFAC 2018) in Central Africa. Two major recommendations were to (1) continue to preserve the integrity of these areas of High Conservation Value (HCV) and (2) regularly monitor these areas to detect any changes that could be a threat to these diverse but fragile ecosystems (OSFAC 2018).

Aims

The primary goal is to conduct a comprehensive biodiversity assessment across multiple taxa, focusing on aspects of biological communities that are either poorly documented or have not been studied extensively. This effort aims to enhance our understanding of biodiversity in Salonga National Park, ultimately aiding in the preservation of its forest ecosystems. The approach includes (1) creating a baseline inventory for selected target groups, (2) identifying and describing new taxa previously unknown to science, and (3) employing standardized survey methods to achieve these objectives.

By engaging in collaborative research and outreach efforts, we aim to increase awareness about the rich biodiversity and the vast, high-quality forest ecosystems within Salonga National Park. Our goal is to foster a global network of contributions that will deepen our understanding and aid in the preservation of these largely intact yet under-researched forest ecosystems in Central Africa, which hold significant global importance.

Access and logistics

Our biodiversity surveys took place in the Southern block of Salonga National Park, located in the Tshuapa province of the Democratic Republic of Congo. The central hub of our expedition was a 'basecamp' established at the WWF station in Monkoto. From this central point, we ventured out to two pre-selected and scouted satellite camps within the region.

The criteria for selecting these sites were centered on surveying representative ecosystems of both marshy "wet" forests and the slightly elevated terra firma "dry" forests, ensuring a comprehensive study of both forest habitats (see map: **Figure 7**). The chosen study sites were endorsed in-country based on recommendations from WWF DRC staff, our local partners. Prior to our arrival, a reconnaissance trip led by Mpongo Iyomi D.M. was conducted to inspect these locations in person and establish a route.

Access to these basecamps from the WWF station involved a combination of canoeing and hiking, with some sites being up to 23 kilometers from the nearest river. We enlisted the help of local communities to transport scientific equipment, logistical supplies, and food, with loads reaching up to 700 kilograms.

Figure 4. Navigating the Luilaka River is the most efficient way to transport materials and large groups of people in Salonga NP. The team, field equipent and a weeklong supply of food were transported along the river towards the "Highland camp" in a motorised canoe. (Photo by Michiel van Noppen)

Study sites

Monkoto, WWF station

25–29 November, 7–9, 14–15 December 2022

Our expedition was headquartered at the WWF station located on the outskirts of Monkoto village, serving as the base from which we conducted visits to various study sites. Data collection at this site was mostly ad-hoc, primarily during the preparatory stages for other field excursions. Situated alongside the Luilaka River and bordered by gallery forest, the WWF station occupies a modest area. It features small patches of low canopy forest and several disturbed but densely vegetated open spaces.

"Highland camp", terra firma dry forest

30 November – 6 December 2022

This camp was located at the edge of a slightly elevated plateau, encircled by forests at lower elevations and intersected by small rivers. The journey to this site involved a full day's boat travel from Monkoto to Kemasoli, followed by a day-long hike. On the plateau, there was no running water; instead, water was either collected from rainfall or fetched from a nearby small stream, about a 15-minute walk away. The forest here exhibited a two-layered structure: a lower layer of trees and bushes around 10–15 meters tall, relatively open, and a higher canopy layer approximately 35 meters high, creating a dense overhead cover. Sunlit clearings were scattered throughout the forest. The ground was covered by a relatively thin layer of leaf litter, which was sparse in many areas, lying over a well-developed root mat about 10 cm thick. Beneath this root mat lay pale, sandy soils.

Figure 5. At the "Highland camp" site, located on the edge of a plateau, most water had to be collected from a nearby stream. (Photo by Michiel van Noppen)

"Lowland camp", marsh forest

9–14 December 2022

This camp was located near the Lokofa camp, a site previously funded by CARPE and featuring some concrete WWF buildings. Access to the site involved a one-hour boat ride from Monkoto, followed by a two-hour trek through marshy forest, navigating over deteriorating wooden walkways. The main river crossed during this journey was the Bompé. The camp itself was positioned at the boundary where marshland transitions into terra firma forest.

The drier forest area surrounding the campsite was marked by a dense, closed undergrowth of Marantaceae and bushes reaching up to 10 meters in height, above which a higher canopy stretched to about 35 meters. The marsh forest, in contrast, was woven around a network of shallow (20 cm) to deep (1.5 m) rivers, their waters ranging from yellowish to light brown, flowing over clear white sandy soil within a muddy floodplain. This complex habitat was rich with trees, lianas, ferns, and diverse other vegetation.

At each camp, we endeavored to conduct extensive surveys across various habitat types. This included, wherever possible, marsh forests near water bodies, terra firma forests, and forests associated with rivers, such as gallery or inundated forests (**Figure 6**).

Figure 6. Different habitat types in Salonga NP. **Top:** Terra firma forest typically found in the higher areas, **Bottom:** Small rivers weave through the marsh forests. (Photos by Michiel van Noppen)

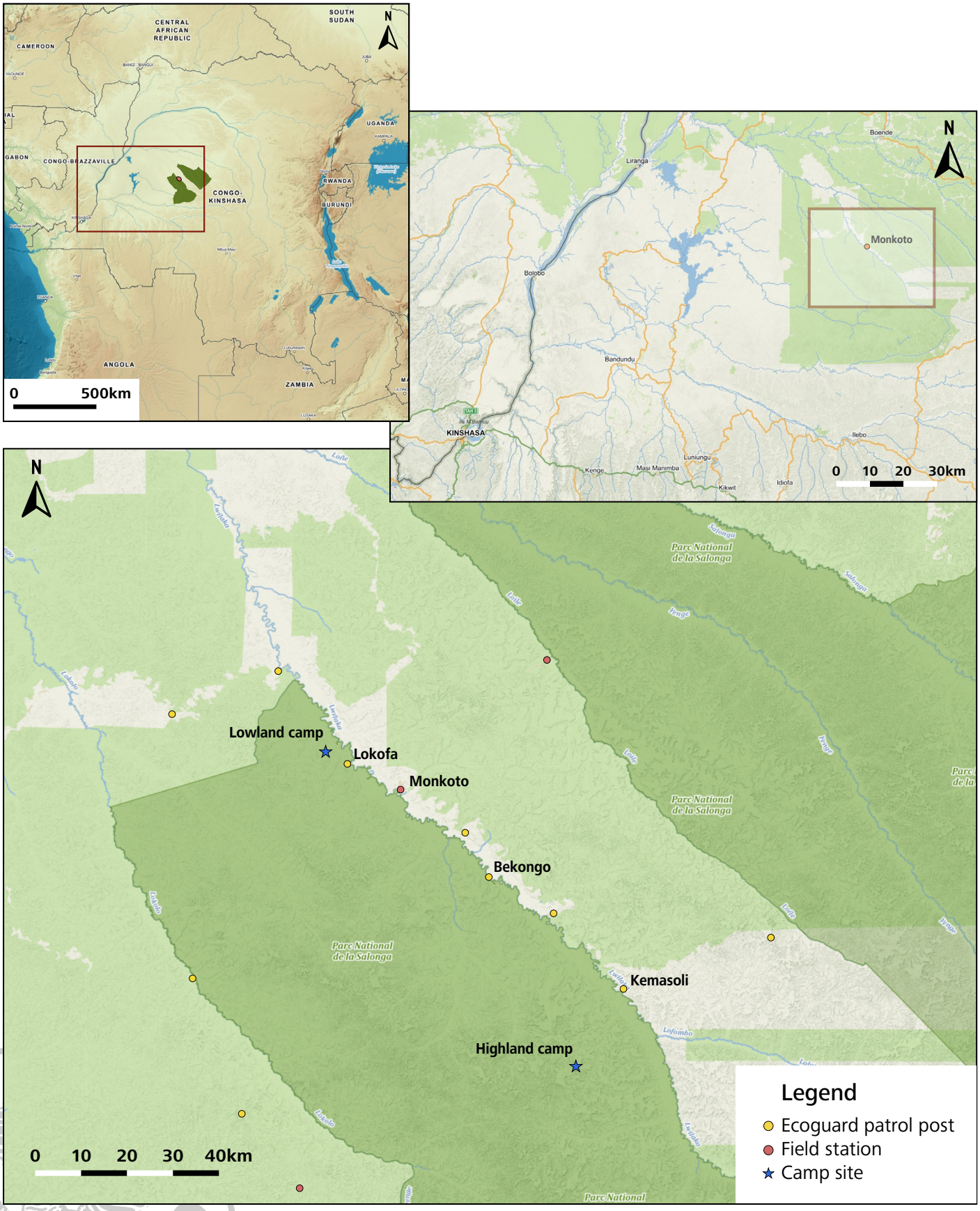

Figure 7. **Top:** Two maps showing the position of Salonga NP in DRC. Dot indicates the location of the Monkoto village, **Bottom:** Study region of the Salonga NP expedition 2022, with indication of the WWF station in Monkoto, transition sites and the two camp locations. Basemap ©openstreetmap; Waypoints ©WWF DRC

2 Biodiversity surveys

2.1 Avifauna

Sam Jones & Gabriel Jamie

2.1.1 Introduction

Despite harbouring some of the greatest avian species diversity in the Afrotropics, ornithological knowledge of the central Congo Basin remains in its infancy. This contrasts with our understanding of the avifaunas of other high diversity lowland tropical forest regions such as the Amazon basin (e.g. Terborgh et al. 1990, Stouffer et al. 2020). Nonetheless, the central Congo Basin is frequently highlighted for its biological richness but also the paucity of data available (e.g. Dean 2021, Deikumah et al. 2014, Butchart & Bird 2010). Consequently, the region is often under-represented in, or even absent from "global" analyses (e.g. Gibson et al. 2011, Verbeek et al. 2011). To this end, the ecology, conservation and evolutionary history of much of the region's avifauna are hardly known.

A significant barrier to the improvement of ornithological knowledge in the central Congo Basin is the region's geographic and logistical remoteness. For these reasons the vast interior of the Congo Basin was not subject to the same intensity of collections by ornithologists during the colonial era (e.g. Chapin 1932, 1939, 1953, 1954), who instead favoured areas more easily accessible by road, rail or river. However, it is also due to this remoteness that the central Congo Basin still harbours some of the globe's most extensive tracts of primary lowland rainforest. One remarkable avian discovery from the Congo Basin during the colonial era is particularly worthy of mention, however, that of Congo Peacock *Afropavo congensis* (Chapin 1936) in that the species is one of few endemic birds to the lowland Congo Basin, in contrast to the more endemism-rich (and generally more accessible) montane regions of the Albertine rift.

Situated in the vast Salonga-Lukenie-Sankuru forest block, Salonga National Park is arguably the flagship protected area within the Congo Basin, representing the largest rainforest reserve in Africa and second largest on earth. Little primary data on Salonga's avifauna exists, representing a fundamental knowledge gap in the characterisation of its avifauna for long term monitoring, as well as the requisite data for Key Biodiversity Area assessments in the Congo Basin (being undertaken at the time of writing). Indeed, more than three decades after Salonga was first designated as a reserve (1956, becoming a national park in 1970) and classified as a world heritage site (Mankoto 1987), a lack of basic information of the park's fauna was still pervasive (d'Huart 1988).

Despite this paucity of data, Salonga was still designated as one of 19 Important Bird Areas in the DRC (Demey & Louette 2001) with data principally from an unpublished survey in 1991 (Cruickshank & Gautier, undated). These authors presented a preliminary checklist from Salonga comprising 166 species, 158 species of which were known to occur from the region by either specimens collected during the colonial era before the parks gazettement, or considered likely to occur according to initial species distribution maps for the region (see Schouteden 1961, Hall & Moreau 1970, Snow 1978, Louette 1988). Further species records were published in Demey & Louette (2001) from various general sources (UNESCO 1987, d'Huart 1988, Davis et al. 1994, IUCN 1990), or presumed as likely to, or possibly to, occur within the park's bounds. The remit of Demey & Louette (2001) was

to summarise the presence of species of highest conservation and biogeographical relevance (using IUCN RedList criteria, and range/biome restriction – see Fishpool & Evans (2001)) in Salonga (rather than compile a complete inventory). In doing so, they reported 101 confirmed species restricted to the Guinea-Congolian Forests biome, with a further 52 Guinea-Congolian species as likely to, or possibly occurring.

Significant security problems as a result of civil war and heavily armed poachers prohibited any research activity in Salonga throughout the 1990s (Fotso 1996, van Krunkelsven et al. 2000). However, even with the stabilisation of the situation and better access around the turn of the millennia, new data on the region's avifauna still remain largely absent. Nonetheless, some ornithological research has been conducted in the park on interspecific dynamics of multi-species flocks (Péron & Crochet 2009), habitat use of Congo Peacock *Afropavo congensis* (Mulotwa et al. 2010), and also on population density of Congo Peacock owing to ease of studying the species in the same manner as terrestrial mammals via remotely triggered trail cameras (Bessone et al. 2020).

Overall, despite the global significance of Salonga, there remains to be either a quantitative baseline survey, or a comprehensive inventory of the park's avifauna published in half a century since Salonga received national park status. To this end, the aims of our survey were principally to: 1) provide a quantitative baseline inventory of the avifauna of Salonga, where feasible using methods that could be repeated in the future, 2) collate all existing data on the parks avifauna, in doing so characterise the representation of Guinea-Congolian biome-restricted species to the overall avian assemblage.

2.1.2 Methods

2.1.2.1 Preparatory work and taxonomy

Before undertaking fieldwork we reviewed species ranges and records from relevant literature on the broader region (Sinclair & Ryan 2010, Chapin 1932, Fishpool & Evans 2001), in addition to online resources relevant to the Salonga NP Important Bird Area (e.g. eBird). We adopted as non-assumptive an approach to our preparatory work as possible, creating a list of plausible species that covered effectively the entire avifauna of the DRC and adjacent regions in central Africa. While collating these data, we also compiled an extensive sound recording archive from pre-existing recording sets (e.g. Chapuis birds of West Africa), augmented with recordings of particular species from the online sound repositories Xeno-canto and the Macaulay Library (www.xeno-canto.org / www.macaulaylibrary.org).

Throughout this chapter we follow the taxonomic order and vernacular/scientific naming conventions as that used by eBird/Clements (v2022; https://science.ebird.org/en/use-ebird-data/the-ebird-taxonomy), only differing from this where specifically relevant for IUCN RedList assessments (which follow BirdLife International), or for minor inconsistencies in vernacular names. Finally, to characterise the contribution of species most characteristic of Congolese forests to our inventory, we denote 'biome-restricted' species (restricted to the 'Guinea-Congolian' biome) following species assessments in Fishpool (2001), used for the gazettement of Important Bird Areas in Africa.

Following the completion of our field work we obtained copies of "Salonga. Au coeur de la grande forêt congolaise" by Jean P. Vande weghe & Gaël R. Vande weghe (Vande wege & Vande weghe 2018). Appendix 3 of this book contains a list of bird species reported from Salonga National Park

(collated from multiple sources) against which we were able to compare the species observed during our fieldwork. At the time of writing these data are still not formally published and we are in the process of collating and verifying all avian data from Salonga in order to publish these collectively.

2.1.2.2 Survey methodologies

We surveyed birds using four techniques (see below) which were supplemented with records/ observations from other occasional methods. Research camps (detailed earlier in the report) were situated in primary lowland rainforest with the first of these ("Camp 1"/ "Highland camp") being 'dry' (on a higher plateau with no swamp forest) and the second ("Camp 2" / "Lowland camp") being wetter (adjacent to a large area of waterlogged/swamp forest though in an undulating landscape that alternated between sections of dry terra firme and waterlogged swamp forest). See introductory sections of report for detailed descriptions and GPS coordinates of each camp. Because of these habitat differences, and the different species they inherently harbour, we made efforts to give coverage to both habitat types in our methods. Dry 'terra firme' forests were characterised by high canopies (40-60m high) with treefall gaps often with Maranthacea understoreys, and waterlogged swamp forests typically had much lower canopies, standing water, small streams and extensive liana tangles. Principal survey methods were as follows:

Dawn chorus records

At each camp we conducted standardised dawn chorus recordings. Dawn chorus recordings followed methods described by Herzog et al. (2016), using directional shotgun microphones (Sennheiser ME66, paired with a recording device). A given survey site was visited within the first hour of the dawn chorus (corresponding with first light at ~05h00), where a 15 minute, uninterrupted, dawn chorus recording was made. During the first 8 minutes of the recording, the recordist initially pointed the microphone in the direction of greatest vocal activity and then rotated 90 degrees clockwise every minute until two rotations were completed. For the remaining 7 minutes recordings were made opportunistically/irrespective of direction to document the vocalisations of species not recorded in the previous 8 minutes, or to get better recordings of species already recorded. Each dawn recording site was separated by at least 250m following recommendations in Herzog et al. (2016) and were typically situated along access trails through the forest for ease of silent movement at dawn. Dawn chorus recordings were usually conducted by two observers, with one observer recording and the other noting down species during the recording. This approach allowed us to archive the dawn chorus and identify unknown species post-hoc. Extensive rainfall during the survey period had significant impacts on avian activity levels at dawn, and we thus generally only recorded on mornings following either no, or light overnight rainfall.

Mist-netting

We erected teams of 5 mist nets at each camp comprising 1 x 6m, 2x9m and 2x12m nets (comprising 48m net in total). Nets were not operated on a specific standardised protocol, but we recorded net effort in order to report capture statistics. Nets were opened at times of peak activity (typically following dawn chorus recordings) and kept open until capture rates discernibly reduced, or when rain (typically in the afternoon) meant nets had to be closed. Captured birds were ringed with uniquely numbered metal bands administered by the South African Bird Ringing Unit (www.safring.birdmap.africa), checked for moult (body and flight-feather), breeding condition and ageing cues. We also measured the following biometrics– maximum and minimum tarsus, maximum (straightened/

flattened) wing chord, Kipp's distance, tail length, bill tip to anterior nares, bill tip to skull, bill width and depth at anterior nares, body mass, hind claw, and wing formulae (emarginated primaries, longest primaries forming the wing tip and the length of the penultimate outermost primary to other primaries). Finally, we also collected blood samples (on FTA cards), feather samples (P1), and took standardised sets of photographs (head and eye, spread wing, spread tail and the bird in the photographic grip) for all captured birds. In addition, we undertook some opportunistic sampling for projects on both cisticolas (*Cisticola* sp.) and tinkerbirds (*Pogoniulus* sp.).

Figure 8. Mist-nets were deployed alongside point count surveys to survey different aspects of the ornithological community. (Photo by Michiel van Noppen)

Passive acoustic monitoring (Audiomoths)

Nocturnal Afrotropical forest species are some of the poorest known species in Central Africa, and we thus made particular efforts to attempt to document their presence and behavioural song patterns. Specifically, Congo Peacock is known to sing at night, and part of our strategy was also to document the presence of this species around our research camps. We deployed 'Audiomoths' (passive acoustic monitoring devices – see openacousticdevices.info/audiomoth) at locations a minimum of 300m apart (but typically up to 1km apart). Each unit was set to record continuously from dusk and into the dawn (1800-0800) in order to incorporate additional sampling time as dawn chorus recordings. Units were equally split across 'terra firme' forest and swamp forest to effectively sample different species.

A total of 9 units were deployed for a total of 33 recording nights and 31 dawns. This comprised 11 nights / 11 dawns from 4 units at camp 1, and 22 nights / 20 dawns from camp 2. At the time of

writing these data are not yet processed, but we intend to include these data in future publications arising from the survey.

Opportunistic surveying
We birdwatched extensively throughout the survey period in addition to the described methods. Particular efforts were made to document species for which our standardised methods were least likely to capture such as non-vocal raptors, aerial insectivores and non-vocal species typically only encountered occasionally in roving mixed species flocks, fruiting trees or on forest edges. Because the phenology of many tropical species is poorly known, we also noted relevant information on breeding behaviour and moult, and report these later in the chapter along with similar data obtained during mist-netting activities. Finally, we also augmented our records with those reliably seen and documented by other members of our expedition team.

2.1.2.3 The daily log, digital vouchers and archiving data via eBird

At the end of each day in the field (21 total days), we compiled our collective sightings in the form of a 'daily log'. This comprised all species detected throughout the day with estimated numbers of individuals within rough habitat types where relevant. Inherently, the daily number of species recorded varied slightly depending on habitat types visited and weather conditions encountered on a given day, but it nonetheless serves as an accurate representation of species relative abundance via 'bird days' within which a species was recorded. Documenting species in this manner allows us to report 'complete' statistics of both relative abundance and species accumulation across the survey without biassing daily data in favour of only notable species.

We made efforts to unambiguously document species in the form of verifiable digital 'vouchers' with sound recordings and photographs to be archived on online recording platforms (e.g. the Macaulay Library). This approach to inventorying in the absence of collecting physical specimens by archiving referenceable digital voucher specimens follows suggestions by Lees et al. (2014) and allows us to re-examine digital specimens in the future in light of any taxonomic changes.

Following our return from the field, we made immediate efforts to archive raw data obtained during fieldwork on the online repository eBird also linked with the Global Biodiversity Information Facility (GBIF). We archived data as full daily log entries in individual checklists (e.g. checklist S124459041) when we were at research camps for complete days and movement distances were limited. For days where we transitioned/travelled between camps (either by river travel or on foot) we submitted multiple shorter checklists (e.g. checklist S124754741) in order to bound data to specific locations following protocols outlined by eBird. For the same reasons, nocturnal observations were separated from diurnal observations. Archiving our raw data in this form allows us to simultaneously bound all digital (species-specific) media to exact observations, whilst also contributing data to this global archive. The Congo Basin of DRC is one of the least sampled regions of the world on eBird, and our data are thus of significant value. For example, our records of Congo Peacock comprise >30% of all records reported for this species in the eBird data set at the time of writing.

Our full survey archiving raw data in eBird, and digital media via the Macaulay Library is summarised in the eBird trip report linked here. Note, the species total in the linked trip report is slightly fewer than that presented in the report owing to the inclusion of some non species level taxon in the annotated checklist which represent distinct species, but were not conclusively identified.

2.1.2.4 Species inventory, accumulation curve and annotated checklist

The species inventory from our survey comprises 160 species. These, in addition to several species whose identity is still to be resolved, are presented in **Table 1**. Included in this table are the daily mean count (± sd), mode count, and 'bird days' (/21) each species was recorded on. In our species inventory, three species are of conservation concern (IUCN RedList status 'near-threatened' or higher), and 88 are biome-restricted species (of the Guinea-Congolian biome).

Accompanying this summary table, **Figure 9** displays a species accumulation of new species added throughout the survey period against the daily total species recorded (as derived from daily log data). We also graphically display the relative abundance of both all (**Figure 10**) and Guinea-Congolian biome-restricted (**Figure 11**) species. The latter characterises the relative proportions of Congolian forest avifauna to the inventory, as opposed to generalist species that are uncharacteristic of the region's forest avifauna (e.g. Black Kite *Milvus migrans* – a species that rapidly colonises following human disturbance).

Below the summary table, we also provide a list of notable records (e.g. first records for Salonga National Park) and then an annotated checklist providing individual accounts for all species recorded during the survey. Finally, owing to the limited data available on phenology (moult and breeding) and morphometrics of much of the avifauna of the region, we follow these summaries with accounts of breeding records, birds in moult, and morphometric data collected during the expedition.

2.1.3 Species inventory

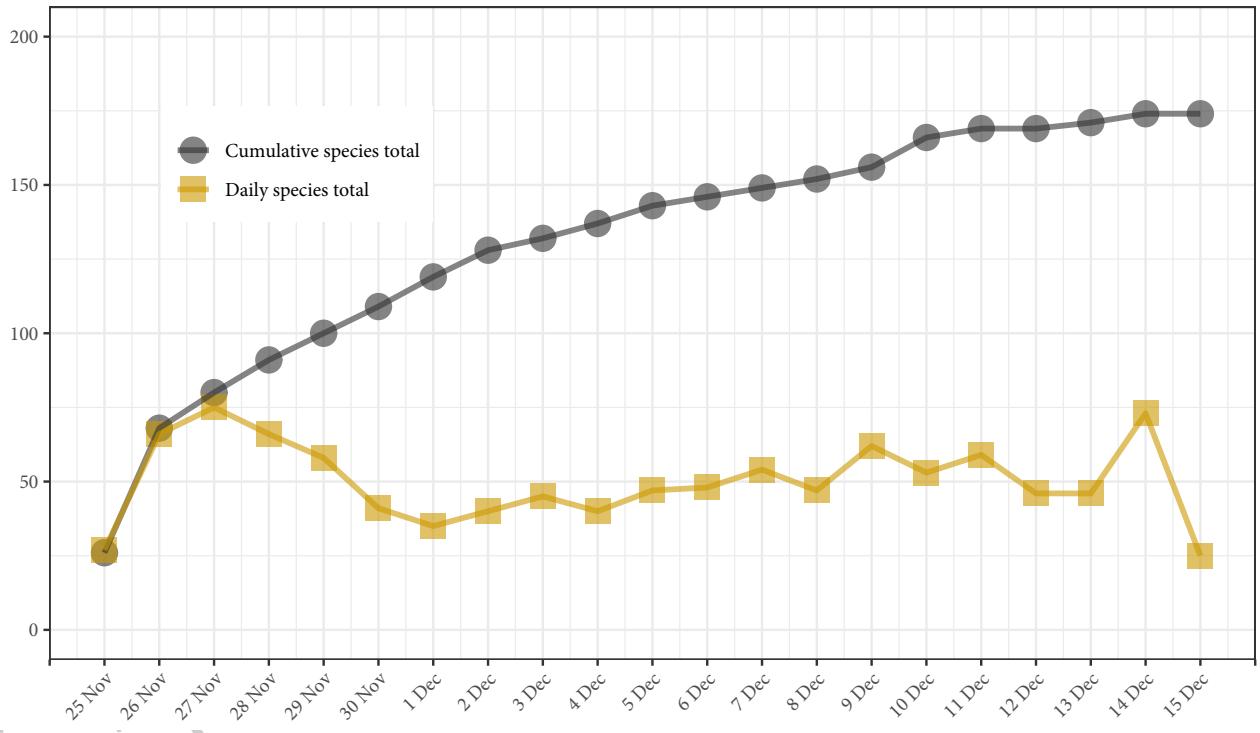

Figure 9. Species accumulation (daily new species detected during our survey) in comparison to daily species log total. The drop in daily species total on 15 Dec is due to limited time in the field on the day of departure.

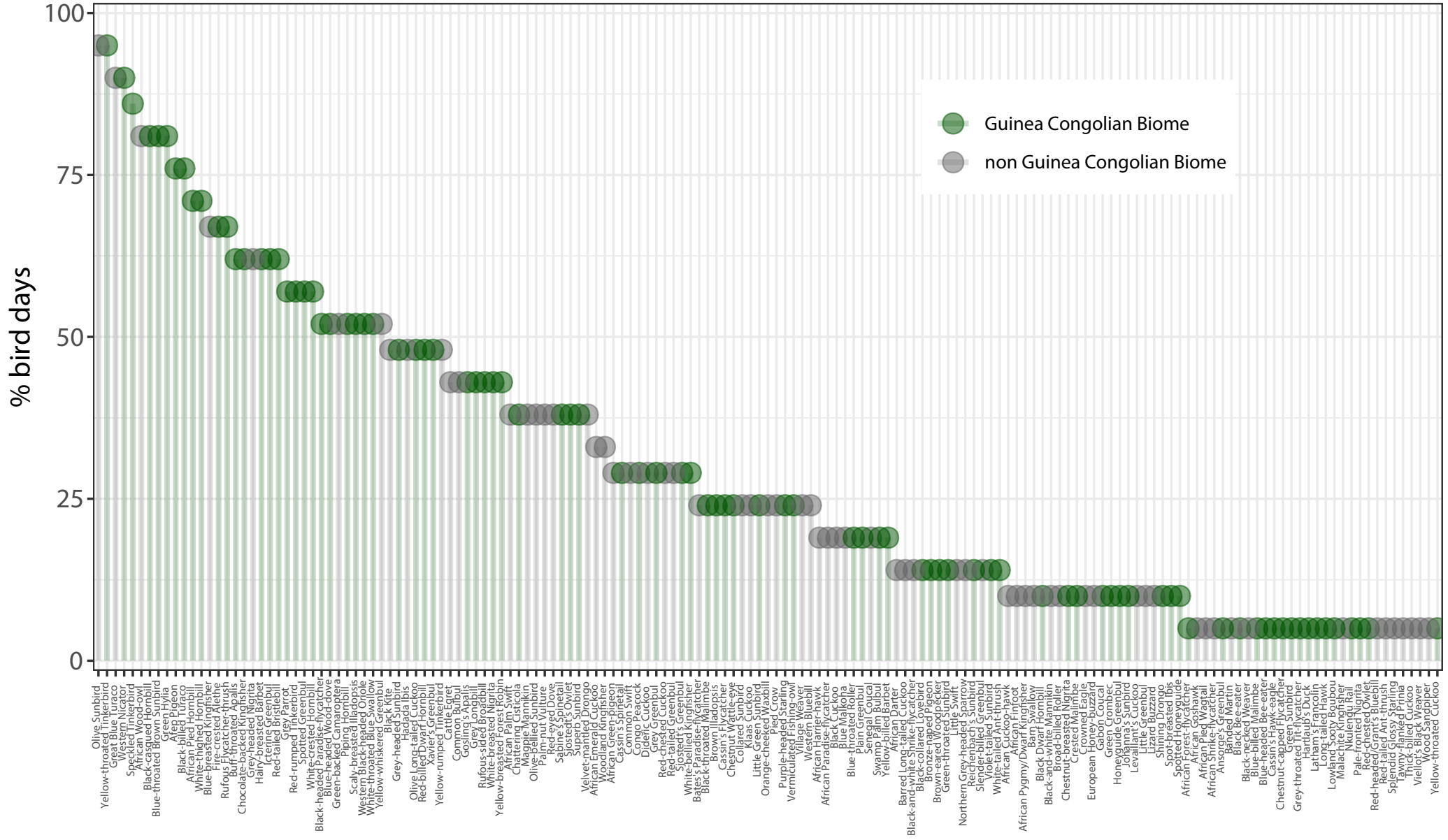

Figure 10. Relative abundance of all species recorded (measured as proportion of days a given species was recorded on), throughout the entire survey (out of a total of 21 survey days).

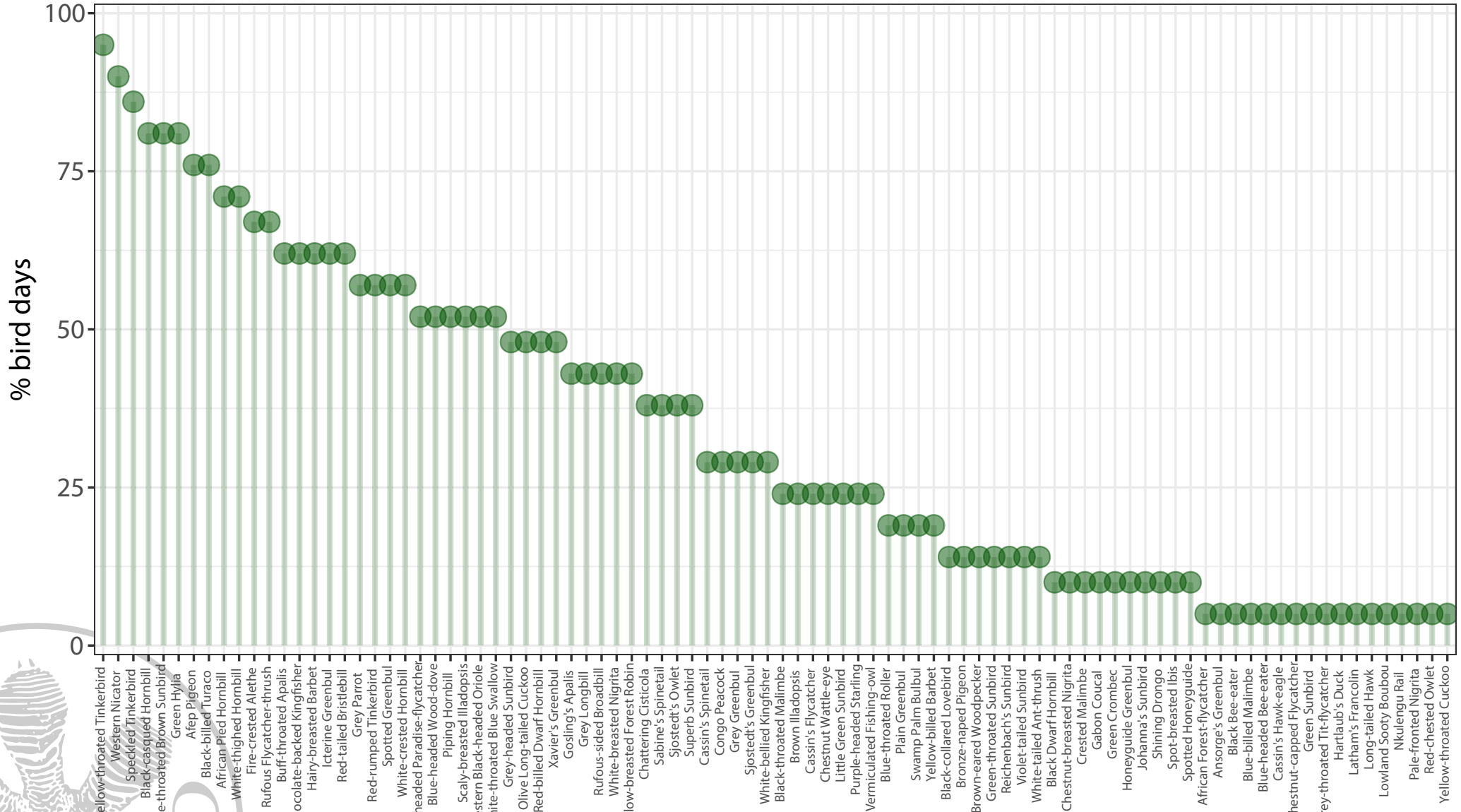

Figure 11. Relative abundance of Guinea-Congolian biome species (by proxy of proportion of days a given species was recorded on), throughout the entire survey (out of a total of 21 survey days).

Table 1. Preliminary inventory of species recorded during the expedition. 'Bird days' represents the number of individual survey days (out of 21 total survey days) on which a given species was recorded, and acts as a proxy for overall abundance of species within the survey period. 'dc' = daily count and is expressed as 'minimum-maximum' number of individuals counted in one day. Coloured species names are those restricted to the Guinea-Congo Basin biome (see Fishpool & Evans (2001)). Full details and associated photos and sound recordings are provided in the following eBird trip report: https://ebird.org/tripreport/100647

n°	English name	Scientific name	IUCN Status	dc	Mean count (sd)	Mode count	Bird days
1	Hartlaub's Duck	*Pteronetta hartlaubii*	LC	1-1	1 (NA)	1	1
2	Guineafowl sp.	*Guttera* sp.	LC	8-8	8 (NA)	8	1
3	Congo Peacock	*Afropavo congensis*	NT	1-6	3 (1.75)	4	6
4	Latham's Francolin	*Peliperdix lathami*	LC	1-1	1 (NA)	1	1
5	Afep Pigeon	*Columba unicincta*	LC	1-5	2 (1.08)	1	16
6	Bronze-naped Pigeon	*Columba iriditorques*	LC	1-1	1 (0)	1	3
7	Red-eyed Dove	*Streptopelia semitorquata*	LC	1-10	4 (3.2)	1	8
8	Turtur sp.	*Turtur* sp.		1-1	1 (NA)	1	1
9	Blue-spotted Wood-dove	*Turtur afer*	LC	1-5	3 (1.77)	1	7
10	Blue-headed Wood-dove	*Turtur brehmeri*	LC	1-3	2 (0.54)	2	11
11	African Green-pigeon	*Treron calvus*	LC	1-8	4 (2.71)	1	6
12	Great Blue Turaco	*Corythaeola cristata*	LC	1-10	3 (2.24)	1	19
13	Black-billed Turaco	*Tauraco schuettii*	LC	1-6	3 (1.45)	2	16
14	Coucal sp.	*Centropus* sp.	LC	1-2	1 (0.58)	1	3
15	Gabon Coucal	*Centropus anselli*	LC	1-1	1 (0)	1	2
16	Senegal Coucal	*Centropus senegalensis*	LC	1-5	3 (1.71)	1	4
17	Blue Malkoha	*Ceuthmochares aereus*	LC	1-1	1 (0)	1	4
18	Levaillant's Cuckoo	*Clamator levaillantii*	LC	1-1	1 (0)	1	2
19	Thick-billed Cuckoo	*Pachycoccyx audeberti*	LC	1-1	1 (NA)	1	1
20	Dideric Cuckoo	*Chrysococcyx caprius*	LC	1-2	1 (0.52)	1	6
21	Klaas Cuckoo	*Chrysococcyx klaas*	LC	1-1	1 (0)	1	5
22	Yellow-throated Cuckoo	*Chrysococcyx flavigularis*	LC	1-1	1 (NA)	1	1
23	African Emerald Cuckoo	*Chrysococcyx cupreus*	LC	1-2	1 (0.49)	1	7
24	Olive Long-tailed Cuckoo	*Cercococcyx olivinus*	LC	1-3	1 (0.63)	1	10
25	Barred Long-tailed Cuckoo (ID to be confirmed)	*Cercococcyx montanus*	LC	1-1	1 (0)	1	3
26	Black Cuckoo	*Cuculus clamosus*	LC	1-1	1 (0)	1	4
27	Red-chested Cuckoo	*Cuculus solitarius*	LC	1-1	1 (0)	1	6
28	Sabine's Spinetail	*Rhaphidura sabini*	LC	1-6	3 (1.81)	1	8
29	Cassin's Spinetail	*Neafrapus cassini*	LC	1-8	4 (2.53)	3	6
30	Swift sp.	*Apus* sp.		3-5	4 (1.15)	5	3
31	Common Swift	*Apus apus*	LC	2-100	31 (37.69)	10	6

n°	English name	Scientific name	IUCN Status	dc	Mean count (sd)	Mode count	Bird days
32	Little Swift	*Apus affinis*	LC	5-8	6 (1.73)	5	3
33	African Palm Swift	*Cypsiurus parvus*	LC	1-10	6 (3.55)	10	8
34	Nkulengu Rail	*Himantornis haematopus*	LC	2-2	2 (NA)	2	1
35	African Finfoot	*Podica senegalensis*	LC	1-2	2 (0.71)	1	2
36	Wood Sandpiper	*Tringa glareola*	LC	1-1	1 (NA)	1	1
37	African Darter	*Anhinga rufa*	LC	1-1	1 (0)	1	3
38	Cattle Egret	*Bubulcus ibis*	LC	3-30	13 (10.01)	3	9
39	Spot-breasted Ibis	*Bostrychia rara*	LC	2-2	2 (0)	2	2
40	Hadada Ibis	*Bostrychia hagedash*	LC	1-6	2 (1.55)	1	10
41	African Harrier-hawk	*Polyboroides typus*	LC	1-4	2 (1.26)	2	4
42	Palm-nut Vulture	*Gypohierax angolensis*	LC	1-7	3 (2.23)	1	8
43	European Honey-buzzard	*Pernis apivorus*	LC	1-1	1 (0)	1	2
44	African Cuckoo-hawk	*Aviceda cuculoides*	LC	1-2	2 (0.71)	1	2
45	Crowned Eagle	*Stephanoaetus coronatus*	NT	1-1	1 (0)	1	2
46	Cassin's Hawk-eagle	*Aquila africana*	LC	1-1	1 (NA)	1	1
47	Lizard Buzzard	*Kaupifalco monogrammicus*	LC	1-1	1 (0)	1	2
48	African Goshawk	*Accipiter tachiro*	LC	1-1	1 (NA)	1	1
49	Long-tailed Hawk	*Urotriorchis macrourus*	LC	1-1	1 (NA)	1	1
50	Black Kite	*Milvus migrans*	LC	1-25	10 (6.31)	10	10
51	Vermiculated Fishing-owl	*Scotopelia bouvieri*	LC	1-1	1 (0)	1	5
52	Red-chested Owlet	*Glaucidium tephronotum*	LC	1-1	1 (NA)	1	1
53	Sjostedt's Owlet	*Glaucidium sjostedti*	LC	1-3	1 (0.74)	1	8
54	African Wood-owl	*Strix woodfordii*	LC	1-2	1 (0.47)	1	17
55	Red-billed Dwarf Hornbill	*Lophoceros camurus*	LC	1-5	3 (1.33)	3	10
56	African Pied Hornbill	*Lophoceros fasciatus*	LC	2-10	5 (3.17)	2	15
57	White-crested Hornbill	*Horizocerus albocristatus*	LC	1-4	2 (0.97)	1	12
58	Black Dwarf Hornbill	*Horizocerus hartlaubi*	LC	1-2	2 (0.71)	1	2
59	Black-casqued Hornbill	*Ceratogymna atrata*	LC	1-20	4 (4.36)	4	17
60	White-thighed Hornbill	*Bycanistes albotibialis*	LC	1-20	7 (5.56)	2	15
61	Piping Hornbill	*Bycanistes fistulator*	LC	1-6	4 (2)	6	11
62	Malachite Kingfisher	*Corythornis cristatus*	LC	1-1	1 (NA)	1	1
63	White-bellied Kingfisher	*Corythornis leucogaster*	LC	1-3	2 (0.84)	1	6
64	Ispidina sp.	*Ispidina* sp.		1-1	1 (0)	1	2
65	Chocolate-backed Kingfisher	*Halcyon badia*	LC	1-3	2 (0.8)	1	13
66	Woodland Kingfisher	*Halcyon senegalensis*	LC	1-2	1 (0.38)	1	7
67	Blue-breasted Kingfisher	*Halcyon malimbica*	LC	1-6	2 (1.27)	2	14

n°	English name	Scientific name	IUCN Status	dc	Mean count (sd)	Mode count	Bird days
68	Bee-eater sp.	*Merops sp*		3-3	3 (NA)	3	1
69	Black Bee-eater	*Merops gularis*	LC	2-2	2 (NA)	2	1
70	Blue-headed Bee-eater	*Merops muelleri*	LC	1-1	1 (NA)	1	1
71	Roller sp.	*Eurystomus* sp.		1-8	4 (3.3)	1	4
72	Broad-billed Roller	*Eurystomus glaucurus*	LC	1-1	1 (0)	1	2
73	Blue-throated Roller	*Eurystomus gularis*	LC	1-2	1 (0.5)	1	4
74	Yellow-billed Barbet	*Trachyphonus purpuratus*	LC	1-2	1 (0.5)	1	4
75	Speckled Tinkerbird	*Pogoniulus scolopaceus*	LC	1-8	2 (1.56)	2	18
76	Red-rumped Tinkerbird	*Pogoniulus atroflavus*	LC	1-2	1 (0.49)	1	12
77	Yellow-throated Tinkerbird	*Pogoniulus subsulphureus*	LC	2-15	6 (3.49)	5	20
78	Yellow-rumped Tinkerbird	*Pogoniulus bilineatus*	LC	1-3	2 (0.84)	1	10
79	Yellow-spotted Barbet	*Buccanodon duchaillui*	LC	1-3	1 (0.76)	1	7
80	Hairy-breasted Barbet	*Tricholaema hirsuta*	LC	1-4	2 (0.91)	2	13
81	Spotted Honeyguide	*Indicator maculatus*	LC	1-2	2 (0.71)	1	2
82	Honeyguide sp.	*Indicator* sp.		1-1	1 (NA)	1	1
83	Woodpecker sp.	*Picidae* sp.		1-1	1 (0)	1	2
84	Brown-eared Woodpecker	*Campethera caroli*	LC	1-2	1 (0.58)	1	3
85	Buff-spotted Woodpecker	*Campethera nivosa*	LC	1-1	1 (0)	1	4
86	Black-collared Lovebird	*Agapornis swindernianus*	LC	5-14	9 (4.58)	5	3
87	Grey Parrot	*Psittacus erithacus*	EN	1-30	7 (8.08)	1	12
88	Rufous-sided Broadbill	*Smithornis rufolateralis*	LC	1-3	2 (0.71)	2	9
89	Western Black-headed Oriole	*Oriolus brachyrynchus*	LC	1-3	2 (0.65)	2	11
90	Oriole sp.	*Oriolus* sp.		1-1	1 (0)	1	2
91	Chestnut Wattle-eye	*Platysteira castanea*	LC	1-3	2 (0.89)	1	5
92	White-spotted Wattle-eye	*Platysteira tonsa*	LC	1-1	1 (NA)	1	1
93	Wattle-eye sp.	*Platysteira* sp.		1-2	1 (0.5)	1	4
94	African Shrike-flycatcher	*Megabyas flammulatus*	LC	1-1	1 (NA)	1	1
95	Black-and-white Shrike-flycatcher	*Bias musicus*	LC	1-2	1 (0.58)	1	3
96	Lowland Sooty Boubou	*Laniarius leucorhynchus*	LC	1-1	1 (NA)	1	1
97	Shining Drongo	*Dicrurus atripennis*	LC	2-2	2 (0)	2	2
98	Velvet-mantled Drongo	*Dicrurus modestus*	LC	1-8	4 (2.51)	2	8
99	Black-headed Paradise-flycatcher	*Terpsiphone rufiventer*	LC	1-4	2 (1.04)	2	11
100	Bates's Paradise-flycatcher	*Terpsiphone batesi*	LC	1-4	2 (1.22)	1	5
101	African Paradise-flycatcher	*Terpsiphone viridis*	LC	1-2	2 (0.58)	1	4
102	Paradise Flycatcher sp.	*Terpsiphone* sp.		1-1	1 (NA)	1	1
103	Pied Crow	*Corvus albus*	LC	1-5	3 (1.48)	3	5

n°	English name	Scientific name	IUCN Status	dc	Mean count (sd)	Mode count	Bird days
104	Western Nicator	*Nicator chloris*	LC	1-3	2 (0.9)	1	19
105	Green Crombec	*Sylvietta virens*	LC	1-2	2 (0.71)	1	2
106	Grey Longbill	*Macrosphenus concolor*	LC	1-2	2 (0.53)	2	9
107	Green Hylia	*Hylia prasina*	LC	1-5	2 (1.28)	2	17
108	Green-backed Camaroptera	*Camaroptera brachyura*	LC	1-10	3 (3.61)	1	11
109	Buff-throated Apalis	*Apalis rufogularis*	LC	1-6	2 (1.46)	1	13
110	Gosling's Apalis	*Apalis goslingi*	LC	1-15	4 (4.36)	1	9
111	Tawny-flanked Prinia	*Prinia subflava*	LC	1-1	1 (NA)	1	1
112	Chattering Cisticola	*Cisticola anonymus*	LC	1-15	4 (4.69)	1	8
113	Banded Martin	*Neophedina cincta*	LC	1-1	1 (NA)	1	1
114	Barn Swallow	*Hirundo rustica*	LC	4-5	4 (0.71)	4	2
115	White-throated Blue Swallow	*Hirundo nigrita*	LC	1-50	13 (16.31)	2	11
116	Swallow sp.	*Hirundo* sp.		3-5	4 (1.41)	3	2
117	Slender-billed Greenbul	*Stelgidillas gracilirostris*	LC	1-2	1 (0.58)	1	3
118	Red-tailed Bristlebill	*Bleda syndactylus*	LC	1-5	3 (1.33)	3	13
119	Honeyguide Greenbul	*Baeopogon indicator*	LC	1-1	1 (0)	1	2
120	Sjostedt's Greenbul	*Baeopogon clamans*	LC	1-3	2 (0.84)	1	6
121	Spotted Greenbul	*Ixonotus guttatus*	LC	2-30	10 (8.28)	2	12
122	Swamp Palm Bulbul	*Thescelocichla leucopleura*	LC	2-6	3 (1.89)	2	4
123	Red-tailed Greenbul	*Criniger calurus*	LC	1-8	5 (2.64)	5	6
124	Grey Greenbul	*Eurillas gracilis*	LC	1-5	3 (1.63)	1	6
125	Ansorge's Greenbul	*Eurillas ansorgei*	LC	2-2	2 (NA)	2	1
126	Plain Greenbul	*Eurillas curvirostris*	LC	2-2	2 (0)	2	4
127	Yellow-whiskered Greenbul	*Eurillas latirostris*	LC	1-4	2 (1.19)	2	11
128	Little Greenbul	*Eurillas virens*	LC	1-2	2 (0.71)	1	2
129	Eurillas sp.	*Eurillas* sp.		1-3	2 (1)	1	3
130	Icterine Greenbul	*Phyllastrephus icterinus*	LC	2-15	7 (4.17)	2	13
131	Xavier's Greenbul	*Phyllastrephus xavieri*	LC	2-5	4 (1.17)	3	10
132	Common Bulbul	*Pycnonotus barbatus*	LC	2-15	5 (3.91)	5	9
133	Chestnut-capped Flycatcher	*Erythrocercus mccallii*	LC	3-3	3 (NA)	3	1
134	Brown Illadopsis	*Illadopsis fulvescens*	LC	2-4	3 (1)	2	5
135	Scaly-breasted Illadopsis	*Illadopsis albipectus*	LC	2-4	3 (0.93)	2	11
136	Purple-headed Starling	*Hylopsar purpureiceps*	LC	1-8	4 (2.77)	1	5
137	Splendid Glossy Starling	*Lamprotornis splendidus*	LC	2-2	2 (NA)	2	1
138	Rufous Flycatcher-thrush	*Stizorhina fraseri*	LC	1-4	2 (0.94)	2	14
139	Red-tailed Ant-thrush	*Neocossyphus rufus*	LC	1-1	1 (NA)	1	1

n°	English name	Scientific name	IUCN Status	dc	Mean count (sd)	Mode count	Bird days
140	White-tailed Ant-thrush	*Neocossyphus poensis*	LC	1-2	1 (0.58)	1	3
141	Cassin's Flycatcher	*Muscicapa cassini*	LC	1-10	3 (3.78)	1	5
142	African Forest-flycatcher	*Fraseria ocreata*	LC	4-4	4 (NA)	4	1
143	Grey-throated Tit-flycatcher	*Fraseria griseigularis*	LC	1-1	1 (NA)	1	1
144	Fire-crested Alethe	*Alethe castanea*	LC	1-6	4 (1.74)	2	14
145	Yellow-breasted Forest Robin	*Stiphrornis mabirae*	LC	1-2	2 (0.53)	2	9
146	Grey-headed Sunbird	*Deleornis axillaris*	LC	1-5	2 (1.34)	2	10
147	Violet-tailed Sunbird	*Anthreptes aurantius*	LC	3-6	4 (1.73)	3	3
148	Little Green Sunbird	*Anthreptes seimundi*	LC	1-2	1 (0.55)	1	5
149	Green Sunbird	*Anthreptes rectirostris*	LC	1-1	1 (NA)	1	1
150	Collared Sunbird	*Hedydipna collaris*	LC	1-5	2 (1.64)	1	5
151	Reichenbach's Sunbird	*Anabathmis reichenbachii*	LC	1-10	5 (4.51)	1	3
152	Blue-throated Brown Sunbird	*Cyanomitra cyanolaema*	LC	1-10	5 (3.46)	2	17
153	Olive Sunbird	*Cyanomitra olivacea*	LC	1-10	5 (3.01)	8	20
154	Green-throated Sunbird	*Chalcomitra rubescens*	LC	1-2	2 (0.58)	2	3
155	Olive-bellied Sunbird	*Cinnyris chloropygius*	LC	1-10	3 (3.15)	2	8
156	Johanna's Sunbird	*Cinnyris johannae*	LC	3-3	3 (0)	3	2
157	Superb Sunbird	*Cinnyris superbus*	LC	1-6	3 (1.69)	2	8
158	Black-throated Malimbe	*Malimbus cassini*	LC	1-4	2 (1.1)	2	5
159	Blue-billed Malimbe	*Malimbus nitens*	LC	1-1	1 (NA)	1	1
160	Crested Malimbe	*Malimbus malimbicus*	LC	1-2	2 (0.71)	1	2
161	Black-necked Weaver	*Ploceus nigricollis*	LC	1-1	1 (NA)	1	1
162	Viellot's Black Weaver	*Ploceus nigerrimus*	LC	1-1	1 (NA)	1	1
163	Village Weaver	*Ploceus cucullatus*	LC	1-5	2 (1.64)	1	5
164	Magpie Mannikin	*Spermestes fringilloides*	LC	2-10	4 (2.45)	4	8
165	Black-and-white Mannikin	*Spermestes bicolor*	LC	2-10	6 (5.66)	2	2
166	White-breasted Nigrita	*Nigrita fusconotus*	LC	1-2	1 (0.44)	1	9
167	Chestnut-breasted Nigrita	*Nigrita bicolor*	LC	1-1	1 (0)	1	2
168	Grey-headed Nigrita	*Nigrita canicapillus*	LC	1-6	2 (1.39)	1	13
169	Pale-fronted Nigrita	*Nigrita luteifrons*	LC	1-1	1 (NA)	1	1
170	Orange-cheeked Waxbill	*Estrilda melpoda*	LC	1-50	19 (20.87)	1	5
171	Western Bluebill	*Spermophaga haematina*	LC	1-4	2 (1.3)	1	5
172	Bluebill sp.	*Spermophaga* sp.		1-1	1 (NA)	1	1
173	Northern Grey-headed Sparrow	*Passer griseus*	LC	4-4	4 (0)	4	3
174	African Pied Wagtail	*Motacilla aguimp*	LC	1-1	1 (NA)	1	1

2.1.4 Notable records

Species of conservation concern

The following species listed as those of conservation concern were observed. See annotated checklist for more details.

- Congo Peacock *Afropavo congensis* - Near threatened
- Grey Parrot *Psittacus erithacus* - Endangered
- Crowned Eagle *Stephanoaetus coronatus*- Near threatened

Species added to Salonga National Park list

We added 9 new bird species to the Salonga National Park list compared to those listed in Appendix 3 of Vande weghe & Vande weghe (2018). For more details see annotated checklist.

- Levaillant's Cuckoo *Clamator levaillantii*
- Wood Sandpiper *Tringa glareola*
- European Honey-buzzard *Pernis avipora*
- Red-chested Owlet *Glaucidium tephronotum*
- Woodland Kingfisher *Halcyon senegalensis*
- Red-tailed Greenbul *Criniger calurus*
- Xavier's Greenbul *Phyllastrephus xavieri*
- Grey-throated Tit-flycatcher *Fraseira griseigularis*
- Pale-fronted Nigrita *Nigrita luteifrons*

2.1.5 Annotated checklist

1. **Hartlaub's Duck (*Pteronetta hartlaubii*)**
   One on river upstream of Monkoto shortly before dusk on 29th November.

2. **Western Crested/Plumed Guineafowl (*Guttera verreauxi/plumifera*)**
   A small group (c. 8 individuals) of "guineafowls" was seen by Miguel Nunes early morning on 5th December close to the light trap at "Highland camp". Description fits either Western Crested or Plumed Guineafowls. Plumed is not yet known from Salonga National Park, while Western Crested has already been recorded. A feather of Western Crested or Plumed Guineafowl was found by Michiel van Noppen at "Lowland camp".

3. **Congo Peacock (*Afropavo congoensis*)**
   Birds detected on 6 days. All detections were auditory except for one visual encounter of three individuals (a male and two females) in terra firma forest at "Lowland camp" at 1445hrs on 11th December. Additionally, two feathers from a male were found in swamp forest during a walk into "Highland camp" on 30 November. Multiple sound recordings were made of this species' duet which may represent some of the best recordings of this species.

At "Highland camp", a pair was heard duetting at dusk (c. 17h45) from terra firma forest near campsite on 1st December. Early the following morning, a pair was again heard duetting from forest on opposite side of camp at c. 03h00. On the evening of 5th December, two pairs were again heard duetting at around 18h00 calling from either side of camp. This was repeated at around 02h00 on 6th December with birds calling from roughly the same localities as on previous evening.

At "Lowland camp", at least three pairs were duetting at c. 23h00 for close to 10 minutes from terra firma forest near the campsite. No birds were heard to vocalise during daylight. Birds did not vocalise on wet nights or when it had rained in the afternoon prior to dusk.

4. **Latham's Francolin (*Peliperdix lathami*)**
Single bird singing after dark in terra firma forest near "Lowland camp" (Lokofa) during Congo Peacock stakeout. Sang for about 20 seconds around 20h30. Sound recorded.

5. **Afep Pigeon (*Columba unicincta*)**
Detected commonly (16 days) from "Highland camp", "Lowland camp" and Monkoto as well as from boat along Lwilaka river during transition days. In canopy of range of forest habitats from interior terra firma to forest edge and flooded forest. Highly vocal and detected much more frequently than Bronze-naped Pigeon.

6. **Bronze-naped Pigeon (*Columba iriditorques*)**
Detected rarely (3 days) from "Highland camp" and "Lowland camp". Much less frequently detected than Afep Pigeon. Each of the three detections was of singing birds, vocalising from the canopy of terra firma forest.

7. **Red-eyed Dove (*Streptopelia semitorquata*)**
Common around Monkoto village but seemingly absent from areas of intact forest at "Highland camp", "Lowland camp" or along Lwilaka river during transition days. Detected on a total of 8 days around the village. Singing frequently.

8. **Blue-spotted Wood-dove (*Turtur afer*)**
As with Red-eyed Dove, common around Monkoto village but seemingly absent from areas of intact forest at "Highland camp", "Lowland camp" or along Lwilaka river during transition days. Detected on a total of 7 days. Singing frequently. Replaced in areas of pristine forest by Blue-headed Wood-dove.

9. **Blue-headed Wood-dove (*Turtur brehmeri*)**
Detected frequently (11 days) from pristine terra firma and swamp forest at "Highland camp" and "Lowland camp". Seemingly absent from disturbed and degraded forest at Monkoto village where largely replaced by Blue-spotted Wood-dove. Singing frequently.

10. **African Green-pigeon (*Treron calvus*)**
Commonly detected around Monkoto village where they were regularly seen in flight or perched in large trees at forest edge but rarer in areas of pristine forest. Of the 6 days where this species was detected, 5 were around Monkoto and just 1 from terra firma forest around "Lowland camp". Birds heard to sing at Monkoto and "Lowland camp".

11. Great Blue Turaco (*Corythaeola cristata*)

Detected commonly (19 days) from Monkoto, "Highland camp" and "Lowland camp" in canopy of forest edge, terra firma and swamp forest. Most vocal early mornings and at dusk. On 28th November near Monkoto a group of 6 was observed together including what may have been a young bird with adults. Also, birds observed in what seemed to be a mixed group with Black-billed Turaco.

Figure 12. Great Blue Turaco (*Corythaeola cristata*) (Photo by Gabriel Jamie)

12. Black-billed Turaco (*Tauraco schuettii*)

Detected commonly (16 days) from Monkoto, "Highland camp" and "Lowland camp" in canopy of terra firma, swamp forest and forest edge habitats. Singing frequently. Two birds on 28th November in a mixed group with Great Blue Turaco.

13. Gabon Coucal (*Centropus anselli*)

1–2 birds singing at "Highland camp" on the evening of 5th December (sound recorded) and another bird singing close to a tree fall gap in terra firma at "Lowland camp" on 10 December.

14. **Senegal Coucal (*Centropus senegalensis*)**
Detected only from degraded forest edge habitats at Monkoto and Bekongo ecoguard camp (4 days). Singing. Not detected from areas of pristine forest at "Highland camp" or "Lowland camp".

15. **Blue Malkoha (*Ceuthmochares aereus*)**
Detected infrequently (4 days) from farmbush at Monkoto, in terra firma at "Highland camp". Singing.

16. **Levaillant's Cuckoo (*Clamator levaillantii*)**
One individual in flight across the Lwilaka River from WWF Monkoto base on 26th November and then again in the same locality on 27th November. First record for Salonga National Park.

17. **Thick-billed Cuckoo (*Pachycoccyx audeberti*)**
One heard giving display flight over enclosed bai swamp forest near "Highland camp" on 7th December.

18. **Dideric Cuckoo (*Chrysococcyx caprius*)**
Recorded only from Monkoto in farm bush and forest edge habitat as well as one observed perched alongside river during boat journey to "Highland camp" (4 days overall). Singing.

19. **Klaas Cuckoo (*Chrysococcyx klaas*)**
Recorded only from Monkoto in farm bush and forest edge habitat and one heard singing in river edge vegetation during boat trip from Lokofa back to Monkoto. Singing.

20. **Yellow-throated Cuckoo (*Chrysococcyx flavigularis*)**
One singing from the canopy of swamp forest at "Highland camp" in the afternoon shortly before dusk on 10 December.

21. **African Emerald Cuckoo (*Chrysococcyx cupreus*)**
Recorded at Monkoto, Lokofa WWF base, during boat journey to "Highland camp" and during walk into "Highland camp" (7 days). From farmbush, forest edge and riverine forest habitats. Singing.

22. **Olive Long-tailed Cuckoo (*Cercococcyx olivinus*)**
Recorded frequently (10 days) from the canopy of terra firma forest at "Highland camp" and "Lowland camp". Most vocal at dawn and dusk.

23. **Black Cuckoo (*Cuculus clamosus*)**
Recorded infrequently (4 days) singing from forest at Monkoto, "Highland camp" and by river en route between "Highland camp" and Monkoto.

24. **Red-chested Cuckoo (*Cuculus solitarius*)**
Recorded infrequently (6 days) singing from riverine, terra firma and swamp forest between Monkoto and "Highland camp", on the walk into "Highland camp" and at "Lowland camp".

25. **Sabine's Spinetail (*Rhaphidura sabini*)**
Recorded over riverine forest and clearings in farmbush at Monkoto and during boat journeys along Lwilaka River to "Highland camp" and Lokofa (8 days).

26. Cassin's Spinetail (*Neafrapus cassini*)
Recorded over riverine forest and clearings in farmbush at Monkoto and during boat journeys along Lwilaka River to "Highland camp" and Lokofa (6 days). Observed slightly less frequently than Sabine's Spinetail though in the same habitats.

27. Common Swift (*Apus* apus)
Recorded infrequently (6 days) over Monkoto and "Highland camp" in flocks of up to 100 birds. Additionally, several unidentified *Apus* swifts were observed with somewhat slighter build and deeper forks.

28. Little Swift (*Apus* affinis)
Recorded infrequently (3 days) over Monkoto above village and farmbush habitats.

29. African Palm Swift (*Cypsiurus parvus*)
Recorded at Monkoto and over the Lwilaka River on the boat journey between Monkoto and "Highland camp".

30. Nkulengu Rail (*Himantornis haematopus*)
Heard duetting at dusk from swamp forest close to Lokofa camp during walk into "Lowland camp" at 18h15 on 9 December.

31. African Finfoot (*Podica senegalensis*)
Two males seen on Lwilaka River on boat journey from Monkoto to "Highland camp" on 29 November. Another male seen on the river during the boat journey to Lokofa from Monkoto on 9 December.

32. Wood Sandpiper (*Tringa glareola*)
One flew over calling early morning on the edge of Lwilaka River at the stop off camp en route from "Highland camp" and Monkoto. First record for Salonga National Park.

33. African Darter (*Anhinga rufa*)
Recorded on Lwilaka River on 3 days during boat journeys between Monkoto and "Highland camp", Monkoto to Lokofa and on the return from Lokofa to Monkoto.

34. Cattle Egret (*Bubulcus ibis*)
Recorded commonly around Monkoto and along Lwilaka River during boat journeys between Monkoto and "Highland camp" and between Monkoto and Lokofa.

35. Spot-breasted Ibis (*Bostrychia rara*)
At least two heard flying over swamp forest near "Lowland camp" pre-dawn on 11 and 12 December – presumably moving between roosting and feeding sites. Sound recorded. Not heard on the morning of 13 December despite an active attempt – possibly due to heavy rains the evening before altering their movements.

36. Hadada Ibis (*Bostrychia hagedash*)
Recorded commonly around Monkoto and flying over Lwilaka River during boat journeys between Monkoto and "Highland camp"/Lokofa. Pair feeding chick(s) in a nest in a tall tree at Monkoto Village (see breeding records).

37. African Harrier-hawk (*Polyboroides typus*)
Recorded infrequently (4 days) at Monkoto and along Lwilaka River on boat journey from Monkoto to "Highland camp". Range of age-classes from adult to sub-adult and juvenile.

38. Palm-nut Vulture (*Gypohierax angolensis*)
Recorded in Monkoto and on the boat trip along Lwilaka River between Monkoto and "Highland camp". Both adults and juveniles observed.

39. European Honey-buzzard (*Pernis apivorus*)
Adult flew over the stop off camp along Lwilaka River near GPS -2.13725, 21.11883 on 7 December and another adult over Lwilaka River during the boat journey between Monkoto and Lokofa on 9 December. First records for Salonga National Park.

40. African Cuckoo-hawk (*Aviceda cuculoides*)
One adult flew over the Lwilaka River during the boat journey between Monkoto and "Highland camp" on 29 November. Two adults flew over the Lwilaka River between Lokofa and Monkoto on 14 December.

41. Crowned Eagle (*Stephanoaetus coronatus*)
One displaying above "Lowland camp" in mid-morning on 10 and 11 December. Sound recorded.

42. Cassin's Hawk-eagle (*Aquila africana*)
One sound recorded calling from terra firma at "Highland camp" on 5 December.

43. Lizard Buzzard (*Kaupifalco monogrammicus*)
One in farmbush in Monkoto on 26 and 27 November.

44. African Goshawk (*Accipiter tachiro*)
One was sound recorded calling over terra firma forest at "Highland camp" on 2 December.

45. Long-tailed Hawk (*Urotriorchis macrourus*)
One flew over Lwilaka River with a prey item during the boat journey from Monkoto to Lokofa on 9 December.

46. Black Kite (*Milvus migrans*)
"Yellow-billed Kites" (*M. (m.) aegyptius*) observed commonly close to human habitation at Monkoto and along Lwilaka River between Monkoto, "Highland camp" and Lokofa. Absent from areas of intact forest away from humans. Active nests observed (see breeding records).

47. Vermiculated Fishing-owl (*Scotopelia bouvieri*)
Recorded infrequently (5 days) singing from swamp forest near Monkoto, "Highland camp" and "Lowland camp".

48. Red-chested Owlet (*Glaucidium tephronotum*)
One singing from terra firma near "Lowland camp" after dusk on 13 December. First record for Salonga National Park.

49. Sjostedt's Owlet (*Glaucidium sjostedti*)
Recorded daily at "Highland camp" where a single bird was singing each night from terra firma around camp (sound recorded and photographed). Three birds detected on walk into "Lowland camp" from Lokofa WWF station on 9 December and another 2 birds singing from terra firma forest near "Lowland camp" on 13 December (including one bird vocal in the afternoon).

Figure 13. Sjostedt's Owlet (*Glaucidium sjostedti*) (Photo by Michiel van Noppen)

50. African Wood-owl (*Strix woodfordii*)
Recorded commonly (17 days) from forest edge, terra firma and swamp forest at Monkoto, "Highland camp" and "Lowland camp". Singing – sound recorded and photographed.

51. Red-billed Dwarf Hornbill (*Lophoceros camurus*)
Recorded frequently (10 days) from terra firma and swamp forest in "Highland camp" and "Lowland camp". Highly vocal and often in association with mixed-species flocks. May also have been loosely associated with a mixed monkey group at "Highland camp" of Northern Black Mangabey, Wolf's and Red-tailed Monkey (which was also being followed by White-crested and Black Dwarf Hornbills).

52. African Pied Hornbill (*Lophoceros fasciatus*)
Recorded commonly (15 days) from forest edge, farmbush, terra firma, swamp and riverine forest at Monkoto, "Highland camp" and "Lowland camp".

53. White-crested Hornbill (*Horizocerus albocristatus*)
"Dark-cheeked" subspecies *cassini* recorded frequently (10 days) in farmbush, riverine forest and terra firma at Monkoto, "Highland camp" and "Lowland camp". Often in association with primate groups including one following a group of Northern Black Mangabey, Red-tailed and Wolf's Monkeys, one following a group of Tholon's Red Colobus and one following a group of De Brazza's Monkeys.

54. Black Dwarf Hornbill (*Horizocerus hartlaubi*)
Two in terra firma near "Highland camp" in association with a mixed monkey group (Northern Black Mangabey, Wolf's, and Red-tailed Monkeys) on 4 December and one seen perched in terra firma above "Highland camp" on 6 December.

55. Black-casqued Hornbill (*Ceratogymna atrata*)
Recorded commonly (17 days) from terra firma, swamp and riverine forest at Monkoto, "Highland camp" and "Lowland camp". Abundance appeared to increase away from Monkoto in areas of undisturbed forest. Highly vocal.

Figure 14. Black-casqued Hornbill (*Ceratogymna atrata*) (Photo by Gabriel Jamie)

56. White-thighed Hornbill (*Bycanistes albotibialis*)
Recorded commonly (15 days) from forest edge, terra firma, swamp forest and riverine forest at Monkoto, "Highland camp" and "Lowland camp". Highly vocal.

57. Piping Hornbill (*Bycanistes fistulator*)
Recorded frequently (11 days) from forest edge, terra firma swamp forest and riverine forest at Monkoto, "Highland camp" and between Monkoto and Lokofa. Somewhat less commonly observed than White-thighed Hornbill. Highly vocal.

58. Malachite Kingfisher (*Corythornis cristatus*)
One in flight over Lwilaka River at Monkoto on 28 November.

59. White-bellied Kingfisher (*Corythornis leucogaster*)
Recorded infrequently (6 days) from swamp forest at "Highland camp" and "Lowland camp". One caught in a mist-net in swamp forest at "Lowland camp" on 11 December.

60. Chocolate-backed Kingfisher (*Halcyon badia*)
Recorded commonly (13 days) from terra firma and swamp forest at "Highland camp", "Lowland camp" and terra firma at stop-off site on boat journey from Monkoto to "Highland camp". Singing. One of the first species to sing in dawn chorus (often pre-dawn) and one of the last at dusk.

61. Woodland Kingfisher (*Halcyon senegalensis*)
Recorded only at Monkoto (6 days) from farmbush and forest edge habitat. Singing. First record for Salonga National Park (not listed in Appendix 3 of Vande weghe & Vande weghe 2018).

62. Blue-breasted Kingfisher (*Halcyon malimbica*)
Recorded commonly (14 days) from terra firma, swamp forest and riverine forest at "Highland camp", "Lowland camp" and during river journeys from Monkoto to each of those sites. Singing.

63. Black Bee-eater (*Merops gularis*)
Two perched on vegetation at the edge of Lwilaka River during the boat journey from Monkoto to "Highland camp" on 29 November.

64. Blue-headed Bee-eater (*Merops muelleri*)
One perched silently in a treefall gap in terra firma around "Highland camp" in the mid-afternoon on 5 December.

65. Broad-billed Roller (*Eurystomus glaucurus*)
One perched in the canopy of riverine forest along Lwilaka River during the boat journey from Monkoto to Lokofa on 9 December and again on the return boat journey on 14 December.

66. Blue-throated Roller (*Eurystomus gularis*)
Seen in forest edge, swamp forest and riverine forest in Monkoto and on the boat journey between Monkoto and Lokofa.

67. Yellow-billed Barbet (*Trachyphonus purpuratus*)
Recorded infrequently (4 days) from terra firma forest at "Highland camp" and "Lowland camp". Singing.

68. Speckled Tinkerbird (*Pogoniulus* scolopaceus)
Recorded commonly (18 days) from farmbush, swamp forest and terra firma at Monkoto, "Highland camp" and "Lowland camp". Singing. One bird watched inspecting a potential nest site.

69. Red-rumped Tinkerbird (*Pogoniulus* atroflavus)
Recorded frequently (12 days) from terra firma and swamp forest in "Highland camp" and "Lowland camp". One mist-netted in swamp forest on 11 December. Singing.

70. Yellow-throated Tinkerbird (*Pogoniulus* subsulphureus)
The most commonly encountered tinkerbird. Recorded almost daily (20 days) from farmbush,

forest edge, terra firma, swamp and riverine forest at Monkoto, "Highland camp" and "Lowland camp".

71. Yellow-rumped Tinkerbird (*Pogoniulus* bilineatus)
Recorded infrequently (10 days) from farmbush and swamp forest at Monkoto, "Highland camp" and "Lowland camp". The least commonly recorded tinkerbird.

72. Yellow-spotted Barbet (*Buccanodon duchaillui*)
Recorded infrequently (7 days) in swamp and terra firma forest at "Highland camp" and "Lowland camp".

73. Hairy-breasted Barbet (*Tricholaema hirsuta*)
Recorded frequently (13 days) in swamp and terra firma forest at "Highland camp" and "Lowland camp".

74. Spotted Honeyguide (*Indicator maculatus*)
Two birds loosely associated with mixed species flock in terra firma at "Highland camp" on 3 December. Photographed. The two birds were observed chasing one another. A bird was then heard to sing from the same area on 4 December.

Figure 15. Spotted Honeyguide (*Indicator maculatus*) (Photo by Gabriel Jamie)

75. Brown-eared Woodpecker (*Campethera caroli*)
One in a mixed species flock in terra firma at "Highland camp" on 4 and 5 December. Two in a mixed species flock in terra firma at "Lowland camp" on 11 December.

76. Buff-spotted Woodpecker (*Campethera nivosa*)
Recorded infrequently (4 days) at "Highland camp" and "Lowland camp". Always with mixed species flocks in terra firma forest.

77. Black-collared Lovebird (*Agapornis swindernianus*)
Flock of at least 14 birds in 1-2 small groups in farmbush on the edge of swamp forest at Monkoto on 28 November and a small flock of 8 over Monkoto on 9 December. A flock of around 5 birds flew over terra firma forest near "Highland camp" on the morning of 11 December.

78. Grey Parrot (*Psittacus erithacus*)
Recorded frequently (12 days) over farmbush, swamp, terra firma and riverine forest at Monkoto, "Highland camp", Lokofa and "Lowland camp". Particularly commonly observed along Lwilaka River in flight and roosting in palm trees on the river's banks.

79. Rufous-sided Broadbill (*Smithornis rufolateralis*)
Recorded infrequently (9 days) displaying in terra firma forest at "Highland camp" and "Lowland camp".

80. Western Black-headed Oriole (*Oriolus brachyrynchus*)
Recorded frequently (11 days) singing in swamp and terra firma forest at "Highland camp" and "Lowland camp".

81. Chestnut Wattle-eye (*Platysteira castanea*)
Recorded infrequently (5 days) in terra firma at "Highland camp" and "Lowland camp". Often associated with mixed species flock including in a flock that also contained White-spotted Wattle-eye. Singing. One male caught in mistnet at "Highland camp".

82. White-spotted Wattle-eye (*Platysteira tonsa*)
One male in a mixed species flock in terra firma forest at "Lowland camp" on 11 December. Same flock also contained Chestnut Wattle-eye.

83. African Shrike-flycatcher (*Megabyas flammulatus*)
Male seen with mixed species flock in trees above a small stream during the walk out from "Highland camp" on 7 December.

84. Black-and-white Shrike-flycatcher (Vanga Flycatcher) (*Bias musicus*)
Male seen displaying at WWF Monkoto from farmbush habitat on 27 and 29 November and a pair was seen in the same area on 9 December.

85. Lowland Sooty Boubou (*Laniarius leucorhynchus*)
Singing from the edge of swamp forest at Monkoto on 28 November.

86. Shining Drongo (*Dicrurus atripennis*)
Two singing alongside mixed species flock in terra firma forest at "Highland camp" on 4 December and two in association with a group of birds following a mixed primate group (Northern Black Mangabey, Wolf's and Red-tailed Monkeys) on 5 December. This species seemed to be present in intact terra firma forest while Velvet-mantled Drongo occurred in disturbed farmbush habitat.

87. Velvet-mantled Drongo (*Dicrurus modestus*)
Seen commonly in degraded farmbush habitat at Monkoto (8 days) but not detected at any other sites surveyed with more intact forest.

88. Black-headed Paradise-flycatcher (*Terpsiphone rufiventer*)
Recorded frequently (11 days) in terra firma forest at "Highland camp", "Lowland camp" and Lokofa. Often in association with mixed species flocks. Singing.

89. Bates's Paradise-flycatcher (*Terpsiphone batesi*)
Recorded infrequently (5 days) in terra firma and swamp forest around "Lowland camp". Often with mixed species flocks. One individual caught in mistnet in terra firma on 11 December. Singing.

90. African Paradise-flycatcher (*Terpsiphone viridis*)
Recorded in farmbush habitat from Monkoto. One seen well on 26 November was an intermediate morph with dark body, and rufous mantle (large white wing patch). Singing.

91. Pied Crow (*Corvus albus*)
Recorded commonly at Monkoto around human habitation but not detected at other surveyed sites in more undisturbed habitats.

92. Western Nicator (*Nicator chloris*)
Recorded commonly (19 days) from farmbush, terra firma and swamp forest at Monkoto, "Highland camp", Lokofa base and "Lowland camp". Often in treefall gaps or areas with dense vine tangles. Singing.

93. Green Crombec (*Sylvietta virens*)
Recorded in forest edge at Monkoto on 28 November and in riverine forest on boat journey from Monkoto to "Highland camp" on 29 November. Singing.

94. Grey Longbill (*Macrosphenus concolor*)
Recorded infrequently (9 days) from farmbush and terra firma forest at Monkoto, "Highland camp" and "Lowland camp". Singing. Sometimes in association with mixed species flock. Singing.

95. Green Hylia (*Hylia prasina*)
Recorded commonly (17 days) from farmbush, swamp forest and terra firma forest at Monkoto, "Highland camp" and "Lowland camp".

96. Green-backed (Grey-backed) Camaroptera (*Camaroptera brachyura*)
Recorded frequently (11 days) in farmbush habitat at Monkoto and the stop-off camp between Monkoto and "Highland camp". Seemingly absent from areas of more pristine forest. Singing.

97. Buff-throated Apalis (*Apalis rufogularis*)
Recorded frequently (13 days) from canopy and sub-canopy of terra firma forest at "Highland camp" and "Lowland camp". Seems to be ecologically segregated from Gosling's Apalis with the latter occurring exclusively in riverine forest. Singing.

98. Gosling's Apalis (*Apalis goslingi*)
Commonly recorded from canopy and sub-canopy vegetation along the banks of Lwilaka River. Seemingly absent from forest (both swamp and terra firma) away from the main river. Singing.

99. Tawny-flanked Prinia (*Prinia subflava*)
One singing from farmbush in Monkoto village on 27 November.

100. Chattering Cisticola (*Cisticola anonymus*)
Common in farmbush habitat and clearings in Monkoto. Three birds mist-netted on 27 November.

Figure 16. Chattering Cisticola (*Cisticola anonymus*) (Photo by Gabriel Jamie)

101. Banded Martin (*Neophedina cincta*)
One bird flew over WWF base in the mid-afternoon at Monkoto on 14 December being mobbed by White-throated Blue Swallows. Possibly an intra-African migrant on passage.

102. Barn Swallow (*Hirundo rustica*)
Four birds hawking insects in farmbush at Monkoto on 27 November and five flying over Monkoto ahead of a rain front on 14 December.

103. White-throated Blue Swallow (*Hirundo nigrita*)
Common along Lwilaka River and sometimes seen foraging up to a few hundred metres away from the river in Monkoto.

104. Slender-billed Greenbul (*Stelgidillas gracilirostris*)
Recorded infrequently (6 days) in swamp and terra firma forest at "Highland camp" and "Lowland camp".

105. Red-tailed Bristlebill (*Bleda syndactylus*)
Recorded frequently (13 days) in terra firma forest at "Highland camp" and "Lowland camp". Several birds mist-netted on 2 and 4 December including a recently fledged juvenile. Occasionally seen moving with understory mixed species flock.

106. Honeyguide Greenbul (*Baeopogon indicator*)
One bird heard calling from terra firma forest near "Lowland camp" on 10 and 12 December. Sound recorded.

107. Sjöstedt's Greenbul (*Baeopogon clamans*)
Recorded infrequently (6 days) from swamp and terra firma forest at "Highland camp" and "Lowland camp". Sound recorded.

108. Spotted Greenbul (*Ixonotus guttatus*)
Recorded frequently (12 days) always moving noisily in single species flocks (c.5–15 individuals) from farmbush, terra firma and swamp forest in Monkoto, "Highland camp" and "Lowland camp".

109. Swamp Palm Bulbul (*Thescelocichla leucopleura*)
Recorded infrequently (4 days) from riverine forest and farmbush at Monkoto.

110. Red-tailed Greenbul (*Criniger calurus*)
Recorded infrequently (6 days) from terra firma forest at "Highland camp" and "Lowland camp". A prominent member of mixed species flocks. Identification complicated by possibility of White-bearded Greenbul (*Criniger ndussumensis*) but identification of Red-tailed confirmed by strident calls that match those on the Chappuis recording set (sound recorded). Red-tailed Greenbul not listed in Vande weghe & Vande weghe 2018 though the species is common and has been recorded on the eBird Salonga National Park IBA hotspot.

111. (Little) Grey Greenbul (*Eurillas gracilis*)
Recorded infrequently (6 days) in terra firma forest at "Highland camp" and "Lowland camp", sometimes in association with mixed species flocks.

112. Ansorge's Greenbul (*Eurillas ansorgei*)
Two birds singing in terra firma forest at "Highland camp" on 2 December.

113. Plain Greenbul (*Eurillas curvirostris*)
Recorded infrequently (4 days) in farmbush at Monkoto and terra firma forest at "Lowland camp". Sometimes in association with mixed species flocks.

114. Yellow-whiskered Greenbul (*Eurillas latirostris*)
Recorded frequently (11 days) in farmbush, swamp forest and terra firma at Monkoto, "Highland camp" and "Lowland camp".

115. Little Greenbul (*Eurillas virens*)
One bird singing from farmbush habitat in Monkoto on 26 November and two birds in the same area on 27 November. Not recorded from more pristine forest areas in "Highland camp" and "Lowland camp".

116. Icterine Greenbul (*Phyllastrephus icterinus*)
Recorded frequently (13 days) in terra firma and swamp forest at "Highland camp" and "Lowland camp". A very vocal and common member of mixed species flocks sometimes together in the same flocks as Xavier's Greenbul.

117. Xavier's Greenbul (*Phyllastrephus xavieri*)
Recorded frequently (10 days) in terra firma forest at "Highland camp" and "Lowland camp". Usually in small groups and often in mixed species flocks that also contained Icterine Greenbul. Not listed as occurring in Salonga National Park in Appendix 3 of Vande weghe & Vande weghe (2018) but expected from the area.

118. Common Bulbul (*Pycnonotus barbatus*)
"Dark-capped Bulbul" (ssp. tricolor) recorded commonly from farm bush at Monkoto but not detected at other sites with more pristine forest.

119. Chestnut-capped Flycatcher (*Erythrocercus mccallii*)
Three birds watched foraging and heard singing in Maranthacea dominated terra firma forest near "Lowland camp" on 6 December.

120. Brown Illadopsis (*Illadopsis fulvescens*)
Recorded infrequently (5 days) singing from terra firma forest at "Highland camp" and "Lowland camp".

121. Scaly-breasted Illadopsis (*Illadopsis albipectus*)
Recorded frequently (11 days) singing from terra firma and swamp forest at "Highland camp" and "Lowland camp".

122. Purple-headed Starling (*Hylopsar purpureiceps*)
Recorded infrequently (5 days) in farmbush and flying over Lwilaka River at Monkoto and during boat journeys to "Highland camp" and Lokofa. Three seen feeding in a fruiting tree at Monkoto on 28 November.

123. Splendid Glossy Starling (*Lamprotornis splendidus*)
Two in farmbush at the edge of Monkoto Village on 28 November.

124. Rufous Flycatcher-thrush (*Stizorhina fraseri*)
Recorded commonly (14 days) in terra firma and swamp forest at "Highland camp" and "Lowland camp".

125. Red-tailed Ant-thrush (*Neocossyphus rufus*)
Caught in a mistnet in terra firma forest at "Highland camp" on 2 December.

126. White-tailed Ant-thrush (*Neocossyphus poensis*)
Caught in a mistnet in terra firma forest at "Highland camp" on 2 December in the same area as Red-tailed Ant-thrush. Also, two birds associated with driver ant swarm in terra firma at "Highland camp" on 3 December and another seen in understory of terra firma at "Highland camp" on 6 December.

127. Cassin's Flycatcher (*Muscicapa cassini*)
Seen frequently in vegetation overhanging the Lwilaka River from Monkoto and during boat trips to "Highland camp" and Lokofa.

128. African Forest-flycatcher (*Fraseria ocreata*)
Four birds in sub-canopy of terra firma forest at "Lowland camp" on 10 December. Photographed and sound recorded.

129. Grey-throated Tit-flycatcher (*Fraseria griseigularis*)
One singing during dawn chorus recordings in terra firma at "Highland camp" on 2 December. Not listed as occurring in Salonga National Park in Appendix 3 of Vande weghe & Vande weghe (2018) but expected from the area.

130. Fire-crested Alethe (*Alethe castanea*)
Recorded commonly (14 days) in terra firma forest at "Highland camp" and "Lowland camp". An adult and recently fledged juvenile captured in mistnet in terra firma at "Highland camp" on 2 December, with a further two adults caught on 5 December. Two birds observed following an ant swarm on 7 December during the walk out from "Highland camp".

131. Yellow-breasted Forest Robin (*Stiphrornis mabirae*)
Recorded infrequently (9 days) from terra firma forest at "Highland camp" and "Lowland camp". Singing. One bird captured in mistnet in terra firma forest at "Highland camp" on 3 December.

132. Grey-headed Sunbird (*Deleornis axillaris*)
Recorded frequently (10 days) from terra firma forest at "Highland camp" and "Lowland camp". Singing. Often in association with mixed species flocks.

133. Violet-tailed Sunbird (*Anthreptes aurantius*)
Recorded frequently in vegetation along banks of Lwilaka River during boat journeys between Monkoto and "Highland camp" and Lokofa.

134. Little Green Sunbird (*Anthreptes seimundi*)
Recorded infrequently (5 days) in farmbush and terra firma habitat at Monkoto and "Lowland camp". Identification versus Bates's Sunbird is still problematic. Sometimes in association with mixed species flocks. One bird watched gathering nesting material on 10 December.

135. Green Sunbird (*Anthreptes rectirostris*)
One photographed in riverine forest along banks of Lwilaka River at Monkoto on 26 November.

136. Collared Sunbird (*Hedydipna collaris*)
Recorded infrequently (5 days) from farmbush at Monkoto, in vine tangles in terra firma near "Highland camp" and around WWF Lokofa base station.

137. Reichenbach's Sunbird (*Anabathmis reichenbachii*)
Birds in farmbush/edge of swamp forest at Monkoto on 26, 27 and 28 November. Singing.

138. Blue-throated Brown Sunbird (*Cyanomitra cyanolaema*)
Recorded commonly (17 days) from farmbush, swamp, riverine and terra firma forest at Monkoto, "Highland camp", Lokofa and "Lowland camp".

139. Olive Sunbird (*Cyanomitra olivacea*)
Recorded commonly (20 days) from farmbush, swamp, riverine and terra firma forest at Monkoto, "Highland camp" and "Lowland camp".

140. Green-throated Sunbird (*Chalcomitra rubescens*)
Recorded in farmbush and riverine forest at Monkoto (3 days)

141. Olive-bellied Sunbird (*Cinnyris chloropygius*)
Recorded in farmbush and forest edge habitat at Monkoto, and stop off camp between Monkoto and "Highland camp".

142. Johanna's Sunbird (*Cinnyris johannae*)
Two females and a male seen in forest edge at lunch camp en route to WWF Monkoto from "Highland camp" on 8 December. Streaky females were seen especially well, 'robbing' prey from spider's web (or caterpillars?). Three birds were then seen at WWF Lokofa base on 14 December.

143. Superb Sunbird (*Cinnyris superbus*)
Recorded infrequently (8 days) from farmbush at Monkoto. Singing.

144. Black-throated (Cassin's) Malimbe (*Malimbus cassini*)
Recorded infrequently (5 days) from edge of swamp forest and farmbush at Monkoto. Singing.

145. Blue-billed Malimbe (*Malimbus nitens*)
Male was caught and brought to us by a child in Monkoto village on 27 November.

146. Crested Malimbe (*Malimbus malimbicus*)
One with mixed species flock in terra firma near "Highland camp" on 3 December and 2 with mixed species flock in terra firma near "Highland camp" on 4 December.

147. Black-necked Weaver (*Ploceus nigricollis*)
A male in farmbush at Monkoto on 27 November

148. Viellot's Black Weaver (*Ploceus nigerrimus*)
One in farmbush in Monkoto village on 28 November

149. Village Weaver (*Ploceus cucullatus*)
Birds seen in Monkoto Village on three days (26, 27 and 28 November) including birds at active nests.

150. Magpie Mannikin (*Spermestes fringilloides*)
Birds seen commonly in farmbush around Monkoto WWF base and village.

151. Black-and-white Mannikin (*Spermestes bicolor*)
Birds seen infrequently in farmbush around Monkoto WWF base and village. Less common than Magpie Mannikin in this area.

152. White-breasted Nigrita (*Nigrita fusconotus*)
Recorded infrequently (9 days) in forest edge, farmbush, and swamp forest at Monkoto, "Highland camp", Lokofa and "Lowland camp". Occasionally associating with mixed species flock. Singing.

153. Chestnut-breasted Nigrita (*Nigrita bicolor*)
One seen in farmbush around Monkoto on 27 November and another caught in mistnet in terra firma forest at "Highland camp" on 3 December.

154. Grey-headed Nigrita (*Nigrita canicapillus*)
Recorded frequently (13 days) from farmbush, swamp and terra firma forest at Monkoto, "Highland camp" and "Lowland camp".

155. Pale-fronted Nigrita (*Nigrita luteifrons*)
One at WWF Lokofa base in a tall fruiting tree on 14 December. Not listed as occurring in Salonga National Park in Appendix 3 of Vande weghe & Vande weghe (2018) but expected from the area.

156. Orange-cheeked Waxbill (*Estrilda melpoda*)
Recorded commonly in farmbush habitat at Monkoto Village but absent from areas of more pristine forest.

157. Western Bluebill (*Spermophaga haematina*)
Recorded commonly in farmbush habitat at Monkoto Village but absent from areas of more pristine forest.

158. Grant's/Red-headed Bluebill (*Spermophaga poliogenys/ruficapilla*)
One male observed in the understory of a treefall gap on slope down towards a small river at "Highland camp" on 5 December. Views too brief to distinguish Grant's from Red-headed.

159. Northern Grey-headed Sparrow (*Passer griseus*)
Recorded frequently in Monkoto village.

160. African Pied Wagtail (*Motacilla aguimp*)
One flew over WWF Monkoto calling in the afternoon on 14 December.

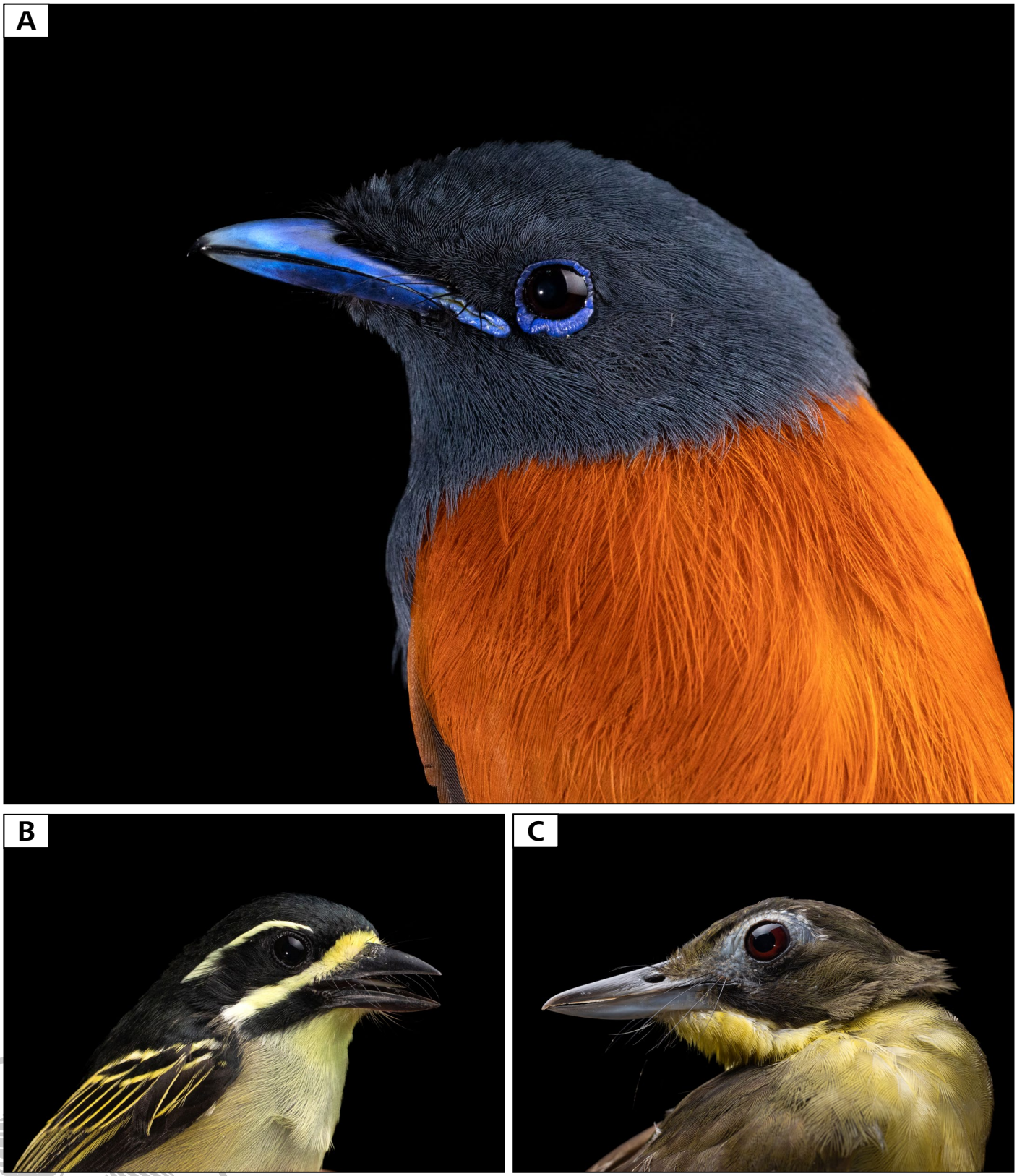

Figure 17. A selection of the bird diversity of Salonga NP. **A.** Bates's Paradise Flycatcher (*Terpsiphone batesi*), **B.** Yellow-throated Tinkerbird (*Pogoniulus subsulphureus*), **C.** Red-tailed Bristlebill (*Bleda syndactylus*). (Photos by Michiel van Noppen)

2.1.6 Phenology

Due to the poorly known status of phenology among much of the world's tropical avifauna (not least in the Afrotropics) we made specific efforts to document both breeding, and moult phenology of species encountered.

Table 2. Breeding records of birds either on active nests, or of recently fledged birds observed in the field or captured in mist-nets.

Species	Date	Observation
Black Kite *Milvus migrans*	25/11/2022	Bird on active nest in large tree at WWF base in Monkoto. Large prey item observed (looked like a chick of a chicken) but no young seen. Nest remained active until at least 28th Nov
Hadada Ibis *Bostrychia hagedash*	26/11/2022	Well developed juvenile in active nest in Monkoto village, remained active until at least 27th Nov
White-throated Blue Swallow *Hirundo nigrita*	29/11/2022	Numerous relatively recently fledged juveniles seen alongside adults on boat journey transition towards "Highland camp"
Red-tailed Bristlebill *Bleda syndactylus*	02/12/2022	Recently fledged juvenile captured during mist-netting (initiating post juvenile moult)
Fire-crested Alethe *Alethe castanea*	02/12/2022	Recently fledged juvenile captured during mist-netting (not yet initiated post juvenile moult)
Icterine Greenbul *Phyllastrephus icterinus*	02/12/2022	Presumed female with an early stage brood patch (not yet incubating) captured during MN
Yellow-throated Tinkerbird *Pogoniulus subsulphureus*	05/12/2022	Individual with what looked like a developing brood patch captured in mist-nets
Black Kite *Milvus migrans*	08/12/2022	Active nest beside river during boat journey transitioning back to Monkoto from "Highland camp"
Little Green Sunbird *Anthreptes seimundi*	10/12/2022	Pair observed gathering nesting material in treefall gap in "Lowland camp"
Fire-crested Alethe *Alethe castanea*	10/12/2022	Recently fledged juvenile bird observed in the field with an adult
Black-headed Paradise Flycatcher *Terisphone rufiventer*	11/12/2022	Recently fledged juvenile captured during mist-netting
Black-headed Paradise Flycatcher *Terisphone rufiventer*	14/12/2022	Recently fledged juvenile observed in mixed species flock at Lokofa camp while exiting from "Lowland camp"
Magpie Mannikin *Spermestes fringilloides*	15/12/2022	Pair observed nest building in large tree above WWF base in Monkoto

Table 3. Records of birds observed in moult either in the field or captured birds. Only species that have been observed in symmetric moult are documented here to avoid conflation of genuine phenology with opportunistic replacement of random feathers.

Species	Date	Observation
Black Kite *Milvus migrans*	26/11/2022	In a late stage of symmetric primary and retrix moult
Chattering Cisticola *Cisticola anonymus*	27/11/2022	Two (of three captured) were in symmetric primary moult
Black-throated Malimbe *Malimbus cassini*	27/11/2022	Male bird observed was in symmetric primary moult
Icterine Greenbul *Phyllastrephus icterinus*	02/12/2022	One in symmetric primary moult captured during mist-netting
White-tailed Ant-Thrush *Neocossyphus poensis*	02/12/2022	One in symmetric primary moult captured during mist-netting
Red-tailed Bristlebill *Bleda syndactylus*	04/12/2022	One in symmetric primary moult captured during mist-netting
Yellow-whiskered Greenbul *Eurillas latirostris*	04/12/2022	One exhibiting a strange pattern of secondary moult during mist-netting
Western Black-headed Oriole *Oriolus brachyrynchus*	03/12/2022	One observed in symmetric retrix moult (unable to ascertain if the birds were also in primary moult)
Shining Drongo *Dicrurus atripennis*	04/12/2022	Two birds observed in symmetric retrix moult (unable to ascertain if the birds were also in primary moult)
Fire-crested Alethe *Alethe castanea*	05/12/2022	One in symmetric primary moult captured during MN. Early stage - presumably initiating its post-breeding moult

2.1.7 Mist-netting

We deployed mist-nets for a total of 6 sessions on 6 different dates for a total of 163.35 net hours, comprising 4 sessions (94.15 net hours) at "Highland camp" and 2 sessions (59.20 net hours) at "Lowland camp". We captured a total of 36 individual birds during these sessions (27 "Highland camp"/ 9 "Lowland camp"). Capture rates were marginally higher at "Highland camp" (0.27 birds per net hour) than "Lowland camp" (0.15 birds per net hour). Almost all captured birds were blood and feather sampled (see Survey methodologies (p. 21), and **Table 4**). In **Table 5** present basic morphometrics from all captured birds, although further notes, moult scores, photos, and information on each session and on each capture are available on request. Cloacal protuberances (CP) were scored from 0-3 as per scores used by the British Trust for Ornithology (BTO), where 0= not present and 3=strongly enlarged/bulbous. Brood patches (BP) were also scored via BTO recommendations where 0=not present, 1=losing feathers on the breast, 2=significant feather lost on breast, but skin defined, 3=skin vascularised and engorged, 4=skin with thin wrinkles and stretches but losing swelling and 5=feathering over. Body moult was scored between 0-4, where 0=none, 1=trace (<5%), 2=light (5-20%), 3=medium (20-60%), 4=heavy (60+%). Flight feather moult was scored as N=None, A=Advantageous (typically replacing a dropped feather/not symmetrical) and S=symmetrical, and scored by BTO standard procedure.

Table 4. List of blood (B) and feather (F) samples collected from birds during the fieldwork. LC = Lowland camp, HC = Highland camp, The codes in "ID n°" correspond with the number on the bird band.

English name	Scientific name	Date	Location	ID n°	B	F
Fire-crested Alethe	*Alethe castanea*	13/12/2022	LC	FC49604	x	x
Xavier's Greenbul	*Phyllastrephus xavieri*	13/12/2022	LC	FC49605	x	x
Fire-crested Alethe	*Alethe castanea*	13/12/2022	LC	FC49606	x	x
Olive Sunbird	*Cyanomitra olivacea*	11/12/2022	LC	N30213	x	x
Black-headed Paradise-flycatcher	*Terpsiphone rufiventer*	11/12/2022	LC	AS79024	x	x
White-bellied Kingfisher	*Corythornis leucogaster*	11/12/2022	LC	Unbanded	x	x
Bates's Paradise-flycatcher	*Terpsiphone batesi*	11/12/2022	LC	AR53099	x	x
Chestnut-breasted Nigrita	*Nigrita bicolor*	03/12/2022	HC	AS78811	x	x
Yellow-breasted Forest Robin	*Stiphrornis mabirae*	03/12/2022	HC	AR53097	x	x
Xavier's Greenbul	*Phyllastrephus xavieri*	02/12/2022	HC	AR53094	x	x
Red-tailed Bristlebill	*Bleda syndactylus*	02/12/2022	HC	FC49405	x	x
Fire-crested Alethe	*Alethe castanea*	02/12/2022	HC	FC49406	x	x
Red-tailed Bristlebill	*Bleda syndactylus*	02/12/2022	HC	FC49407	x	x
Icterine Greenbul	*Phyllastrephus icterinus*	02/12/2022	HC	AR53096	x	x
Icterine Greenbul	*Phyllastrephus icterinus*	02/12/2022	HC	AR53095	x	x
Fire-crested Alethe	*Alethe castanea*	02/12/2022	HC	FC49507	x	x
White-tailed Ant-thrush	*Neocossyphus poensis*	02/12/2022	HC	FC49508	x	x
Red-tailed Ant-thrush	*Neocossyphus rufus*	02/12/2022	HC	BE35801	x	x
Chestnut Wattle-eye	*Platysteira castanea*	04/12/2022	HC	AR53098	x	x
Olive Sunbird	*Cyanomitra olivacea*	04/12/2022	HC	N30009	x	x
Olive Sunbird	*Cyanomitra olivacea*	04/12/2022	HC	N30010	x	x
Yellow-whiskered Greenbul	*Eurillas latirostris*	04/12/2022	HC	AS79023	x	x
Red-tailed Bristlebill	*Bleda syndactylus*	04/12/2022	HC	FC49409	x	x
Olive Sunbird	*Cyanomitra olivacea*	05/12/2022	HC	N30211	x	x
Fire-crested Alethe	*Alethe castanea*	05/12/2022	HC	FC49410	x	x
Fire-crested Alethe	*Alethe castanea*	05/12/2022	HC	FC49411	x	x
Yellow-throated Tinkerbird	*Pogoniulus subulphureus*	05/12/2011	HC	N30212	x	x
Yellow-whiskered Greenbul	*Eurillas latirostris*	04/12/2022	HC	AS78812	x	x
Xavier's Greenbul	*Phyllastrephus xavieri*	04/12/2022	HC	FC49408	x	x
Olive Sunbird	*Cyanomitra olivacea*	03/12/2022	HC	N30007	x	x
Olive Sunbird	*Cyanomitra olivacea*	03/12/2022	HC	N30008	x	x
Chattering Cisticola	*Cisticola anonymus*	27/11/2022	Monkoto	AS78809	x	
Chattering Cisticola	*Cisticola anonymus*	27/11/2022	Monkoto	AS78810	x	
Chattering Cisticola	*Cisticola anonymus*	27/11/2022	Monkoto	AS79022	x	

Table 5. Morphometric data from all captures during the expedition. All measurements in mm. CP = Cloacal protuberance, BP = Brood patch, FF moult = Flight feather moult, KD = Kipps distance, B = Blood sample, F = Feather sample, LC = Lowland camp, HC = Highland camp

Date	Site	Species	Band no.	Age	Sex	CP	BP	Body moult	FF moult	Max tarsus	Min tarsus	Wing	Tail	Mass (g)	Bill width	Bill depth	Bill-Nares	Bill-Skull	KD	B	F	P	Wing formula
2-Dec-22	LC	*Phyllastrephus xavieri*	AR53094	UPU	M?	2/3	0	1	S	23.7	20.7	87	80	28.3	4.9	4.8	12.4	21.2	12.5	Y	Y	Y	Em: P3-P7, 2<P10, Wing tip: 5-6
2-Dec-22	LC	*Bleda syndactylus*	FC49405	FPF	U	0	0	4	N	28.6	24.7	95		41.2	5.7	5.7	10.9	21	12.7	Y	Y	Y	Em: P3-P5, P2<P10, Wing tip: P5-P6
2-Dec-22	LC	*Alethe castanea*	FC49406	DCB?	M?	2	0	0	N	27.7	24	95	74	33.9	5.2	5.4	11.2	19.9	16.9	Y	Y	Y	Em: P3-P7, P2=P10, Wing tip: P5
2-Dec-22	LC	*Bleda syndactylus*	FC49407	DCB?	U	0	0	1	A	30.2	25.7	108	97	43.9	5.3	7.2	16.8	26.8	15.6	Y	Y	Y	Em: P7-P4, P2=P10, Wing tip: P5/6
2-Dec-22	LC	*Phyllastrephus icterinus*	AR53095	UCU	U	0	0	1	A	21.6	18.4	76	70	18.6	4.3	4.2	10.1	16.3	8.3	Y	Y	Y	Em: P2-P7, P2<P10, Wing tip= P4/5/6
2-Dec-22	LC	*Phyllastrephus icterinus*	AR53096	UCU	F	0	1	0	N	20.7	17.8	71	63	16.2	4.8	4	10	17.5	12.2	Y	Y	Y	Em: 3-6, P2<P10, Wing tip: P5/6
2-Dec-22	LC	*Alethe castanea*	FC49507	FCJ	U	0	0	0	N	29.9	26.2	88	67	32.1	4.6	4.9	11	17.7	15.5	Y	Y	Y	Em: 3-7, P2=P10, Wing tip: P5/6
2-Dec-22	LC	*Neocossyphus poensis*	FC49508	UPU	U	0	0	2	S	32.1	28	110	91	49.4	5.4	5.2	10.6	21	22.4	Y	Y	Y	Em: 3-7 (P8 growing), P2=P7/8, Wing tip: P4
2-Dec-22	LC	*Neocossyphus rufus*	BE35801	UCU	U	1	0	0	N	31.6	26.7	116	97	58.6	6.7	5.4	11.7	19.7	21	Y	Y	Y	Em: P3-P6, P2=P7, Wing tip: P4/5
3-Dec-22	LC	*Cyanomitra olivacea*	-	-																N	N	N	
3-Dec-22	LC	*Stiphrornis mabirae*	AR53097	DCB?	U	0	0	0	N	27.4	24.5	65	36	17.8	3.8	3.3	9	14.5	6.1	Y	Y	Y	Em: P3-P7, P2<P10, Wing tip: P5/P6
3-Dec-22	LC	*Cyanomitra olivacea*	N30007	DCB?	F	0	5	1	N	15.7	13.6	55	38	8.4	3.9	3	17.7	22.7	9.4	Y	Y	Y	Em: P3-P6, P2=P10, Wing tip: P4/5/6
3-Dec-22	LC	*Cyanomitra olivacea*	N30008	DCB?	M	1	0	0	N	19.3	16.3	67	54	11.9	4.7	3.5	18.2	26.4	10.9	Y	Y	Y	Em: P3-P6, P2=P9/P10, Wing tip: P4/5/6
3-Dec-22	LC	*Nigrita bicolor*	AS78811	FCF	U	0	0	0	N	16.2	14	61	45	12.1	4.9	4.7	7.6	12.9	12.5	Y	Y	Y	Em:P3-P6, P2=P6/7, Wing tip: P3/4
3-Dec-22	LC	*Cyanomitra olivacea*	-																	N	N	N	
4-Dec-22	LC	*Platysteira castanea*	AR53098	DCB?	M	0	0	4	A	18.2	15.7	61	28	14.4	5	3.9	9.1	16.9	5.9	Y	Y	Y	Em: P3-P8, P2<P10, Wing tip: P4/5/6
4-Dec-22	LC	*Cyanomitra olivacea*	N30009	DCB?	F	0	0	0	N	16.9	14.7	57	41	9.6	4.3	3.4	17.9	23	7.9	Y	N	Y	Em: P3-P6, P2=P10, Wing tip: P4/5/6
4-Dec-22	LC	*Cyanomitra olivacea*	N30010	DCB?	M	0	0	0	N	17.7	15.7	63	45	11.17	3.7	3.4	18.1	26.7	11	Y	Y	Y	Em: P3-P6, P2=P9/P10, Wing tip: P4/5/6
4-Dec-22	LC	*Eurillas latirostris*	AS78812	FCJ		0	0	0	N	22.3	19.3	77	68	21.4	4.8	4.1	8.3	15.3	12.5	Y	N	N	Em: P3-P7, P2<P10, Wing tip: P5/P6
4-Dec-22	LC	*Phyllastrephus xavieri*	FC49408	FCJ		0	0	0	N	23.3	20.4	86	77	30	4.8	4.9	12.4	20	15.1	Y	Y	Y	Em: P3-P7, P2<P10, Wing tip: P4/P5/P6
4-Dec-22	LC	*Eurillas latirostris*	AS79023	FCJ		0	0	0	S	21.8	19.2	78	72	22.5	4.5	4.9	8.5	13.8	19.2	Y	Y	Y	Em: P3-P7, P2<P10, Wing tip: P5/P6
4-Dec-22	LC	*Bleda syndactylus*	FC49409	UPU	U	0	0	4	S	29.2	25.3	105	93	44	4.9	7	15.7	24.6		Y	Y	Y	Em: P3-P7, P2<P10, Wing tip: NA (in moult)
4-Dec-22	LC	*Cyanomitra olivacea*	-																	N	N	N	
5-Dec-22	LC	*Cyanomitra olivacea*	N30211	DCB?	M	3	0	0	N	18.2	16.1	64	51	11.9	4.7	3.4	19.8	25.5	10.5	Y	Y	Y	Em: P3-P6, P2=P9/P10, Wing tip: P5/P6
5-Dec-22	LC	*Alethe castanea*	FC49410	UPU		0	0	2	S	28.7	24.8	94	74	30.2	4.5	5.1	11.4	18.6	15.1	Y	Y	Y	Em: P3-P7, P2=NA(moult), Wing tip: P4/5/6
5-Dec-22	LC	*Pogoniulus subsulphureus*	N30212	UCU	F	0	5	0	N	15.3	13.2	49	21	9.3	4.8	4.7	9	11.3	6.6	Y	Y	Y	Em: P3-P6, P2<P10, Wing tip: P5/P6
5-Dec-22	LC	*Alethe castanea*	FC49411	UCU		0	?	0	N	27.3	23.9	88	70	28.7	4.7	5.2	11.3	21.2	23.9	Y	Y	Y	Em: P3-P7, P2<P10, Wing tip: P5/6
11-Dec-22	HC	*Corythornis leucogaster*	-	DCB?		0	0	0	N	9.7	8.6	54	23	12.4	5.5	6.3	23.7	30.9	13.8	Y	Y	Y	Em: P2-4, P=P5, Wing tip: P4
11-Dec-22	HC	*Terpsiphone batesi*	AR53099	DCB?	M	0	0	0	N	17.1	14.9	80	115	15.4	6.2	4.7	10.5	15.9	13.3	Y	Y	Y	Em: P2-P6, P2=P10, Wing tip: P5
11-Dec-22	HC	*Pogoniulus atroflavus*	AS78813	DCB?		0	0	0	N	18.7	16.2	60	29	17.2	6.1	5.8	9.5	13.1	16.2	Y	Y	Y	Em: P3-P6, P2=P10, Wing tip: P4/5/6
11-Dec-22	HC	*Cyanomitra olivacea*	-																	N	N	N	
11-Dec-22	HC	*Cyanomitra olivacea*	N30213	UUU	U	0	0	0	N	17.2	15.4	59	43	9.2	4.1	3.1	17.3	23.7	9.3	Y	Y	Y	Em: P3-P7, P2=P9/10, Wing tip: P4/5
11-Dec-22	HC	*Terpsiphone rufiventer*	AS79024	FCJ		0	0	0	N	17.5	14.7	72	72	15.6	6.5	4.5	12.1	20.1	13.6	Y	Y	Y	Em: P3-P6, P2=P9/10, Wing tip: P4/5
13-Dec-22	HC	*Alethe castanea*	FC49604	DCB?		0	0	0	N	29.2	25.8	95	69	31.5	5.1	5.1	11.5	21.3	20.5	Y	Y	Y	Em: P3-P7, P2=P10, Wing tip: P5
13-Dec-22	HC	*Phyllastrephus xavieri*	FC49605	FCF		0	0	0	N	24.1	20.4	84	81	26.6	4.9	4.6	12.3	21	11.2	Y	Y	Y	Em: P2-P5, Pe<P10, Wing tip: P5/6
13-Dec-22	HC	*Alethe castanea*	FC49606	DCB?		0	0	0	N	27.1	23.5	91	71	29.4	4.5	5.2	10.7	20.5	18.6	Y	Y	Y	Em: P3-P7, P2=P10, Wing tip: P4/P5

2.1.8 Conclusion and further work

We recorded 160 species during the study period including 9 new species for Salonga National Park (compared to those listed in Appendix 3 of Vande weghe & Vande weghe (2018)). Our species accumulation curve continued to rise throughout the survey, suggesting that more field time would have uncovered more species. Species-abundance curves for the avian community at Salonga National Park shows a typical pattern for species rich tropical rainforest with many rare species and far fewer common species (the opposite pattern tends to predominate in the temperate zones). It is this pattern (of many species living at low abundances) that underlies the time required for species-accumulation curves to asymptote in such environments. In our species inventory, we detected three species of conservation concern (IUCN RedList status 'near-threatened' or higher), and 88 biome-restricted species (of the Guinea-Congolian biome).

When combined with the bird records listed in Appendix 3 of Vande weghe & Vande weghe (2018), the total species list for Salonga National Park now stands at 287 species. The true total is likely much higher than this given the size of Salonga, and the relatively small amount of survey effort that has taken place here. Work is now in progress to collate other unpublished records to produce a comprehensive avian species list for the national park. This complete baseline inventory will be published in an upcoming peer-reviewed article that showcases the avian richness of Africa's largest rainforest reserve.

2.2 Herpetofauna

Merlijn Jocque

2.2.1 Introduction

While the Congo Basin harbours some of the largest intact tropical forests in the world, much remains unknown about the distribution, phylogeography and natural history of the amphibians and reptiles inhabiting the region. Hence, on both sides of the Congo River and in between its many tributaries, distribution gaps exist for most of the described central African herpetofauna, and many species likely remain undiscovered. As habitat degradation continues to surge within the region (Tyukavina et al. 2018), this is a significant impediment to biodiversity conservation efforts. Indeed, the Congo Basin has been noted as being one of the most data-deficient areas in the world in conservation assessments of reptiles (Böhm et al. 2013) and being a 'blind spot' for herpetofauna in general (Kielgast & Lötters 2011). Studies looking at reptile diversity patterns in Africa noticed a diversity depression in the Congo Basin (Lewin et al. 2016) which could be related to a lower environmental heterogeneity but at least partly will be the result of the little information available from this region.

Most of the present knowledge on reptiles and amphibians in the Congo Basin was established around the early 1900s (see e.g. Schmidt & Noble 1998). Herpetological studies subsequently remained sparse throughout the 20th century due to the onset of civil war and the general inaccessibility of the central African rainforest. During the past decades however, a new wave of Congolese and international biologists have continued research and conservation activities within the Congo Basin (e.g. Hirschfeld et al. 2015, Petersen et al. 2015, Badjedjea et al. 2022), with even description of a new genus of *Hyperolius* (Nečas et al. 2021) illustrating the vast herpetological diversity likely still residing across the region. More specifically for Salonga NP, very little herpetological information is available (published). These include the description of *Hyperolius veithi* (Schick et al. 2010) and a biodiversity study from Ikati et al. 2017 (WCS) in the Lomela section.

We here assemble herpetological observations from this survey conducted to contribute to a better understanding of the herpetofauna in Salonga NP in support of regional conservation efforts by WWF and other initiatives.

2.2.2 Surveys

We searched for amphibians and reptiles using several different methods. In each of the three field camps, we performed visual encounter surveys during the night, amounting to 2.5 hours of effective searching per survey (not including photography, sounds recording or other data handling time). In this way, three nocturnal surveys were conducted per field site. As no repeated measures of standardised transects could be conducted within the expedition time, these surveys were aimed at providing baseline semi-quantitative data on species occurrences across the focal habitats.

To detect species potentially overlooked by active search methods, we additionally set up three pitfall trap arrays in each camp. A single pitfall trap array consisted of four large 20 L buckets (pitfalls) spaced 5 m apart and connected by a 5 m plastic drift fence (total 25 m, **Figure 18**). These were checked twice a day (once in the morning and once in the evening) for herpetofauna and to collect possible bycatch. Pitfall traps were set up for 5 days in the "highland camp" and 4 days in the "lowland camp".

Identification of amphibians and reptiles was based on various sources, including Chippaux & Jackson (2019) for the snake fauna, Frétey et al. (2011) for the amphibian fauna and Channing & Rödel (2019) for general reference. These field guides were complemented with various other primary literature sources, including species descriptions and taxonomic reviews.

2.2.3 Preliminary results and discussion

We tentatively recorded 32 species of amphibians and reptiles (**Table 6**). These comprise 17 species of frogs, 7 lizard species, 5 snake species and one species of worm lizard. Molecular analysis were performed on most of the samples and sequences are available. Several potential new frog species for science were identified (*Hyperolius* sp.) and we are in the process of solidifying these identifications and describing the species. Genus identifications are more robust now, but species identifications remain preliminary.

The provided list is relatively short in number of taxa, due to the limited time in the field, climatic conditions (heavy rains) affecting the survey methods (drift fence) and surveys (visual encounter surveys) and the low seasonal activity of herpetofauna (end of rainy season). Nevertheless, it contains observations of species with conservation concern such as the Forest Hinge-back Tortoise (*Kinixys erosa*) (DD on the IUCN Red List, **Figure 19C**). Also for some common species such as the black lined emerald snake (*Hapsidophrys lineatus*), our observations are (substantial) range expansions (Chippaux & Jackson 2019). Several observations have the potential of undescribed species, pending confirmation after study of the material.

Figure 18. Pitfall trap array connected by a drift fence to catch amphibians and reptiles. (Photo by Michiel van Noppen)

Figure 19. A selection of the herpetofauna diversity of Salonga NP. **A.** *Lepidothyris hinkeli*, a species of skink native to Central Africa, **B.** "*Hyperolius* sp.1", **C.** *Kinixys erosa*, Forest Hinge-back Tortoise. (Photos by Michiel van Noppen)

Table 6. The amphibian and reptile species are provisionally recorded in study sites in Salonga NP. Localities refer to Monkoto (MK, the area surrounding the WWF station), Highland camp (HC), Lowland camp (LC) and Bekongo (BK, ecoguard patrol post). Note that Monkoto was only surveyed opportunistically, and did not receive the same searching effort as the other field localities.

n°	Class | Family	Species	Authority	MK	HC	LC	BK
	AMPHIBIA						
1	Arthroleptidae	*Arthroleptis* sp.1					
2	Arthroleptidae	*Arthroleptis sylvaticus*	Laurent, 1954		x		
3	Arthroleptidae	*Leptopelis* sp.1				x	
4	Arthroleptidae	*Leptopelis* cf. *notata*			x	x	
5	Bufonidae	*Nectophryne batesii*	Boulenger, 1913			x	
6	Bufonidae	*Sclerophrys* sp.1			x		
7	Bufonidae	*Sclerophrys* sp.2			x		
8	Hyperoliidae	*Congolius* cf. *robustus*			x		
9	Hyperoliidae	*Hyperolius* sp.1			x		
10	Hyperoliidae	*Hyperolius* sp.2			x	x	
11	Hyperoliidae	*Hyperolius* sp.3			x		
12	Hyperoliidae	*Hyperolius* cf. *phantasticus*				x	
13	Phrynobatrachidae	*Phrynobatrachus* sp.1			x		
14	Phrynobatrachidae	*Phrynobatrachus* sp.2			x		
15	Phrynobatrachidae	*Phrynobatrachus* sp.3				x	
16	Pipidae	*Xenopus pygmeus*	Loumont, 1986			x	
17	Ranidae	*Amnirana* sp.1			x		
	REPTILIA						
18	Amphisbaenidae	indet.			x		
19	Boidae	*Calabaria reinhardtii*	(Schlegel, 1851)		x		
20	Chameleonidae	*Chameleo* sp.			x		
21	Colubridae	*Hapsidophrys lineatus*	Fischer, 1856	x			
22	Colubridae	*Dipsadoboa* sp.1				x	
23	Gekkonidae	*Hemidactylus mabouia*	(Moreau de Jonnès, 1818)	x			
24	Gekkonidae	*Hemidactylus*				x	
25	Gekkonidae	*Hemidactylus* cf. *fasciatus*			x		
26	Gekkonidae	*Lygodactylus* sp.1					x
27	Lamprophiidae	*Bothropthalmus lineatus*	(Peters, 1863)	x			
28	Scincidae	*Mochlus* cf. *maculilabris*		x			
29	Scincidae	*Lepidothyris hinkeli*	Wagner et al. 2009			x	
30	Scincidae	indet.				x	
31	Testudinidae	*Kinixys erosa*	(Schweigger, 1812)		x	x	
32	Typhlopidae	indet.				x	

2.3 Fish

Miguel Nunes (text, prelim. identifications) & Maarten Van Steenberge (identifications)

2.3.1 Introduction

The Congo River and its widespread network of tributaries in the Congo Basin form an extensive aquatic habitat that sustains an incredible diversity of aquatic species. Seasonal variation in precipitation determines the water levels with alternating dry (June–August; December–February) and rainy (March–May; September–November) periods which promotes the genesis of seasonally flooded areas around and within the tropical rainforest. These dynamic changes and the diverse river conditions along the countless river ramifications provide a multitude of habitat and niches to occupy. Many small range endemic fish species are found in the Congo Basin making this understudied region an area of high interest for fish biodiversity research (Van der Zee & Sonnenberg 2011; Harrison et al. 2016; Day et al. 2017; Liyandja et al. 2019; Mikembi et al. 2019).

Salonga National Park (SNP), positioned centrally in the Congo Basin, is one of the most difficult to reach and lesser explored areas in DRC. Throughout the park, the main rivers are the Luilaka, Loile, Yenge, Salonga and Lomela, eventually all tributaries to the Congo River. Transport over the rivers is the main access route to Salonga NP and the local communities rely on small-scale fishing as a major source of food and protein, as well as cash income for their households (Béné et al. 2009; Inogwabini, 2014).

The difficult access to the region has negatively affected the biodiversity studies in the area, and Salonga NP is currently one of the more poorly sampled regions on the continent for fish (Stiassny et al. 2011). Despite this, several ichthyological surveys have been conducted since the early 2000s in and around Salonga National Park (Inogwabini 2005; Stiassny et al. 2013). The increase in research in the last few years has created some momentum with an updated species list (Iyaba & Stiassny 2013) and the description (or redescription) of some new species from the park (Stiassny et al. 2013; Baba et al. 2020; Bernt & Stiassny 2022). Samples collected from Salonga NP also contributed to larger overarching analyses looking into the classification of fish taxa (Stiassny et al. 2021) or used as comparative material for the description of new species (Jerep & Vari 2014; Jerep et al. 2014; Stiassny et al. 2016). However, many studies advance slowly due to the lack of data and well-preserved or correctly identified specimens (Van der Zee & Sonnenberg 2011; Baba et al. 2020) and large parts of the region remain virtually unexplored.

During this expedition, the main aim of our fieldwork was to sample small species and more inconspicuous habitats (e.g., small trickles of water and temporary pools at the edge of marsh areas) to supplement the available information from previous mostly gill net-based surveys.

2.3.2 Surveys

Fish specimens were mostly collected opportunistically using a hand net. Less often, fish nets were also set in deeper river sections with the help of the local support team whenever the timing for such an approach was suitable and the sampling site seemed ideal. Finally, some specimens were additionally bought from a local fisherman (for lunch) on the Luilaka River, and the specimens were also subsampled.

Opportunistic sampling was conducted by scientists and local people either walking through short sections of the smaller and shallower forest rivers (SR and MR), spotting and collecting fish on the way, or by collecting fish on the side of the larger Luilaka River, next to the village of Monkoto. To increase our sampling success and cover a higher fish diversity, for some sampling sites the opportunistic river surveys were conducted both during the day and during the night. The locations where surveys took place are listed in **Table 7**.

When possible, the fish specimens collected were kept alive and photographed in a glass cuvette (**Figure 20**). Photographed specimens were then labelled and sampled. Most specimens were sampled whole, while for larger specimens sometimes only the heads (with gills) were kept. All the small specimens were killed and preserved in 70% ethanol. Larger (dead) specimens were otherwise preserved in 4% formaldehyde and a fin clip was collected on 98% ethanol.

Table 7. List of sampling locations where fish surveys were conducted. The survey method (O = opportunistic; N = net fishing), the number of surveys and an estimate of the number of specimens collected (#ind.) are provided and an indication of river size "Dc" = Depth category: SR – Shallow River (<0.5 m); MR – Medium (depth) River (>0.5 m; <1.5 m); DR – Deep River (>1.5 m).

Location	Method	#surveys	#ind.	Dc
Monkoto	O + N	3	7	DR
Highland camp	O	1	24	SR
Highland camp	O	4		SR
Kemasoli	N	1	12	DR
Lowland camp	O	2	37	SR
Lowland camp	O	2		SR/MR[1]
Lowland camp	O + N	2		SR/MR[1]
Lokofa	N/A[2]	1	11	DR

[1]Rivers with both shallow and medium depth sections.
[2]Site where fish specimens were bought from a local fisherman and later subsampled.

Figure 20. A. Preparation of the small-mesh gill net, aimed at catching smaller species in the Luilaka River, **B.** A hand net is used to opportunistically catch small fish in the marsh forest streams, **C.** Photographing a fish specimen in a glass cuvette, **D.** A resulting image of an *Enteromius* sp. and **E.** an *Aphyosemion* sp. (Photo A, D & E by Michiel van Noppen, Photo B by Merlijn Jocque, Photo C by Miguel Nunes)

2.3.3 Results

The results from the fish surveys of this expedition revealed at least 32 species encountered within over 100 specimens collected. From these, 5 species, and 1 genus and family are here recorded for the first time for Salonga National Park: *Congochromis squamiceps* (Cichlidae), *Enteromius candens* (Cyprinidae), *Distichodus antonii* (Distichodontidae), *Mastacembeus* sp. (Mastacembelidae), *Marcusenius schilthuisiae* (Mormyridae). Also worth noting is the rediscovery of *Clarias monsembulai* (Clariidae), an air-breathing catfish species described in 2022 from Salonga NP specimens collected between 2006 and 2010 by the Congolese researcher Raoul Monsembula Iyaba (Bernt & Stiassny, 2022).

For some specimens collected during our surveys, species determination is ongoing. This includes possible unknown species for science. Therefore, the number of fish species that were discovered on this expedition and are presented on this report is not yet definitive and will be updated further on. All species and genus already identified are displayed in **Table 8**.

Table 8. List of fish species collected during our fieldwork in Salonga NP.

n°	Family	Species	Authority
1	Alestidae	*Bathyaethiops greeni*	(Fowler, 1949)
2	Alestidae	*Micralestes congicus*	(Poll, 1967)
3	Alestidae	*Phenacogrammus aurantiacus*	(Pellegrin, 1930)
4	Anabantidae	*Ctenopoma nigropannosum*	(Reichenow, 1875)
5	Anabantidae	*Microctenopoma nanum*	(Günther, 1896)
6	Cichlidae	*Hemichromis lifalili*	(Loiselle, 1979)
7	Cichlidae	*Congochromis squamiceps*	(Boulenger, 1902)
8	Clariidae	*Clarias angolensis*	(Steindachner, 1866)
9	Clariidae	*Clarias monsembulai*	(Bernt & Stiassny, 2022)
10	Clariidae	*Clarias* sp.3	
11	Clariidae	*Clariallabes centralis*	(Poll & Lambert, 1958)
12	Claroteidae	*Chrysichthys punctatus*	(Boulenger, 1899)
13	Claroteidae	*Parauchenoglanis punctatus*	(Boulenger, 1902)
14	Cyprinidae	*Enteromius candens*	(Nichols & Griscom, 1917)
15	Cyprinidae	*Enteromius miolepis*	(Boulenger, 1902)
16	Cyprinidae	*Enteromius* sp.3	
17	Cyprinidae	*Enteromius* sp.4	
18	Cyprinidae	*Enteromius* sp.5	
19	Cyprinidae	*Enteromius* spp.	
20	Distichodontidae	*Distichodus antonii*	(Schilthuis, 1891)
21	Malapteruridae	*Paradoxoglanis caudivittatus*	(Norris, 2002)
22	Mastacembelidae	*Mastacembelus* sp.1	
23	Mochokidae	*Synodontis flavitaeniatus*	(Boulenger, 1902)

n°	Family	Species	Authority
24	Mochokidae	*Synodontis nigriventris*	(David, 1936)
25	Mormyridae	*Marcusenius lambouri*	(Pellegrin, 1904)
26	Mormyridae	*Marcusenius moorii*	(Günther, 1867)
27	Mormyridae	*Marcusenius schilthuisiae*	(Boulenger, 1899)
28	Mormyridae	*Stomatorhinus* sp.	
29	Mormyridae	*Petrocephalus* sp.	
30	Nothobranchiidae	*Aphyosemion* spp.	
31	Pantodontidae	*Pantodon buchholzi*	(Peters, 1876)
32	Schilbeidae	*Schilbe marmoratus*	(Boulenger, 1911)

2.3.4 Discussion

Despite the restricted time in the field, tough logistics and setbacks on sampling material, we were still able to assemble a significant list of fish species based on opportunistic sampling, including 5 species and a genus new for Salonga National Park, the rediscovery of a park endemic and some candidate new species for science (to be confirmed with molecular analysis).

Among the new park records, we highlight the very first record of a spiny eel fish species (Mastacembelidae) from the genus Mastacembelus, which had been found in both lower and northern regions of the Congo Basin but with no previous confirmed records for this park. The spiny eel species collected, although attributed to the genus Mastacembelus, is yet to be determined and is currently under study.

The additional new records of *Congochromis squamiceps* (Cichlidae) and *Enteromius candens* (Cyprinidae), both endemic from the Congo Basin and the DRC, represent important range expansions for their relatively short known distributions within the Middle to Upper Congo tributaries. These species were previously known from the regions of Itimbiri, Ikela and Lindi river, with *C. squamiceps* also being recorded from Aruwimi and *E. candens* from Yamgambi and Lake Tumba (Stiassny & Schliewen 2007; Decru et al. 2017; Katemo Manda et al. 2019; Moons et al. 2023).

Conversely, *Distichodus antonii* (Distichodontidae) and *Marcusenius schilthuisiae* (Mormyridae), endemic from the Congo Basin but not DRC exclusive, are found across a larger extension of the basin (*D. antonii* widespread; *M. schilthuisiae* from Kinshasa to Kisangani and small rivers and lakes in between – Ruki, Momboyo, lake Mai-Ndombe) (Daget et al. 1984; Boden et al. 1997) but were nonetheless unknown from the park and are now recorded in its waters for the first time.

We additionally acknowledge the remarkable discovery of *Clarias momsebulai* on this expedition, an air-breathing catfish species that was recently described (Bernt & Stiassny, 2022) and one that is endemic to Salonga National Park and its close surroundings. Despite being described in 2022, this species was last found and collected more than a decade ago and was rediscovered for the first time on our surveys.

The fish results presented here, are based on opportunistic records and not representative for fish

communities in SNP rivers. Even so, our results are exciting and highlight the amazing fish diversity present in the rivers of this park and warrant the need for more in-depth studies.

Large parts of SNP remain unstudied for fish biodiversity, and it is certain that more studies and fieldwork will continue to uncover more species unknown for the park and possibly also unknown for science.

The identification of some specimens from this expedition is ongoing and will be updated posteriorly to this report.

2.3.5 Acknowledgements

We thank Jos Snoeks and Maarten Van Steenberge for providing gillnets and sampling material for this survey and the ongoing collaboration with identification and publication of results.

2.4 Small mammals

Merlijn Jocque (text) & Rainer Hutterer (identifications)

2.4.1 Introduction

Crocidura, a genus encompassing a diverse range of shrew species (Soricidae), holds a significant place in the Democratic Republic of Congo's (DRC) mammalian fauna. This genus, known for its adaptability to various ecological niches, is well-represented in the DRC, from dense rainforests to savannah landscapes (Jacquet et al. 2015). Little is known on the *Crocidura* in DRC with some of the more recent findings being the discovery of *Crocidura lwiroensis* (Kerbis et al. 2013).

2.4.2 Methods

Small mammals that fell in the herp pitfall traps (see "Surveys" on page 56) and drowned were collected and studied.

2.4.3 Results

There are three species of *Crocidura* in the samples, one probably a new species, then some *C.* cf. *hildegardeae* (but not exactly this species), and a few *Crocidura lwiroensis* Kerbis Peterhans & Hutterer, in Kerbis Peterhans et al., 2013. The last species was known only by the holotype from eastern DR Congo.

All three species identified from the opportunistic samples were interesting reflecting the dire need to look into more detail in the small mammal fauna in this region. The type locality of *Crocidura lwiroensis*, the only species identified to species level, is near the village of Mizimu, above the western shore of Lake Tanganyika in Katanga Province. The species is known from a primary forest at an elevation of 1250 meters (Kerbis et al. 2013). The current observation of this species inland at low elevation is remarkable and needs further investigation.

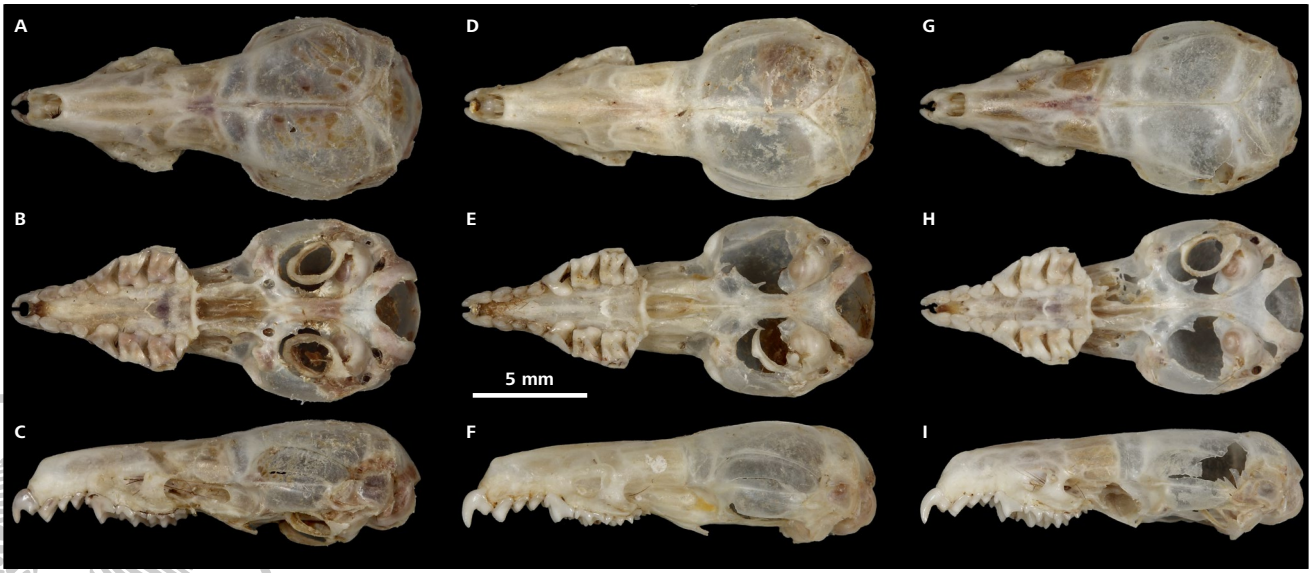

Figure 21. Dorsal, ventral and lateral images of the skulls of the three shrew species. **A.-C.** *Crocidura* sp., **D.-F.** *Crocidura* cf. *hildegardeae*, **G.-I.** *Crocidura lwiroensis*. (Photos by Rainer Hutterer)

2.5 Invertebrates – general

Jan Mertens, Brogan Pett, Miguel Nunes, Martijn van Roie, Marco de Haas, Merlijn Jocque

2.5.1 Introduction

Collectively, invertebrates constitute almost 95% of currently described animal diversity on the planet. The most diverse invertebrate phylum, the Arthropoda contains ~1.11 million described species, with many millions more to be discovered (Eisenhauer & Hines 2021). Recent estimates anticipate the earth to contain ~8.7 million species (Mora et al. 2011), with the majority expected to fall in Arthropoda. Insects, spiders, and other arthropod taxa play crucial roles in many ecosystem processes (e.g. nutrient cycling, pollination) and since most arthropods occupy lower levels of the ecological food chain, they are an important food source for other organisms.

Most invertebrates are well-adapted to specific habitats and will often respond to small-scale environmental changes and local conditions, making them ideal indicator-species for habitat quality (Brown 1991). However, to assess the quality of a specific habitat through indicator-taxa, a good understanding of the taxon's species composition, geographical distribution and environmental preferences is required. Yet, despite their incredible diversity, ecological importance, and potential as indicator species, invertebrates are most often excluded from biodiversity assessments, especially in tropical environments (Bonebrake et al. 2010).

Invertebrate research in DRC consists mostly of isolated studies and surveys (e.g. Ducarme 2018; Dijkstra & Heughebaert, 2015) and few higher taxon overviews are available and/or are outdated (e.g. "Les Papillons du Zaïre", Berger & Seko 1981). More specifically for Salonga NP, our study region, no published invertebrate-checklists are available to our knowledge. The largest part of present biodiversity in Salonga NP is currently unaccounted for, which would be needed to assess its ecological and conservation value. Through preliminary standardised surveys and working with target invertebrate groups we hope to initiate and accelerate the study of invertebrates in Salonga NP.

The following subchapters of the report provide a first look into the species richness of several invertebrate taxa present in the study area. Target groups (**Table 9**) included butterflies (Papilionoidea), hawk moths (Sphingidae), emperor moths (Saturniidae), dragonflies and damselflies (Odonata), praying mantises (Mantodea), several taxa of planthoppers, leafhoppers and cicadas (Auchenorrhyncha), and beetles (Coleoptera). Within the latter insect order, we focused on tiger beetles (Cicindelidae), ground beetles (Carabidae), dung and scarab beetles (Scarabaeoidea), rove beetles (Staphylinidae) and longhorns (Cerambycidae). To study the above mentioned taxa standardised survey techniques were supplemented with opportunistic collections.

Figure 22. A selection of insects from the target groups of the survey. **A.** A longhorn beetle (Cerambycidae - Lamiinae), **B.** A planthopper nymph (Lophopidae) **C.** A praying mantis with an ootheca (egg sack protected by a foamy excretion). (Photos by Michiel van Noppen)

2.5.2 Methods

Invertebrates were collected with a wide range of standardised survey methods (pitfall trapping, bait trapping, light trapping) as well as opportunistic collecting (side catch from other methods and hand catching). We surveyed different (micro)habitats to cover as much diversity as possible.

Table 9. Overview of targeted invertebrate groups and the collecting methods used for each group.

		Pitfall trap	Bait trap	Light trap	Winkler trap	Hand net
Arachnida		x			x	
Coleoptera	Carabidae	x		x		
	Cicindelidae	x		x		x
	Cerambycidae			x		x
	Chrysomelidae					x
	Staphylinidae	x	x	x	x	
	Scarabaeoidea	x	x	x		x
Hemiptera	Auchenorrhyncha			x		x
	Psylloidea			x		x
Lepidoptera	Sphingidae			x		
	Saturniidae			x		
	Papilionoidea		x			x
Mantodea				x		x
Odonata				x		x

2.5.2.1 Invertebrate pitfall traps

Pitfall series consisted of five transparent 1 L plastic cups (height: 13.7 cm, ø 11.5 cm) spaced about 5 m from each other in a line. The cups were dug into the ground so that the rim was flush with the forest floor. The pitfalls were filled with a 6% formaldehyde solution as a preservative (see **Table 10**). Several beetle families (dung beetles, ground beetles, rove beetles and tiger beetles), ants (see 2.6 Formicidae) and spiders (see 2.9 Araneae) were the target groups of this method. Other invertebrates that fell in the traps were also collected.

Table 10. Location and survey effort of Invertebrate pitfall trap series in each camp. A series consisted of five pitfall traps (1 L). The latitude (South-S) and longitude (East-E), setup date, take down date, and total duration in number of days are provided.

Camp	Latitude	Longitude	From	To	#days
Monkoto	S01°44.79'	E20°40.902'	26/11/2022	14/12/2022	18
Monkoto	S01°44.862'	E20°40.817'	26/11/2022	14/12/2022	18
Monkoto	S01°44.805'	E20°40.888'	26/11/2022	14/12/2022	18
Monkoto	S01°44.79'	E20°40.931'	26/11/2022	14/12/2022	18
Highland camp	S02°17.27'	E21°01.273'	01/12/2022	06/12/2022	5
Highland camp	S02°17.27'	E21°01.245'	01/12/2022	06/12/2022	5

Camp	Latitude	Longitude	From	To	#days
Highland camp	S02°17.27'	E21°01.222'	01/12/2022	06/12/2022	5
Highland camp	S02°17.282'	E21°01.205'	01/12/2022	06/12/2022	5
Highland camp	S02°17.302'	E21°01.158'	01/12/2022	06/12/2022	5
Highland camp	S02°17.338'	E21°01.107'	01/12/2022	06/12/2022	5
Lowland camp	S01°39.992'	E20°32.038'	10/12/2022	13/12/2022	3
Lowland camp	S01°40.025'	E20°32.038'	10/12/2022	13/12/2022	3
Lowland camp	S01°39.955'	E20°31.957'	10/12/2022	13/12/2022	3
Lowland camp	S01°39.942'	E20°31.937'	10/12/2022	13/12/2022	3
Lowland camp	S01°39.908'	E20°31.583'	10/12/2022	13/12/2022	3
Lowland camp	S01°39.895'	E20°31.878'	10/12/2022	13/12/2022	3

2.5.2.2 Herpetological pitfall trap

The herpetological pitfall series were mainly geared towards herpetofauna (see "Herpetofauna" on page 56 for survey effort and methodology) but also large invertebrates were captured. Beetles and spiders were collected daily in the morning and the evening.

2.5.2.3 Butterfly bait traps

Butterfly bait traps were modified hanging organisers (IKEA PS FÅNGST) with a horizontal cut at the bottom to provide access to the bait on a plate at the bottom of the trap (**Figure 23A**). The bait consisted of crushed fruit (mostly banana and pineapple) that was fermented for several days in a closed container. The main target species of this survey method were fruit-feeding butterflies but any beetles – rove beetles (Staphilinidae) and shining leaf chafers (Rutelinae) – were also collected. The traps were checked daily to collect any insects and the bait was replaced every one to two days, depending on the weather conditions.

Two series of five bait traps were set up in each study site (**Table 11**). Each series had three traps at approximately 20 cm above the forest floor and the remaining two just below the tree canopy (between 20-30 m). Several additional traps were installed opportunistically at interesting points in the forest (e.g. a small stream or fruiting tree). To set up the canopy traps, a shooting line (Tendon 3.0 mm ø, 50 m long) was launched into the canopy with a catapult (Notch Big Shot) and a throw bag (Tendon Timber 350 g).

Table 11. Butterfly bait trap locations in latitude (South-S) and longitude (East-E) at each camp. Setup date, take down date, and total survey duration are provided.

Camp	Latitude	Longitude	From	To	Duration
Highland camp	S02°17.218'	E21°01.298'	02/12/2022 15:00	06/12/2022 13:30	2d 22h30
Highland camp	S02°17.272'	E21°01.24'	02/12/2022 12:00	06/12/2022 13:30	3d 1h30
Highland camp	S02°17.317'	E21°01.145'	02/12/2022 12:00	06/12/2022 13:30	3d 1h30
Lowland camp	S01°39.93'	E20°31.938'	10/12/2022 12:00	13/12/2022 12:00	2d
Lowland camp	S01°39.997'	E20°32.023'	10/12/2022 12:00	13/12/2022 12:00	2d

Figure 23. **A.** Forest floor butterfly bait trap. Leaves are attached to the top to help protect the bait from rain, **B.** Light trap overlooking the Luilaka River in Kemasoli at dusk. (Photos by Michiel van Noppen)

2.5.2.4 Light trap

A light trap uses a powerful lamp that emits a wide UV spectrum to attract insects at night. The trap was set up for at least four nights at each study site as well as in Monkoto at the WWF site for a total of 60 hours spread across 14 nights (**Table 12**). A cross-shaped tent composed of white reflective cloth (Entosphinx, Type "B") was placed in a forest clearing at each study site, or near the river in Monkoto and Kemasoli (**Figure 23B**). The tent remained attended at all times and relevant taxa were continuously collected from the sheet. The light, a 125W UV Mercury vapour bulb (Philips, HPL-N), was powered by a generator (Honda eu10i) and protected from eventual rain by a tarp set up above the tent. Timing and duration of each trapping night was largely influenced by the weather; on cold or rainy nights, few insects visited the sheet. The focal taxa attracted to the light included numerous beetle families, dragonflies, praying mantises, cicadas, hawk moths and emperor moths. Beetles and cicadas (with exception of the Cicacidae) were collected directly in jars containing 70% ethanol. The other taxa were firstly captured and sedated in an ammonia-laden jar with a cotton layer at the bottom. Afterwards, the specimens were stored dry in glassine envelopes.

Table 12. Light trap locations in latitude (South-S) and longitude (East-E) at each camp. Date, the start and end time, and a total of the trapping effort are provided.

Camp	Latitude	Longitude	Date	Start	End	Duration
Monkoto	S01°44.865'	E20°40.823'	26/11/2022	18:00	23:30	5h30
Monkoto	S01°44.865'	E20°40.823'	27/11/2022	17:00	20:45	3h45
Monkoto	S01°44.865'	E20°40.823'	28/11/2022	19:00	21:00	2h00
Highland camp	S02°17.218'	E21°01.298'	01/12/2022	19:00	21:15	2h15
Highland camp	S02°17.218'	E21°01.298'	02/12/2022	17:45	23:15	5h30
Highland camp	S02°17.218'	E21°01.298'	03/12/2022	17:45	00:00	6h15
Highland camp	S02°17.218'	E21°01.298'	04/12/2022	17:30	22:30	5h00
Highland camp	S02°17.218'	E21°01.298'	05/12/2022	17:30	23:00	5h30
Kemasoli	S02°08.207'	E21°07.102'	07/12/2022	17:30	20:00	2h30
Lowland camp	S01°39.95'	E20°31.982'	10/12/2022	17:15	22:30	5h15
Lowland camp	S01°39.95'	E20°31.982'	11/12/2022	17:30	23:00	5h30
Lowland camp	S01°39.938'	E20°31.945'	12/12/2022	19:15	22:00	2h45
Lowland camp	S01°39.938'	E20°31.945'	13/12/2022	17:30	20:15	2h45
Monkoto	S01°44.865'	E20°40.823'	14/12/2022	19:00	01:15	6h15
					TOTAL	60h15

2.5.2.5 Winkler traps

Leaf litter was collected from a 0.5 m^2 quadrant up to the root mat at the four corners of two 10 m^2 plots at the "highland" camp site. The collected material of each corner was placed in its own Winkler trap. Additionally, nine smaller winkler traps were filled with material specifically from the root mats (under the leaf litter) outside of the predefined plots. All traps were placed under a tarp so that the material could dry and the invertebrates would fall into the collection jars filled with 70% ethanol at the bottom of the trap. The traps were left undisturbed for four days. High humidity, lack of sun and short available time limited the efficiency of the Winkler traps. Spiders, ants and pseudoscorpions were the focal taxa collected with this method.

Figure 24. Left: collection of leaf litter from a 0.5m^2 quadrant, **Right:** winkler traps being set up under a tarp. (Photos by Michiel van Noppen)

2.5.2.6 Diurnal catching

Surveys with handheld insect nets were performed at different times of the day to collect invertebrates through opportunistic catching. The target groups were butterflies, dragon- and damselflies and tiger beetles but other taxa were also collected when encountered.

2.5.2.7 Processing and preserving collected specimens

Invertebrate samples were processed and preserved using different methods that optimise the quality and longevity of the sample whenever possible. Lepidoptera (butterflies and moths) were stored, with their wings folded up, in glassine envelopes and subsequently dried in airtight containers with silica gel. Odonata (dragon- and damselflies) and praying mantises were preserved in glassine envelopes submerged in a box with acetone to preserve colours as much as possible. Spiders, beetles and cicadas were collected and preserved in small jars with 70% ethanol. In some instances, specific spiders (fishing spiders) were preserved in 100% ethanol to maximise the genetic condition of those samples for phylogenetic analysis.

2.5.3 Results

This section comprises the species lists of the invertebrate groups that were collected opportunistically. The invertabrate groups of focus are presented in their own chapters: Formicidae (p. 80), Hemiptera (p. 86), Lepidoptera (p. 100), Araneae (p. 112).

2.5.3.1 Tortoise beetles (Chrysomelidae - Cassidinae)

Martijn Van Roie & Lukáš Sekerka (identifications)

Leaf beetles (Coleoptera: Chrysomelidae) are very speciose and occur almost globally, consisting of over 35,000 described species (Hespenheide, 2001). They are classically notoriously difficult to identify, and many taxonomic revisions are needed to make identification feasible. Nonetheless, this group consists of many brilliantly colored phytophagous beetles with interesting life histories. Within Chrysomelidae, the subfamily of tortoise beetles (Cassidinae) has arguably been the best studied in Africa. Thus, during the express survey, we focused on this interesting group.

A total of 38 collected specimens yielded 11 species (**Table 13**). Most species belonged to the genus *Aspidimorpha*. This large genus is common in the Old World tropics and subtropics and its species are highly variable both in coloration and shape. There were no new country records among the collected species.

Table 13. Species list of Cassidinae. The column labeled '#' represents the number of individuals caught.

n°	Tribe	Species	Authority	#
1	Aspidimorphini	*Aspidimorpha chlorina*	Boheman, 1854	1
2	Aspidimorphini	*Aspidimorpha diaphana*	(Sahlberg, 1823)	4
3	Aspidimorphini	*Aspidimorpha honesta*	(Spaeth, 1902)	3
4	Aspidimorphini	*Aspidimorpha isparetta*	Boheman, 1854	4
5	Aspidimorphini	*Aspidimorpha nigromaculata*	(Herbst, 1799)	2
6	Aspidimorphini	*Aspidimorpha officiosa*	Boheman, 1862	2
7	Aspidimorphini	*Aspidimorpha strigosa*	(Gorham, 1892)	1
8	Aspidimorphini	*Conchyloctenia signatipennis*	(Boheman, 1854)	1
9	Aspidimorphini	*Laccoptera corrugata*	(Sahlberg, 1823)	9
10	Cassidini	*Chiridopsis aubei*	(Boheman, 1855)	9
11	Hispini	*Dactylispa normalis*	Uhmann, 1931	2

Aspidimorpha chlorina is a relatively common species distributed in West and Central Africa east to Uganda. Part of a group of *Aspidimorpha* with uniformely yellow to green elytral disc without impressions.

Aspidimorpha diaphana is distributed in West and Central Africa east to Uganda. Known from forest localities.

Aspidimorpha honesta almost exclusively known from DRC, with one record from the Central African Republic. Closely similar to *A. isparetta*.

Aspidimorpha isparetta is arguably the most common species in its genus in West and Central Africa,

with some relict populations in forested areas of eastern Africa. Host plant includes Convolvulaceae, namely *Merremia hederacea*. It is highly variable, ranging from forms without dorsal maculation, to forms with completely black elytra.

Aspidimorpha nigromaculata is distributed throughout most of tropical Africa. Recognisable species with scattered, black maculae on elytra. Host plant includes Concolvulaceae, namely *Merremia hederacea* and *Ipomoea argentaurata/heterotricha* and *Ipomoea eriocarpa*.

Aspidimorpha officiosa is known from West and Central Africa. It's a common species in collections, though no host plant information is known at the moment.

Aspidimorpha strigosa is distributed in Central Africa. No host plant information known.

Conchyloctenia signatipennis is a common species known from West and Central Africa. No further information on ecology is known.

Laccoptera corrugata is a common species from West and Central Africa. Mostly recorded from lowlands. No host plant information known.

Chiridopsis aubei is one of the most common African cassids, known from West to East (sub) tropical Africa. The species is highly variable in both form and coloration. Host plant unknown.

Dactylispa normalis is a common species found throughout Central Africa.

While not many species of tortoise beetles were found and all of these species are relatively well-known, we can contribute this to the fact that all Chrysomelidae were collected opportunistically. Most species were collected in the more rural areas, en route from one camp to another. Traditional methods for catching tortoise beetles would imply carefully studying vegetation, like rolled up palm leaves. This renders the present study quite successful. Moreover, it shows that even in rural areas one cannot underestimate the biodiversity of this speciose group. Lastly, the low availability of knowledge on host plants underlines the need for more study of all tortoise beetles, including the more common ones.

Figure 25. Two specimens of *Aspidimorpha*. (Photos by Michiel van Noppen)

2.5.3.2 Tiger beetles (Cicindelidae)

Merlijn Jocque (text) & Juergen Wiesner (identifications)

During this expedition, we opportunistically collected five species of tiger beetles (Cicindelidae), as detailed in **Table 14**. It is anticipated that many more species of this family are present in the area.

Table 14. Species list of Cicindelidae and number of specimens caught at each location: Monkoto (MK), Highland camp (HC), Lowland camp (LC), Lokofa (LK) and Bekongo (BK).

n°	Species	Authority	MK	HC	LC	LK	BK
1	*Cicindela (Hipparidium) interrupta*	Fabricius, 1775	6			1	
2	*Cylindera (Ifasina) octoguttata octoguttata*	(Fabricius, 1787)	1				
3	*Lophyra (Lophyra) neglecta neglecta*	(Dejean, 1825)	3	1*			1
4	*Myriochila (Monelica) vicina vicina*	(Dejean, 1831)	2		1	2	
5	*Myriochila (Myriochila) melancholica melancholica*	(Fabricius, 1798)			1	1	2

*specimen of *L. neglecta* at the Highland camp was collected on a sandy stretch of riverbank alongside one of the many rivulets in the area

Figure 26. *Myriochila vicina* (Cicindelidae). (Photo by Michiel van Noppen)

2.5.3.3 Odonata

Merlijn Jocque (text) & Rosser Garrison (identifications)

During our study, we opportunistically collected a modest total of about 100 dragonflies, representing 42 species. This collection included at least one species that is new to science (*Allocnemis* sp., currently under preparation by Jocque, Mbende & Mponi). These specimens represent some of the initial records for Salonga National Park, and for many of these species, our observations contribute significantly to filling gaps in their known geographical distribution or extending their recorded range.

Notably, we observed the species *Prodasineura odzalae* and *Elattoneura incerta* from the Platycnemididae family, with these sightings indicating a southern and eastern expansion in their distribution areas, respectively.

Additionally, we recorded sightings of *Pseudagrion simplicilaminatum* from the Coenagrionidae family and *Gomphidia bredoi* from the Gomphidae family, both of which suggest a southern expansion of their distribution areas.

Figure 27. *Hadrothemis versuta* in copula. (Photo by Michiel van Noppen)

Table 15. Species list of Odonata and number of specimens caught at each location: Monkoto (MK), Highland camp (HC), Lowland camp (LC), Lokofa (LK), Bekongo (BK) and other locations that were samples opportunistically (O).

n°	Family | Species	Authority	MK	HC	LC	LK	BK	O
	Aeshnidae							
1	*Gynacantha bullata*	Karsch, 1891			1			
	Calopterygidae							
2	*Umma cincta*	(Hagen in Sélys, 1853)		2				
3	*Umma longistigma*	(Selys, 1869)			5			
4	*Phaon camerunensis*	Sjöstedt, 1900			2			
5	*Phaon iridipennis*	(Burmeister, 1839)	2					
	Chlorocyphidae							
6	*Chlorocypha aphrodite*	Le Roi, 1915			5			
	Coenagrionidae							
7	*Ceriagrion corallinum*	Campion, 1914	1					
8	*Ceriagrion platystigma*	Fraser, 1941			2			
9	*Mortonagrion stygium*	(Fraser, 1954)			1			
10	*Pseudagrion glaucum*	(Sjöstedt, 1900)	1				1	
11	*Pseudagrion simplicilaminatum*	Carletti & Terzani, 1997			2			
	Gomphidae							
12	*Gomphidia bredoi*	(Schouteden, 1934)	3	1				
13	*Phyllogomphus coloratus*	Kimmins, 1931						1
	Libellulidae							
14	*Acisoma trifidum*	Kirby, 1889	2					
15	*Acisoma variegatum*	Kirby, 1898	3					
16	*Aethiothemis erythromelas*	(Ris, 1910)			1			
17	*Chalcostephia flavifrons*	Kirby, 1889	1					
18	*Hadrothemis defecta*	(Karsch, 1891)	2					
19	*Hadrothemis infesta*	(Karsch, 1891)						1
20	*Hadrothemis versuta*	(Karsch, 1891)			1			1
21	*Hemistigma albipunctum*	(Rambur, 1842)				1		
22	*Micromacromia camerunica*	Karsch, 1890			1			
23	*Orthetrum africanum*	(Selys, 1887)			1			
24	*Orthetrum austeni*	(Kirby, 1900)						1
25	*Orthetrum julia*	Kirby, 1900	1		4			
26	*Orthetrum stemmale*	(Burmeister, 1839)	1		5			
27	*Palpopleura ?lucia*	(Drury, 1773)	1					
28	*Palpopleura lucia*	(Drury, 1773)	2			1		
29	*Pantala flavescens*	(Fabricius, 1798)	1					
30	*Parazyxomma flavicans*	(Martin, 1908)	1					

n°	Family | Species	Authority	MK	HC	LC	LK	BK	O
31	*Rhyothemis notata*	(Fabricius, 1781)	1					
32	*Tramea basilaris*	(Palisot de Beauvois, 1817)	1					
33	*Trithemis* sp.		1					
34	*Trithemis tropicana*	Fraser, 1953			1			
35	*Zyxomma atlanticum*	Selys, 1889		1				
	Platycnemididae							
36	*Allocnemis cyanura*	(Förster, 1909)		1				
37	*Allocnemis* sp.nov.			1				
38	*Elattoneura incerta*	(Pinhey, 1962)			5			1
39	*Elattoneura lliba*	Legrand, 1985		1	6			
40	*Elattoneura morini*	Legrand, 1985			5			
41	*Elattoneura vrijdaghi*	Fraser, 1954			2			
42	*Prodasineura odzalae*	(Aguesse, 1966)	1		2			

2.6 Formicidae

Matthew Hamer

2.6.1 Introduction

Ants (Hymenoptera; Formicidae) are an ecologically dominant group of eusocial insects found across the globe, other than the poles. A total of 14,171 species are currently known, with 806 species currently known from the Democratic Republic of Congo (Bolton 2023; Janicki 2016; Guenard, 2017). The actual number of species occurring in the region is undoubtedly much higher, with many undetermined and undescribed species known (antweb.org). Survey effort, severe taxonomic confusion, and lack of expertise (both local and internationally) synergistically limit our understanding of the true ant diversity of the region.

Here I present the initial results of the Salonga National Park express survey. Examining previous records reveals that the collecting localities by this expedition have likely never been visited by myrmecologists before, highlighting the importance of these specimens and the data they hold.

2.6.2 Methods

Ants were collected via two methods, pitfall traps and leaf litter extractions using Winklers. Both methods sample different communities of ants. Pitfall traps predominately target epigaeic species, whilst leaf litter extraction targets cryptic species dwelling in soil and decaying leaf litter humus. For more information on the sampling design of the pitfall and Winkler trap surveys methods, see p. 69 and p. 73 respectively.

Raw samples were sorted to target taxonomic groups, with ant specimens sent to the author in Hong Kong. Ant specimens were sorted to morphospecies, i.e. specimens which differ in some aspect of their form and structure from all other specimens in the sample. A single individual specimen from each morphospecies was point-mounted, and given a unique code (DRC-PNS-###). Specimens were then identified to species level wherever possible, however owing to the taxonomic limitations described above, many were only given a morphospecies code. Nevertheless, such specimens likely represent real species and will greatly contribute to our understanding of their distribution once identifications can be made.

2.6.3 Results

A total of 1301 ant specimens were collected and sorted to morphospecies from both pitfall and Winkler samples (646 and 655 respectively). These specimens have comprised 8 subfamilies and so far comprised 37 genera and 101 species (**Table 16**). At the time of this report, all pitfall traps samples have been mounted and identified to the best of our ability. Leaf litter samples are so far sorted to morphospecies only, and with only genera identified. The overall number of 101 species included unidentified species from Winkler samples. The species number will undoubtedly be higher after all Winkler specimens have been examined. Species identification for these specimens will follow in due course.

Table 16. Genera and species composition by subfamily across both pitfall and winkler samples.

Subfamily	Genera	Species
Amblyoponinae	2 (5.4%)	2 (2%)
Dolichoderinae	1 (2.7%)	4 (4%)
Dorylinae	2 (5.4%)	2 (2%)
Formicinae	4 (10.8%)	9 (8.9%)
Myrmicinae	15 (40.5%)	63 (62.4%)
Ponerinae	12 (32.4%)	20 (19.8%)
Proceratiinae	1 (2.7%)	1 (1%)

Owing to the severe taxonomic issues in the Afrotropical region, only a few species have so far been identified to species level. However, upon sorting, several specimens were immediately noticed as potential candidates for new species. This included *Xymmer* sp.nov., and *Anochetus* sp.1 (**Table 17**; **Figure 28**). The *Xymmer* specimen was found in a pitfall trap sample (**Table 17**; **Figure 28A-B**, which is not the typical way in which this genus is collected being a predominately leaf litter and soil specialist. Only two other species of *Xymmer* are known in the world, one from Asia (*X. phungi*), and another from the Afrotropics (*X. muticus*). This specimen was compared to both described species and was distinctly different from both and most certainly new to science, being considerably smaller, and with a good series of morphological characters which differed strongly with both described species. Another potential new species is *Anochetus* sp.1 (**Figure 28C-D**), which, when run through identification keys to Afrotropical *Anochetus* species, fails to key to any species satisfactorily. This is a more diverse genus than *Xymmer*, but it was clear from the considerable amount of hair on the body that this species is likely new to science, especially considering that other members of the genus in the region lack this characteristic.

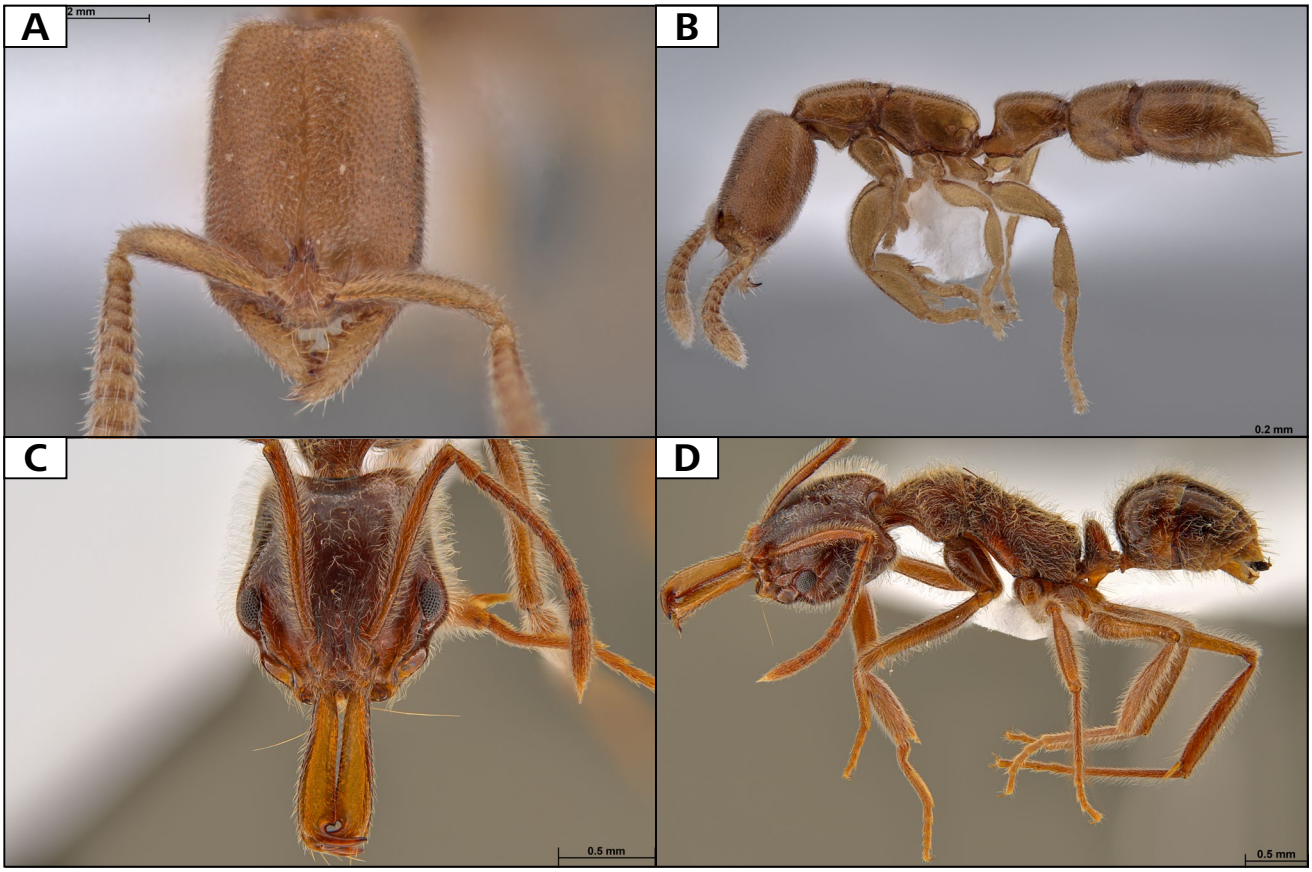

Figure 28. A.-B. *Xymmer* sp.nov., **C.-D.** *Anochetus* sp.1. (Photos by Matthew Hamer)

Table 17. Checklist of currently identified specimens and the sampling method (W = Winkler trap, P = Pitfall trap). Winkler specimens are designated as spp. until further examination.

n°	Subfamily	Species	Authority	Method
1	Amblyoponinae	*Prionopelta* spp.		W
2	Amblyoponinae	*Xymmer* sp.nov.		P
3	Dolichoderinae	*Technomyrmex andrei*	Emery, 1899	P
4	Dolichoderinae	*Technomyrmex* cf. *parviflavus*	Bolton, 2007	P
5	Dolichoderinae	*Technomyrmex* sp.1		P
6	Dolichoderinae	*Technomyrmex* spp.		W
7	Dorylinae	*Dorylus burmeisteri-group*		P
8	Dorylinae	*Lioponera foreli*	(Santschi, 1914)	P
9	Formicinae	*Acropyga* spp.		W
10	Formicinae	*Camponotus* sp.1		P
11	Formicinae	*Camponotus* sp.2		P
12	Formicinae	*Camponotus* sp.3		P
13	Formicinae	*Camponotus* spp.		W

n°	Subfamily	Species	Authority	Method
14	Formicinae	*Lepisiota* sp.1		P
15	Formicinae	*Nylanderia* sp.1		P
16	Formicinae	*Nylanderia* sp.2		P
17	Formicinae	*Nylanderia* spp.		W
18	Myrmicinae	*Atopomyrmex cryptoceroides*	Emery, 1892	P
19	Myrmicinae	*Calyptomyrmex* spp.		W
20	Myrmicinae	*Carebara* spp.		W
21	Myrmicinae	*Cataulacus erinaceus*	Stitz, 1910	P
22	Myrmicinae	*Cataulacus guineensis*	Smith, 1853	P
23	Myrmicinae	*Crematogaster* sp.1		P
24	Myrmicinae	*Crematogaster* sp.2		P
25	Myrmicinae	*Crematogaster* sp.3		P
26	Myrmicinae	*Crematogaster* sp.4		P
27	Myrmicinae	*Crematogaster* sp.5		P
28	Myrmicinae	*Crematogaster* sp.6		P
29	Myrmicinae	*Crematogaster* sp.7		P
30	Myrmicinae	*Crematogaster* sp.8		P
31	Myrmicinae	*Crematogaster* sp.9		P
32	Myrmicinae	*Crematogaster* sp.10		P
33	Myrmicinae	*Crematogaster* sp.11		P
34	Myrmicinae	*Crematogaster* sp.12		P
35	Myrmicinae	*Crematogaster* sp.13		P
36	Myrmicinae	*Crematogaster* sp.14		P
37	Myrmicinae	*Crematogaster* sp.15		P
38	Myrmicinae	*Crematogaster* spp.		W
39	Myrmicinae	*Fisheropone* spp.		W
40	Myrmicinae	*Monomorium* sp.1		P
41	Myrmicinae	*Monomorium* spp.		W
42	Myrmicinae	*Myrmicaria congolensis*	Forel, 1909	P
43	Myrmicinae	*Pheidole* sp. nr. *setosa*		P
44	Myrmicinae	*Pheidole* sp.1		P
45	Myrmicinae	*Pheidole* sp.2		P
46	Myrmicinae	*Pheidole* sp.3		P
47	Myrmicinae	*Pheidole* sp.4		P
48	Myrmicinae	*Pheidole* sp.5		P
49	Myrmicinae	*Pheidole* sp.6		P
50	Myrmicinae	*Pheidole* sp.7		P

n°	Subfamily	Species	Authority	Method
51	Myrmicinae	*Pheidole* sp.8		P
52	Myrmicinae	*Pheidole* sp.9		P
53	Myrmicinae	*Pheidole* sp.10		P
54	Myrmicinae	*Pheidole* sp.11		P
55	Myrmicinae	*Pheidole* sp.12		P
56	Myrmicinae	*Pheidole* sp.13		P
57	Myrmicinae	*Pheidole* sp.14		P
58	Myrmicinae	*Pheidole* sp.15		P
59	Myrmicinae	*Pheidole* sp.16		P
60	Myrmicinae	*Pheidole* sp.17		P
61	Myrmicinae	*Pheidole* sp.18		P
62	Myrmicinae	*Pheidole* sp.19		P
63	Myrmicinae	*Pheidole* spp.		W
64	Myrmicinae	*Pristomyrmex* spp.		W
65	Myrmicinae	*Solenopsis* spp.		W
66	Myrmicinae	*Strumigenys bernardi*	Brown, 1960	P
67	Myrmicinae	*Strumigenys* spp.		W
68	Myrmicinae	*Syllophopsis* spp.		W
69	Myrmicinae	*Tetramorium* afrc-tz22		P
70	Myrmicinae	*Tetramorium boltoni*	Hita Garcia et al., 2010	P
71	Myrmicinae	*Tetramorium* cf. *constanciae*	Arnold, 1917	P
72	Myrmicinae	*Tetramorium* nsp Cameroun fk 20		P
73	Myrmicinae	*Tetramorium quadridentatum*	Stitz, 1910	P
74	Myrmicinae	*Tetramorium reptana*	(Bolton, 1976)	P
75	Myrmicinae	*Tetramorium* sp.1		P
76	Myrmicinae	*Tetramorium* sp.2		P
77	Myrmicinae	*Tetramorium* sp.3		P
78	Myrmicinae	*Tetramorium* sp.4		P
79	Myrmicinae	*Tetramorium* sp.5		P
80	Myrmicinae	*Tetramorium* spp.		W
81	Myrmicinae	*Tetramorium venator*	Hita Garcia & Fisher, 2014	P
82	Myrmicinae	*Tetramoriuum* spp.		W
83	Ponerinae	*Anochetus* cf. *bequaerti*	Forel, 1913	P
84	Ponerinae	*Anochetus* sp.1		P
85	Ponerinae	*Anochetus* spp.		W
86	Ponerinae	*Bothroponera* cf. *ancilla*	(Emery, 1899)	P
87	Ponerinae	*Bothroponera pachyderma*	(Emery, 1901)	P

n°	Subfamily	Species	Authority	Method
88	Ponerinae	*Brachyponera sennaarensis*	(Mayr, 1862)	P
89	Ponerinae	*Fisheropone* spp.		W
90	Ponerinae	*Hypoponera* spp.		W
91	Ponerinae	*Mesoponera* sp.1		P
92	Ponerinae	*Mesoponera* sp.2		P
93	Ponerinae	*Odontomachus assiniensis*	Emery, 1892	P
94	Ponerinae	*Odontomachus troglodytes*	Santschi, 1914	P
95	Ponerinae	*Odontomachus* spp.		W
96	Ponerinae	*Paltothyreus tarsatus*	(Fabricius, 1798)	P
97	Ponerinae	*Parvaponera* sp.1		P
98	Ponerinae	*Phrynoponera bequaerti*	Wheeler, 1922	P
99	Ponerinae	*Phrynoponera gabonensis*	(André, 1892)	P
100	Ponerinae	*Phrynoponera* spp.		W
101	Ponerinae	*Ponera* spp.		W
102	Proceratiinae	*Discothyrea* spp.		W

2.6.4 Future work

Future work will largely involve further identification of both pitfall and Winkler specimens. It is hoped that with collaboration with myrmecologists in the region more specimens can be identified to species level. Both *Xymmer* and *Anochetus* will also be described in independent papers. Writing of the paper in which the *Xymmer* species will be described has begun in collaboration with a researcher in Spain who works in the Afrotropics, and has contributed additional queen and male specimens of *X. muticus* which will also be described in the paper alongside the new species. Work on the *Anochetus* species has yet to commence.

2.7 Hemiptera

Marco de Haas & Jan Mertens: Auchenorrhyncha & Psylloidea
Miguel Nunes: literature study on Cicadidae

2.7.1 Auchenorrhyncha

The Auchenorrhyncha or true hoppers form an abundant plant-feeding group of insects with over 43,000 described species (Bartlett et al., 2018). The Auchenorrhyncha fauna of the DRC is relatively well-studied. The RMCA in Tervuren (Belgium) holds a large collection of specimens from the country, which has been studied by several Auchenorrhynchologists. Other African countries lack a collection of this scale. Despite this, many undescribed species or new species for the fauna of the DRC are to be expected, especially in the lesser studied areas such as the extensive rainforests in the northwest of the DRC, including Salonga National Park.

The true hoppers were a group of focus during the nocturnal survey at the light trap. Certain Auchenorrhyncha are attracted to UV-light and can therefore serve as an ideal candidate in standardised biodiversity surveys. The groups that do not come to light are predominantly surveyed by sweep-netting herbaceous plants, shrubs and trees in a variety of habitats throughout the study area. As sweep-netting was not part of the standard sampling methods, these taxa are not represented in the samples.

Specimens were collected from the light trap sheet and direclty preserved in 70% ethanol. A total of 28 distinct species have been identified (**Table 18**). More species were collected during the survey, most notably within the Cicadellidae, further identification on these taxa is ongoing and may be added in a subsequent version of the report. The collected material representes 16 true hopper families, representing nearly half of the extant true hopper families. Taxa belonging to the Fulgoromorpha and Cercopoidea were the main focus during the identification process. The Fulgoridae and Eurybrachidae have been identified by Jérôme Constant.

2.7.1.1 Aphrophoridae

Three species of Aphrophoridae were found, all belonging to the genus *Ptyelus* Le Peletier de Saint-Fargeau & Serville, 1825. One of these species is close to *Ptyelus grossus* var. *centralis* or *P. grossus* var. *nigripes*, but differs from *Ptyelus grossus* s.str. (Fabricius, 1781) in details of the aedeagus.

2.7.1.2 Cercopidae

Five species of Cercopidae have been collected, most of which belong to the genus *Literna* Stål, 1866. A more detailed study of the material is needed to confirm the species-identifications.

2.7.1.3 Cicadellidae

This family is represented by several dozen species, few of which have been studied so far. Material of the subfamily Iassinae is included in **Table 18**.

2.7.1.4 Cicadidae

The true cicadas are represented by eight distinct morphotypes. Identifications of the 45 collected specimens are still ongoing. See Cicadidae (p. 92) for more details and a literature study on the available knowledge on the family.

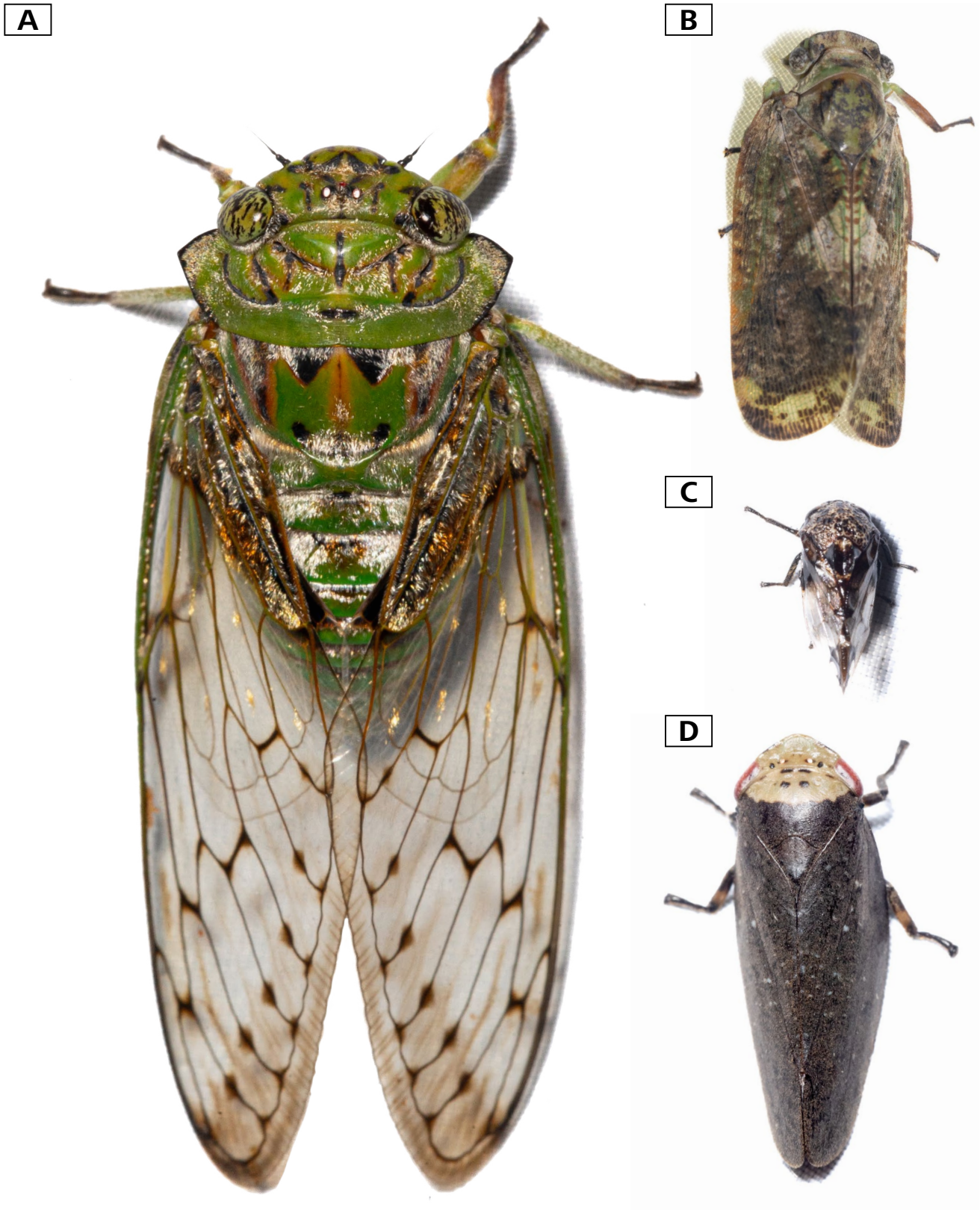

Figure 29. Auchenorrhyncha diversity depicted by species resting on the sheet of the light trap. **A.** Unidentified species belonging to the Cicadidae, **B.** *Aspidonitys* sp. (Eurybrachidae), **C.** *Enderleinia bispina* (Machaerotidae), **D.** *Ptyelus* sp. (Aphrophoridae). (Photos by Michiel van Noppen)

2.7.1.5 Machaerotidae

Three species of Machaerotidae are collected. *Enderleinia bispina* Schmidt, 1907 is a relatively widespread species and was collected in several locations. Two species of *Labramachaerota* Bell & Cryan, 2013 are new to science (De Haas & Mertens, submitted manuscript).

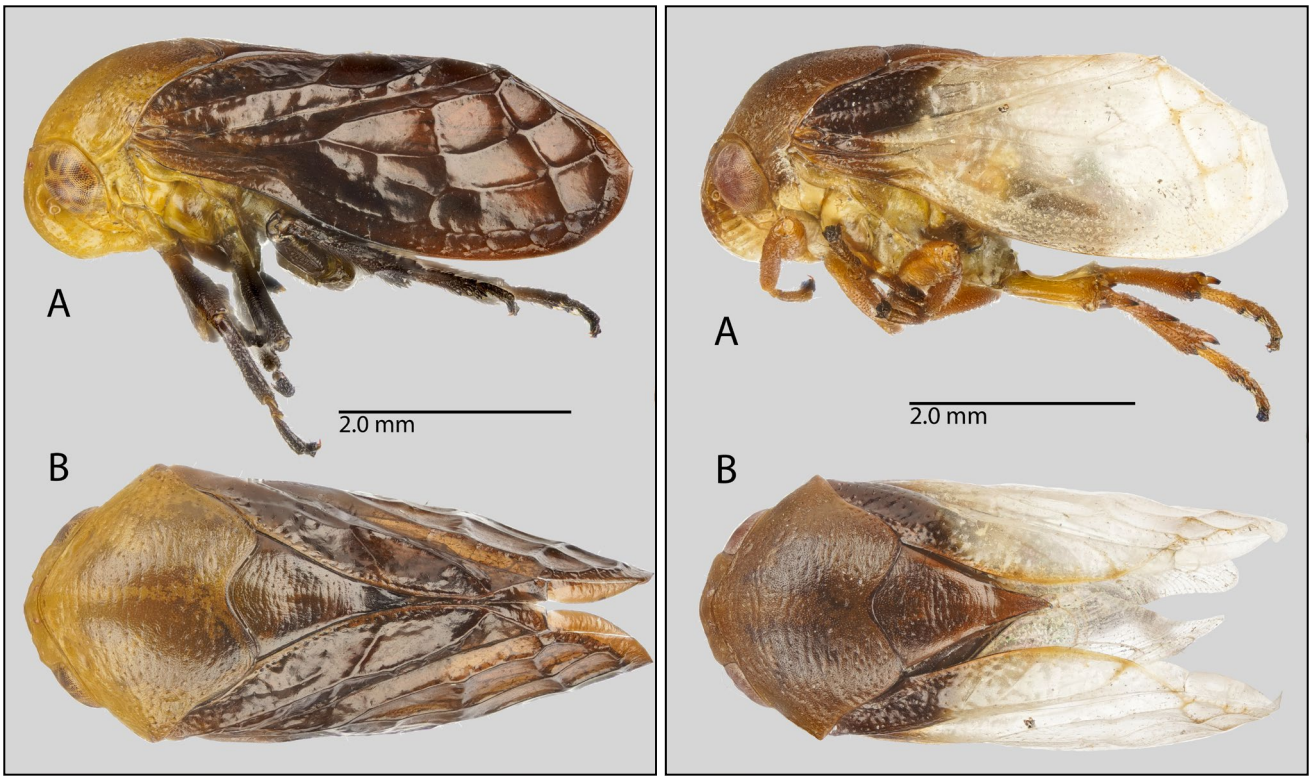

Figure 30. Dorsal and lateral images of two new species of *Labramachaerota*. (Photos by Marco de Haas)

2.7.1.6 Membracidae

The collected material contains 10-15 species of Membracidae, these are not yet studied and remain unidentified.

2.7.1.7 Achilidae

Several species in the family Achilidae have been collected, some of which are likely to be undescribed taxa. A more detailed study of this material is needed.

2.7.1.8 Cixiidae

Three species of Cixiidae are collected, two of which are new to science. More material of these undescribed taxa is needed in order to describe them.

2.7.1.9 Delphacidae

Several unidentified species of Delphacidae have been collected.

2.7.1.10 Derbidae

Two described species of Derbidae are found in the collected material. *Mysidioides ampliata*

Synave, 1973 is a new record for the Democratic Republic of the Congo and the material includes the hitherto undescribed male of this species. Besides this, several undescribed taxa have been collected.

2.7.1.11 Dictyopharidae

Few specimens representing 2-3 morphospecies are collected. This material is not yet identified.

2.7.1.12 Eurybrachidae

One species of the family Eurybrachidae was collected, belonging to the genus *Aspidonitys* Karsch, 1895. This genus is currently represented by 16 described species, but a revision of the genus is needed.

2.7.1.13 Flatidae

One unidentified species in the genus *Cryptoflata* Melichar, 1902 (**Figure 31A**).

2.7.1.14 Fulgoridae

One Fulgoridae was collected, an unidentified female belonging to the genus *Metaphaena* Schmidt, 1905.

2.7.1.15 Ricaniidae

The Ricaniidae are still under investigation, the material contains six morphospecies.

2.7.1.16 Tropiduchidae

One undescribed species of Tropiduchidae was found among the material. The species is close to *Tropiduchis bifasciatus* Van Stalle, 1985 but differs in details of the genitalia.

Figure 31. A. *Cryptoflata* sp. (Flatidae), **B.** *Ricanopsis* sp. (Ricaniidae) (Photos by Michiel van Noppen)

Table 18. List of distinct (morpho)species of true hoppers (Auchenorrhyncha) collected during the Salonga NP survey.

n°	Family (subfamily)	Species	Authority
1	Aphrophoridae	*Ptyelus escalerai*	Distant, 1908
2	Aphrophoridae	*Ptyelus grossus*	(Fabricius, 1781)
3	Aphrophoridae	*Ptyelus* nr. *grossus* var. *centralis/nigripes*	
4	Cercopidae	*Literna* cf. *adonis*	Linnavuori, 1973
5	Cercopidae	*Literna* cf. *haglundi*	Schmidt, 1920
6	Cercopidae	*Literna* cf. *limbata*	Schmidt, 1920
7	Cercopidae	*Locris maculata*	(Fabricius, 1781)
8	Cercopidae	*Jeanneliensia lujai*	Lallemand, 1949
9	Cicadellidae (Lassinae)	*Batracomorphus* nr. *punctatissimus*	(Melichar, 1908)
10	Cicadellidae (Lassinae)	*Jassulus* sp. nov. *1*	
11	Cicadellidae (Lassinae)	*Jassulus* sp. nov. *2*	
12	Cicadellidae (Lassinae)	*Jassulus* sp. nov. *3*	
13	Cicadellidae (Lassinae)	*Jassulus* sp. nov. *4*	
14	Cicadellidae (Lassinae)	*Krisna gravis*	(Stål, 1858)
15	Cixiidae	*Brixidia* sp. nov.	
16	Cixiidae	*Lalobidius lootensi*	(Synave, 1956)
17	Cixiidae	*Lalobidius* sp. nov.	
18	Derbidae	*Muiralevu africanus*	(Muir, 1926)
19	Derbidae	*Mysidioides ampliata*	Synave, 1973
20	Eurybrachidae	*Aspidonitys* sp.	
21	Flatidae	*Cryptoflata* sp.	
22	Fulgoridae	*Metaphaena* sp.	
23	Machaerotidae	*Enderleinia bispina*	Schmidt, 1907
24	Machaerotidae	*Labramachaerota* sp. nov. *1*	
25	Machaerotidae	*Labramachaerota* sp. nov. *2*	
26	Ricaniidae	*Lugardia* sp.	
27	Ricaniidae	*Ricanopsis* sp.	
28	Tropiduchidae	*Tropiduchis* sp. nov.	

2.7.2 Psylloidea

Like the Auchenorrhyncha, the Psylloidea are plant-feeding insects. This superfamily is represented by over 4,000 described species. Several Psyllids were collected as by-catch when collecting Auchenorrhyncha. These psyllids have been identified by Daniel Burckhardt (**Table 19**). Six species have been found in the material, two of which are potentially undescribed species. More intensive research in the same area, focusing on Psyllids, will undoubtedly yield many additional species.

Table 19. List of distinct (morpho)species of psyllids (Psylloidea) collected during the Salonga NP survey.

n°	Species	Authority	#males	#females
1	cf. *Caradocia* sp. nov.			1
2	*Ciriacremum* cf. *bicaudatum*	Enderlein		1
3	*Ciriacremum* cf. *nigripes*	Hollis		1
4	*Euryconus* sp. nov.		3	1
5	*Kleiniella congoensis*	Hollis		4
6	*Kleiniella jassina*	(Enderlein)	2	2

2.7.3 Cicadidae

2.7.3.1 **Introduction**

The true cicadas, a group with about 3,000 known species worldwide (Stephen, 2021), are found in various biomes across all continents except Antarctica (Sanborn, 2008). These insects, like many invertebrates, rely on specific host plants and trees for nourishment and growth. Their larvae live and develop underground, with the duration of that stage varying among species and environmental conditions. The fully developed nymphs then emerge for their final moult into the audible, adult form recognized for their distinctive and often diagnostic calls (Boulard, 2002; Sanborn, 2008; Stephen, 2021).

The first descriptions of cicada species from the Afrotropical region date from the 18th century (Fabricius, 1775). However, the scientific knowledge on cicadas and the discovery of new species rapidly increased during the 19th and 20th centuries, when many specimens were collected and studied through the course of several European expeditions taking place in the African continent (Leopold, 1994). Some of these expeditions also explored and established medium to long term stations in different areas of the Democratic Republic of the Congo, thus contributing to the sampling of local specimens and consequent increase of the knowledge on this country's biodiversity (Tuckey, 1818; Cameron, 1876).

However, the information on cicada species in the DRC and their distribution is fragmented across many old publications by various authors, often with vague or unclear details about the sources of these records. Thus to consolidate existing knowledge about DRC cicadas into a single reference and aid future research on this group, we have compiled a comprehensive list of Cicadidae species recorded in the DRC. Additionally, we provide details on the morphotypes identified in this study.

Figure 32. Exuvia (shed covering) of a cicada on a tree trunk at the Lowland campsite. (Photo by Miguel Nunes)

2.7.3.2 Surveys

During the expedition, 45 cicada specimens were collected at both Highland and Lowland campsites. The sampling took place at night, as the individuals were drawn to the UV light from the light trap (see p. 72). Initially, these specimens were captured and sedated in a jar containing ammonia and a cotton base, then temporarily preserved in 70% ethanol throughout the expedition. Subsequently, they were pinned at the Lisbon Museum of Science and Natural History. For some specimens, a leg was retained in ethanol for possible future molecular studies.

For species identification, all specimens were photographed at the Museum of Science and Natural History of Lisbon using a Canon 6D Mark IV with a Canon 100mm f/2.8 L series lens, set on a fixed mounted structure. Additionally, the representative males from each morphotype collected had their genitalia carefully exposed and photographed using a Canon EF 100mm f/2.8 L Macro IS USM.

2.7.3.3 Literature review

In this preliminary literature review we assembled the observations of 52 Cicadidae species based on published records for the Democratic Republic of the Congo (**Table 20**). Not unexpectedly, none of the published records came from Salonga National Park and we here provide possibly the very first Cicadidae records for this large region.

Table 20. List of 52 Cicadidae species with published records for the Democratic Republic of the Congo.

n°	Subfam.|Tribe	Species|Authority	Region(s) in DRC	References
	Cicadettinae			
1	Chlorocystini	*Musoda flavida* (Karsch, 1890)	Lokandu	Dlabola, 1960
2	Lamotialnini	*Hylora differata* (Dlabola, 1960)	Kasenyi, Mongbwalu, Kilo, Bambesa	Dlabola, 1960
3	Lamotialnini	*Panka silvestris* (Jacobi, 1912)	Upper Ituri (between Irumu and Mawambi), Moto (Haut-Uele), Mayumbe, Rutshuru, Kisala, Kundelungu	Jacobi, 1912; Dlabola, 1960
4	Lamotialnini	*Panka umbrosa* (Distant, 1920)	Kindu, Lufira river, Kapanga (Lulua), Medje (Ituri), Mongbwalu, Lubilash, Uele, Kaniama, Lubumbashi, Kasongo, Shabunda, Haut-Uele, Kisala	Distant, 1920; Dlabola 1960
5	Lamotialnini	*Trismarcha atrata* (Distant, 1905b)	Tukpo (Uele), Mobanga (Maniema), Yambata	Dlabola, 1960
6	Lamotialnini	*Trismarcha decolorata* (Dlabola, 1960)	Bokuma	Dlabola, 1960
7	Lamotialnini	*Trismarcha excludens* (Walker, 1858)	Uele, Walungu, Bambesa, Bokuma, Kapanga (Lulua), Flandria (Tshuapa), Mayumbe, Mbandaka	Dlabola, 1960
8	Lamotialnini	*Trismarcha ferruginosa* (Karsch, 1891)	Buta, Mayumbe	Distant, 1919
9	Lamotialnini	*Trismarcha nana* (Dlabola, 1960)	Kirungu, Moba (Tanganyika)	Dlabola, 1960
10	Lamotialnini	*Trismarcha umbrosa* (Karsch, 1891)	Mayumbe, Kapanga (Lulua), Lokandu, Bena-Bendi, Kasenyi, Kavumu, Mingazi, Lukula, Bambesa, Pinga (Masisi), Sankuru, Bokote	Distant, 1919; Dlabola, 1960
	Cicadinae			
11	Platypleurini	*Afzeliada afzelii* (Stål, 1854)	Cassai river, Lusinga, Kanonga, Kilwezi (Lufira), Bolobo, Lake Mai-Ndombe, Bukavu, Katanga	Karsch, 1890; Dlabola, 1960; Malaisse, 1997
12	Platypleurini	*Afzeliada deheegheri* (Boulard, 1975a)	Kananga, Kasaï	Boulard, 1975a
13	Platypleurini	*Afzeliada donskoffi* (Boulard, 1979)	Mbanza-Ngungu	Boulard, 1979
14	Platypleurini	*Afzeliada duplex* (Dlabola, 1961)	Katanga	Malaisse, 1997
15	Platypleurini	*Afzeliada izzardi* (Dlabola, 1960)	Sankuru	Dlabola, 1960
16	Platypleurini	*Afzeliada ladona* (Distant, 1919)	Bukama	Distant, 1919
14	Platypleurini	*Afzeliada lusingana* (Boulard, 1979)	Lusinga	Boulard, 1979
18	Platypleurini	*Afzeliada rutherfordi* (Distant, 1883)	Kasongo-Lunda (Kwango), Kisangani, Katanga, Bokuma, Lemfu, Maniema, Bokapo (Lisala), Niarembe (Mahagi), Barumbu, Banalia, Mpala (Tanganyika), Lubumbashi, Yangambi, Kasai, Ubangui, Uele, Kapanga (Lulua)	Dlabola, 1960
19	Platypleurini	*Dyticopycna hecuba* (Distant, 1904a)	Northwest bank of Lake Tanganyika, Southwest of Lake Albert, Virunga National Park (Kamatembe)	Jacobi, 1912; Dlabola, 1960

n°	Subfam.|Tribe	Species|Authority	Region(s) in DRC	References
20	Platypleurini	*Ioba bequaerti* (Distant, 1913)	Sankishia (Katanga)	Distant, 1913
21	Platypleurini	*Ioba horizontalis* (Karsch, 1890)	Cassai river, Kilwezi (Lufira), Kiamakoto (between Masombwe and Mukana), Katanga	Karsch, 1890; Dlabola, 1960; Malaisse, 1997
22	Platypleurini	*Ioba leopardina* (Distant, 1881)	Katanga	Malaisse, 1997
23	Platypleurini	*Ioba limbaticollis* (Stål, 1863)	Lemba	Distant, 1919
24	Platypleurini	*Koma bombifrons* (Karsch, 1890)	Kilwezi (Lufira), Lusinga, Lubumbashi	Dlabola, 1960
25	Platypleurini	*Koma semivitrea* (Distant, 1914b)	Kapiri (Katanga), Lubumbashi	Distant, 1914b; Dlabola, 1960
26	Platypleurini	*Muansa clypealis* (Karsch, 1890)	Avakubi	Distant, 1919
27	Platypleurini	*Munza furva* (Distant, 1897)	Kilwezi (Lufira), Lusinga, Kanonga, Kansenia, Dilolo, Katanga	Dlabola, 1960; Malaisse, 1997
28	Platypleurini	*Munza signata* (Distant, 1914b)	Kapiri (Katanga)	Distant, 1914b
29	Platypleurini	*Munza straeleni* (Dlabola, 1960)	Kanonga	Dlabola, 1960
30	Platypleurini	*Platypleura adouma* (Distant, 1904a)	Mayidi, Tukpo (Uele), Bambesa, Lukula, Katanga, Kahuzi, Mulungu, Katana, Shabunda, Kamituga, Lemfu, Cattier, Moto (Haut-Uele), Mutaka (Kakanda), Bukavu, Mutwanga (West Mt. Ruwenzori), Kibali, Mongbwalu, Bunia, Lubumbashi, Kwango, Beni, Budjala (Ubangi), Djiba, Uvira	Dlabola, 1960
31	Platypleurini	*Platypleura crampeli* (Boulard, 1975b)	Unknown location	Medler, 1980; Sanborn, 2014
32	Platypleurini	*Platypleura gowdeyi* (Distant, 1914c)	Bunia (Ituri), Niarembe (Ituri), Kibali (Ituri), Kapanga (Lulua), Kasai	Dlabola, 1960
33	Platypleurini	*Platypleura hirtipennis* (Germar, 1834)	Idjwi (Lake Kivu)	Jacobi, 1912
34	Platypleurini	*Platypleura kabindana* (Distant, 1919)	Kabinda (Lomami)	Distant, 1919
35	Platypleurini	*Platypleura makaga* (Distant, 1904a)	Ituri (between Avakubi and Bumili), Kisangani, Yangambi, Kapanga (Lulua)	Jacobi, 1912; Dlabola, 1960
36	Platypleurini	*Platypleura murchisoni* (Distant, 1905d)	Uele	Distant, 1919
37	Platypleurini	*Platypleura witteana* (Dlabola, 1960)	Kanonga, Bukama	Dlabola, 1960
38	Platypleurini	*Orapa numa* (Distant, 1904a)	Itimbiri (Uele), Lukuga, Lusinga	Dlabola, 1960
39	Platypleurini	*Orapa tangana* (Strand, 1910)	Lukuga	Distant, 1919

n°	Subfam.|Tribe	Species|Authority	Region(s) in DRC	References
40	Platypleurini	*Oxypleura clara* (Amyot & Audinet-Serville, 1843)	Pool Malebo, Uvira, Moba (Tanganyika), Boma, Northwest Mt. Ruwenzori, Lukula	Karsch, 1890; Dlabola, 1960
41	Platypleurini	*Oxypleura lenihani* (Boulard, 1985)	Kindu	Boulard, 1985
42	Platypleurini	*Severiana severini* (Distant, 1893)	Boma, Kitobola	Distant, 1919; Dlabola, 1960
43	Platypleurini	*Soudaniella melania* (Distant, 1904c)	Bunia (Ituri), Faradje (Ituri), Niarembe (Ituri)	Dlabola, 1960
44	Platypleurini	*Soudaniella schoutedeni* (Distant, 1913)	Kalenge, Sankishia, Kindu	Distant, 1913 & 1919
45	Platypleurini	*Sadaka aurovirens* (Dlabola, 1960)	Kapanga (Lulua), Lukuga, Lake Mweru	Dlabola, 1960
46	Platypleurini	*Sadaka morini* (Boulard, 1985)	Kimbau (Kwango)	Boulard, 1985
47	Platypleurini	*Sadaka radiata* (Karsch, 1890)	Cassai river, Avakubi (Upper Aruwimi River), Kindu, Kanonga, Bumba, Katanga	Karsch, 1890; Jacobi, 1912; Distant, 1919; Dlabola, 1960; Malaisse, 1997
48	Platypleurini	*Ugada limbalis* (Karsch, 1890)	Bamanya (Mbandaka), Bokuma, Yangambi, Lufira river, Lusinga, Mitwaba, Mabwe (Lake Upemba), Katanga	Dlabola, 1960; Malaisse 1997
49	Platypleurini	*Ugada limbata* (Fabricius, 1775)	West of Mts. Ruwenzori, West of Lake Albert, Mayumbe, Bomboma, Kondue (Sankuru), Katanga, Lubilu river, Kimbau (Kwango), Avakubi, Mayidi, Lemfu, Kisangani, Kisantu, Shabunda, Cattier, Karawa (Ubangi), Kibali (Ituri), Mbanza-Ngungu, Kabwe, Lomami, Lukuga, Lubumbashi, Niarembe, Kananga, Bambesa, Kambove, Kanonga, Mabwe (Lake Upemba), Kankunda (Lupiala river)	Jacobi, 1912; Dlabola, 1960
50	Platypleurini	*Ugada limbimacula* (Karsch, 1893)	Katanga	Malaisse, 1997
	Tettigomyiinae			
51	Iruanini	*Iruana sulcata* (Distant, 1905c)	Kamatembe (Virunga National Park), North Kivu, Rutshuru	Dlabola, 1960
52	Iruanini	*Lacetas annulicornis* (Karsch, 1890)	Kindu, Kaswabilenga (Lufira river), Kankunda (Lupiala river), Mabwe (Lake Upemba)	Distant, 1919; Dlabola, 1960

An additional list was assembled to enumerate 27 more Cicadidae species that have either been recorded outside the borders of DRC but geographically close to them, or that have ambiguous records regarding their collection site at bordering regions (e.g., around the lakes Tanganyika and Albert). The list is presented in **Table 21**.

Due to the high dispersal capacity of cicadas within an ecologically suitable biome, it is likely that the species represented on this list may also occur in the Democratic Republic of the Congo, still waiting for a formal discovery inside its borders.

Table 21. List of 27 Cicadidae species recorded at geographically close sites from DRC borders or presenting unclear bordering records.

n°	Subfam.|Tribe	Species|Authority	Region(s) - Country	References
	Cicadettinae			
1	Chlorocystini	*Musoda gigantea* (Distant, 1914a)	Boukoko - Central African Republic	(Collected by Boulard in 1968)
2	Chlorocystini	*Musoda orientalis* (Boulard, 1974a)	Kayonza-Kigezi - Uganda	Boulard, 1974a
3	Lamotialnini	*Hylora bonneti* (Boulard, 1975a)	Brazzaville - Republic of the Congo	Boulard, 1975a
4	Lamotialnini	*Hylora mondziana* (Boulard, 1971b)	Boukoko - Central African Republic	Boulard, 1971b
5	Lamotialnini	*Panka duartei* (Boulard, 1975c)	Maiombe - Angola	Boulard, 1975c
6	Lamotialnini	*Panka lunguncus* (Boulard, 1970)	Boukoko, Maboké - Central African Republic	Boulard, 1970
7	Lamotialnini	*Panka minimuncus* (Boulard, 1970)	Boukoko, Maboké - Central African Republic	Boulard, 1970
8	Lamotialnini	*Panka parvula* (Boulard, 1971b)	Boukoko - Central African Republic	Boulard, 1971b
9	Lamotialnini	*Trismarcha lobayensis* (Boulard, 1971b)	Boukoko, Maboké - Central African Republic	Boulard, 1971b
	Cicadinae			
10	Platypleurini	*Afzeliada bernardii* (Boulard, 1971a)	Maboké - Central African Republic	Boulard, 1971b
11	Platypleurini	*Afzeliada christinetta* (Boulard, 1971b)	Boukoko - Central African Republic	Boulard, 1971b
12	Platypleurini	*Dyticopycna baxteri* (Distant, 1914c)	Kigoma (Tanganyika) - Tanzania	Distant, 1914c
13	Platypleurini	*Dyticopycna quanza* [1] (Distant, 1899)	Iswa (Lake Albert) – Unknown if in DRC or in Uganda	Dlabola, 1960
14	Platypleurini	*Ioba stormsi* [2] (Distant, 1893)	Lake Tanganyika (unspecific) - Uncertain if in DRC or Tanzania	Distant, 1893
15	Platypleurini	*Koma intermedia* (Boulard, 1980)	Chingola - Zambia	Boulard, 1980
16	Platypleurini	*Munza basimacula* (Walker, 1850)	Congo (Unspecific)	Walker, 1850
14	Platypleurini	*Oxypleura pointeli* [3] (Boulard, 1985)	Resna - Burundi	Boulard, 1985
18	Platypleurini	*Soudaniella cortustusa* (Boulard, 1974b)	Boukoko - Central African Republic	Boulard, 1974b
19	Platypleurini	*Soudaniella sudanensis* (Distant, 1913)	Yei to Maridi – South Sudan	Distant, 1913
20	Platypleurini	*Sadaka virescens* [4] (Karsch, 1890)	Malange, Quibocolo (Zombo) - Angola	Karsch, 1890; Distant, 1919

n°	Subfam.|Tribe	Species|Authority	Region(s) - Country	References
21	Platypleurini	*Ugada dargei* (Boulard, 2012)	West of Namanyere (Rukwa Region) - Tanzania	Boulard, 2012
22	Platypleurini	*Ugada giovanninae* (Boulard, 1971b)	Boukoko - Central African Republic	Boulard, 1971b
23	Platypleurini	*Ugada grandicollis* [5] (Germar, 1830)	From Sangha (Republic of the Congo) to Bangui (Central African Republic)	Boulard, 1971b
24	Platypleurini	*Ugada nigrofasciata sylvicola* (Boulard, 1971b)	Boukoko - Central African Republic	Boulard, 1971b
25	Platypleurini	*Ugada nutti* (Distant, 1904c)	Nyasa plateau, near Tanganyika (unspecific)	Distant, 1904c
26	Platypleurini	*Ugada parva* (Boulard, 1971b)	Boukoko - Central African Republic	Boulard, 1971b
	Tettigomyiinae			
27	Tettigomyiini	*Stagira consobrina* (Distant, 1920)	Nile Prov. – Uganda; Dékoa, Fort Sibut - Central African Republic	Distant, 1920; Boulard, 1975b

1 – The locality Iswa was not located on the map and there is no other specific context on the collection site;
2 – This record is attributed to Captain Émile Storms, who oversaw long-term posts in Karema, Tanzânia (for less than a year) and Mpala, DRC (for 2 years);
3 – The locality Resna was not located on the map, but the record is unmistakably attributed to Burundi.
4 – There are two unpublished records of this species for DRC, one with unspecific location and another for the region of Boma.
5 – Boulard 1971b says that this species distribution extends through the whole forest biome of intertropical Africa. There is one unpublished record of this species for DRC near the village of Basoko, and another for Uganda, near Budongo on the East side of Lake Albert.

2.7.3.4 Results

Out of the 45 specimens collected on this expedition, eight different morphotypes were identified. All these specimens are currently under examination for species determination. The results on the cicada species found on this expedition will follow up on the present report.

2.7.3.5 Discussion

Although a significant number of cicada species have already been recorded in the Democratic Republic of the Congo, its anticipated that this number will rise. This expectation is based on the substantial number of additional cicada species present in neighbouring countries, close to the DRC borders, such as the surroundings of Lakes Tanganyika and Albert in the East, near villages from Central African Republic in the North, the city Brazzaville (Republic of the Congo) in the West or northern Angola and Zambia villages in the South (see **Table 21**). Considering cicadas' strong flying capabilities, these distances are easily traversable if the connecting biomes are ecologically compatible for the species. This suggests that extensive research across the DRC is necessary to uncover the true diversity of cicadas in the region.

Moving from a national to a regional perspective, one might assume that a vast, untouched, and protected region like Salonga National Park would host a considerable proportion of the forest species documented in the country. Yet, cicadas in Salonga National Park remain notably under-researched. This expedition's initial cicada sampling in Salonga National Park paves the way for more targeted research and extensive fieldwork on these insects within the park. Cicadas, an intriguing and fascinating group, have likely only had a fraction of their presence and diversity revealed during this expedition.

We highly welcome any collaborations with specialists interested to join forces to further study and possibly help describe new species from this region.

Figure 33. Cicada specimen from the genus *Ugada* (Distant, 1904b) photographed at the Museum of Science and Natural History of Lisbon. (Photo by Miguel Nunes)

2.7.4 Acknowledgements

Jérôme Constant is thanked for the identifications of the Fulgoridae and Eurybrachidae respectively. Daniel Burckhardt is thanked for identifying the Psyllids.

The Museum of Science and Natural History of Lisbon is acknowledged for storing the Cicadidae specimens as well as Roberto Keller and Tatiana Moreira for allowing me to use the museum materials to analyse the cicada specimens, to Gonçalo Costa for helping mount and organise the cicadas and for exposing the genitalia of male specimens, and to Dr. Allen Sanborn for his suggestions and advice on literature and Cicadidae nomenclature.

2.8 Lepidoptera

Jan Mertens

2.8.1 Background

As discussed in the Introduction (p. 67), biodiversity surveys often exclude invertebrates as they are difficult to collect and identify, among other reasons. But when invertebrates are surveyed, it is often the butterflies and some moth groups that are the first taxa to be studied in an area. Butterflies are a relatively small insect group, with around 17,500 described species globally. Moths on the other hand, are incredibly diverse counting around 160,000 described species and between 250,000 and 450,000 yet to be discovered. Identification of butterflies is relatively accessible because their biodiversity is well-studied on a global level (Thomas 2005) and, in many cases, the wing patterns are species-specific.

A nationwide checklist and identification manual for DRC dates back to 1981 ("Les Papillons du Zaïre", Berger & Seko 1981). Since then, there has been isolated research on advancements in the field of afrotropical butterfly taxonomy in DRC including taxonomic revisions (e.g. Aduse-Poku et al. 2016; Mitter et al. 2011) and newly discovered species of butterflies (e.g. Sáfián et al. 2020). There have been surveys on butterflies in several areas across the country such as the north-east (Ducarme, 2018) and the Mai-Ndombe province (Jocque et al. 2022).

Figure 34. Left: The Shining Red Charaxes (*Charaxes zingha*), like many *Charaxes*, lives mostly in the forest canopy but often comes down to the understorey in forest clearings. This species eluded bait traps and was only captured on photo. (Photo by Gabriel Jamie) **Right:** One of the four species of Pathfinders (*Evena* sp.) present in the forests of SNP. (Photo by Michiel van Noppen)

A larger study on the biodiversity of the Albertine rift reports 43 endemic butterfly species from Eastern DRC (Davenport 2003), but the total number of butterfly species of the area could not be reported due to a lack of surveys (Plumptre et al. 2007). In line with the above mentioned examples, the butterflies of Salonga NP are still poorly known (Vande Weghe & Vande Weghe 2018). During a 2017 survey of the butterfly diversity in the southern part of the park, 399 species were identified (Bessone et al. 2019) and a new species of Lycaenidae was described (Sáfián et al. 2021). However, at the time of writing and to our knowledge, no butterfly species list has been published or is available.

The moths of DRC are poorly studied. There is no country-wide species list or species richness estimates, but information is available online on several databases (e.g. Afromoths - De Prins & De Prins 2017, Sphingidae Taxonomic Inventory - Kitching 2022). New species are described from DRC (e.g. Prozorov et al. 2021 Sruoga & De Prins 2022), but many species are known from their type locality only, indicating the need for more substantial surveys. Some moth taxa have received global taxonomic attention akin to that of the butterflies. Several moth families, including hawk moths and emperor moths, were surveyed in the southern part of the park between 2014 and 2018 and resulted in a total of 59 identified taxa (Bessone et al. 2018). This study only mentions the total number of taxa encountered and to our knowledge no published species list is available.

2.8.2 Methods

For relevant survey methods, see p. 69. Moth species were usually collected around the light trap. Fruit feeding butterflies were attracted to the bait traps. Most butterfly species, however, were caught opportunistically during the day with butterfly nets.

A large portion of the collected butterflies was transferred to the Zoological Museum of the Jagiellonian University, Krakow, Poland (MZUJ) where they were prepared accordingly and incorporated into the institute's butterfly collection. Species identification is based on the museum's reference collection in combination with available literature, including: Papillons du Gabon (Vande Weghe 2010), Butterflies of West Africa (Larsen 2005), Révision des Anthene africains (Libert 2010), Revision of the genus Neptis (Richardson 2019), and Afrotropical Butterflies and Skippers (Williams 2021). The latter is also used as a reference for butterfly taxonomy and naming.

2.8.3 Results

2.8.3.1 **Butterflies**

A total of 484 butterfly specimens were collected of which 433 were transferred to the MZUJ for curation. Dorsal and ventral reference photographs were made for 203 of the curated specimens.

Identification of butterflies is still ongoing. At this time, 195 distinct (morpho)species are included in the species list provided in **Table 22**. Several specimens require close examination of genital structures and reference material from other museum collections to corroborate the species identification. These uncertainties are marked by 'cf.' before the specific epithet in the table. Insect legs were collected from specimens of particular interest for DNA sequencing. Results from the DNA analyses are still pending. The species list as well as updates on the species' distribution will be updated as more information becomes available.

Of the 195 distinct butterfly taxa, 160 were collected opportunistically with butterfly nets, 27 were exclusively found in the bait traps, five were only captured on photos, and all three taxa that came to the light trap were not collect by any other means. These numbers illustrate the utility of different sampling methods.

***Charaxes nobilis nobilis* Druce, 1873**

The Noble White Charaxes (Nymphalidae: Charaxinae) typically flies high-up in the forest canopy. It is a scarce species that is not often encountered and seems restricted to the large, continuous lowland forests of the afrotropical region from Guinea in the West to Kenya in the East (Larsen 2005). As it is relatively widespread across Africa, it is most likely not a particularly rare or threatened species. Yet, we know very little about *C. nobilis*. It can only be confused with one other Charaxes, *C. superbus*, where the hindwing underside is marked with a broad orange band along the black margin. *C. nobilis* is separated into three distinct subspecies, two of which occur in DRC: the nominate subspecies, depicted in **Figure 35,** and subsp. *rosemariae* which occurs in eastern DRC and western Uganda. The latter is more squat and has broader black bands (Larsen, 2005). During our survey, one individual was caught in a canopy bait trap set up in the marsh forest (Lowland site). The specimen is digitized and deposited in the MZUJ (refn. 150729-N).

Figure 35. Reference photographs of the dorsal (left) and ventral (right) side of the collected specimen of *Charaxes nobilis*, deposited in the MZUJ. (Photos by Jan Mertens)

Euphaedra* cf. *ceres

The genus *Euphaedra* (Nymphalidae: Limenitdinae), also known as Foresters, is the largest butterfly genus of the Afrotropical region with over 250 described species (Williams, 2021). Many *Euphaedra* species are strongly associated to forests where they predominantly feed on fallen fruits and animal remains. Bait trapping is an effective method to survey these species and we collected at least 21 distinct morphospecies of which about half with bait traps.

Euphaedra are subcategorized in eight subgenera which are in turn split up in several species groups and sometimes 'subgroups' based on certain external morphological characteristics. One such groups is the *Euphaedra* "*ceres*-group" which is likely to still hold several hidden species (Lorenc, pers. comm.), exemplified by a relatively recent description of two new species within the

species group (Pyrcz 2011). Among our samples, we collected a set of six similar-looking specimens that morphologically fit within the "*ceres*-subgroup" of the "*ceres*-group", three of which are shown in **Figure 36**. *Euphaedra ceres*, the Small Streaked Forester, is a very variable species with a wide distribution and to properly compare our specimens with that species, a study of the genital structures is needed. Material for DNA analysis has also been collected.

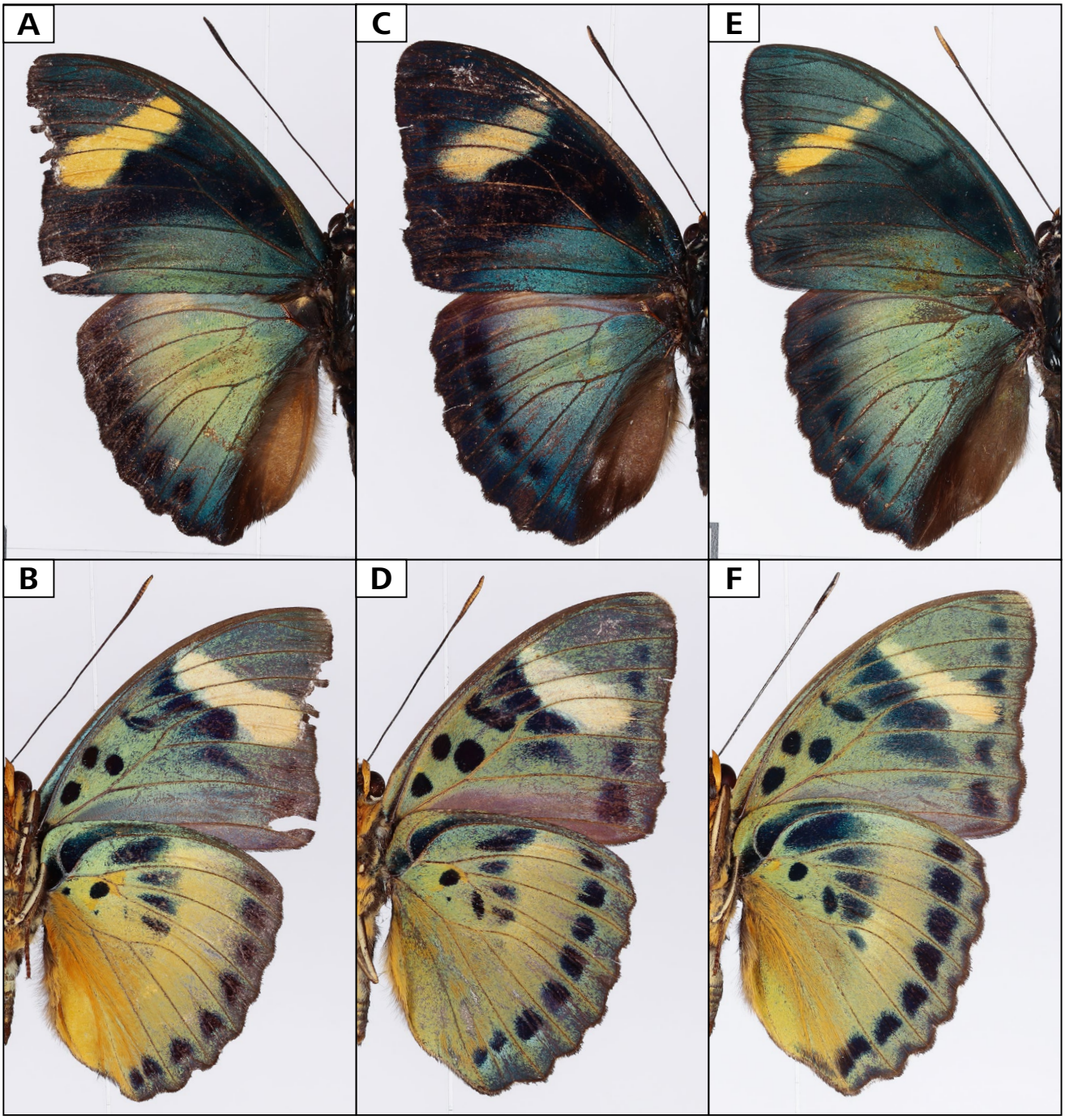

Figure 36. Images showcasing the variability of similar *Euphaedra* specimens within the "*ceres*-group", top and bottom rows show dorsal and ventral sides of the same specimens (A-B, C-D, E-F). (Photos by Jan Mertens)

Table 22. List of butterfly species collected during the Salonga NP survey. The last column indicated the survey method: opportunistic catching with (O), bait trap set up in the understory or canopy (Bu and Bc), light trapping (L), or identifiable photos (P).

n°	Family | Subfamily	Species	Authority	Method
	Papilionidae			
1	Papilioninae	*Graphium antheus*	(Cramer, [1779])	O
2	Papilioninae	*Graphium leonidas*	(Fabricius, 1793)	O
3	Papilioninae	*Graphium ucalegon*	(Hewitson, [1865])	P
4	Papilioninae	*Papilio chrapkowskoides*	Storace, [1952]	O
5	Papilioninae	*Papilio gallienus*	Distant, 1879	O
6	Papilioninae	*Papilio nireus*	Linnaeus, 1758	O,P
	Pieridae			
7	Coliadinae	*Terias floricola*	(Boisduval, 1833)	O
8	Coliadinae	*Terias hecabe*	(Linnaeus, 1758)	O
9	Coliadinae	*Terias senegalensis*	Boisduval, 1836	Bu,O,P
10	Pierinae	*Appias epaphia*	(Cramer, [1779])	O
11	Pierinae	*Appias sabina*	(Felder & Felder, [1865])	O
12	Pierinae	*Appias sylvia/perlucens*		O
13	Pierinae	*Belenois sudanensis*	(Talbot, 1929)	O,P
14	Pierinae	*Belenois* cf. *theuszi*	(Dewitz, 1889)	O
15	Pierinae	*Leptosia hybrida*	Bernardi, 1952	O
16	Pierinae	*Leptosia marginea*	(Mabille, 1890)	O
17	Pierinae	*Leptosia nupta*	(Butler, 1873)	O
18	Pierinae	*Leptosia wigginsi*	(Dixey, 1915)	O
19	Pierinae	*Mylothris* cf. *asphodelus*	Butler, 1888	O
20	Pierinae	*Mylothris* cf. *flaviana*	Grose-Smith, 1898	O
21	Pierinae	*Mylothris rhodope*	(Fabricius, 1775)	O
22	Pseudopontiinae	*Pseudopontia australis*	Dixey, 1923	O
	Nymphalidae			
23	Biblidinae	*Ariadne albifascia*	(Joicey & Talbot, 1921)	O
24	Biblidinae	*Ariadne enotrea*	(Cramer, [1779])	O
25	Biblidinae	*Neptidopsis ophione*	(Cramer, 1777)	O
26	Charaxinae	*Charaxes* cf. *bocqueti*	Minig, 1975	Bc
27	Charaxinae	*Charaxes castor*	(Cramer, 1775)	Bc
28	Charaxinae	*Charaxes catachrous*	van Someren & Jackson, 1952	Bc
29	Charaxinae	*Charaxes* cf. *cedreatis*	Hewitson, 1874	Bc
30	Charaxinae	*Charaxes cynthia*	Butler, 1866	Bc

n°	FAMILY | Subfamily	Species	Authority	Method
31	Charaxinae	*Charaxes lycurgus*	(Fabricius, 1793)	Bu
32	Charaxinae	*Charaxes nobilis*	Druce, 1873	Bc
33	Charaxinae	*Charaxes pleione*	(Godart, [1824])	Bc
34	Charaxinae	*Charaxes protoclea*	Feisthamel, 1850	Bc,Bu,O
35	Charaxinae	*Charaxes trajanus*	(Ward, 1871)	Bc
36	Charaxinae	*Charaxes zingha*	(Stoll, [1780])	P
37	Coliadinae	*Terias floricola*	(Boisduval, 1833)	O
38	Cyrestinae	*Cyrestis camillus*	(Fabricius, 1781)	O,P
39	Heliconiinae	*Acraea epaea*	(Cramer, [1779])	O
40	Heliconiinae	*Acraea leucographa/endoscota*		P
41	Heliconiinae	*Lachnoptera anticlia*	(Hübner, [1819])	O
42	Heliconiinae	*Phalanta eurytis*	(Doubleday, [1847])	O
43	Heliconiinae	*Telchinia aurivillii*	(Staudinger, 1896)	O
44	Heliconiinae	*Telchinia circeis*	(Drury, 1782)	O
45	Heliconiinae	*Telchinia lycoa*	(Godart, [1819])	O,P
46	Heliconiinae	*Telchinia penelope*	(Staudinger, 1896)	O
47	Heliconiinae	*Telchinia semivitrea*	(Aurivillius, 1895)	O
48	Limenitidinae	*Aterica galene*	(Brown, 1776)	Bu,O,P
49	Limenitidinae	*Bebearia abesa*	(Hewitson, 1869)	O
50	Limenitidinae	*Bebearia* cf. *amieti*	Hecq, 1994	O
51	Limenitidinae	*Bebearia barce*	(Doubleday, 1847)	O
52	Limenitidinae	*Bebearia* cf. *brunhilda*	(Kirby, 1889)	Bu
53	Limenitidinae	*Bebearia cocalia*	(Fabricius, 1793)	Bu,O,P
54	Limenitidinae	*Bebearia* cf. *congolensis*	(Capronnier, 1889)	Bu
55	Limenitidinae	*Bebearia* cf. *fontaineana*	Hecq, 1987	Bu
56	Limenitidinae	*Bebearia ikelemba*	(Aurivillius, 1901)	Bu
57	Limenitidinae	*Bebearia makala/chloeropis*		Bu,O
58	Limenitidinae	*Bebearia mandinga*	(Felder & Felder, 1860)	O
59	Limenitidinae	*Bebearia micans*	(Aurivillius, [1899])	Bu,O
60	Limenitidinae	*Bebearia* cf. *oxione*	(Hewitson, [1866])	O
61	Limenitidinae	*Bebearia* cf. *pseudovesta*	Vande weghe, 2009	Bu
62	Limenitidinae	*Bebearia* cf. *seeldrayersi*	(Aurivillius, [1899])	O
63	Limenitidinae	*Bebearia* cf. *sophus*	(Fabricius, 1793)	Bu,O
64	Limenitidinae	*Bebearia* sp.1		O
65	Limenitidinae	*Bebearia* sp.2		O

n°	FAMILY | Subfamily	Species	Authority	Method
66	Limenitidinae	*Bebearia* cf. *tentyris*	(Hewitson, [1866])	Bu
67	Limenitidinae	*Bebearia* cf. *tessmanni*	(Grünberg, 1910)	Bu
68	Limenitidinae	*Bebearia* cf. *vandeweghei*	Hecq, 2005	Bc,Bu,O
69	Limenitidinae	*Bebearia* cf. *zonara*	(Butler, 1871)	O
70	Limenitidinae	*Cymothoe altisidora*	(Hewitson, [1869])	O
71	Limenitidinae	*Cymothoe caenis*	(Drury, 1773)	O
72	Limenitidinae	*Cymothoe crocea*	Schultze, 1917	O
73	Limenitidinae	*Cymothoe hesiodotus*	Staudinger, 1890	O
74	Limenitidinae	*Cymothoe sangaris*	(Godart, [1824])	O
75	Limenitidinae	*Euphaedra* cf. *alacris*	Hecq, 1978	O
76	Limenitidinae	*Euphaedra ansorgei*	Rothschild, 1918	O
77	Limenitidinae	*Euphaedra* cf. *ceres*	(Fabricius, 1775)	Bu,O,P
78	Limenitidinae	*Euphaedra clio*	Hecq, 1981	O
79	Limenitidinae	*Euphaedra* cf. *dargeana*	Hecq, 1980	Bu
80	Limenitidinae	*Euphaedra ducarmei*	Hecq, 1977	O
81	Limenitidinae	*Euphaedra edwardsii*	(van der Hoeven, 1845)	Bu,O
82	Limenitidinae	*Euphaedra eleus*	(Drury, 1782)	Bu,O
83	Limenitidinae	*Euphaedra* cf. *fascinata*	Hecq, 1984	Bu,O,P
84	Limenitidinae	*Euphaedra harpalyce*	(Cramer, 1777)	Bu,O,P
85	Limenitidinae	*Euphaedra margaritifera/ravola*		Bu,O,P
86	Limenitidinae	*Euphaedra mirabilis*	Hecq, 1980	O
87	Limenitidinae	*Euphaedra permixtum*	(Butler, 1873)	Bu,O
88	Limenitidinae	*Euphaedra* cf. *preussi*	Staudinger, 1891	O
89	Limenitidinae	*Euphaedra rubrocostata*	(Aurivillius, 1897)	O
90	Limenitidinae	*Euphaedra ruspina*	(Hewitson, [1865])	P
91	Limenitidinae	*Euphaedra shaba*	Hecq, 2012	Bu
92	Limenitidinae	*Euphaedra* sp.1		O
93	Limenitidinae	*Euphaedra* sp.2		O
94	Limenitidinae	*Euphaedra* sp.3		O
95	Limenitidinae	*Euphaedra symphona*	Bethune-Baker, 1908	Bu,O
96	Limenitidinae	*Euphaedra* cf. *temeraria*	Hecq, 2007	O
97	Limenitidinae	*Euriphene* cf. *amaranta*	(Karsch, 1894)	O
98	Limenitidinae	*Euriphene amicia*	(Hewitson, [1871])	O
99	Limenitidinae	*Euriphene doriclea*	(Drury, 1782)	Bu,O
100	Limenitidinae	*Euriphene* cf. *glaucopis*	(Gaede, 1916)	Bu

n°	FAMILY | Subfamily	Species	Authority	Method
101	Limenitidinae	*Euriphene mundula*	(Grünberg, 1910)	Bu
102	Limenitidinae	*Euriphene* cf. *schultzei*	(Aurivillius, 1909)	Bu,O
103	Limenitidinae	*Euriphene tadema*	(Hewitson, [1866])	Bu,O
104	Limenitidinae	*Euryphura chalcis*	(Felder & Felder, 1860)	Bc,Bu,O
105	Limenitidinae	*Evena angustatum*	(Felder & Felder, [1867])	O
106	Limenitidinae	*Evena crithea*	(Drury, 1773)	Bu,O
107	Limenitidinae	*Evena niji*	(Fox, 1965)	O
108	Limenitidinae	*Evena oberthueri*	(Karsch, 1894)	O
109	Limenitidinae	*Harma theobene*	Doubleday, [1848]	Bu,O,P
110	Limenitidinae	*Neptis melicerta*	(Drury, 1773)	O
111	Limenitidinae	*Neptis metella*	(Doubleday, [1850])	O
112	Limenitidinae	*Neptis mixophyes*	Holland, 1892	O
113	Limenitidinae	*Neptis nemetes*	Hewitson, [1868]	O
114	Limenitidinae	*Neptis nicomedes*	Hewitson, 1874	Bc,O
115	Limenitidinae	*Neptis quintilla*	Mabille, 1890	O
116	Limenitidinae	*Neptis* cf. *stellata*	Pierre-Baltus, 2007	Bc
117	Limenitidinae	*Neptis strigata*	Aurivillius, 1894	O
118	Limenitidinae	*Neptis trigonophora*	Butler, 1878	O
119	Limenitidinae	*Pseudacraea lucretia*	(Cramer, [1775])	O
120	Limenitidinae	*Pseudacraea warburgi*	Aurivillius, 1892	O
121	Limenitidinae	*Pseudathyma* cf. *neptidina*	Karsch, 1894	Bc
122	Nymphalinae	*Hypolimnas anthedon*	(Doubleday, 1845)	O
123	Nymphalinae	*Hypolimnas* cf. *mechowi*	(Dewitz, 1884)	O
124	Nymphalinae	*Hypolimnas salmacis*	(Drury, 1773)	O,P
125	Nymphalinae	*Junonia cymodoce*	(Cramer, 1777)	O
126	Nymphalinae	*Junonia oenone*	(Linnaeus, 1758)	O
127	Nymphalinae	*Junonia sophia*	(Fabricius, 1793)	O,P
128	Nymphalinae	*Junonia terea*	(Drury, 1773)	L,O,P
129	Nymphalinae	*Precis octavia*	(Cramer, 1777)	O,P
130	Satyrinae	*Bicyclus alboplaga*	(Rebel, 1914)	Bc,Bu,O
131	Satyrinae	*Bicyclus* cf. *auricruda*	(Butler, 1868)	O
132	Satyrinae	*Bicyclus golo*	(Aurivillius, 1893)	O
133	Satyrinae	*Bicyclus graueri*	(Rebel, 1914)	Bu
134	Satyrinae	*Bicyclus hewitsoni*	(Doumet, 1861)	O
135	Satyrinae	*Bicyclus ignobilis*	(Butler, 1870)	O

n°	Family | Subfamily	Species	Authority	Method
136	Satyrinae	*Bicyclus medontias*	(Hewitson, 1873)	Bu
137	Satyrinae	*Bicyclus mollitia*	(Karsch, 1895)	Bc,Bu
138	Satyrinae	*Bicyclus moyses*	Condamin & Fox, 1964	Bu,O,P
139	Satyrinae	*Bicyclus uniformis*	(Bethune-Baker, 1908)	Bu
140	Satyrinae	*Bicyclus* cf. *vulgaris*	(Butler, 1868)	O
141	Satyrinae	*Brakefieldia* cf. *nigrescens*	(Bethune-Baker, 1908)	Bu
142	Satyrinae	*Gnophodes parmeno*	Doubleday, [1849]	O
143	Satyrinae	*Ypthima doleta*	Kirby, 1880	O
	Lycaenidae			
144	Miletinae	*Megalopalpus* cf. *metaleucus*	Karsch, 1893	O
145	Miletinae	*Megalopalpus zymna*	(Westwood, [1851])	O,P
146	Polyommatinae	*Anthene larydas*	(Cramer, [1780])	O
147	Polyommatinae	*Anthene* cf. *ligures*	(Hewitson, 1874)	O
148	Polyommatinae	*Anthene rubricinctus/ituria*		O
149	Polyommatinae	*Anthene* cf. *sylvanus*	(Drury, 1773)	O
150	Polyommatinae	*Azanus mirza*	(Plötz, 1880)	O,P
151	Polyommatinae	*Cacyreus lingeus*	(Stoll, [1782])	O,P
152	Polyommatinae	*Cupidesthes thyrsis*	(Kirby, [1878])	O
153	Polyommatinae	*Euchrysops hippocrates*		O
154	Polyommatinae	*Neurellipes lachares*	(Hewitson, [1878])	O
155	Polyommatinae	*Neurellipes pyroptera*	(Aurivillius, 1895)	O
156	Polyommatinae	*Neurellipes xanthopoecilus*	(Holland, 1893)	O
157	Polyommatinae	*Oboronia* cf. *guessfeldtii*	(Dewitz, 1879)	O,P
158	Polyommatinae	*Pseudonacaduba aethiops*	(Mabille, 1877)	O,P
159	Polyommatinae	*Thermoniphas alberici*	(Dufrane, 1945)	O,P
160	Polyommatinae	*Zizeeria knysna*	(Trimen, 1862)	O
161	Poritiinae	*Citrinophila tenera*	(Kirby, 1887)	O
162	Poritiinae	*Epitolina* cf. *catori*	Bethune-Baker, 1904	O
163	Poritiinae	*Falcuna margarita*	(Suffert, 1904)	O
164	Poritiinae	*Iridana* cf. *katera*	Stempffer, 1964	L
165	Poritiinae	*Larinopoda lagyra*	(Hewitson, [1866])	O,P
166	Poritiinae	*Larinopoda tera*	(Hewitson, 1873)	O,P
167	Poritiinae	*Pentila tachyroides*	Dewitz, 1879	O
168	Poritiinae	*Pentila* cf. *umangiana*	Aurivillius, 1898	O
169	Poritiinae	*Ptelina carnuta*	(Hewitson, 1873)	O

n°	Family | Subfamily	Species	Authority	Method
170	Poritiinae	*Telipna centralis*	Libert, 2005	O
171	Poritiinae	*Telipna citrimaculata*	Schultze, 1916	O
172	Poritiinae	*Telipna ducarmei*	Libert, 2005	O
173	Poritiinae	*Tetrarhanis* sp.1		O
174	Poritiinae	*Tetrarhanis* sp.2		O
175	Poritiinae	*Toxochitona* sp.1		O
176	Theclinae	*Hypolycaena* cf. *liara*	Druce, 1890	O
177	Theclinae	*Oxylides binza*	Berger, 1981	O
178	Theclinae	*Pilodeudorix* cf. *gagnoti*	Libert, 2004	O
	Hesperiidae			
179	Coeliadinae	*Coeliades libeon*	(Druce, 1875)	O
180	Coeliadinae	*Pyrrhochalcia iphis*	(Drury, 1773)	O
181	Hesperiinae	*Acada annulifer*	(Holland, 1892)	O
182	Hesperiinae	*Acleros mackenii*	(Trimen, 1868)	O
183	Hesperiinae	*Andronymus fenestrella*	Bethune-Baker, 1908	O
184	Hesperiinae	*Andronymus* cf. *marcus*	Usher, 1980	O
185	Hesperiinae	*Ceratrichia clara*	Riley, 1925	O
186	Hesperiinae	*Ceratrichia wollastoni*	Heron, 1909	O
187	Hesperiinae	*Gretna carmen*	Evans, 1937	L
188	Hesperiinae	*Melphinyet* cf. *unistriga*	(Holland, 1893)	L
189	Hesperiinae	*Meza meza*	(Hewitson, 1877)	O
190	Hesperiinae	*Osmodes adonia*	Evans, 1937	O
191	Hesperiinae	*Paracleros biguttulus*	(Mabille, 1889)	O
192	Hesperiinae	*Pardaleodes edipus*	(Stoll, [1781])	O
193	Hesperiinae	*Pardaleodes incerta*	(Snellen, 1872)	O,P
194	Hesperiinae	*Pardaleodes* cf. *sator*	(Westwood, [1852])	O
195	Tagiadinae	*Sarangesa thecla*	(Plötz, 1879)	P

2.8.3.2 Hawk moths

A preliminary hawk moth species list (**Table 23**) counts 17 distinct species. Reliable identification of several hawk moth groups requires morphological examination of larger series, often including a comparison of the genitalia and a molecular analysis (Kitching, pers. comm.).

Table 23. Preliminary list of hawk moth species collected during the Salonga NP survey. Final identifications are still pending further research.

n°	Subfamily	Species	Authority	Method
1	Macroglossinae	*Atemnora westermannii*	(Boisduval, 1875)	light trap
2	Macroglossinae	*Euchloron megaera*	(Linnaeus, 1758)	light trap
3	Macroglossinae	*Nephele* cf. *maculosa*		light trap
4	Macroglossinae	*Nephele funebris*	(Fabricius, 1793)	light trap
5	Macroglossinae	*Temnora* sp.		light trap
6	Smerinthinae	*Phylloxiphia* cf. *bicolor*		light trap
7	Smerinthinae	*Phylloxiphia* cf. *illustris*		light trap
8	Smerinthinae	*Phylloxiphia* cf. *oberthueri*		opportunistic
9	Smerinthinae	*Polyptychus andosa*	(Walker, 1856)	light trap
10	Smerinthinae	*Polyptychus carteri*	(Butler, 1882)	light trap
11	Smerinthinae	*Polyptychus* cf. *paupercula*		light trap
12	Smerinthinae	*Polyptychus* cf. *retusus*		light trap
13	Smerinthinae	*Polyptychus guessfeldtii*	(Dewitz, 1879)	light trap
14	Smerinthinae	*Polyptychus murinus*	Rothschild, 1904	light trap
15	Smerinthinae	*Polyptychus nigriplaga* group		light trap
16	Smerinthinae	*Polyptychus orthographus*	Rothschild & Jordan, 1903	light trap
17	Sphinginae	*Agrius convolvuli*	(Linnaeus, 1758)	light trap

Figure 37. *Polypthychus carteri*, a common hawk moth found across most of tropical Africa. (Photo by Michiel van Noppen)

2.8.4 Discussion

There is still very little information on butterfly and moth diversity in and around Salonga NP. The 195 species of butterflies and 17 hawk moths found during this express survey only provide first insights into the vast diversity of these taxa in SNP. More work on the collected material is needed to verify whether it includes any hitherto undescribed species, range expansions or new country records. It is very realistic to assume that the national park still harbours butterfly species new to science.

The 2017 butterfly survey in the southern part of the park noted 399 distinct species but did not provide a species list (Bessone et al. 2019). To our knowledge, a significant part of the material that was collected in the 2017 survey is also stored in the MZUJ in Krakow (T. Pyrcz pers. comm.) and our aim is to collaborate and combine our findings and make the invaluable biological information available for future researchers and policymakers.

2.8.5 Acknowledgements

The research on Afroptropical butterflies is greatly facilitated by the Zoological Museum of the Jagiellonian University in Krakow (Poland). The museum staff is duly thanked for the curatorial work and hospitality.

2.9 Araneae

Brogan Pett

2.9.1 Background

With almost 51,000 species described to date (WSC, 2023), and an estimated 150,000–200,000 total species, spiders constitute one of the world's truly hyper-diverse taxa. Due to an obligatory carnivorous lifestyle, spiders also occupy a unique sphere in global ecology as the top arthropod predators in most biomes and ecosystems (Cardoso et al. 2011). The combination of high numbers of species, trophic position and local abundance position spiders as a key indicator taxon of local and regional biodiversity (Cardoso et al. 2004; Scott et al. 2006).

In DRC, Jocque et al. (2013) recorded 630 species of Arachnida (the class containing spiders, scorpions, mites and allies) in their review of the biodiversity of the African continent. No conclusive list exists of the recorded Congolese spider fauna but a current estimate of between 500–600 described species is reasonable. An overall number that is reasonably high compared to neighbouring countries and hides a depauperate image of the state of knowledge on Congolese spider fauna. Outside of a few well revised groups in specialist systematic works that span the Congo Basin e.g. for Zodariidae (*Diores* Simon, 1893; *Murphydrela* Jocque & Russell-Smith, 2022, revised by Jocque (1990) and Jocque & Russell-Smith (2022) respectively; Corinnidae (*Carteronius* Simon, 1896; *Cambalida* Simon, 1909, *Copa* Simon, 1886, *Hortipes* Bosselaers & Ledoux, 1998, and *Pseudocorinna* revised by Bonaldo et al. (2022), Haddad (2012), Haddad (2013), Bosselaers & Jocque (2000), and Jocque & Bosselaers (2011)) very few studies are available on spiders from DRC. Recorded species are often known from single isolated records, documented from one sex, with scarce sampling in the majority of the country. Regarding Salonga NP, not a single spider record in collections spanning much of Europe and North America could be found and it very much looks like this is the very first standardised survey of spiders in the region.

2.9.2 Surveys

Gaining an accurate picture of the spider community in a complex environment requires a myriad of sampling methods (Cardoso, 2009). This owes to the large variety of general feeding guilds that define a spider's life history and habits (Cardoso et al. 2011).

Surveys for spiders included: (i) Invertebrate pitfall traps (p. 69), (ii) Winkler traps (p. 73), (iii) diurnal hand collecting, (iv) leaf-litter sieving and (v) nocturnal hand collecting. Hand collecting involves walking and examining in detail various strata and attempting to manually collect spiders, this is often more productive at night when the majority of spiders are active. Target groups from manual nocturnal collecting include: Ctenidae, Zodariidae, Lycosidae, Corinnidae, Sparassidae and Pisauridae, as these spiders are often active wondering at this point, either on the ground, low on vegetation, or moving close to water. Diurnal hand collecting often focuses on Salticidae and Araneidae (among other web weavers). Leaf-litter sieving involves collecting around 0.5m^2 of the top layer of leaf litter and using a sieve directly over a white rice sack to catch smaller and often inconspicuous spiders that have life histories not typically detectable by other methods (e.g. Oonopidae, Theridiosomatidae, Palpimanidae, smaller Corinnidae and Salticidae).

2.9.3 Preliminary results

Taxonomic knowledge of spiders in tropical regions is generally poorly known, when corrected for true species richness of hyperdiverse taxa, it is grossly insufficient. The inherent challenges of identifying to species level, requiring detailed examination of genitalia and comparison with type material, make species level IDs a relatively slow process in the majority of spider groups.

Despite this, numerous very interesting novelties have been identified already from groups the author works on (**Table 24**). Also see **Figure 41** & **Figure 42** at the end of the chapter where we illustrate the body forms of some of the larger spiders encountered in Salonga, typically forming the "ground-hunter" guild. Namely, we have published the descriptions of four new species of jumping spiders (Salticidae) so far. All four were published in December 2023 and have local names. *Myrmarachne salongensis* (**Figure 38**) is an ant- mimicking jumping spider and the epithet means "from Salonga", this species was described from males and females in the taxonomy journal Arthropoda Selecta.

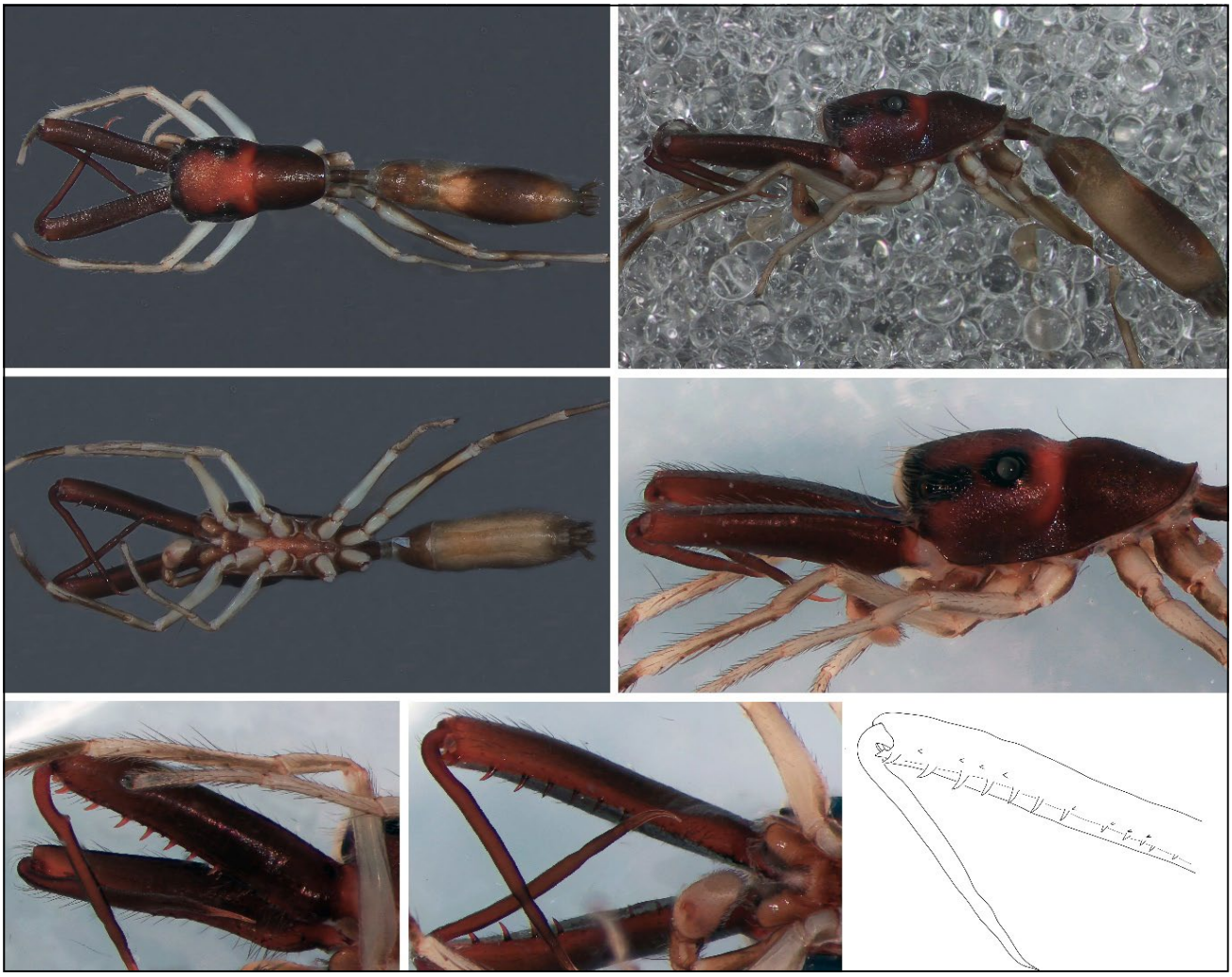

Figure 38. *Myrmarachne salongensis* sp. nov. habitus plate from recent Arthropoda Selecta manuscript. All images are of the male paratype. (Photos by Brogan Pett)

A second paper, likely published in late December 2023, described three new species of dwelling *Thiratoscirtus* spiders. These spiders are typically small, cryptically coloured, and can be found in leaf litter, previously only one species of this hyperdiverse genus was known from D.R. Congo. *Thiratoscirtus iyomii* sp. nov. () was named by villagers in Monkoto to honour an historic tribal chief. *Thiratoscirtus kalisia* honours the creator god "Kalisia" in Bantu Pygmy mythology, *Thiratoscirtus khonvoum* honours the god of the hunt "Khonvoum", also in Bantu pygmy mythology. Both names refer to Bantu pygmies as they were the original inhabitants of the dense forests in Congo. Furthermore, several species confirmed as new to science will be described in forthcoming manuscripts throughout 2024, and a further several that represent both new records for the region, and undescribed sexes of poorly known species (i.e. a species known only from a single specimen of one sex).

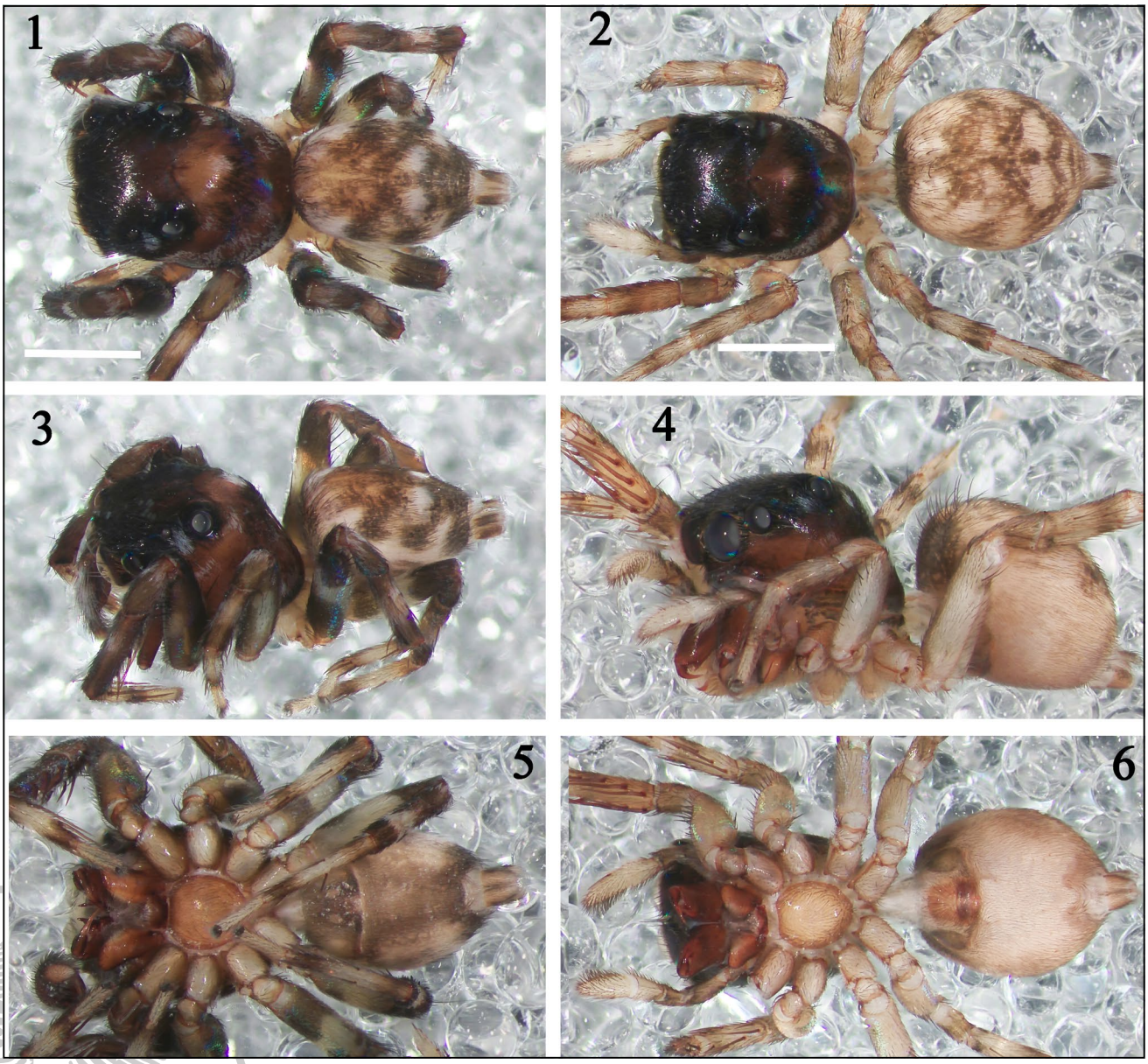

Figure 39. *Thiratoscirtus iyomii* sp. nov. habitus plate from recent Zootaxa publication. Male (left) and female (right). (Photos by Brogan Pett)

Further examination of comparative museum materials will allow final determinations on a few other highly probable new species. Additionally, not included in the table below, our collection of ant-eating spiders (Zodariidae) contain a high proportion of new species to science, several species from the genus *Mallinella* and one from Ascuea. It is also of note, that the Salticidae are exceptionally promising, with at least six further candidate new species to be worked on in early 2024, from genera *Phintella*, *Pochytoides* and *Saraina*.

Table 24. Noteworthy spider species identified during initial examination. The column labeled '#' represents the research paper that will cover the species in detail.

n°	Subfamily	Species	Importance	Next steps	#
1	Araneidae	*Psyllo nitida*	Sp. known from two females described 50 years ago	Redescription of the species	1
2	Corinnidae	*Carteronius* sp. nov.	New species to science	Describe	2
3	Corinnidae	*Hortipes* cf. *centralis*	Male unknown	Further examination and describe unknown male	2
4	Corinnidae	*Pseudocorinna* sp. nov. ?	Likely new species to science	Further examination and describe	2
5	Corinnidae	*Pseudocorinna* cf. *gevaertsi*	New record or new species to science	Compare with museum specimen (RMCA) for final ID	2
6	Hersiliidae	*Hersilia caronae*	Female unknown	Describe unknown female and new record	3
7	Hersiliidae	*Hersilia occidentalis*	New record	Report in paper 3	3
8	Mimetidae	*Anansi* sp. nov.	New species to science	Describe	4
9	Palpimanidae	*Scelidocteus* sp. nov. ?	Likely new species to science	Compare with museum specimen (MNHNP) for final confirmation	5
10	Salticidae	*Belippo* sp. nov.	New species to science	Describe	6
11	Salticidae	*Myrmarachne foenisex*	New record	Report in paper 6	6
12	Salticidae	*Myrmarachne* cf. *mussungue*	Male unknown or new species to science	Compare with museum specimen (BMNH) for final ID	6
13	Trachelidae	*Orthobula* sp.	No species known from Central Africa	Further examination	-

In general, having four new species published within 12 months of the Salonga expedition is positive, but further work is needed to continue elucidating the enormity of the spider diversity of the park. I anticipate at least five further manuscripts on spiders collected during the Salonga expedition in 2024. In general I aim to publish an interesting new *Scelidocteus* (Palpimanidae), *Pseudocorinna* (Corinnidae), *Hortipes* (Liocranidae), *Anansi* (Mimetidae), and a redescription paper on *Psyllo nitida* Thorrell, 1899 (**Figure 40**), of which I have loaned the holotype from Stockholm. *Psyllo nitida* is especially interesting as it is a monotypic genus of orb weavers known from across Central and Western Africa, but only known from two female specimens in the literature. We have identified the first males and have capacity to disentangle the identity of true *Psyllo nitida*, which - if monotypic - is truly remarkable from an evolutionary standpoint.

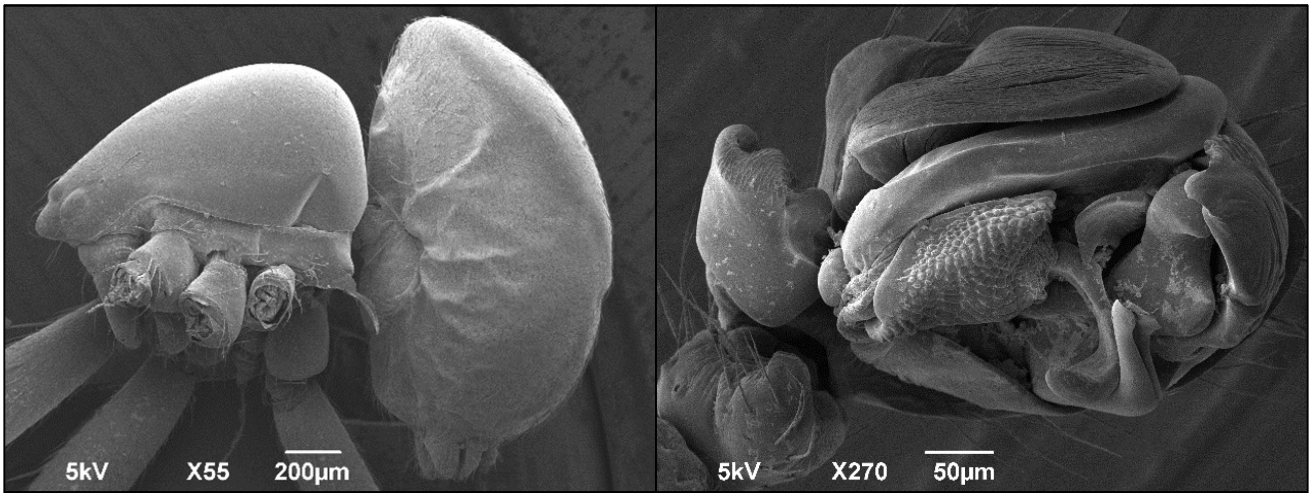

Figure 40. Scanning electron microscopy images of *Psyllo nitida*. (Photos by Brogan Pett)

We got good amounts of diversity of Pholcidae (daddy long-legs spiders; seven species), Ctenidae (wandering spiders; eight species), Araneidae (orb weaver spiders; eleven species), Theridiidae (comb- footed spiders; twelve species), Sparassidae (huntsman spiders; eight species) and Pisauridae (fishing spiders; seven species). Additionally, relatively rare spider families were found, such as Theridiosomatidae (ray spiders; two new species), and Cyatholipidae (one new species).

2.9.4 Manuscripts

Published manuscripts

- Pett, B.L., Mpongo Iyomi, D.M. & Mbende, M. (2023a). Myrmarachnini (Araneae: Salticidae: Salticinae: Astioida) of the Salonga National Park, D.R. Congo, with description of a new species and two new species records. *Arthropoda Selecta*, 32(4): 466–473.

- Pett, B.L., Mpongo Iyomi, D.M. & Mbende, M. (2023b). Discovery of three new species of *Thiratoscirtus* (Araneae: Salticidae: Thiratoscirtinae) from Central African rainforest. *Zootaxa*.

Manuscripts in preparation

- Pett, B.L. A new species of *Scelidocteus* (Araneae: Palpimanidae) from Salonga National Park, D.R. Congo.

- Pett, B. L. & Jocqué, R. Four new species of *Pseudocorinna* (Araneae: Corinnidae) from Central and West Africa. [includes one new species from Salonga]

- Pett, B.L. & Jocqué, R. Two new species of *Hortipes* (Araneae: Liocranidae) and first description of the male of H. architelones. [includes the description of the unknown male of *Hortipes* architelones from Salonga]

- Pett, B.L., Castanheira, P. & Pashkevich, M.D.P. Redescription of the monotypic central African orb- weaver genus *Psyllo* (Araneae: Araneidae).

2.9.5 Conclusion

Our sampling yielded a remarkably diverse community of spiders, varying from the semi-disturbed areas of Monkoto, characteristic riparian spider communities, and varying levels of forest specialist groups as we surveyed deeper in the forest. The species we have encountered point towards an extraordinary and unique spider fauna and shines a brief light on the true magnitude of the spider fauna (and invertebrate fauna more generally) of Salonga.

The four new species we have published so far represent a first step towards publicising the unexplored and undocumented araneofauna of Salonga. More than a dozen new spider species awaiting description from the 2022 expedition, and no doubt as further work is planned on larger and more complex groups, these numbers will only increase. Yet, we can only guess at the true diversity of spiders in the park. No spider had ever been recorded in the scientific literature from Salonga prior to our work, and we have currently published six species, from at least 1,000 that remain to be reported.

We hope this report serves to provide a preliminary confirmation of the remarkable diversity of Salongan invertebrates, our desire to continue working on them, and of the possibilities to document an entirely unexplored spider fauna. Finally, we would like to open the name of the next species to WWF for their continued collaboration and support.

Figure 41. Selection of spiders encountered in Salonga National Park. **A.** *Heteroscodra* sp. (Theraphosidae), **B.** *Dolomedes* sp. (Pisauridae), **C.** *Macroctenus* sp. (Ctenidae). (Photos by Michiel van Noppen)

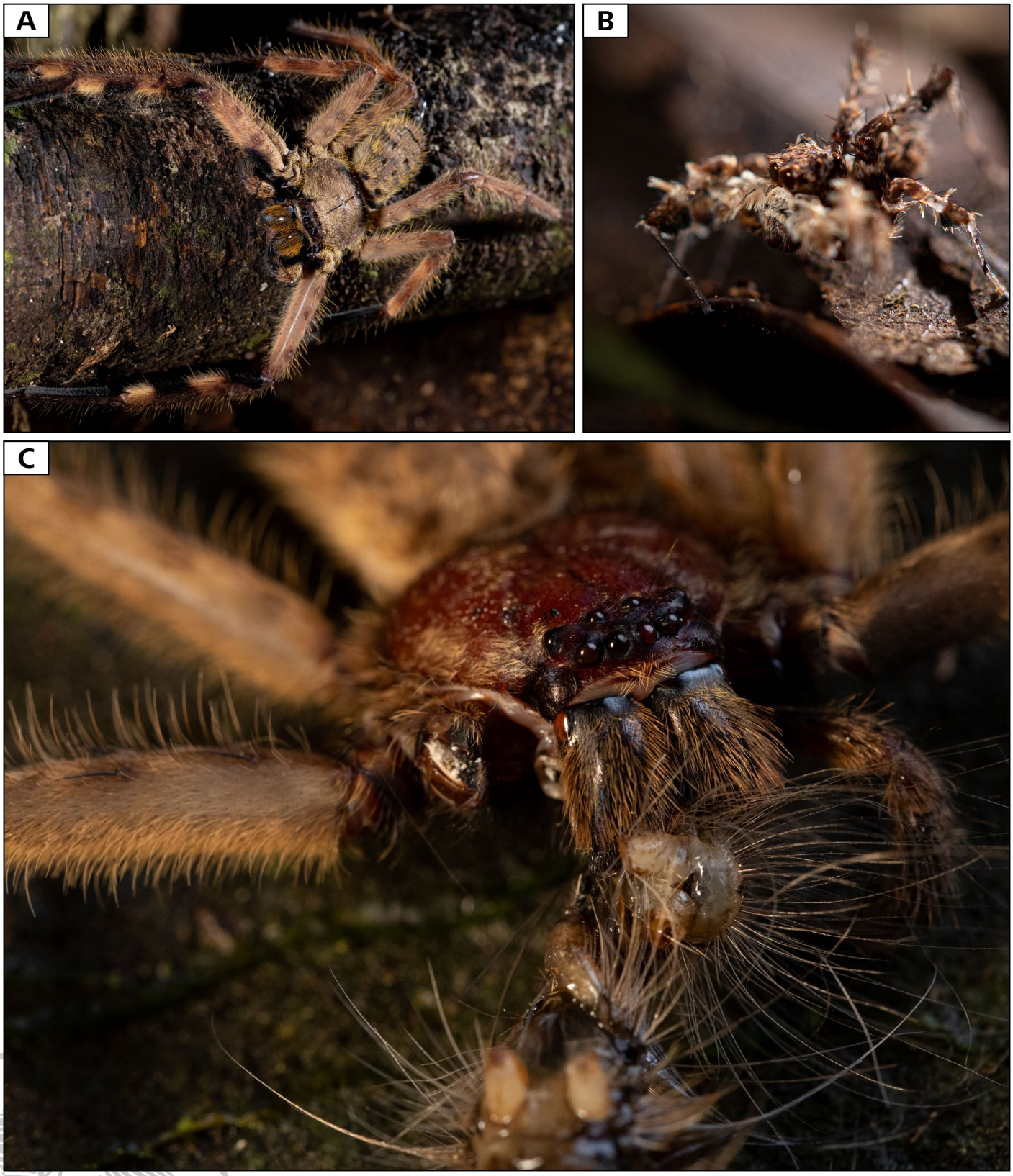

Figure 42. Selection of spiders encountered in Salonga National Park. **A.** *Barylestis* sp. (Sparassidae), **B.** *Portia* sp., (Salticidae) **C.** Indet. Sparassidae. (Photos by Michiel van Noppen)

3 Concluding remarks

General findings

Our rapid biodiversity assessment within Salonga National Park, despite being limited by time and space, has yielded significant new insights into the park's biodiversity. We successfully documented a wide array of species across various taxonomic groups, including several of conservation concern such as the Congo Peacock, Crowned Eagle, Forest Hinge-back Tortoise, and Grey Parrot. Our survey led to the discovery of numerous new records and range expansions for the park. During this brief field trip, we encountered new species to science in almost every taxonomic group we studied, ranging from a shrew, frog, and fish to spiders, ants, dragonflies, and bugs, with more expected as we analyze the collected material in greater detail. This richness underscores the park's status as a veritable 'Garden of Eden.'

To our knowledge, we conducted the first inventory of spiders, ants and cicadas in the area. Next to new species, we gathered new information on species' distributions, ecological data of birds and the first field documentation of several species through sound and images. The sound recordings of Congo Peacock duets we captured are among the finest ever recorded for this species.

Figure 43. A Banded Leaf-toed Gecko (*Hemidactylus* cf. *fasciatus*), spirited reminder of the invisible diversity when walking through the vast forests in Salonga NP. (Photo by Michiel van Noppen)

Field challenges

The scheduling of our fieldwork towards the end of the rainy season posed significant logistical challenges. This timing, dictated by the closure of our funding cycle, led to substantial impacts on our field activities. We faced prolonged and intense rainfall, which not only reduced our effective time for field research but also complicated the use of various trapping methods. For instance, banana-baited butterfly traps required frequent rebaiting following rain showers, and drift fences used for herpetofauna studies needed regular clearing.

The incredible potential of Salonga NP

Despite the high biodiversity numbers reported for the DRC (Mittermeier & Mittermeier, 1997), a recent study on reptile diversity highlighted a notable decrease in species richness within the Congo Basin, a phenomenon termed the "Congo gap" by researchers and experts analyzing the data. While environmental heterogeneity, particularly when compared to the endemic-rich mountainous regions like the Virunga, might contribute to this pattern, it is more likely an underestimation due to the scarcity of taxonomic surveys and the inadequate documentation of flora and fauna in the region (Brummett et al., 2011).

The Congo Basin, home to the world's second-largest forest reserve, is an area larger than Belgium, situated near the equator, with no road access, largely intact forest ecosystems, minimal human impact, and most taxonomic groups remaining largely unexplored. To put this into perspective, a search in the online database of the Africa Museum in Tervuren, which houses the most extensive collection of Central African biodiversity, yielded not a single spider record from SNP. This situation is unparalleled; no other large national park in the world offers a team the opportunity to potentially document the first individual capture of a species from a hyperdiverse taxon. Given the limited time frame and challenging conditions (rainy season), our investigation into invertebrate groups across three study sites in Salonga National Park (noting that technically, Monkoto lies outside SNP) has produced preliminary findings that align with our expectations. These findings reveal highly diverse assemblages characterized by remarkable richness. However, these results are just a glimpse, and more comprehensive, long-term studies are necessary to fully grasp the extent of this diversity.

The significant number of taxa, currently undescribed by science, discovered during this brief expedition underscores the region's lack of extensive study. Yet, it also highlights the immense potential for further exploration of biodiversity in this area. The need for more detailed and prolonged studies is evident to better understand the full scope of this diversity. Surveys like ours demonstrate the ease with which new species can be discovered, emphasizing the urgent need for continued research and field collections. Such efforts are vital not only for enhancing our knowledge of species diversity but also for informing conservation strategies for these ecosystems.

A cry for collaboration

Effective nature conservation relies on a wealth of data, enabling the assessment and validation of decisions and actions with the necessary information. Internationally, successful forest conservation efforts can typically be distilled into four key steps: 1. bringing together a variety of partners, 2. identifying biological and sociocultural assets, 3. understanding local residents' utilization of natural resources, and 4. adapting these insights to meet the needs of decision-makers (Pitman et al. 2021).

Choosing to invest in research is a deliberate decision, often challenging to balance with the ever-present need for funding. This funding is crucial for supporting communities in their journey towards sustainable coexistence with natural resources, safeguarding these resources in protected areas from threats like poaching, and facilitating education and capacity building among a wide array of stakeholders at different stages.

The identification of biological assets can occur in various phases, ideally culminating in a sustained effort focusing on selected components. In Salonga National Park, this approach is partially implemented through comprehensive, standardized baseline surveys like the large mammal camera trap study (Bessone et al. 2019) and ongoing monitoring projects, such as those focusing on elephants at bais. These elements are vital to the value of forest ecosystems, and the health and status of large mammal populations serve as crucial indicators of the overall state of these ecosystems. Given the intense poaching pressures in SNP, these indicators also reflect the extent of anthropogenic impacts.

Tropical forest ecosystems encompass many dimensions of biodiversity, each with varying levels of direct relevance. However, all these dimensions are interconnected and contribute in some way to the ecosystem's functionality. Ultimately, they influence human interactions, forming a complex web of ecological and social interdependencies. The task of researching such a vast and varied ecosystem as this one is a colossal challenge. It demands a broad spectrum of expertise, encompassing fields like taxonomy, ecology, social sciences, geology, and more. Addressing this challenge effectively calls for a concerted, collaborative effort that is bolstered by international support. Establishing such a framework is a time and resource-intensive endeavor.

Biodiversity rapid assessments play a crucial role in this context. They serve as an initial foray into exploring regions and taxa that are either unstudied or under-researched. These surveys are instrumental in uncovering the research and conservation potential of these areas, drawing both national and international focus, and sparking further investment and collaboration in research.

We are hopeful that our fieldwork will ignite interest and further research in this largely untouched lowland rainforest region. We warmly invite local and international scientists and other stakeholders to collaborate on the information and samples we have collected, with the aim of preserving this unique environment for future generations. We encourage interested parties to reach out to us, WWF, ICCN, or any other involved organizations. Every contribution counts, be it data points, species identification, or conservation efforts. Now is the time to act!

Figure 44. Canopy of terra firma forest in an extensive and largely intact lowland rainforest ecosystem, Salonga National Park (DRC). (Photo by Michiel van Noppen)

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