

Inferred African Crowned Eagle (*Stephanoaetus coronatus*) Predation on a Tana River Mangabey (*Cercocebus galeritus*)

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Abstract: We recovered an adult male Tana River mangabey (*Cercocebus galeritus*) cranium with puncture wounds from the forests of the lower Tana River. The five puncture wounds are similar to those inflicted to primate skulls found under African crowned eagle (*Stephanoaetus coronatus*) nests in other sites. As crowned eagles are present along the lower Tana River, and no other predator present in Tana could inflict wounds like this, we conclude that this mangabey was most likely killed by a crowned eagle.

Keywords: African crowned eagle, *Cercocebus galeritus*, predation, *Stephanoaetus coronatus*, Tana River mangabey

Résumé : Nous avons découvert la boîte crânienne d'un mangabey adulte de la Tana (*Cercocebus galeritus*) avec 5 blessures profondes. Ces blessures sont semblables à celle vues sur les crânes de primates trouvés sous les nids d'aigles couronnés africains (*Stephanoaetus coronatus*) dans d'autres régions. Sachant que les aigles couronnés sont présent le long de la rivière Tana et qu'aucun autre prédateur présent dans cette région ne peut causer de telles blessures, nous concluons que ce mangabey a été tué par un aigle couronné.

Mots clés: Aigle couronné Africain, *Cercocebus galeritus*, prédation, *Stephanoaetus coronatus*, Mangabey de la Tana

INTRODUCTION

The African crowned eagle (*Stephanoaetus coronatus*; Figure 1) is a major predator of primates, with primates comprising >80% of their prey at some sites (Brown *et al.*, 1982; Struhsaker & Leakey, 1990; Mitani *et al.*, 2001; Sanders *et al.*, 2003). In this paper, we present data on a Tana River mangabey (*Cercocebus galeritus*) cranium with puncture wounds. Based on the similarity of damage between this cranium and those of other primate species known to be victims of crowned eagles (Sanders *et al.*, 2003; McGraw *et al.*, 2006; Gilbert *et al.*, 2009), we conclude that the most likely predator of this mangabey was a crowned eagle.

The Tana River mangabey (Figure 2) is endemic to a 60-km stretch of forest along the lower Tana River in southeastern Kenya. It is classified as Endangered (IUCN, 2011), numbering approximately 2000 individuals (Wieczkowski *et al.*, 2002; J. Wiecekowsky, unpub. data).

RESULTS AND DISCUSSION

Tana River mangabey cranium

Eight non-human primate species – including five cercopithecoid species – range within the Tana River Primate National Reserve, Kenya (171 km²; ca. 1° 52' 35" S, 40° 08' 24" E) (De Jong & Butynski, 2011). On 11 July 2006, JW found a cranium of an adult primate in Mchelelo West Forest in the Reserve. The skull was 'clean', indicating that the animal died some months or years earlier. No mandible or other bones were found in the vicinity of the skull. The skull has excavated suborbital fossae, moderate prognathism, and large fourth premolars, all features diagnostic of *Cercocebus* mangabeys (Fleagle & McGraw, 1999; Singleton, 2009). Based on these features, we conclude that the skull is that of a Tana River mangabey. Both third molars are fully erupted and worn, and the sutures are closed. The canines are long (22 mm), and the skull measurements (greatest length: 125 mm; greatest width: 79 mm) are those of an adult male (Wieczkowski & Butynski, in press).

The cranium has five puncture wounds, three across the back of the cranium and two in the occipital (Table 1; Figures 3 & 4). Wounds 2, 3, and 4 are ‘can-opener’ perforations (Sanders *et al.*, 2003) with flaps of bone hinging into the braincase (Figure 5).

Crowned eagles at the lower Tana River

Crowned eagles are widespread along the lower Tana River (Andrews *et al.*, 1975; Lewis & Pomeroy, 1989; Zimmerman *et al.*, 1999; D.N.M. Mborara, pers. comm.) and



Figure 1. Adult male African crowned eagle *Stephanoaetus coronatus*. Photograph by Simon Thomsett.



Figure 2. Adult male Tana River mangabey *Cercocebus galeritus*. Photograph by Julie Wieczkowski.

Table 1 - Puncture wound location and diameters in the skull of an adult male Tana River mangabey.

Puncture wound	Location of wound	Minimum diameter of puncture (mm)	Maximum diameter of puncture (mm)
1	On suture between left parietal and temporal bones	5.5	6.7
2	Middle of left parietal bone	3.6	5.9
3	Middle of right parietal bone	2.5	5.5
4	Left side of occipital, more posterior	4.9	6.7
5	Right side of occipital, more anterior	2.4	3.6

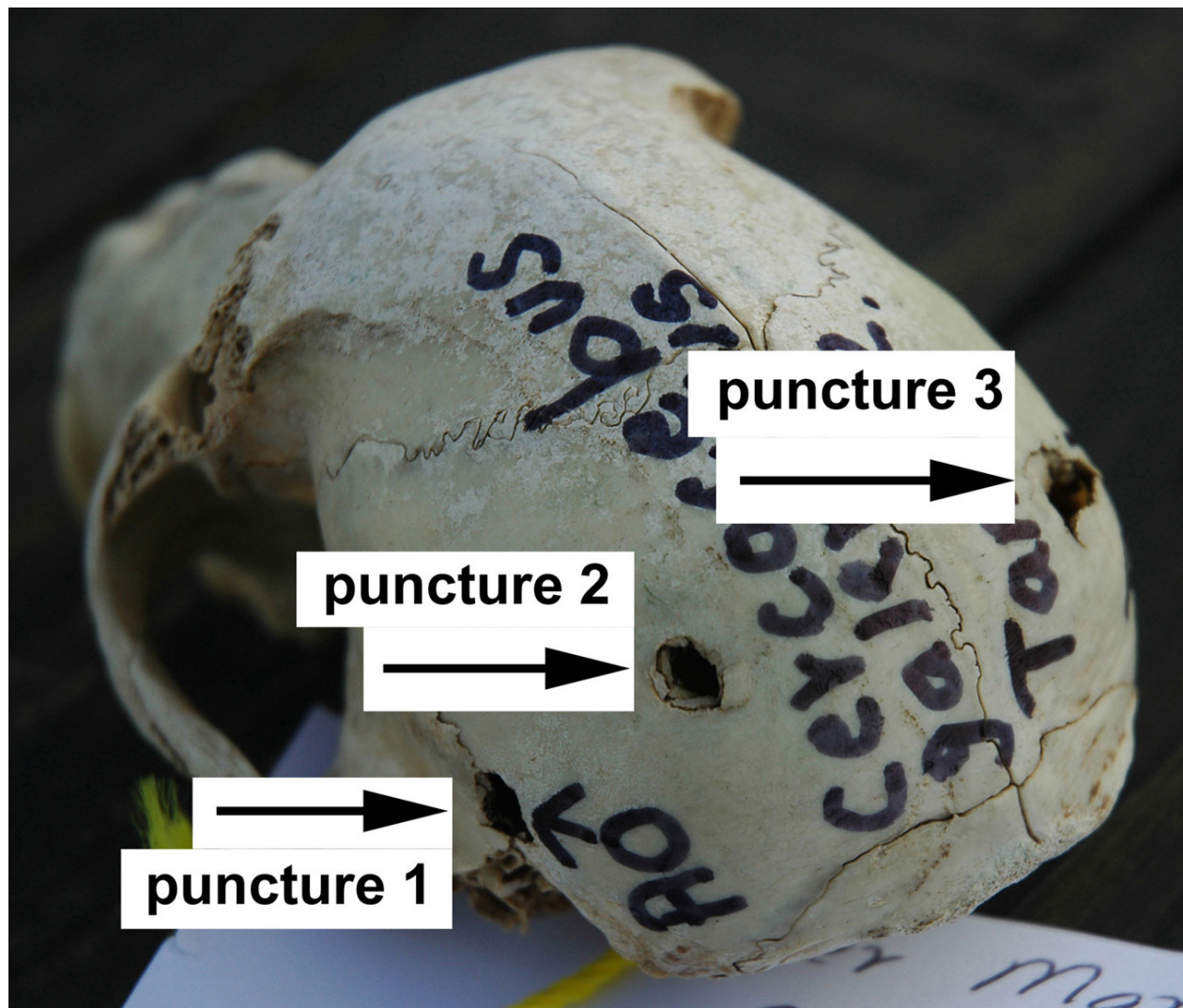


Figure 3. Three puncture wounds on the superior aspect of the cranium of an adult male Tana River mangabey *Cercocebus galeritus*. Photograph by Tom Butynski and Yvonne de Jong.

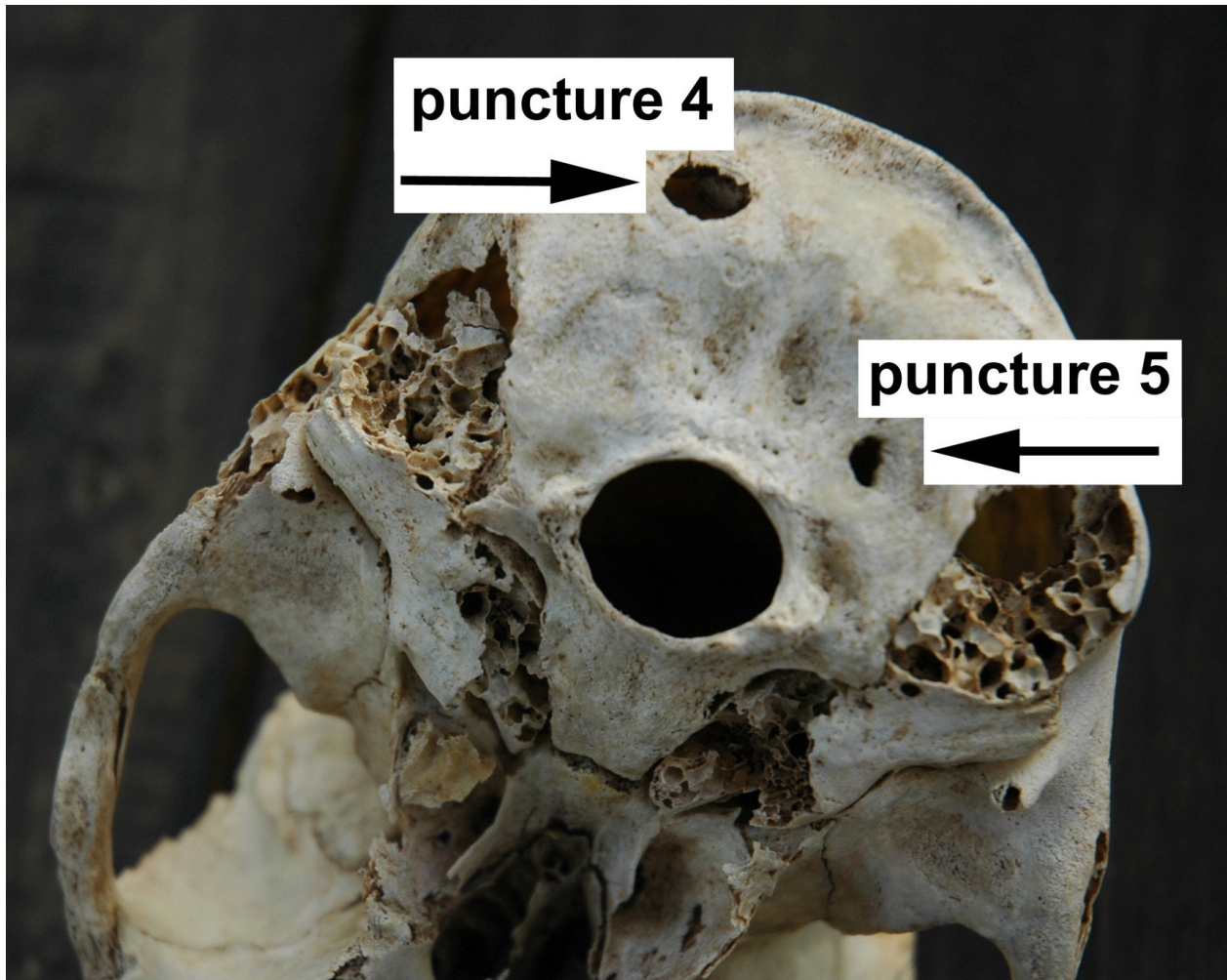


Figure 4. Two puncture wounds on the inferior aspect of the cranium of an adult male Tana River mangabey *Cercocebus galeritus*. Photograph by Tom Butynski and Yvonne de Jong.



Figure 5. A typical 'can-opener' perforation on the cranium of an adult male Tana River mangabey *Cercocebus galeritus*. This is Wound 3 in Figure 2. Photograph by Julie Wieczkowski.

in the coastal forests to the east and southeast (e.g., Witu Forest Reserve; Nielsen & Sick, 2008). There is a breeding record for crowned eagles on the Kipini Conservancy (Dowsett-Lemaire and Dowsett, 2007), ca. 70 km southeast of Mchelelo West Forest (where the mangabey cranium was found). Crowned eagles seem uncommon, however, in the forests along the lower Tana River; there are few observations of crowned eagles, no breeding has been confirmed, and none of the current researchers have heard the far-carrying, distinctive, prolonged display call of crowned eagles during many years of research in these forests (D.N.M. Mboru, pers. comm.; T.M. Butynski & J. Wieczkowski, pers. obs.).

Puncture wounds in cranium

This cranium is complete. Adult crania recovered from below the nests of crowned eagles are often complete (Sanders *et al.*, 2003; McGraw *et al.*, 2006; Gilbert *et al.*, 2009), although the basi-cranium and/or inferior portion of a parietal is typically fractured by eagles so that they may access the brain (McGraw *et al.*, 2006). Of 10 relatively complete monkey skulls recovered in Tai Forest, Ivory Coast, two were un-opened (McGraw *et al.*, 2006).

The five puncture wounds on this cranium range in diameter from 2.4 mm to 6.7 mm (Table 1). These agree well with diameters of punctures and can-opener perforations measured by Sanders *et al.* (2003) on monkey skulls found below crowned eagle nests in Kibale National Park, southwestern Uganda; 2 – 10 mm, with the majority 4 – 6 mm in maximum diameter.

The puncture wounds are round, and some are can-opener perforations. These are common wound types present in the crania of crowned eagle prey (Sanders *et al.*, 2003; McGraw *et al.*, 2006). Although most puncture wounds are described as being at pterion and at/near the orbits (Sanders *et al.*, 2003; McGraw *et al.*, 2006), it is reasonable to assume that eagles will grasp a skull at all localities that afford a reliable grip (Sanders *et al.*, 2003). This means that puncture wounds should be found in a diversity of locations, including the back of the skull where these wounds are positioned. In fact, our Wound 5 is in the same location (but on the opposite side) as that on a fossilized cercopithecoid cranium hypothesized to have been killed by a raptor (Gilbert *et al.*, 2009).

Age, sex, and weight of crowned eagle prey

Our recovered Tana River mangabey skull is that of an adult male. Adult male monkeys can make a substantial contribution to prey remain assemblages of crowned eagles (Struhsaker & Leakey, 1990; Mitani *et al.*, 2001; Sanders *et al.*, 2003).

Although we do not have body weight measurements of adult male Tana River mangabeys, the body weights of adult males of other *Cercocebus* spp. are typically 8 - 10 kg (Delson *et al.* 2000). Crowned eagles are known to kill prey that weigh more than 10 kg (Daneel, 1979; Brown *et al.*, 1982; Struhsaker & Leakey, 1990; Sanders *et al.*, 2003; McGraw *et al.*, 2006).

Other predators along the lower Tana River

The most common predator of Tana River mangabeys is thought to be the Central African rock python *Python sebae*; other likely predators are martial eagle *Polemaetus bellicosus*, Nile crocodile *Crocodylus niloticus*, and leopard *Panthera pardus* (Wieczkowski & Butynski, in press).

Python and crocodile are excluded as possible predators of this individual as neither produce puncture wounds as observed on this skull, and neither would leave a skull as complete as this one. Leopards can be excluded, as well, based on the lack of extreme destruction and chew marks (Peterhans & Singer, 2006; Gilbert *et al.*, 2009); there is also the lack of symmetrical opposing puncture wounds that a carnivore would make (S. Thomsett, pers. comm.). Martial eagles are generally found in more open habitats and not known to hunt forest primates or to take prey heavier than 5 kg (Brown *et al.*, 1982), but might kill infant and juvenile Tana River mangabeys when in open areas.

CONCLUSION

In conclusion, due to the similarities of the trauma inflicted on this adult male mangabey skull to primate skulls found under crowned eagle nests in other sites, the fact that crowned eagles are present along the lower Tana River, and that they take prey the weight of an adult male mangabey, we conclude that the most likely predator of this particular adult male Tana River mangabey was an African crowned eagle.

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LITERATURE CITED

- Andrews, P., C.P. Groves, & J.F.M. Horne. 1975. Ecology of the lower Tana River flood plain (Kenya). *Journal of the East Africa Natural History Society and National Museum* 151: 1-31.
- Brown, L.H., E.K. Urban, & K. Newman. 1982. *Birds of Africa* – Volume 1. Academic Press, London.
- Daneel, A.B.C. 1979. Prey size and hunting methods of the crowned eagle. *The Ostrich* 50: 120-121.
- De Jong, Y.A., & T.M. Butynski. 2012. The primates of East Africa: Country lists and conservation priorities. *African Primates* 7 (2): 135-155.
- Delson, E., C.J. Terranova, W.L. Jungers, E.J. Sargis, N.G. Jablonski, & P.C. Dechow. 2000. Body mass in Cercopithecidae (Primates, Mammalia): Estimation and scaling in extinct and extant taxa. *American Museum of Natural History, Anthropological Papers* No. 83. 159 pp.
- Dowsett-Lemaire, F., & R.J. Dowsett. 2007. Surveys of the vegetation, birds and mammals of Kipini Conservancy (Lamu and Tana River Districts), Kenya, October – December 2006. Dowsett-Lemaire Miscellaneous Report No. 55.
- Fleagle, J.G., & W.S. McGraw. 1999. Skeletal and dental morphology supports diphyletic origin of baboons and mandrills. *Proceedings of the National Academy of Sciences, USA* 96: 1157-1161.
- Gilbert, C.C., W.S. McGraw, & E. Delson. 2009. Plio-Pleistocene eagle predation on fossil cercopithecids from the Humpata Plateau, southern Angola. *American Journal of Physical Anthropology* 139: 421-429.
- IUCN. 2011. *The IUCN Red List of Threatened Species*. www.redlist.org
- Lewis, A., & D. Pomeroy. 1989. *A Bird Atlas of Kenya*. Balkema Publishers, Rotterdam, Netherlands.
- McGraw, W.S., C. Cooke, & S. Shultz. 2006. Primate remains from African crowned eagle (*Stephanoaetus coronatus*) nests in Ivory Coast's Tai Forest: Implications for primate predation and early hominid taphonomy in South Africa. *American Journal of Physical Anthropology* 131: 151-165.
- Mitani, J.C., W.J. Sanders, J.S. Lwanga, & T.L. Windfelder. 2001. Predatory behavior of crowned hawk-eagles (*Stephanoaetus coronatus*) in Kibale National Park, Uganda. *Behavioral Ecology and Sociobiology* 49: 187-195.
- Nielsen, M.R., & C. Sick. 2008. Conservation and use of Witu Forest, Kenya: Biodiversity and disturbance survey and management recommendations. The Danish Zoological Society, Copenhagen.
- Peterhans, J.C.K., & R. Singer. 2006. Taphonomy of a lair near the Peers (or Skildegat) Cave in Fish Hoek, Western Cape Province, South Africa. *South African Archaeological Bulletin* 61: 2-18.
- Sanders, W.J., J. Trapani, & J.C. Mitani. 2003. Taphonomic aspects of crowned hawk-eagle predation on monkeys. *Journal of Human Evolution* 44: 87-105.
- Singleton, M. 2009. The phenetic affinities of *Rungwecebus kipunji*. *Journal of Human Evolution* 56: 25-42.
- Struhsaker, T.T., & M. Leakey. 1990. Prey selectivity by crowned hawk-eagles on monkeys in the Kibale Forest, Uganda. *Behavioral Ecology and Sociobiology* 26: 435-443.
- Wieczkowski, J.A., & T.M. Butynski. In press. *Cercocebus galeritus* (Tana River mangabey). In: Butynski, T.M., J. Kingdon & J. Kalina, eds. *Mammals of Africa - Vol. II: Primates*. Bloomsbury Publishers, London.
- Wieczkowski, J., D.N.M. Mborera, A. Kariuki, & S. Strum. 2002. Progress report: Tana River primate and habitat monitoring project. Unpublished report to Conservation International – Margot Marsh Biodiversity Foundation. Washington DC.
- Zimmerman, D.A., D.A. Turner, & D.J. Pearson. 1999. *Birds of Kenya and Northern Tanzania*. Princeton University Press, Princeton, NJ.

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