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New range record for Campbell's monkeys (*Cercopithecus campbelli*) in West Africa

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Abstract: The current distribution of Campbell's monkeys *Cercopithecus campbelli* extends from southwestern Gambia to the western Ivory Coast. In Senegal, the species has only been confirmed in western part of the country. Here, we report for the first time its presence in southeastern Senegal. We obtained camera trap footage of a Campbell's monkey individual in the Dindefelo Community Nature Reserve located in Kedougou region, 174 km away from its known distribution range. In the footage, a single Campbell's monkey appears alongside a group of at least nine green monkeys *Chlorocebus sabaeus*. We discuss different hypotheses that could explain the presence of the Campbell's monkey in Dindefelo, and conclude that this individual may be a single migrant.

Key words: Distribution range; Dindefelo; Senegal; camera trapping; migrant.

Introduction

The Campbell's monkey *Cercopithecus campbelli* Waterhouse, 1838 is a catarrhine primate that ranges from southwestern Gambia and Senegal to western Ivory Coast, including Sierra Leone, Liberia, and the western parts of Guinea and Guinea Bissau (Matsuda Goodwin et al. 2020). This species has a wide distribution and is still common in Guinea Bissau, Guinea, and in several protected areas along its geographic range (Gonedelé Bi 2012; Matsuda Goodwin et al. 2020). It occupies lowland forests, gallery forests, mangroves, woodlands, woody savannahs, and farrow lands, as well as degraded and exploited lands (Oates 2011; Matsuda Goodwin et al. 2020). However, the species has been listed as Near Threatened by the IUCN Red List of Threatened Species due to a suspected population decline caused by an increase in hunting pressure and more than 30% habitat loss through its distribution range between 2008 and 2019 (Matsuda Goodwin et al. 2020). In the Taï region of Ivory Coast, hunting pressure on Campbell's monkeys exceeded sustainability by more than 300% in 2001 (Refisch and Koné 2005). In 2012, Campbell's monkeys were present

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in nearly 95% of the reserves surveyed within its expected geographic range in that country (Gonedelé Bi 2012), but since then, detection rates have decreased in different protected areas (Matsuda Goodwin et al. 2020).

Campbell's monkey social groups are typically formed by one male, many females, and immatures (Zuberbühler 2000; Buzzard 2010; Oates 2011; Matsuda Goodwin et al. 2020) and can range in size between two and more than 30 individuals (Buzzard 2006a; Buzzard 2010; Matsuda Goodwin et al. 2020). They are primarily frugivorous, although, during months of fruit scarcity, they tend to prey on invertebrates (Buzzard 2006b; Matsuda Goodwin et al. 2020).

In Senegal, information on Campbell's monkey distribution is scarce and its presence has only been confirmed in the southwestern part of the country: in Basse Casamance National Park and some forest reserves (Matsuda Goodwin et al. 2020). Here we report the presence of a Campbell's monkey in the Dindefelo Community Nature Reserve (hereafter Dindefelo), southeastern Senegal, 174 km away from its known distribution range (Figure 1).

Materials and methods

Study site

Dindefelo is a 140 km^2 protected area constituted by a mosaic of different vegetation types including grassland, woodland, bamboo forest, and gallery forests (Dotras et al. 2024; Jane Goodall Institute Spain (JGIS) in Senegal and A.P.E.S. Wiki Team 2023). The reserve

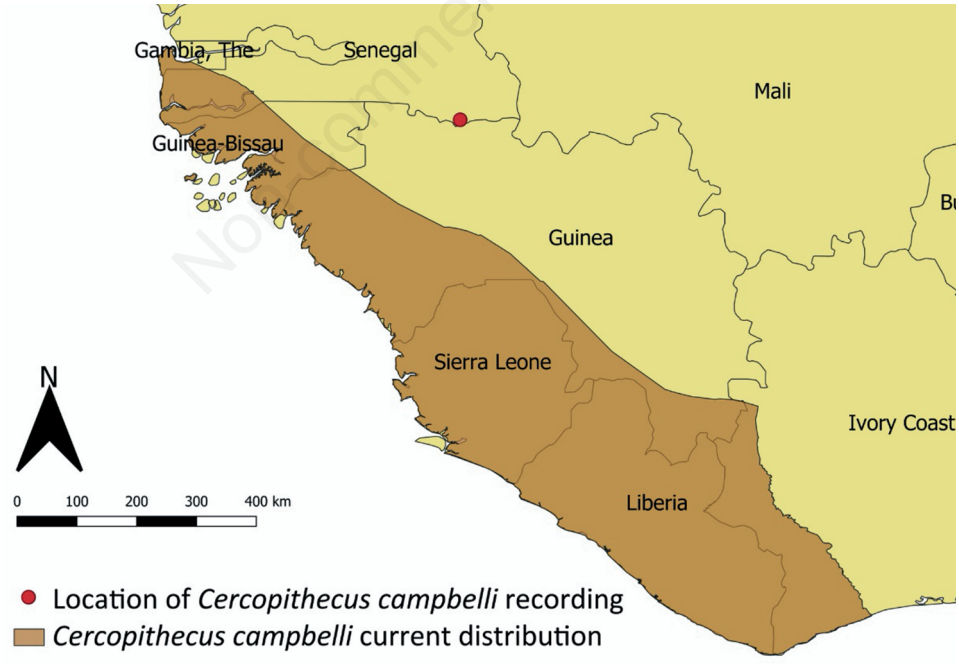

Figure 1. The distribution of *Cercopithecus campbelli* as recognized by the International Union for Conservation of Nature (IUCN 2018. *Cercopithecus campbelli*. The IUCN Red List of Threatened Species. Version 2022-2) and the location in southeastern Senegal where the species was detected in camera trap video footage.

is located in the Kedougou region, southeastern Senegal, and it borders Guinea in its southern and western limits. The climate in Dindefelo has a marked seasonality, with a rainy season lasting from June to October and a dry season from November to May (Dotras et al. 2024; JGIS in Senegal and A.P.E.S. Wiki Team 2023). Since 2009, the JGIS has conducted research and conservation programs in the reserve to protect the Critically Endangered western chimpanzee *Pan troglodytes verus* Schwarz, 1934 and its habitat fostering the sustainable development of the human local communities.

Video footage collection

As part of the ecological monitoring of chimpanzees in Dindefelo, a total of 58 camera traps have been placed in 63 different locations of the reserve since 2017. We obtained Campbell's monkey video footage from a single camera trap (UTM 0797406-1373808). This site is located on the upper part of a very steep slope leading to a plateau, at 380 m a.s.l., and is an ecotone between woodland and bamboo forest. The camera was placed on the trunk of a tree, approximately 50 cm from the ground, facing a rock wall from where a water spring comes out.

This location is one of the few permanent water points known in that part of the reserve, with no other water sources in a radius of approximately 2 km, and where water is available even during the dry season. Seventeen different mammal species have been spotted drinking water in this spot, including chimpanzees, Guinea baboons *Papio papio* (Desmarest, 1820) and warthogs *Phacochoerus africanus* (Gmelin, 1788). There were 306 camera-trapping days between January 2020, when a camera trap was first installed there, and March 2022. Due to the steep slope and difficult access, this location is very likely not visited by humans or livestock. There was no evidence of their presence, neither from indirect evidence nor from the camera trap footage. The closest place where human activity had been detected is on the lower part of the slope, 214 m below, where machete cuts on bamboo have been found.

Results

On 7th May 2021, four one-minute-long videos of a single adult Campbell's monkey individual were obtained. The videos were recorded at 10:10, 12:29, 12:33 and 12:35 hours. The Campbell's monkey always appeared together with a group of green monkeys *Chlorocebus sabaeus* (Linnaeus, 1766), a species which is usually seen in camera trap footage from this exact spot. A minimum of two and a maximum of nine green monkey individuals were seen alongside the Campbell's monkey in the different videos. Based on its physical characteristics (see below), the fact that it was always together with green monkeys, that the last three videos were almost consecutive and the first one was only two hours apart in time, the Campbell's monkey was likely the same individual in all videos.

We identified the individual as a Campbell's monkey (Figure 2A) using descriptions from Kingdon (2015) and Oates (2011). This species could be distinguished from the green monkeys by its size and back coloring. The Campbell's monkey was larger, and its hair was dark grey, while the green monkeys were smaller in size and brownish/yellowish. The tail of the green monkeys was yellow, while the tail of the Campbell's monkey was entirely dark grey. However, the most distinct characteristic was the face: the Campbell's monkey had a white forehead and ruff, and the upper part of the face was grey with a pink coloration below the nose. In contrast, the face of green monkeys was completely black.

The first video showed a Campbell's monkey and two adult green monkeys. In the following three videos, recorded two hours later, the Campbell's monkey had its back facing

the camera and seemed to be licking water from the rock wall. At the end of the last video, it turned its head and could be clearly identified as a Campbell's monkey (Figure 2B). Most of the green monkeys seen alongside the Campbell's monkey in these videos were looking at it, but did not approach it or had any other interaction with it.

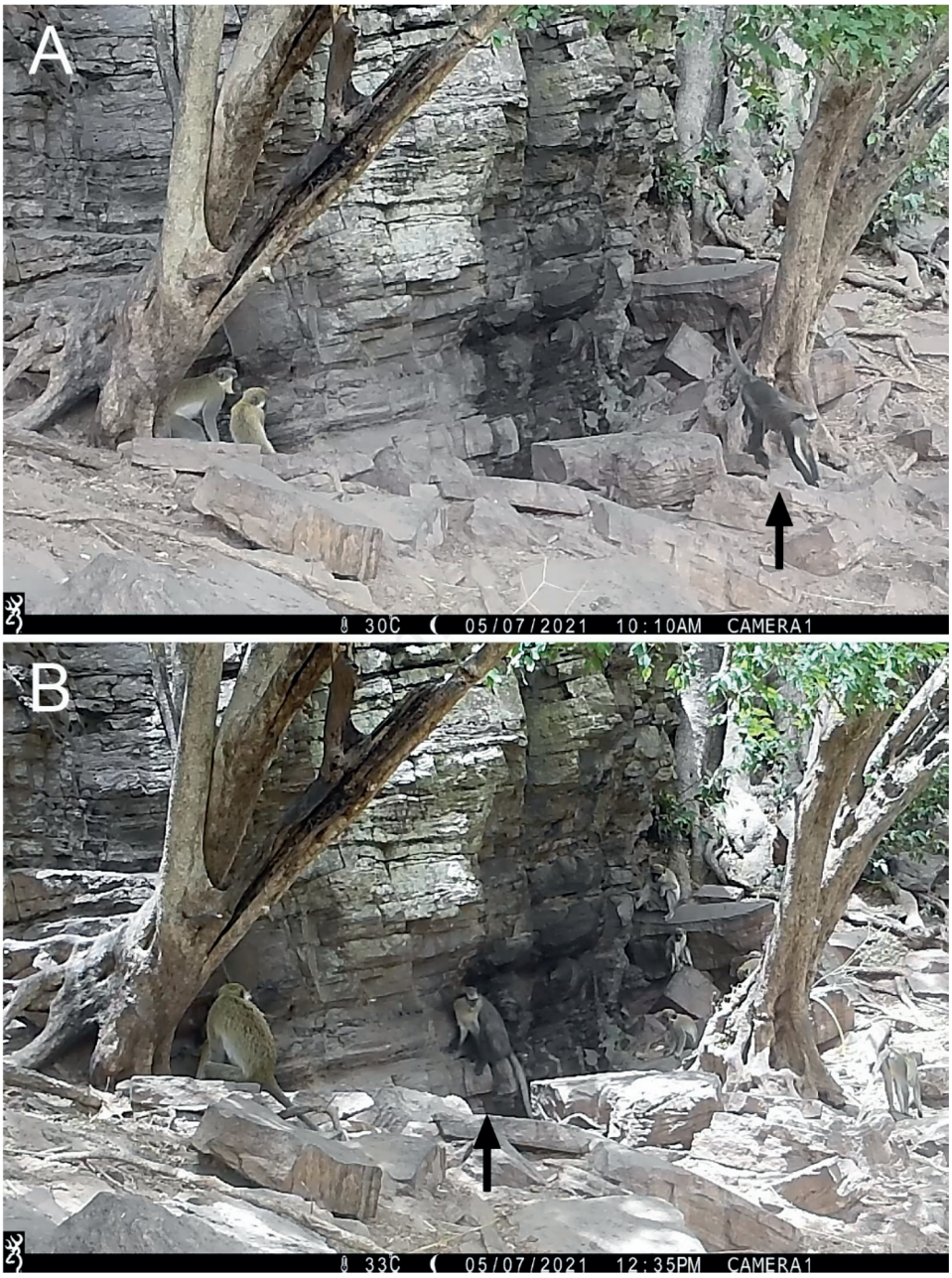

Figure 2. Video footage of a Campbell's monkey in Dindefelo, southeastern Senegal, alongside a group of green monkeys (*Chlorocebus sabaeus*). A) First video, where the species was identified; B) last video, where it is seen licking the rock wall, probably to obtain water.

Discussion

Ours is the first recorded sighting of the Campbell's monkey in southeastern Senegal, outside its known distribution range. Therefore, we propose different hypotheses that could explain the presence of this primate in Dindefelo: i) the species has always been in the area but had not been detected until now, ii) the individual we recorded is an escaped pet, or iii) the individual is an exceptional migrant.

First of all, we cannot overlook the possibility that the IUCN current distribution map may lack information, and Campbell's monkey distribution may extend further east. Tappen (1960) stated that Campbell's monkeys ranged from Ghana to Guinea, following the coastal forest, and Wolfheim (1983) reported this species to be present in the coastal area from Southwest Senegal to Northwest Guinea Bissau, including Gambia, and in two small patches in Middle and Upper Guinea. Gippoliti and Dell'Omo (2003) mentioned that Campbell's monkeys were common in Guinea Bissau, except for the north-eastern region, which is the closest to Senegal and Guinea. In addition, Sunderland-Groves et al. (2011) confirmed the presence of Campbell's monkeys in Nialama Classified Forest, in Upper Guinea, which is halfway between the current IUCN distribution range of the species and Dindefelo. However, neither Middle nor Upper Guinea are shown in the current IUCN distribution range of this primate. This suggests that the IUCN map is not presenting all the available information and that the distribution of Campbell's monkeys extends indeed further east.

Similarly, other primate species have also been detected outside their reported IUCN distribution range. Pruetz et al. (2010) documented the presence of a lesser spot-nosed guenon *Cercopithecus petaurista* (Schreber, 1774) in Fongoli, a site located in Kedougou, the same region where our study site is located. In 2019, Alonso et al. (2019) confirmed the presence of the King colobus *Colobus polykomos* (Zimmermann, 1780) in Northern Fouta Djallon, north-eastern Guinea. Moreover, Dotras et al. (2022) reported for the first time the presence of the same *Colobus* species in Dindefelo, our study site. These examples show that this geographical area has not been extensively surveyed, and our report is not the first of a primate species found in the last years in this area. The King colobus in Dindefelo was detected several times during the last years by direct observations and camera traps (Dotras et al. 2022), while the lesser spot-nosed guenon at Fongoli was only seen during two consecutive days and assumed to be a migrant.

Buzzard (2010) estimated the home range of two Campbell's monkey groups in Taï Forest (Ivory Coast) to be 52 and 80.5 ha respectively. The species may exhibit larger home ranges in open and dry habitats compared to rainforest habitats, as reported for red-tailed monkeys *Cercopithecus ascanius* (Audebert, 1799) (McLester 2019), chimpanzees (Lindshield et al. 2021) and Ashy red colobus monkeys *Piliocolobus tephrosceles* (Elliot, 1907) (Kibaja et al. 2023). Thus, the possibility that Campbell's monkeys were always present in Dindefelo yet went undetected until now is very low, especially considering that the area of the reserve where the species was recorded has been regularly surveyed on foot since 2009 and camera traps have been deployed since 2017.

It also seems unlikely that the Campbell's monkey individual we recorded was a former pet. It is not surprising to see green monkeys and particularly patas monkeys *Erythrocebus patas* (Schreber, 1774) kept as pets in households and even in hotels and tourist camps in the region of Kedougou. Both of these species are also frequently seen in the wild in Dindefelo. It would be difficult for a different monkey species, one that has never been observed in the reserve before, to have gone undetected if it had been someone's

pet. Local field assistants were asked if they had seen this species before, and none of them could recognize it. Thus, we found no support for these two first hypotheses.

The fact that the Campbell's monkey individual we recorded was seen only once suggests that it may have been traveling through, and that it had not stayed in Dindefelo for long. During the dry season, when this species was detected, most water sources in the reserve are regularly monitored by field assistants or camera traps, and if present in the area, Campbell's monkeys would be expected to use the few water sources available. The species has not been detected since the only day when we recorded it, giving support to the hypothesis that the Campbell's monkey individual in Dindefelo was a single migrant. The area between Dindefelo and the closest Campbell's monkey distribution edge according to the IUCN map, comprises similar vegetation types to the ones found in Dindefelo (including patches of forest and woodland) but contains more abundant evergreen forests (Oates 2011; Sunderland-Groves et al. 2011; Verschoren 2012). Thus, it is possible that the Campbell's monkey individual we recorded in Dindefelo travelled across suitable habitat, further east than the IUCN distribution range reported for the species.

It is interesting that the Campbell's monkey we recorded was seen alongside a group of green monkeys. Campbell's monkeys usually form mixed-species associations with other primate species such as other guenons and colobus (Zuberbühler 2000; Gippoliti and Dell'Omo 2003; Buzzard 2010). Zuberbühler (2000) and Buzzard (2010) suggested that the reason Campbell's monkeys associate with other primate species is probably because these associations offer better protection against predators. In Taï Forest, Campbell's monkeys were found in single-species social groups only 4.5% of the time, while they were associated with other primate species the rest of the time (Buzzard 2010). As far as we know, associations between Campbell's monkeys and green monkeys have not been reported despite having overlapping distributions. Furthermore, having just a single observation, we cannot consider the Campbell's monkey we recorded alongside the green monkey group to reflect an association, especially because green monkeys in Dindefelo seem to tolerate other mammal species close to them. They have been seen in camera traps footage sharing space with several species including patas monkeys, Guinea baboons, bushbucks *Tragelaphus scriptus* (Pallas, 1766), mongooses *Atilax paludinosus* (Cuvier, 1829), and greater cane rats *Thryonomys swinderianus* (Temminck, 1827) (JGIS, unpublished data). In addition, our observations occurred at a water spring, and it is not surprising to see two species sharing this resource. Nevertheless, we cannot conclude if the encounter between the Campbell's monkey and the green monkeys at the water spring was accidental or if the Campbell's monkey temporarily joined the green monkey group. Green monkeys usually associate with other primate species across their distribution range (see Pourrut et al. (1996) for green monkey association with other primates in Senegal).

It is important to identify and report new species records outside their known distribution ranges, as they can help us understand species movements through space and time, and detect new incursions and changes in their distribution. It would be interesting to see if the recordings of individuals of a primate species in new areas are just one-time observations or if they will become more common in the future due to the increasing destruction of their habitats, the bushmeat trade, and climate change. Reporting sightings of species outside their distribution ranges can help us better assess the conservation status of species, design more effective measures for their preservation, and investigate the causes that could be driving them to new places. In addition, it highlights the importance of being attentive to possible interactions between new and native species.

Conclusions

We obtained camera trap footage of a Campbell's monkey individual in the Dindefelo Community Nature Reserve located in the Kedougou region, Senegal, 174 km away from its known distribution range. In the footage, this single Campbell's monkey appears alongside a group of green monkeys, and we conclude that the Campbell's monkey may be a single migrant. We report for the first time the presence of the species in southeastern Senegal.

Authors' contributions

NM collected data and wrote the first version of the manuscript, with contributions from all authors. ML and AB overviewed data collection. All authors revised manuscript drafts, read and approved the final version, and agreed to be held accountable for all aspects of the work.

Conflict of interest

The authors declare no potential conflict of interest.

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Availability of data and materials

All data generated or analyzed during this study are included in this published article.

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