

Range Extension of the Western Patas Monkey (*Erythrocebus patas patas*) in Northern Sierra Leone, West Africa

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Abstract: The patas monkey (*Erythrocebus patas*) is endemic to tropical Africa and includes three recognized subspecies (*pyrrhonotus*, *patas*, *villiersi*). This paper presents evidence to extend the geographic range of the western or West African patas monkey (*Erythrocebus patas patas*) 60 km southwest to include Outamba Kilimi National Park, central north Sierra Leone, West Africa. In 2018 and 2022 we conducted interviews with photo elicitation exercises with a total of 363 adult residents of Outamba Kilimi National Park to identify reported wildlife species present and inform camera trapping locations. Since May 2018, 25 camera traps have been placed throughout the Outamba Section of Outamba Kilimi National Park. Further research using both biological and social science methods is needed to accurately assess the conservation status of patas monkeys in Sierra Leone.

Key words: *Erythrocebus patas*, Outamba Kilimi National Park, patas monkey, range extension, Sierra Leone, West Africa

INTRODUCTION

Patas monkeys (*Erythrocebus*) Trouessart, 1897 are endemic to tropical Africa. Three species are currently recognized within the genus: patas monkey (*E. patas*), Heuglin's patas monkey (*E. poliophaeus*) and southern patas monkey (*E. baumstarki*) (de Jong & Butynski 2021). Three subspecies are currently recognized for *Erythrocebus patas*: western or West African patas monkey (*E. p. patas*) (Wallis 2020), eastern patas monkey (*E. p. pyrrhonotus*) (de Jong & Butynski 2020), and Air patas monkey (*E. p. villiersi*) (de Jong & Butynski 2022).

Patas monkeys are medium-sized, diurnal, and largely terrestrial monkeys with reddish-brown coloration on the body and head, and lighter colored grey to cream/white legs (Isbell 2013). Patas' top-speed has been reported as 55 km/h, making them the fastest primate species (Hall 1965). Their speed is most likely an adaptation for predator avoidance in an unpredictable dry and open environment such as savanna and grassland (Rowell & Richards 1979; Zihlman & Underwood 2013). Given they are predominantly terrestrial and make use of open

habitat, patas monkeys are thought to be highly vulnerable to predation, despite their physical and behavioral adaptations such as high speed locomotion (Burnham & Riordan 2012). Potential predators of patas monkeys include lions (*Panthera leo*), leopards (*Panthera pardus*), spotted hyenas (*Crocuta crocuta*), servals (*Leptailurus serval*), Golden cats (*Caracal aurata*) and martial eagles (*Polemaetus bellicosus*) (Enstam & Isbell 2002; Burnham & Riordan 2012).

In East Africa, home range sizes of patas social groups can be as large as 52 km² (Hall 1965). Throughout the day, patas monkeys spend the majority of their time on the ground foraging (Hall 1965; Nakagawa 1989; Isbell *et al.* 1998; Schmidt 2010). The mean group size of patas monkeys is 15 (Hall 1965), although groups as large as 75 individuals have been reported (de Jong *et al.* 2009). One-male groups are common when females are not receptive to conception (Rowell 1988). In northern Cameroon, the typical age for western patas monkey males to emigrate from their natal group is between 2.5 and 4.5 years old (Nakagawa *et al.* 2003).

Patas monkeys, previously listed as Least Concern by the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (Kingdon *et al.* 2008), are now classified as Near Threatened (de Jong *et al.* 2022). According to this latest assessment, populations of this species have decreased by more than 20% in the last 30 years and their range is expected to continue to decline. The main threats to patas monkeys are habitat loss, fragmentation, and degradation, mainly due to human population increase and subsequent expansion of agricultural activity, infrastructure construction, and natural resource extraction (Oates 2011; de Jong *et al.* 2022).

Western patas monkeys are widespread south of the Sahara Desert. The subspecies ranges from southern Mauritania, Senegal, and The Gambia in the west, to Chad, Cameroon, and the Central African Republic in the east (Wallis 2020; de Jong *et al.* 2022). The eastern limits of the western patas monkey's geographic range are uncertain (de Jong *et al.* 2022). The western patas monkey is listed as Near Threatened on the IUCN Red List of Threatened Species (Wallis 2022). In addition to the threats to patas monkeys more generally, the habitat of western patas monkeys has been especially threatened with fire, desertification, and livestock grazing (Oates 2011). The western patas monkey is occasionally hunted for food and targeted due to crop foraging (Oates 2011; Wallis 2022).

In Sierra Leone, the western patas monkey is

restricted to the northeast of the country (Oates 2011), however, there is very little information regarding their status, distribution and socioecology. To date there is no working protocol to handle captive wildlife in Sierra Leone – except for western chimpanzees (*Pan troglodytes verus*), which are confiscated and transferred to Tacugama Chimpanzee Sanctuary. When found captive, as pets or otherwise, National Protected Area Authority staff are responsible for confiscating wildlife. When this occurs, the only option is to release the animal. This presents considerable anthropozoonotic disease risk, especially between human and nonhuman primates, which are highly phylogenetically related (Wallis & Lee 1999; Dunay *et al.* 2018). To the best of our knowledge, in the vicinity of Outamba Kilimi National Park (hereafter: OKNP), central north Sierra Leone, when primates are confiscated they are released into the park.

This paper presents evidence of western patas monkeys in OKNP, central north Sierra Leone. Patas monkeys were first mentioned as present in the landscapes that would become designated as OKNP in the 1980s (Teleki *et al.* 1981). To our knowledge, this is the first evidence of this taxon in OKNP and the first paper with a focus on patas monkeys in Sierra Leone.

METHODS

Study Area

Sierra Leone is bordered by the Atlantic Ocean to the west, the Republic of Guinea in the north and east, and by Liberia in the southeast (Figure 1). Sierra Leone has a monsoon-type climate with a dry and wet season (Wadsworth *et al.* 2019). In the last four decades annual rainfall in the north has significantly decreased which, among other changes, has contributed to more extremes of climate including flooding and drought (Wadsworth *et al.* 2019). The first gazetted national park in Sierra Leone, OKNP, was formally established in 1995 and is the first legally protected non-forest habitat in the country (Okoni-Williams *et al.* 2001; Munro 2015). The OKNP is located in the central north of Sierra Leone, bordering Guinea. Northern Sierra Leone is adjacent to the Guinean Forests of West Africa biodiversity hotspot said to have over 250 endemic vertebrate species, including more than 60 endemic mammal species (Mittermeier *et al.* 1998; Myers *et al.* 2000; Darwall *et al.* 2015). The OKNP is divided into two geographically separated areas: the Outamba Section (783 km²) in the northeast and the



Figure 1. Sierra Leone, West Africa, with the Outamba Section and Kilimi Section of Outamba Kilimi National Park depicted in orange.

Kilimi Section (274 km²) further southwest (Brncic *et al.* 2010). All data obtained in this study are from Outamba.

Outamba is characterized as forest-savanna mosaic including grasslands, woodlands, and riverine forests (Okoni-Williams *et al.* 2001; Brncic *et al.* 2010). Outamba is relatively flat with hills on the eastern side reaching 480 m asl. The southwestern boundary of Outamba is delimited by the Little Scarcies River and its subsidiary, the Mongo, or Mong, River.

Based on the authors' observations, common tree species found in Outamba include white silk cotton tree (*Ceiba pentandra*), African pepper or spice tree (*Xylopia aethiopica*), African locust bean tree (*Parkia biglobosa*), crystal-bark tree (*Crossopteryx febrifuga*), African kino tree (*Pterocarpus erinaceous*), bitterbark or cherry mahogany tree (*Sacoglottis gabonensis*), velvet tamarind tree (*Dialium guineense*) and sugar plum tree (*Uapaca guineensis*).

At least 10 species of primate are present in OKNP (Teleki & Baldwin 1981; Teleki *et al.* 1981; McGiffin 1985), including the Critically Endangered western chimpanzee (*Pan troglodytes verus*), Endangered western black-and-white

colobus (*Colobus polykomos*) and Vulnerable sooty mangabey (*Cercocebus atys*) (Table 1). The diversity of large mammals in OKNP is high, many of which are globally threatened, including forest elephant (*Loxodonta cyclotis*: Critically Endangered), lion (*Panthera leo*: West Africa subpopulation: Critically Endangered), leopard (*Panthera pardus*: Vulnerable), hippopotamus (*Hippopotamus amphibius*: Vulnerable), forest buffalo (*Syncerus caffer*: Near Threatened) and yellow-backed duiker (*Cephalophus silvicultor*: Near Threatened) (Brncic *et al.* 2010). At least 256 species of birds can be found in OKNP (Okoni-Williams *et al.* 2001).

The Outamba Section's National Protected Area Authority headquarters of OKNP is based in the village Kotor, 1.6 km west of the official boundary of Outamba and within the 2 km wide buffer zone. The largest ethnic group of Kotor is the Susu (460 residents), smaller populations of other ethnic groups from Sierra Leone and Guinea reside there, too (Chesney 2018). In 2018, the average household size in Kotor was 15, and the total population was 482: 153 men, 150 women and 179 children (Chesney 2018).

Table 1. Primates of the Outamba Section of Outamba Kilimi National Park, Sierra Leone as seen during camera trap surveying unless otherwise stated. Names in languages in Sierra Leone written as known/ reported to authors.

Common Name	Name in languages in Sierra Leone	Scientific Name	IUCN Status <i>Population Trend</i>	IUCN Red List Reference
Western Chimpanzee	<i>Babu</i> (Krio) <i>Demuru</i> (Fula) <i>Demui</i> (Susu) <i>Ngolei</i> (Mende) <i>Pehtee</i> (Limba)	<i>Pan troglodytes verus</i>	Critically Endangered <i>Decreasing</i>	Humble <i>et al.</i> 2016
Western Red Colobus <i>Presence uncertain</i>	<i>Nhandjo</i> (Fula) <i>Yambey Gbeley</i> (Susu) <i>Dowei</i> (Mende)	<i>Piliocolobus badius</i>	Endangered <i>Decreasing</i>	McGraw <i>et al.</i> 2020
King or Western Black-and-White Colobus	<i>Bando</i> (Fula) <i>Yambey</i> (Susu) <i>Tuwei</i> (Mende) <i>Kubandoh</i> (Limba)	<i>Colobus polykomos</i>	Endangered <i>Decreasing</i>	Gonedelé Bi <i>et al.</i> 2020a
Sooty Mangabey	<i>Kakamassi</i> (Susu) <i>Towei</i> (Mende) <i>Huntaralanko</i> (Limba)	<i>Cercocebus atys</i>	Vulnerable <i>Decreasing</i>	Koné <i>et al.</i> 2020
West African or Western Potto	<i>Binkey</i> (Susu) <i>Kondei</i> (Mende)	<i>Perodicticus potto</i>	Near Threatened <i>Decreasing</i>	Svensson <i>et al.</i> 2020
Campbell's Monkey	<i>Krikissa</i> (Fula) <i>Kuley Foreh</i> (Susu) <i>Lorgboi</i> (Mende) <i>Kendor</i> (Limba)	<i>Cercopithecus campbelli</i>	Near Threatened <i>Decreasing</i>	Matsuda Goodwin <i>et al.</i> 2020b
Western Spot Nosed Monkey	<i>Yorima</i> (Susu) <i>Hopkala-Kolei</i> (Mende) <i>Kendor</i> (Limba)	<i>Cercopithecus petaurista</i>	Near Threatened <i>Decreasing</i>	Matsuda Goodwin <i>et al.</i> 2020a
Western or West African Patas Monkey <i>Range Extension</i>	<i>Cula-N'buduke</i> (Fula) <i>Wondokuley</i> (Susu) <i>Kubandoh</i> (Limba)	<i>Erythrocebus patas patas</i>	Near Threatened <i>Decreasing</i>	Wallis 2022
Guinea Baboon	<i>Gorilla</i> (Krio) <i>Cula-Goki</i> (Fula) <i>Gokhie</i> (Susu)	<i>Papio papio</i>	Near Threatened <i>Decreasing</i>	Wallis 2021
Olive Baboon	<i>Kongogolei</i> (Mende) <i>Kohgiee</i> (Limba)	<i>Papio anubis</i>	Least Concern <i>Stable</i>	Wallis 2020
Green Monkey	<i>Kuley Firreh</i> (Susu) <i>Cula-Mela</i> (Fula) <i>Nja-guaa</i> (Mende)	<i>Chlorocebus sabaeus</i>	Least Concern <i>Decreasing</i>	Gonedelé Bi <i>et al.</i> 2020b
Demidoff's Dwarf Galago <i>Presence uncertain</i>		<i>Galagoides demidoff</i>	Least Concern <i>Stable</i>	Svensson <i>et al.</i> 2019
Thomas's Dwarf Galago	<i>Konfoloyie</i> (Susu) <i>Landei</i> (Mende) <i>Chen-cheh</i> (Limba)	<i>Galagoides thomasi</i>	Least Concern <i>Stable</i>	Svensson & Bearder 2019
Northern Lesser Galago <i>Presence uncertain</i>		<i>Galago senegalensis</i>	Least Concern <i>Decreasing</i>	de Jong <i>et al.</i> 2019

Data Collection

From May to July 2018, 239 adult residents (81 women and 158 men) of 11 villages in Outamba participated in focus group interviews and were shown photo flashcards with different wildlife species. From April to May 2022, 124 adult residents (56 women and 68 men) of four villages on the western border of Outamba were involved in one-on-one interviews. Interviews were conducted with the help of a translator (English to Susu and vice-versa). Interviews in 2018 and 2022 used similar flashcards and participants were asked to identify wildlife species present near their villages. Photo elicitation exercises were used with the goal of evoking information and memories (Harper 2002; Newing 2011).

Results from the 2018 interviews, our own observations and our collection of informal reports from park staff and other information about wildlife were used to inform opportunistic camera trapping locations for a mammalian species assemblage survey, as widely used to identify species in different contexts (Hofmeester *et al.* 2021). Since May 2018, 25 camera traps were opportunistically placed throughout Outamba on wildlife trails, near watering holes, and on the edges of farmland within the park.

The purposes of the study were explained to the interviewees and informants, and all gave their informed consent to participate. Interviewee and informant responses were kept anonymous at all times.

Data analysis

Following the photo elicitation exercises conducted in 2018 and 2022, we estimated the frequency of people who identified patas monkeys as present in Outamba. All other data, which were collected non-systematically, are described as reports of observations. Of the many hours of footage collected by the camera traps, we carefully analyzed a single video containing a patas monkey. We report estimated sex and age of the individual.

RESULTS

Of the 11 villages who participated in focus group interviews in May to July 2018, six reported patas monkeys to be “nearby”. In these six villages, people referred to patas monkeys as “very fast”, as “a monkey that is only ever on the ground and not going in trees” and that their preferred cultivated

foods are (in order of frequency of mention from highest to lowest): corn, peanut, cassava, rice, potato, okra, mango and pineapple. People said of the patas behavior that they are “cowardly”, “if it sees humans, it runs away” and “they will hide and then when you go, they will go into the crops”. People reported seeing them in grasslands more than any other habitat and said they share their habitat with green monkeys (*Chlorocebus sabaues*). In the four villages that participated in interviews in April and May 2022, 52%-63% of interviewees reported patas monkeys to be present in the Outamba area and reported similar knowledge of the patas monkeys' socioecology and behavior as interviewees in 2018.

In June 2018, at the beginning of the rainy season, while conducting an interview in Kotor, CC (author) was alerted by a young boy of the presence of a “fula monkey,” as patas are often referred to in Sierra Leone. We observed the monkey as it ran on the ground from the bush, across the road, under a large papaya tree (*Carica papaya*), and back into the bush. We identified the primate in this observation as a patas monkey based on the coloration (including the whitish legs and reddish body, which could not be confused with any other primate species present in OKNP) and the high speed of terrestrial movement.

On 19th February 2022, a young adult female patas monkey, approximately three years old, was captured on a camera trap (Figure 2).

Park staff have reported three captive patas monkeys being held as pets in the vicinity of Outamba since 2018. In all three cases the patas monkeys were reported to have originated in Outamba and were released in Outamba. According to park staff, the ‘owners’ have always referred to hunting incidents within Outamba as the origin. These reports often associate the capture of primates in Outamba to logging and people who may come from outside Outamba to log.

In September 2022, MRB (author) observed what was mostly likely an adult male patas monkey crossing the road near Kotor. In October that same year, a juvenile male patas monkey, approximately 1.5 to 2 years old, was found to be kept as a pet in a village near Kotor (<5 km away) (Figure 3).

Since we began our research in May 2018, informants from Outamba and vicinity reported two distinct ‘red’ monkeys, identifying them as the ‘ground-red’ monkey (likely patas) and the ‘tree-red’ monkey (potentially red colobus). These local reports indicate that the patas monkeys they refer to are not released individuals. We therefore propose to extend their geographic range to include Outamba (Figure 4).



Figure 2. Stills from a camera trap video recorded on 19th February 2022 of a young female patas monkey *Erythrocebus patas* at the border of the Outamba Section of Outamba Kilimi National Park, Sierra Leone (9°39'17.9"N 12°10'59.7"W).

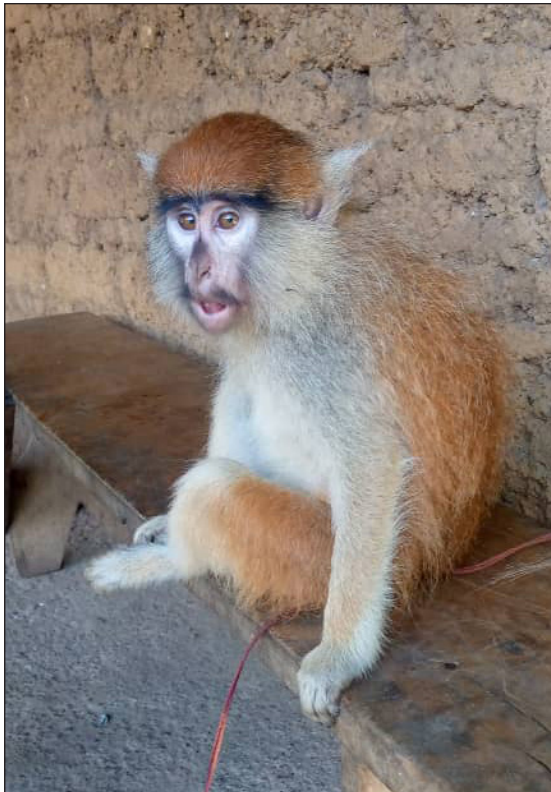


Figure 3. A juvenile male (approximately 1.5 – 2 years old) patas monkey (*Erythrocebus patas patas*) being kept as a pet near the Outamba Section of Outamba Kilimi National Park, Sierra Leone. Photograph by Osman Mohamed Kamara.

DISCUSSION

Until 2018 there were only a few records of the western patas monkey in Sierra Leone, all of which are old and not detailed. Two studies mention the species but do not specify the area of the country (Tappen 1964; Wilkinson 1974) and one study says “red patas monkeys *Erythrocebus patas* create problems on the ground-nut [peanut] farms of northern Sierra Leone” (Robinson 1971). They are mentioned in the western-most areas of their range in other countries, for instance, by Minhós *et al.* (2013) in a bushmeat market survey in Guinea-Bissau and by Henty and McGrew (2014), who collected ecological and ethological data in Senegal.

This study is the first to confirm the presence of western patas monkeys in the Outamba Section of OKNP, north central Sierra Leone, about 60 km southwest of their known geographic range (de Jong *et al.* 2022; Wallis 2022). This paper highlights the importance of local ecological knowledge: the information provided by local people and park staff contributed to our proposed extension.

Limitations

Our direct observations (in 2018 and 2022) and the camera trap video (2022) are each of a single patas monkey. Though we think unlikely, these observations could be of the same few individuals

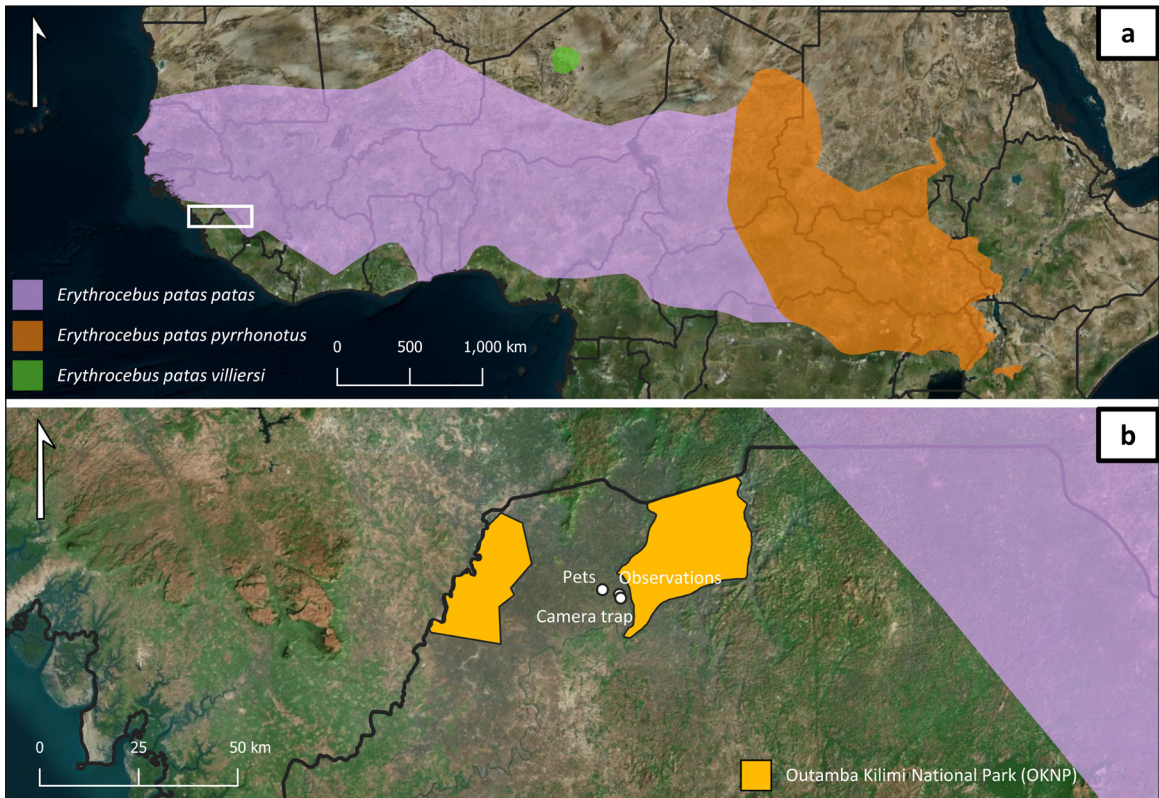


Figure 4. a: The current geographic range of the three subspecies of patas monkey *Erythrocebus patas*. b: Direct observations, camera trap locations, and where patas monkeys have been observed as pets - outside the current range of the species. Base map is adapted from Bing Maps aerial imagery. Subspecies distributions are from de Jong & Butynski (2020), Wallis (2022), and de Jong & Butynski (2022). Boundaries of Outamba Kilimi National are from UNEP-WCMC and IUCN (2020).

based on the distance between the observations compared with typically larger patas home range sizes. One possible explanation is that it may be a few single males emigrating from the natal group congruent with the observed average age of male emigration reported in Nakagawa *et al.* (2003), though at least one of our observations is of a female. Another explanation for each observation being of one single animal may be that all observed patas monkeys are released ex-captive individuals. Although this would not necessarily constitute a range extension, local people continue to report observations of patas monkeys, which leads us to believe there is an actual population of the western subspecies in Outamba.

Future research and recommendations

Further research investigating the reported association between hunting incidents, logging, and people keeping patas monkeys (and other primates) as pets in Outamba, and elsewhere in Sierra Leone, is necessary. Our research highlights the need to

establish a sustainable protocol to confiscate and manage the release of wild captive animals in OKNP. Finally, there is a lack of knowledge regarding the general status of western patas monkeys, and other primates, in OKNP. Based on local reports it is likely that the western red colobus (*Piliocolobus badius badius* and/or *Piliocolobus badius temmincki*) and at least one other species of galago (likely: *Galago senegalensis* and/or *Galgoides demidoff*) also occurs in Outamba. We hope this study encourages an increase in research and conservation action for patas monkeys and other primates in OKNP, and Sierra Leone more widely, and suggest further research to be conducted with both biological and social science methods. We consider this crucial for primate conservation in Sierra Leone and, more broadly, in West Africa.

Future research should also consider direct sightings and reports of patas monkeys north of Bambuna near the Seli or Rokel river recorded by Janette Wallis in an unpublished report based on semi-structured interviews conducted in 2004 as part of the environmental impact assessment for the

Bumbuna Hydropower Dam project in the Tonkolili District, which is also outside the western patas monkey's known range in Northern Province, Sierra Leone (Wallis unpublished report 2004; J. Wallis pers. comm. 2023).

CONCLUSION

We confirmed the presence of western patas monkeys in the Outamba Section of OKNP, north central Sierra Leone. Though patas were reported to be in Outamba in the 1980s (Teleki *et al.* 1981; McGiffin 1985), this is the first study to confirm their continued presence. We therefore propose to extend their geographic range a minimum of 60 km southwest of their known range, into Northern Province, Sierra Leone.

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