

HUNTING AND SALE OF PANGOLINS ACROSS SUB-SAHARAN AFRICA: A PRELIMINARY ANALYSIS

Summary

Pangolins (Pholidota: Manidae) are hunted and traded for their meat and scales. We conducted preliminary analyses on the hunting and sale at markets of four species of pangolin across Sub-Saharan Africa based on data from the OFFTAKE database. Our analyses show that all four species of African pangolin are hunted and sold at markets throughout much of Sub-Saharan Africa. The proportion of pangolins as part of the total vertebrates hunted has increased significantly during the 43 years, from 1972-2014, for which we have data.

Pangolins (Pholidota: Manidae) are hunted and traded for their meat and scales, and are classified as threatened or critically endangered by IUCN. To assess where pangolins are hunted and offered for sale at markets, and whether the proportions of pangolins observed has changed over time, we analysed available data in the OFFTAKE database of African pangolins across Sub-Saharan Africa.

We extracted all studies which collected data on the entire community of vertebrates hunted or sold at markets in Sub-Saharan Africa from the OFFTAKE database (www.offtake.org). We combined data on all four species of pangolin, White-bellied Pangolin (*Phataginus tricuspis*), Black-bellied Pangolin (*P. tetradactyla*), Giant Ground Pangolin (*Smutsia gigantea*), and Temminck's Ground Pangolin (*S. temminckii*), to calculate the percentage of pangolins of the total number of individual vertebrates hunted or sold. We fitted linear mixed effects models (with normal errors) to investigate whether the percentage of pangolins hunted or sold changed over time in Sub-Saharan Africa. Percentage data were arcsine transformed before analyses. We included reference ID (published source of data) as a random factor in the analyses to account for some of the variation due to researcher or sampling methodology. We fitted two models

Daniel J. Ingram

School of Life Sciences, University of Sussex,
Brighton BN1 9QG, UK

D.Ingram@sussex.ac.uk
info@offtake.org

Lauren Coad

Center for International Forestry Research, Jalan
CIFOR Situ Gede, Sindang Barang Bogor (Barat)
16115, Indonesia.

Jörn P.W. Scharlemann

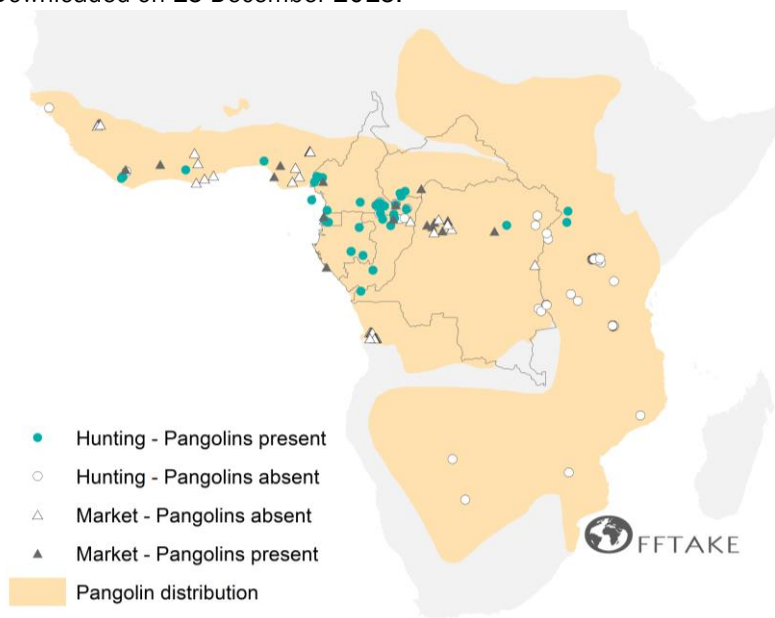
School of Life Sciences, University of Sussex,
Brighton BN1 9QG, UK

Citation: Ingram DJ, Coad L & Scharlemann JPW (2016) Hunting and sale of Pangolins across Sub-Saharan Africa: A preliminary analysis. *OFFTAKE Working Paper No. 1*. doi:10.5281/zenodo.44527. Available at: www.offtake.org.

Disclaimer: This working paper presents preliminary research and analysis. Its production was intended for timely discussion, and its contents are being revised and submitted for publication.

Acknowledgements: We thank all researchers who have made their published and unpublished data available to us: D Gill, A Noss, M Thibault., N Van Vliet, A Willcox, S Abugiche, M Colell, N Kumpel, P Muchaal, J Rist, P Mbete, M Mockrin, P Anadu, S Pailler, J Dupain, D Crookes, P Okorie, M Puit, H Yasouka, C Fargeot, C Hodgkinson, A Fusari, A Rija, W Olupot, M Osaki, M Ichikawa, E Asibey, K Kitanishi, S King, S Okiwelu, T Tee, J Okeke, R Hitchcock, F Amubode, G Cowlshaw, Falconer, G Martin, A Bennett Hennessey, J Swensson, E Greengrass, H Hofer, C Fimbel, S Jeffrey, J Fa, M Riddell, J Schleicher, S Ziegler, H Terashima, H Roth, Y Opare-Ankrah, R Seino, K Shada, E Bersacola, S Blake, K Bobo, M Nielsen, E Gandiwa, T Minhós, L Coad, P Wilfred, T Holmern, M Makeya, K Hayashi, W Kamgaing, M Dethier, E Dounias, D Wilkie, L Rieu, and C Whitham.

Figure 1. Sites where pangolins have been observed at markets (filled triangles) and in hunting bags (filled circles) across 113 hunting (circles) and 53 market (triangle) studies across Sub-Saharan Africa. Congo basin subset indicated by country outlines. Extent of occurrence of four pangolin species (orange shading) from IUCN (2014) *The IUCN Red List of Threatened Species. Version 2014-1* <http://www.iucnredlist.org>. Downloaded on 15 December 2015.



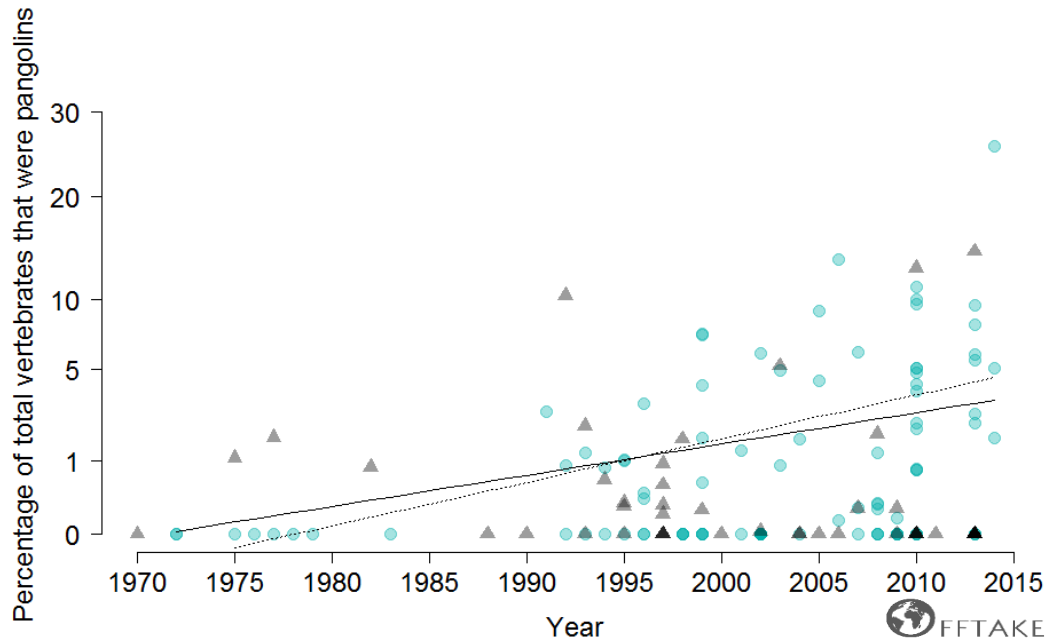
one for all Sub-Saharan Africa data and one for the Congo Basin separately (Cameroon, Central African Republic, Congo Republic, Democratic Republic of Congo, Equatorial Guinea, and Gabon). All analyses were conducted in R version 3.0.2.

A total of 166 studies (samples taken at one location at one point in time) across 153 sites were identified (Figure 1). Of these, 113 studies across 96 sites investigated the number of vertebrates hunted at a particular location and time period, while 53 studies across 52 locations investigated vertebrates on sale at markets. The hunting or sale of all four species of pangolin is widespread, observed in 12 of the 18

Table 1. Proportion of individual vertebrates hunted or sold at markets that were pangolins (Manidae) across 18 countries in Sub-Saharan Africa, by number of individuals. Proportion given as median percentage, interquartile range (IQR) and number of studies (n). Congo basin countries are shaded grey.

Country	Hunted			Sold at market		
	Median	IQR	n	Median	IQR	n
Angola	-	-	-	0.00	0.00 - 0.00	12
Botswana	0.00	0.00 - 0.00	2	-	-	-
Cameroon	2.52	0.79 - 5.56	26	10.34	-	1
Central African Republic	1.47	0.67 - 2.91	8	1.00	0.12 - 1.87	2
Congo	0.18	0.02 - 0.55	11	0.28	0.00 - 0.55	2
Dem. Republic of Congo	0.00	0.00 - 0.00	6	0.07	0.00 - 0.14	11
Equatorial Guinea	7.34	4.97 - 9.60	5	8.98	5.23 - 12.74	2
Gabon	7.09	4.75 - 10.05	4	1.69	-	1
Ghana	0.05	-	1	0.00	0.00 - 0.00	5
Guinea	-	-	-	0.07	0.00 - 0.17	4
Guinea-Bissau	0.00	-	1	-	-	-
Ivory Coast	-	-	-	2.20	-	1
Liberia	1.42	0.39 - 2.93	4	1.09	-	1
Mozambique	0.00	-	1	-	-	-
Nigeria	1.23	-	1	0.00	0.00 - 0.00	11
Tanzania	0.00	0.00 - 0.00	38	-	-	-
Uganda	0.06	0.00 - 0.15	4	-	-	-
Zimbabwe	0.00	-	1	-	-	-

Figure 2. Change over time in the proportion of pangolins (*Manidae*) hunted (circles) or sold at markets (triangles) from 166 studies across Sub-Saharan Africa. Proportion of pangolins given as percentage pangolins of the total number of individual vertebrates hunted or sold at markets. Trend lines for all of the hunting data (solid) and Congo Basin hunting data (dotted) are fitted using linear mixed effects models.



countries (Table 1) and at 46 of 96 hunting sites and 39 of 52 markets.

Pangolins hunted

Hunting studies showed that on average, over time and across countries, pangolins made up 0.68% (sd = 1.26%) of the individual vertebrates hunted. The maximum contribution of pangolins to the total number of individual vertebrates hunted was 26% (one study in the Congo Republic).

Hunting studies were conducted between 1972 and 2014 (Figure 2). The proportion of total individual vertebrates hunted represented by pangolins has increased significantly over time across Sub-Saharan Africa ($n = 113$, $p = 0.008$) and for the Congo Basin ($n = 60$, $p = 0.0002$). The proportion of pangolins hunted has increased 9-fold from pre-2005 ($n=64$) when on average 0.18% of individual vertebrates hunted were pangolins, to post-2005 ($n=49$) when 1.68% were pangolins in SSA.

Pangolins sold at markets

At markets pangolins made up on average 0.23% (sd = 0.85%) of the vertebrate carcasses observed. The maximum observed contribution of pangolins to the vertebrate carcasses offered for sale at markets was 14% (one study in Angola). Market studies were conducted between 1970 and 2013, and the proportion of pangolins observed at markets did not change significantly over time (Sub-Saharan Africa: $p = 0.36$, Congo basin: $p = 0.36$).

These preliminary analyses show that all four species of African pangolin are hunted and sold at markets throughout much of Sub-Saharan Africa. The proportion of pangolins as part of the total vertebrates hunted has increased significantly during the 43 years for which we have data.



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