

Golden-bellied mangabeys (*Cercocebus chrysogaster*) consume and share mammalian prey at LuiKotale, Democratic Republic of the Congo

Field Note

Cite this article: McLester E (2022) Golden-bellied mangabeys (*Cercocebus chrysogaster*) consume and share mammalian prey at LuiKotale, Democratic Republic of the Congo. *Journal of Tropical Ecology* **38**, 254–258. <https://doi.org/10.1017/S026646742200013X>


Received: 13 December 2021
Revised: 27 January 2022
Accepted: 6 February 2022
First published online: 1 March 2022

Keywords:

Predation; meat-eating; food sharing; primate; duiker; cusimanse

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Abstract

Predator–prey dynamics are an important aspect of community ecology, but predation events are often difficult to observe. Among African primates, observations of mammal predation are particularly uncommon and generally restricted to a few ape and cercopithecoïd species. I report five observations of mammal predation by golden-bellied mangabeys (*Cercocebus chrysogaster*) living in rainforest at the LuiKotale study site, Democratic Republic of the Congo. Over 46 all-day follows, mangabeys from one group caught and consumed four duikers (*Cephalophinae* spp.) and one Alexander's cusimanse (*Crossarchus alexandri*). Individuals begged from the feeding individual in three of five observations. I observed one successful attempt at begging, which resulted in an adult female tolerating removal of blue duiker by a juvenile. These are the first detailed observations of mammal predation and food sharing by *Cercocebus* mangabeys and suggest mammals that feed alongside mangabeys may balance predation risk against social foraging benefits. Food sharing is rarely observed in most cercopithecoïd monkeys and could provide a useful metric to examine socio-ecological patterns of food acquisition.

Introduction

Predator–prey relationships are important elements of community ecology, influencing animal life histories, population dynamics, and ecosystem structure (Hart 2007; Pettorelli *et al.* 2011). Predation is of particular interest in the biodiverse rainforests of central Africa, where mammal communities alone comprise dozens of species that interact, avoid, or associate with each other. Observations of predation events are therefore useful in providing explicit evidence for hypotheses of animal foraging and anti-predator behaviour, particularly for the many species in these environments that have rarely, if ever, been studied in the wild.

Among Africa's primates, consumption of vertebrate prey has been observed in at least 22 species of cercopithecoïd monkeys and great apes (Watts 2020). Predation of small and medium mammals (e.g. mongooses, antelopes) is rarer, however, with most occurrences reported from chimpanzees (*Pan troglodytes*), bonobos (*P. paniscus*), and baboons (*Papio* spp.; Surbeck *et al.* 2009; Watts 2020). Observations of mammal predation by primates highlight the ecological role of these animals as predators, while also highlighting the potential importance of meat as an important dietary component. Moreover, observations of predation can reveal social behaviours typically associated with meat-eating. For example, unlike small fruit and insects that can typically be consumed quickly and discretely, catching and consuming relatively large mammals is an energetically costly activity that results in large food items that can be monopolised by a single individual (Feistner & McGrew 1989). As such, chimpanzees and bonobos feeding on vertebrate prey often attract other group members that attempt to obtain meat through sharing (actively giving an item or passively tolerating removal by another individual) or aggressive theft (Goffe & Fischer 2016; Fruth & Hohmann 2018; Samuni *et al.* 2018). Given sharing and aggression over food is closely associated with primate social structure and reproductive success, observations of these behaviours can highlight possible social influences (e.g. dominance, mate choice) on food acquisition (Feistner & McGrew 1989; Jaeggi & Van Schaik 2011; Goffe & Fischer 2016).

I report observations of mammal consumption and sharing by golden-bellied mangabeys (*Cercocebus chrysogaster*), a large-bodied, predominantly terrestrial monkey that lives in the swamp rainforests of central Democratic Republic of the Congo (DRC). These observations describe mammal predation and accompanying social behaviours that have never been reported previously in this species and are rarely observed among most cercopithecoïd monkeys.

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Methods

I collected data at the LuiKotale study site, which spans four neighbouring community-owned forests in the southwest buffer zone of Salonga National Park, DRC. I collected data as part of an ongoing biodiversity study by the long-term LuiKotale Bonobo Project, which has maintained a researcher presence in this area since 2002 (Hohmann & Fruth 2003). Vegetation at LuiKotale is a mosaic of mostly dry *terra firma* rainforest interspersed with temporarily and permanently inundated swamp forest (Mohneke & Fruth 2008). In addition to golden-bellied mangabeys, fauna in these forests includes bonobos, seven other cercopithecoid monkeys, five duiker species, and a range of small mammals (e.g. bats, civets, cuscimanse, and squirrels; see Bessone *et al.* 2020).

From March to June 2021, I followed a single group of golden-bellied mangabeys (M2 group) typically from 05:30 h to 17:30 h daily in sets of four consecutive follow days. M2 group consisted of approximately 65 individuals (12 adult males, 30–40 adult females and subadult males and females, and 15–25 juveniles). I made observations while habituating the group to researcher presence, which took around 20 days until I could move around within the peripheries of the group without eliciting alarm calls from most individuals. By the end of the study, I could individually identify four adult males, three adult females, and three subadults, although I was not able to identify the individuals involved in my observations. I took photographs and videos of mangabey behaviour using a Canon 5D IV camera with 100–400 mm II lens (video: 3840 x 2160 resolution at 30 frames per second). To investigate possible food sharing, I noted evidence of begging; that is, if a different mangabey positioned within arm's reach of the individual in possession of the prey item peered, reached for the prey or the mouth of the possessor, or attempted to take a portion of the prey. I considered begging as successful if the possessor tolerated a begging individual obtaining a portion of the prey (following Goffe & Fischer 2016; Goldstone *et al.* 2016).

Observations

I followed M2 group for 46 follow days for a total of 445 contact hours (mean: 9.5 hours daily). I recorded five observations of mammal capture and/or consumption, all of which began or were first observed while the group was travelling in a cohesive progression. I observed begging by five individuals in total across three of five observations. One instance of begging was successful, in which an adult female tolerated removal of prey pieces by a juvenile (summarised in Table 1).

Observation 1

On 8 April, 2021 at 11:24, I observed an adult male mangabey catch a duiker (*Cephalophinae* spp.). I could not observe whether the male stalked or chased the duiker beforehand because of dense vegetation. Due to limited habituation early in the study, I immediately lost the mangabey as it carried the duiker out of sight. I could not identify the duiker species visually but distress calls made while being carried by the mangabey were consistent with those of blue duikers (*Philantomba monticola*) and red duikers (*Cephalophus natalensis*).

Observation 2

On 1 May 2021 at 10:09, I observed an adult male mangabey sitting terrestrially consuming a cuscimanse (*Crossarchus* spp.; Figure 1a).

An adult female sitting next to the adult male peered at him for the duration of the observation but did not obtain any of the prey. The observation ended when the adult male carried the prey out of sight after being approached by another adult male. I later identified the prey as an Alexander's cuscimanse (*C. alexandri*) based on the pelage.

Observation 3

On 30 May 2021 at 08:24, I observed an adult male mangabey catch a blue duiker and carry it out of sight followed closely by two adult female or subadult mangabeys. The mangabey appeared to catch the duiker opportunistically; that is, I did not observe the mangabey stalking or chasing the duiker beforehand. Approximately 2 minutes later, I heard aggression vocalisations, after which an adult female carrying a dead duiker appeared in view and was pursued up a tree by an adult male. The adult male ceased pursuit and descended as soon as the adult female reached a height of *ca.* 8 metres (Figure 1b; start of supplementary video 1). While feeding on the duiker, the female was approached by three subadult males in turn. The first subadult broke off and consumed five separate pieces from the remains. The second subadult begged by peering at and sniffing the remains, and the third subadult begged by reaching for the remains from above the female. Neither the second nor third subadult obtained any of the prey item. After *ca.* 2.5 minutes feeding on the duiker, the adult female descended to ground level while carrying the remains and moved out of sight (end of supplementary video 1). Less than one minute later, I heard aggression vocalisations and observed an adult male run out of sight with duiker remains, closely followed by two mangabeys of unknown age-sex class. 55 minutes later at 09:27, I observed an adult male travelling terrestrially while carrying and feeding on duiker remains. At 09:32, the adult male produced a threat face (eyes widened, mouth open, and canines bared) in response to a mangabey who approached within a few metres (supplementary video 2). I lost the adult male at 09:40 when he stopped feeding on the duiker to chase a mangabey located out of sight a few metres away, while still carrying the remains. I could not identify if the adult male feeding on the duiker directed aggression at the same individual in both cases. At 10:54, I briefly observed either an adult female or subadult mangabey travelling with duiker remains before moving out of sight. The consistent depletion of the duiker remains and an absence of other duiker distress vocalisations (heard each time I saw mangabeys catch duikers) indicate only one duiker was consumed throughout the observation, which lasted at least 2.5 hours. I could not individually identify the mangabeys I observed but based on age-sex classes at least three different individuals handled and consumed duiker meat.

Observation 4

On 30 May 2021 at 10:57, I observed an adult male mangabey jump on and catch a blue duiker that was foraging approximately 2 m from the male (the second blue duiker caught by a mangabey in M2 group that morning, after Observation 3). Similar to Observation 3, the catch appeared to be opportunistic and I did not observe the mangabey stalk or chase the duiker. The male climbed *ca.* 8–10 m high in a tree, immediately descended to the ground, and travelled terrestrially out of sight while carrying the duiker. At 12:09, I observed an adult male carrying duiker remains climb *ca.* 2 m high into a tree, where he fed on the duiker for the next 29 minutes while other individuals rested (Figure 1c). I could not identify if this adult male was the same individual that

Table 1. Summary of prey caught, consumed, and shared by golden-bellied mangabeys in M2 group during the study. Duration of observation refers to the total duration from first to last observation of any mangabey handling the same prey item, including intervals when the prey item was out of sight. Total durations are minimums because each observation ended in a mangabey carrying the prey item out of view (AM = adult male; AF = adult female; SAM = subadult male; JUV = juvenile of unknown sex)

Observation ID	Date	Prey species	Duration of observation	Individuals observed handling prey (n)	Individuals observed begging (n)	Figure
1	8 th April 2021	Duiker (likely blue duiker, <i>Philantomba monticola</i> or red duiker, <i>Cephalophus natalensis</i>)	1 minute	1 (caught by AM)	0	–
2	1 st May 2021	Alexander's cusimanse (<i>Crossarchus alexandri</i>)	1 minute	1 (consumed by AM)	1 unsuccessful (AF)	Figure 1a
3	30 th May 2021	Blue duiker	2 hours 30 minutes	3 (caught by AM; consumed by AF, SAM, AM)	1 successful (SAM); 2 unsuccessful (SAM x2)	Figure 1b; supplementary videos 1 & 2
4		Blue duiker	2 hours 3 minutes	1 (caught by AM; consumed by AM)	1 unsuccessful (JUV)	Figure 1c; supplementary video 3
5	19 th June 2021	Blue duiker	12 minutes	2 (carried by AF; consumed by SAM)	0	Figure 1d

(a)



(b)



(c)



(d)



Figure 1. Mammal predation by golden-bellied mangabeys in M2 group at LuiKotale: (a) adult male feeding on Alexander's cusimanse with adult female in foreground (Observation 2); (b) adult female; (c) adult male; and (d) subadult male feeding on blue duiker (Observations 3–5, respectively).

caught the duiker at the start of Observation 3 but the duiker remains were more recent (e.g. the head was intact), indicating a different duiker to that in Observation 3. While feeding, the adult male was approached by a juvenile mangabey who begged unsuccessfully by peering at and twice reaching towards the duiker, before moving away without obtaining any of the remains or eliciting a visible response from the male (supplementary video 3). At 12:38, the male dropped the duiker on the ground, retrieved them, and travelled and fed on the remains terrestrially for the next 22 minutes during a group progression. The adult male was last seen at 13:00 moving out of sight while carrying the remains.

Observation 5

On 19 June 2021 at 15:04, I observed an adult female mangabey carrying a blue duiker run through the group centre closely followed by four mangabeys of unknown age-sex class. After losing sight of the female, I immediately heard aggression vocalisations. At 15:07, I observed a subadult male carrying a dead duiker climb into a tree *ca.* 4 m high, where he fed on the remains for 9 minutes (Figure 1d). No other individuals approached the subadult male within 5 m and he fell to the back of the group progression. The observation ended at 15:16 when the subadult male descended to the ground and moved out of sight terrestrially while carrying the remains.

Discussion

These are the first detailed observations of medium mammal predation and food sharing by *Cercocebus* mangabeys. The only other published observations of *Cercocebus* preying on vertebrates describe consumption of frogs by Sanje mangabeys (*C. sanjei*; McCabe 2012), and frogspawn by agile mangabeys (*C. agilis*; Quris 1975) and sooty mangabeys (*C. atys*; Rödel *et al.* 2002). Sooty mangabeys also consume forest giant squirrels (*Protoxerus stangeri*) relatively infrequently (approximately once per 200 follow hours – A. Mielke personal communication). Reports of medium mammal predation by other *Cercocebus* species are limited to agile mangabeys (*C. agilis*), which have been observed catching and consuming blue duikers, Peter's duikers (*C. callipygus*), and water chevrotains (*Hyemoschus aquaticus*; T. Fuh personal communication). Primate consumption of vertebrate prey is usually associated with acquiring micronutrients that are harder or impossible to obtain from plants and insects (Watts 2020). Detailed dietary data from golden-bellied mangabeys will be required to establish if and how vertebrate meat supplements nutrition in this species. Examining ecological factors at LuiKotale could also help explain why golden-bellied mangabeys consume meat. Given duikers are sympatric with all six other *Cercocebus* species (Kingdon & Hoffman 2013; see below), conditions at LuiKotale, such as possible higher mammal densities or more seasonal availability of plant foods, may influence more frequent vertebrate predation versus other sites (Mitani & Watts 2005; Watts 2020). Moreover, *Pan* and *Papio*, which consume mammals most frequently, are also some of the most-studied African primates and subjects of numerous long-term (>10 year) studies. As such, vertebrate predation in many African primates, including *Cercocebus*, may be more common than available data suggest.

Four of the five animals preyed on by mangabeys were duikers. I observed red and blue duikers travelling and foraging next to mangabeys on approximately 75% and 50% of follow days, respectively. Duikers may benefit from a reduced search effort for food by

following mangabeys that are foraging terrestrially for the same fruit species, both at LuiKotale and other sites. For example, red-capped mangabeys at Setté Cama (Gabon; Cooke 2012) and sooty mangabeys at Taï National Park (Ivory Coast; McGraw *et al.* 2007) both forage for fruit alongside duikers. Golden-bellied mangabeys in this study consumed four duikers in 46 follow days; a rate similar to that of leopards in tropical forest at Taï, which on average hunted one duiker every ten days over 27 months (Zuberbühler & Jenny 2002). More data are needed to establish if mangabeys consistently prey on duikers as often as I observed. Nonetheless, predator presence alone can influence animal behaviour irrespective of how often predation occurs (Hill & Cowlshaw 2002), raising the question of how duikers might balance predation risk against possible social foraging benefits when feeding alongside mangabeys.

These observations also illustrate social behaviours associated with large prey items that can be monopolised by one individual: begging, sharing, and theft. An adult female and a subadult male appeared to obtain duiker remains through aggressive theft (Observations 3 and 5), and an adult male feeding on duiker twice displayed aggression against other group members (supplementary video 2). Adult males caught prey in at least three of five observations, while the one successful begging attempt resulted in an adult female tolerating removal of duiker meat by a juvenile. Adult females and juveniles may therefore rely on sharing and theft as the primary way of obtaining meat and any associated nutritional benefits. Kin and non-kin relationships influence patterns of food sharing in primates, meaning it is difficult to assess why certain individuals steal or share food without knowing individual identities of golden-bellied mangabeys in this study (Goffe & Fischer 2016). In future studies, rates of vertebrate prey sharing and theft could be compared against variation in fruit and invertebrate availability to investigate the extent to which begging or stealing mammalian prey might supplement foraging for plant and insect foods and help mangabeys meet daily dietary requirements.

Supplementary material. To view supplementary material for this article, please visit <https://doi.org/10.1017/S026646742200013X>

Acknowledgements. Research in the DRC was conducted under the umbrella of the LuiKotale Bonobo Project, with permission granted by the Institut Congolais pour la Conservation de la Nature and Lompole, Bekombo, and Mbungusani village communities. The LuiKotale Bonobo Project is funded by the Centre for Research and Conservation of the Royal Zoological Society of Antwerp and the Department for the Ecology of Animal Societies at the Max-Planck Institute of Animal Behavior. I thank Iris Witkamp, Daniel Blankenheim, Papas Moreno, Mabele, Bopa, and Djanana, and the Ekongo field team for assistance with data collection, Reiko Matsuda Goodwin, Scott McGraw, Gráinne McCabe, Alex Mielke, and Terence Fuh for sharing field observations, and Anne-Sophie Crunchant for manuscript feedback. I especially thank Barbara Fruth and Gottfried Hohmann for supporting this preliminary field work and directing research at LuiKotale.

Competing interests. None.

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