University of Kent

Kent Academic Repository

Ndiaye, Mouhamadou, Drouilly, Marine, Senghor-Aziz, Abdoul, Thiaw, Ousmane, Ingram, Daniel J., Shirley, Matthew H., Strampelli, Paolo, Marti-Martinez, Chele and Henschel, Philipp (2024) *Rediscovery of the endangered giant pangolin (Smutsia gigantea) in Senegal after 24 years*. African Journal of Ecology, 62 . ISSN 0141-6707.

Downloaded from

https://kar.kent.ac.uk/105969/ The University of Kent's Academic Repository KAR

The version of record is available from

https://doi.org/10.1111/aje.13279

This document version

Author's Accepted Manuscript

DOI for this version

Licence for this version

UNSPECIFIED

Additional information

Versions of research works

Versions of Record

If this version is the version of record, it is the same as the published version available on the publisher's web site. Cite as the published version.

Author Accepted Manuscripts

If this document is identified as the Author Accepted Manuscript it is the version after peer review but before type setting, copy editing or publisher branding. Cite as Surname, Initial. (Year) 'Title of article'. To be published in ***Title of Journal*** , Volume and issue numbers [peer-reviewed accepted version]. Available at: DOI or URL (Accessed: date).

Enquiries

If you have questions about this document contact ResearchSupport@kent.ac.uk. Please include the URL of the record in KAR. If you believe that your, or a third party's rights have been compromised through this document please see our Take Down policy (available from https://www.kent.ac.uk/guides/kar-the-kent-academic-repository#policies).

Rediscovery of the endangered giant pangolin (*Smutsia gigantea*) in Senegal after 24 years

Mouhamadou Mody Ndiaye[1,*], Marine Drouilly[1,2,3], Abdoul Aziz Senghor[4], Ousmane Thiaw[4], Daniel J. Ingram[5,6], Matthew H. Shirley[6,7,8], Paolo Strampelli[1], Chele Martinez Marti[1], Philipp Henschel[1]

[1]Panthera Senegal, Tambacounda, Senegal

[2]Centre for Social Science Research, University of Cape Town, South Africa

[3]Institute for Communities and Wildlife in Africa, University of Cape Town, South Africa

[4]Direction des Parcs Nationaux (DPN), Senegal

[5]Durrell Institute of Conservation and Ecology, University of Kent, Canterbury, CT2 7NR, UK

[6]IUCN SSC Pangolin Specialist Group, % Zoological Society of London, Regent's Park, London, NW1 4RY, United Kingdom

[7]Global Forensics and Justice Center, Florida International University, Largo, FL 33777, USA

[8]Project *Mecistops*, Sarasota, FL 34231, USA

*Corresponding author: mndiaye@panthera.org

Abstract

Pangolins have generated great interest in recent years, largely due to the unprecedented scale of trafficking the species experiences. Detailed knowledge of pangolin distribution in West Africa is lacking, but many local extinctions are suspected. The last documented sighting of a giant pangolin in Senegal was in Niokolo Koba National Park (NKNP), and dates back to 1999. Following a large camera-trap survey carried out in NKNP in 2023, we present photographic evidence that giant pangolins are still present in the park. Such rediscoveries not only underscore the importance of systematic biodiversity inventories, but also the critical value of West Africa's large protected areas.

KEYWORDS: Camera trapping, Niokolo–Koba–National–Park, West Africa, biomonitoring, rediscovery, species conservation

Résumé

Les pangolins ont suscité un grand intérêt ces dernières années, en grande partie du fait de l'ampleur du commerce illégal auquel ils sont confrontés. Bien que nous manquions de connaissances détaillées sur la distribution des pangolins en Afrique de l'Ouest, de nombreuses extinctions locales sont soupçonnées. La dernière observation documentée d'un pangolin géant au Sénégal dans le Parc National du Niokolo Koba (PNNK) remonte à 1999. A la suite d'une vaste étude par piégeage photographique menée dans le PNNK en 2023, nous présentons une preuve photographique que les pangolins géants sont toujours présents dans le parc. De telles redécouvertes soulignent non seulement l'importance des inventaires systématiques de la biodiversité, mais aussi la valeur critique des grandes aires protégées en Afrique de l'Ouest.

Introduction

Pangolins have generated a great deal of interest in recent years, not only because of the intense illegal trade they are facing (Emogor et al. 2021; Tinsman et al. 2023), but also for their purported role in the COVID-2019 outbreak (Zhang et al. 2020), which remains dubious (Frutos et al. 2020). The giant pangolin (*Smutsia gigantea*) is the most widely distributed of Africa's four pangolin species, occurring throughout West and Central Africa from Senegal to western Kenya (Nixon et al. 2019; Sandri et al. 2023). The species is fairly generalist in its habitat requirements, occupying a wide range of habitats, including primary and secondary tropical forests, gallery forests, forest-savanna mosaics, and wooded savannas. Despite its extensive distribution, its presence is increasingly patchy due to large-scale habitat loss and overexploitation, particularly in West Africa. As a result, the species meets the IUCN Red List criteria for Endangered (EN) species (Nixon et al., 2019).

Giant pangolin is the only confirmed pangolin species present in Senegal, where it was previously reported from Niokolo Koba National Park (NKNP) and Basse Casamance National Park (Gueye, 1991). In NKNP, an individual was captured and formally identified by the people of Badi on April 15, 1967 (Dupuy, 1971). Subsequently, two sightings were recorded as part of the ecological monitoring conducted in the park in June 1999 at Simenti (PNNK, 2018). Since then, there has been no documented information on its presence in Senegal despite several large-scale camera-trap surveys conducted in Niokolo National Park (Table 1), although it has been identified in the sub-region, in bordering countries Mali, Guinea, and Sierra Leone (Ingram et al., 2022).

Survey	Area (km^2)	Number of camera traps deployed	Number of camera trap days	Number of field researchers	Method
2019	_	63	5,327	2	2*2 cells accros park roads
2020	_	56	2,902	2	2*2 cells accros park roads
2021	_	66	3840	2	Camera-trap for ecological monitoring
2021	1,523	139 including 69 paired stations	11,082	2	Paired camera-traps for large mammals
2022	7,020	219	18,478	6	Large systematic camera traps 6*6 grids

2023	4,393	111 paired stations	15,610	1	Paired camera-traps for large mammals

Table 1: Camera-trap surveys conducted in Niokolo Koba National Park, Senegal since 2019 and that never detected a giant pangolin.

Despite the lack of recent confirmation of its continued presence, giant pangolins are listed as Integrally Protected under Article D36 of decree no. 86-844 of 14 July 1986 on hunting and wildlife protection in Senegal. Here, we present photographic evidence of a giant pangolin taken by a camera-trap during a large carnivore survey carried out by Panthera and the Direction des Parcs Nationaux (DPN) in NKNP in the dry season of 2023. This observation confirms the continuing presence of giant pangolin in Senegal and in the NKNP, and underscores the importance of the NKNP for Senegal's and West Africa's threatened wildlife.

Methods

We conducted a camera-trap survey in the NKNP, eastern Senegal, from 8 February-23 May 2023. The park (latitude 13.0029, longitude -13.0311) expands over 9,130 km^2 and contains all the unique ecosystems of the Sudanese bioclimatic zone, including the main rivers (Gambia, Niokolo, and Koulountou), gallery forests, flood plains, seasonally flooded grasslands, freshwater swamps and ponds associated with former river lakes, dense dry forests, rocky slopes and hills with patches of closed-canopy forest. We deployed 217 cameras traps divided amongst 111 stations (most stations contained paired cameras to photograph both flanks of carnivores) over an area of 4,393 km^2 (size of the minimum convex polygon of the camera grid; 52% of the park's area). Cameras were set to be triggered 24 hours a day. As the survey targeted large carnivores, the cameras traps were placed on the park's network of roads, game trails, dry riverbeds, and near waterpoints.

Results and Discussion

This survey totaled 9,377 station-level camera-trap nights over 105 days. We detected 45 mammal species > 0.2 kg, including the giant pangolin at one station (Fig. 1).



Figure 1: Giant pangolin photographed by a camera-trap on 8 March 2023 at 01:37 in a dry riverbed in the Niokolo Koba National Park, Senegal.

The giant pangolin was recorded on 8 March 2023 at 01:37 a.m. by one of the camera-traps deployed in dry riverbeds (Fig. 2). This is the first observation of giant pangolin in Senegal since being sighted in 1999 (PNNK, 2018), but, more importantly, represents the first objectively documented evidence of the species' presence in Senegal since 1967 (Dupy, 1971). It is also the first observation of the species in the eastern part of the park, as previous observations were in the Simenti area, in the central area of the park. The station was located in a gallery forest, while the previous observations in the NKNP were in wooded savannas, both known habitats for this species (Hoffmann et al., 2019; Khwaza et al., 2019; Mouafo et al., 2023). As giant pangolins are reported from 5.3% of West Africa's protected areas, but most protected areas lack recent concrete evidence of presence, observations such as this are important to address this knowledge gap (USAID, 2020).

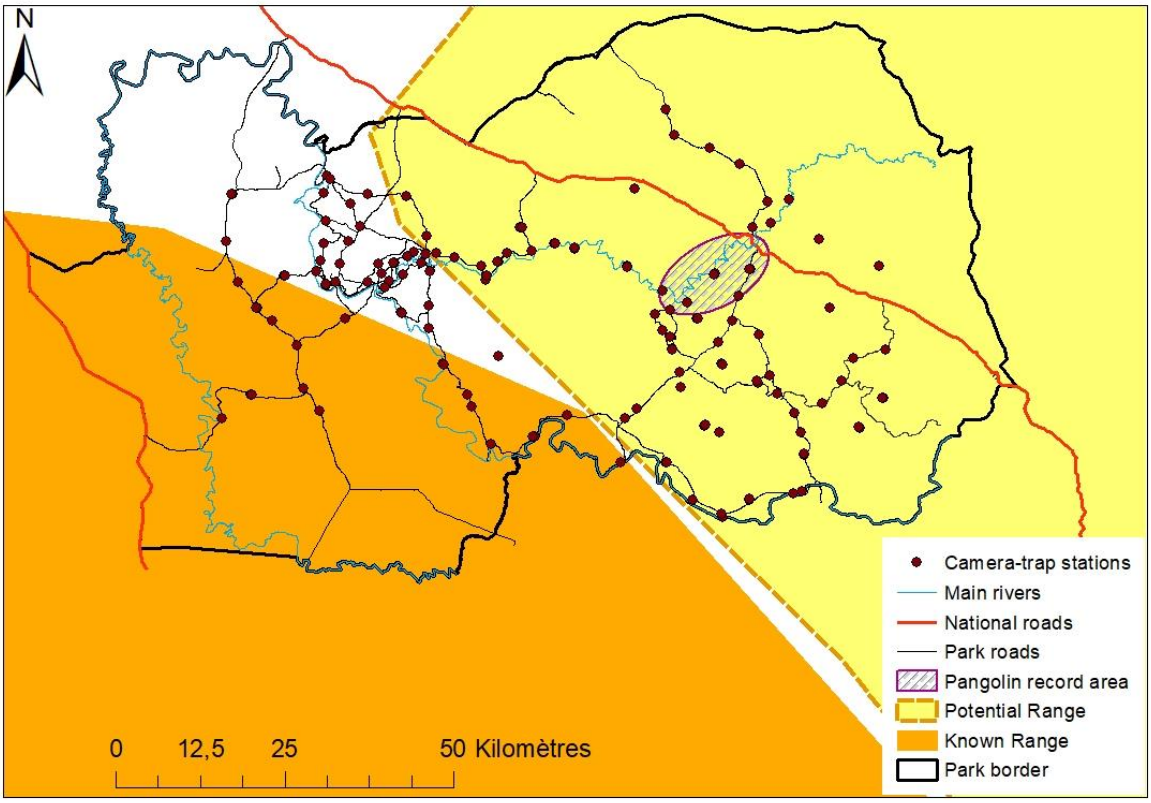


Figure 2: General area where the giant pangolin was recorded during the 2023 camera-trap survey conducted in Niokolo Koba National Park, Senegal. The specific area was obfuscated due to the vulnerability of the species. In orange, the current range of the species according to the IUCN Red List (Nixon et al., 2019). The yellow represents part of the potential range according to USAID (2020).

The low detection rate in this survey could be explained by the rarity of the species and/or the survey design, which targeted large carnivores. Rarity and shy behaviour were cited as potential reasons for the low detection of Temminck's pangolin (Smutsia temminckii) in Hwange National Park, Zilbabwe (Sabashau et al. 2024). Even in areas where pangolins are known to be present, large carnivore surveys often fail to detect them, or exhibit very low capture rates (Panthera, unpublished data). Pangolins are rarely considered in systematic protocols and monitoring them using traditional camera-trapping methods can be challenging (Ingram et al., 2019; Willcox et al., 2019). Indeed, Khwaja et al. (2019) previously showed that the probability of giant pangolin detection is always low, and inversely proportional to the distance from rivers. Furthermore, although recent work suggests that targeting giant pangolin burrows will increase detection probability (Bruce et al., 2018; Matthews et al. 2023), a recent burrow occupancy

survey conducted in the Simenti area of NKNP failed to capture giant pangolins (Daelemans, 2023), further reinforcing the likely rarity of this species in the park.

The future of giant pangolins in the Basse Casamance National Park, the other area where giant pangolins were reported, is uncertain due to the possible presence of the Movement of Democratic Forces of Casamance (MFDC), making it difficult to protect this area from poaching and other illegal activities. The NKNP therefore protects the largest extent of giant pangolin habitat in the northwestern limit of its range, and might represent the last bastion for this endangered species in Senegal. Future efforts aiming to obtain additional insights on the species in the park should target the area around the Niokolo River and its tributaries in the eastern part of the park, including burrows.

ACKNOWLEDGEMENTS

We would like to thank our main partner in Senegal, the DPN, for the permission to conduct our camera-trap survey in the park. We are grateful to the DPN rangers, in particular Capitaine El Hadji Mamadou Thiaw, Sergeant Abdoul Aziz Ndiaye, and all the patrol team leaders for their help in the field. We thank the anonymous reviewers for their comments.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The only picture of pangolin taken during the survey is shared in this manuscript.

References

Bruce, T., Kamta, R., Mbobda, R. B. T., Kanto, S. T., Djibrilla, D., Moses, I., Deblauwe, V., Njabo, K., LeBreton, M., Ndjassi, C., Barichievy, C., & Olson, D. (2018). Locating giant ground pangolins (Smutsia gigantea) using camera traps on burrows in the Dja Biosphere Reserve, Cameroon. *Tropical Conservation Science*, 11, pp.1-5. https://doi.org/10.1177/2F1940082917749224

Daelemans, V. (2023). Cohabitation d'espèces animales dans les terriers du parc national du Niokolo-Koba, Sénégal. Mémoire de master. Université de Liège, Liège, Belgique. 68p. http://hdl.handle.net/2268.2/18252

Dupuy, A. R. (1971). Le parc national du niokolo-koba Sénégal. *Biological Conservation*, 3(4), 0–310. https://doi.org/10.1016/0006-3207(71)90356-9

Emogor, C.A., Ingram, D.J., Coad, L., Worthington, T.A., Dunn, A., Imong, I. & Balmford, A. (2021). The scale of Nigeria's involvement in the trans-national illegal pangolin trade: Temporal and spatial patterns and the effectiveness of wildlife trade regulations. *Biological Conservation*, 264, 109365. https://doi.org/10.1016/j.biocon.2021.109365

Frutos, R., Serra-Cobo, J., Chen, T. & Devaux, C.A. (2020). COVID-19: Time to exonerate the pangolin from the transmission of SARS-CoV-2 to humans. Infection, Genetics and Evolution, 84, pp.104493. https://doi.org/10.1016/j.meegid.2020.104493

Gueye, M. (1991). Managing the wildlife resources of Senegal's forests and wildlands. MSc Thesis, Virginia Polytechnic Institute and State University, Virginia, USA. 209p.

Hoffmann, M., Nixon, S., Alempijevic, D., Ayebare, S., Bruce, T., Davenport, T. R. B., Hart, J., Hart, T., Hega, M., Maisels, F., Mills, D. & Ndjassi, C. (2020). Giant pangolin *Smutsia gigantea* (Illiger, 1815). In *Pangolins: Science, Society and Conservation* (pp.157-173). Academic Press. https://doi.org/10.1016/B978-0-12-815507-3.00010-1

Ingram, D. J., Edwards, I. B., & Kedzierska Manzon, A. (2022). Of meat and ritual: Consumptive and religious uses of pangolins in Mali. *African Journal of Ecology*, 60, 184–192. https://doi.org/10.1111/aje.12945

Ingram, D.J., Willcox, D. & Challender, D.W.S. (2019) Evaluation of the application of methods used to detect and monitor selected mammalian taxa to pangolin monitoring. Global Ecology and Conservation, 18, e00632. https://doi.org/10.1016/j.gecco.2019.e00632

Khwaja, H., Buchan, C., Wearn, O.R., Bahaa-El-Din, L., Bantlin, D., Bernard, H., Bitariho, R., Boekee, R., Bohm, T., Borah, J., Brncic, T., Brodie, J., Chutipong, W., Du Preez, B., Ebang-Mbele, A., Edwards, S., Fairet, E., Frechette, J.L., Garside, A., Gibson, L., Giordano, A., Gopi, G.V., Granados, A., Gubbi, S., Harich, F., Haurez, B., Havmøller, R.W., Helmy, O., Isbell, L.A., Jenks, K., Kalle, R., Kamjing, A., Khamcha, D., Kiebou-Opepa, C., Kruger, C., Laudisoit, A., Lynam, A., MacDonald, S.E., Mathai, J., Metsio Sienne, J., Meier, A., Mohamed, A., Mills, D., Mohd-Azlan, J., Mtui, A., Nakashima, Y., Nash, H.C., Ngoprasert, D., Nguyen, A., O'Brien, T., Olson, D., Orbell, C., Ramesh, T., Reeder, D., Reyna, R., Rich, L.N., Rode-Margono, J., Poulsen, J., Rovero, F., Sheil, D., Shirley, M.S., Stratford, K., Sukumal, N., Suwanrat, S., Tantipisanuh, N., Tilker, A., Van Berkel, T., Varney, M., Van Der Weyde, L.K., Weise, F., Wiesel, I., Wilting, A., Wong, S., Waterman, C. & Challender, D.W.S. (2019). Pangolins in global camera trap data: implications for ecological monitoring. *Global Ecology and Conservation,* 20, e00769. https://doi.org/10.1016/j.gecco.2019.e00769

Matthews, N., Nixon, S., von Hardenberg, A., Isoke, S., & Geary, M. (2023). Targeting burrows improves detection in giant pangolin Smutsia gigantea camera trap surveys. *Oryx*, 57(6), 718-726. https://doi.org/10.1017/S0030605322000692

Mouafo, A.D.T., Tedonzong, L.R.D., Ingram, D.J., Binda, V.A., Nfor Ngwayi, I.C. and Mayaka, T.B. (2023). Maximum entropy modeling of giant pangolin *Smutsia gigantea* (Illiger, 1815) habitat suitability in a protected forest-savannah transition area of central Cameroon. *Global Ecology and Conservation,* 43, e02395. https://doi.org/10.1016/j.gecco.2023.e02395

Nixon, S., Pietersen, D., Challender, D., Hoffmann, M., Godwill, I. I., Bruce, T., Ingram, D. J., Matthews, N., & Shirley, M. H. (2019). Smutsia gigantea. The IUCN Red List of Threatened Species v2019: e.T12762A123584478. https://doi.org/10.2305/IUCN.UK.2019-3.RLTS.T12762A123584478

PNNK, 2018. Plan d'action et d'aménagement du Parc National du Niokolo-Koba. Tambacounda, Sénégal. 275p.

Sabashau, K., Utete, B., Madlamoto, D., Ngwenya, N., & Madamombe, H. (2024). Ecology, status, and distribution of Temminck's pangolin (Smutsia temminckii) in Hwange National Park. Wildlife Letters.

Sandri, T., Okell, C., Nixon, S., Matthews, N., Omengo, F., Mathenge, J., Ndambuki, S., Challender, D.W., Chepkwony, R., Omondi, P. and Ngene, S. (2023). Three spatially separate

records confirm the presence of and provide a range extension for the giant pangolin *Smutsia gigantea* in Kenya. Oryx, 57(6), pp.714-717. https://doi.org/10.1017/S0030605322000126

Tinsman, J.C., Gruppi, C., Bossu, C.M., Prigge, T.L., Harrigan, R.J., Zaunbrecher, V., Koepfli, K.P., LeBreton, M., Njabo, K., Wenda, C. and Xing, S., 2023. Genomic analyses reveal poaching hotspots and illegal trade in pangolins from Africa to Asia. Science, 382(6676), pp.1282-1286. https://doi.org/10.1126/science.adi5066

USAID/ West Africa Biodiversity and Climate Change (WA BiCC). (2020). Scoping study for pangolin conservation in West Africa. 2nd Labone Link, North Labone, Accra, Ghana. 227pp. https://pdf.usaid.gov/pdf_docs/PA00X9WW.pdf

Willcox, D., Nash, H.C., Trageser, S., Kim, H.J., Hywood, L., Connelly, E., Ichu Ichu, G., Nyumu, J.K., Moumbolou, C.L.M., Ingram, D.J. & Challender, D.W.S. (2019). Evaluating methods for detecting and monitoring pangolin (Pholidata: Manidae) populations. *Global Ecology and Conservation,* 17, e00539. https://doi.org/10.1016/j.gecco.2019.e00539

Zhang, T., Wu, Q. & Zhang, Z. (2020). Probable pangolin origin of SARS-CoV-2 associated with the COVID-19 outbreak. *Current Biology*, 30(7), pp.1346-1351. https://doi.org/10.1016/j.cub.2020.03.063