

## Research Article

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# Conservation implications of the illegal trade in Hooded Vultures *Necrosyrtes monachus* for belief-based use in Benin, West Africa

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## Summary

Persecution for belief-based uses is a major threat to raptors in West Africa. Critically Endangered Hooded Vultures *Necrosyrtes monachus* are traded openly in West African vodun (also known as voodoo or fetish) markets in Benin, despite national laws protecting this species. We interviewed 115 vendors selling Hooded Vultures and/or their body parts at nine different markets in southern Benin to understand the extent and drivers of this illegal trade. Over four months, we counted a total of 522 Hooded Vultures in market stalls, including whole dried vulture carcasses (73.4% of vulture products offered for sale), vulture heads (17.2%), and live birds (9.4%). Vultures offered for sale originated from at least 10 foreign countries, suggesting there are far-reaching impacts of illegal trade on Hooded Vultures. Vodun practitioners sacrifice and consume vultures in the belief these practices will protect them from witchcraft and achieve other supernatural aims, and the resulting high demand for vultures has driven the price of a Hooded Vulture to exceed the average monthly income in Benin. Despite serious legal, conservation, and animal welfare concerns, wildlife trade for belief-based use is thriving and growing in West Africa, and our findings highlight that legislation aimed at protecting vultures in Benin appears to be currently ineffective. From our discussions with traders, it appears that low education levels, weak law enforcement, and disregard for legislation contribute to this trade that threatens remaining vultures across West Africa. Public awareness campaigns to educate residents about conservation laws and improved law enforcement are urgently needed to mitigate on-going threats to this and other Critically Endangered species.

## Résumé

Le commerce illégal constitue une menace majeure pour les rapaces en Afrique de l'Ouest. Les vautours charognards, une espèce entièrement protégée et en danger critique d'extinction, sont commercialisés librement sur les marchés fétiches au Bénin, malgré les lois nationales interdisant cette activité. Nous avons interrogé 115 vendeurs vendant des parties de vautours sur neuf marchés différents au Bénin pour comprendre l'ampleur et les moteurs de ce commerce illégal. Pendant quatre mois, 522 vautours charognards ont été recensés sur les étalages du marché. La majorité d'entre eux étaient des cadavres entiers de vautours séchés (73.4 %), tandis que 17.2 % étaient des têtes de vautours et 9.4 % étaient des ventes de vautours charognards vivants. Nous avons constaté que ces vautours étaient originaires d'au moins 10 pays en plus du Bénin lui-même. Certains des principaux fournisseurs étrangers étaient le Ghana, le Burkina-Faso, le Nigeria et le Niger. Nous avons constaté que 90 % des vautours charognards sont commercialisés à des fins fondées sur des croyances. Nous avons catégorisé les usages fondés sur des croyances comme « mystiques » ou « médicaux », dans lesquels les usages mystiques sont ancrés dans des pouvoirs surnaturels ou mystiques pour susciter la bonne ou la mauvaise fortune chez l'utilisateur ou sur d'autres personnes (près des deux tiers des usages), et les usages médicaux sont ceux prescrits pour soigner des maladies (près d'un tiers des usages). Le marché semble être influencé par la valeur économique élevée des vautours charognards (128 dollars américain en moyenne pour un vautour), qui est approximativement égale au revenu

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mensuel moyen au Bénin. De nos discussions avec les vendeurs du marché, nous concluons que le faible taux d'éducation, le manque d'application de la loi et le mépris ou la mauvaise interprétation de la législation nationale visant à protéger les vautours doivent tous être abordés afin de renforcer les capacités de conservation et la sensibilisation à cette espèce en danger critique d'extinction.

## Introduction

Almost half of all wild bird species are persecuted for use in commercial trade (Butchart 2008; Donald et al. 2024), which is driving declines in the conservation status of at least 200 globally threatened bird species (Challender et al. 2019). In Asia, many bird species are in high demand for the caged bird industry and Buddhist rituals including releasing captive birds for spiritual merit (Su et al. 2025), threatening some species in the region with extinction (Donald et al. 2024). In Africa, more than 354 bird species are persecuted for belief-based use, the largest number of avian species hunted for such purposes on any continent (Williams et al. 2014). Such belief-based use is related to traditional African religious practices involving animal sacrifice. Animal sacrifice has been practised in many regions of the world for much of human history, including in ancient Greek, Roman, and Jewish religious practices, but began to decline in the fourth and fifth centuries with the rise of Christianity (Carrasco 2013; Naiden 2016; Ullucci 2011). In West Africa, both animal and human sacrifice were important traditional practices prior to European colonisation (Law 1985). For example, a recent analysis of the palace of a nineteenth-century king in Abomey, capital of Dahomey (now Benin), provides forensic evidence of both human and animal sacrifice (Charlier et al. 2024). The frequency of African ritual sacrifice apparently increased following European contact as regional elites' wealth and power increased during the period of the Atlantic slave trade (Parker 2021). Both human and animal sacrifice persist in many African countries, despite being illegal, due to poor regulation, weak law enforcement, as well as social and economic pressures (Bukuluki 2014; Bukuluki and Mpyangu 2014; Mensah 2015; Williams et al. 2021).

Persecution for belief-based use and trade is among the main threats driving on-going declines of African vultures (CITES 2019; Daboné et al. 2023b; Di Vittorio et al. 2018; Goded et al. 2023; Muhammad and Mustapha 2020; Nikolaus 2011; Williams et al. 2021). Tracking data on vultures and other large terrestrial birds have revealed that the ratio between human-caused and natural mortality is 2.4 times higher in Africa than in Asia or Europe (Serratos et al. 2024). Due to their precipitous global declines in recent decades, many African vulture species have been designated as Critically Endangered and Endangered by the International Union for the Conservation of Nature (IUCN) (CITES 2019; McClure et al. 2018; Ogada et al. 2022; Shaw et al. 2024). In addition to intentional persecution, anthropogenic factors driving vulture declines include accidental poisoning, declines in food availability, and habitat degradation including the destruction of nest trees (Buechley and Şekercioğlu 2016; Goded et al. 2023; Ogada and Buij 2011; Ogada et al. 2012; Safford et al. 2019). In Asia, vulture declines have been linked to unintentional poisoning by the veterinary drug diclofenac, which is highly toxic to vultures feeding on carcasses of treated livestock (Green et al. 2004). In Africa, where poisoning related to pastoralism has been likewise identified as a major driver of vulture declines (Ogada et al. 2012), many vulture mortality events occur when poisoned carcasses illegally left by livestock herders to target carnivores have been consumed by vultures

(Craig et al. 2018; Safford et al. 2019). Regulating diclofenac use has mitigated the declines of some Asian vulture species (Prakash et al. 2012), but human-caused bird mortality in the African–Eurasian flyway does not appear to have declined over the last 15 years, despite conservation efforts (Serratos et al. 2024).

Now among the most threatened birds in the world, West African vulture species including the Hooded Vulture *Necrosyrtes monachus*, White-headed Vulture *Trigonoceps occipitalis*, White-backed Vulture *Gyps africanus*, Rüppell's Griffon Vulture *Gyps rueppelli*, and Lappet-faced Vulture *Torgos tracheliotos*, have exhibited population declines of 50–96% (CITES 2019; Ogada et al. 2016; Thiollay 2006). Poachers actively target vultures, both to prevent them from drawing attention to their activities and to exploit them for illegal trade (Botha et al. 2017; Margalida et al. 2019; Safford et al. 2019). Commercial demand for vultures in markets that supply animals, animal parts, and other products for rituals, also known as fetish markets, threatens remaining vulture populations in West Africa (Nikolaus 2011). In some regions in Nigeria, for example, a majority of residents report engaging in fetish practices (Atuo et al. 2015), and in some areas these practices are growing (Byansi et al. 2014; Muhammad and Mustapha 2020; Nxumalo et al. 2011; Williams et al. 2021). In Ghana, Hooded Vultures are persecuted, trapped, and killed at landfills and outdoor slaughterhouses for illegal trade to meet demand in Nigeria (Gbogbo et al. 2016). Vulture poisoning events in countries including Guinea-Bissau and Burkina Faso may also have been motivated by cross-border trade (Daboné et al. 2023b; Henriques et al. 2020).

Critically Endangered Hooded Vultures are the most commercially exploited vulture species in West Africa (Daboné et al. 2023b; Saidu and Buij 2013; Williams et al. 2021). Heads of vultures and other raptors are among the most traded and valuable products sold in fetish markets (Atuo et al. 2015; Nikolaus 2011). The sacrifice of vultures and use of their parts is purported to protect against witches and witchcraft, increase intelligence, bring good luck, and help users win the lottery and succeed in business (Deikumah 2020; Saidu and Buij 2013). Living vultures are sacrificed to appease traditional gods, revoke evil curses, and treat incurable ailments; vulture heads are burnt and ground into powder as part of treatments to increase power and prolong human life (Akeredolu et al. 2018). Vultures and their body parts are also prescribed in belief-based treatments for epilepsy, mental illness, stroke, infertility, childbirth, and to stimulate walking in infants (Deikumah 2020; Saidu and Buij 2013).

Although ~50% of Benin's population today identifies as Christian (CIA 2024), Benin's government supports traditional religious practices as part of the country's cultural heritage (UNEP-WCMC 2021), and vodun (commonly known as voodoo) has been recognised as a national religion of Benin since 1996 (Janssen 2010). Vodun practices include ritual sacrifice (Forte 2010), including both the sacrifice of live animals in rituals as well as the ritual use of carcasses and body parts. There is thus a thriving trade to supply demand for wildlife in ritual animal sacrifice and belief-based use at fetish markets in Benin. This trade includes at least 268 bird species, 96 mammal species, and 59 species of reptiles

(Zanvo et al. 2024), and vultures feature prominently (Buij et al. 2016).

Hooded Vultures survive in Benin's central and northern regions (Dowsett-Lemaire and Dowsett 2019), but are absent from the southern parts of the country, such that vultures traded in southern Benin must be brought in from other areas. Live captive birds, dried carcasses, and vulture heads are displayed openly at fetish markets, raising the question of their origins. Here, we evaluated the conservation implications of the illegal trade in Hooded Vultures in Benin, with attention to the following information: (1) how many vendors are involved in the vulture trade and what are their attributes, including their awareness levels of legislation protecting vultures?; (2) how many vultures are sold in a given period, and where did these birds originate?; and (3) which vulture products are most in demand, what are their selling prices, and what are their belief-based uses? Our overarching goal was to answer these questions to provide a basis for the development of effective local conservation and educational strategies to prevent the extinction of this and other Critically Endangered species.

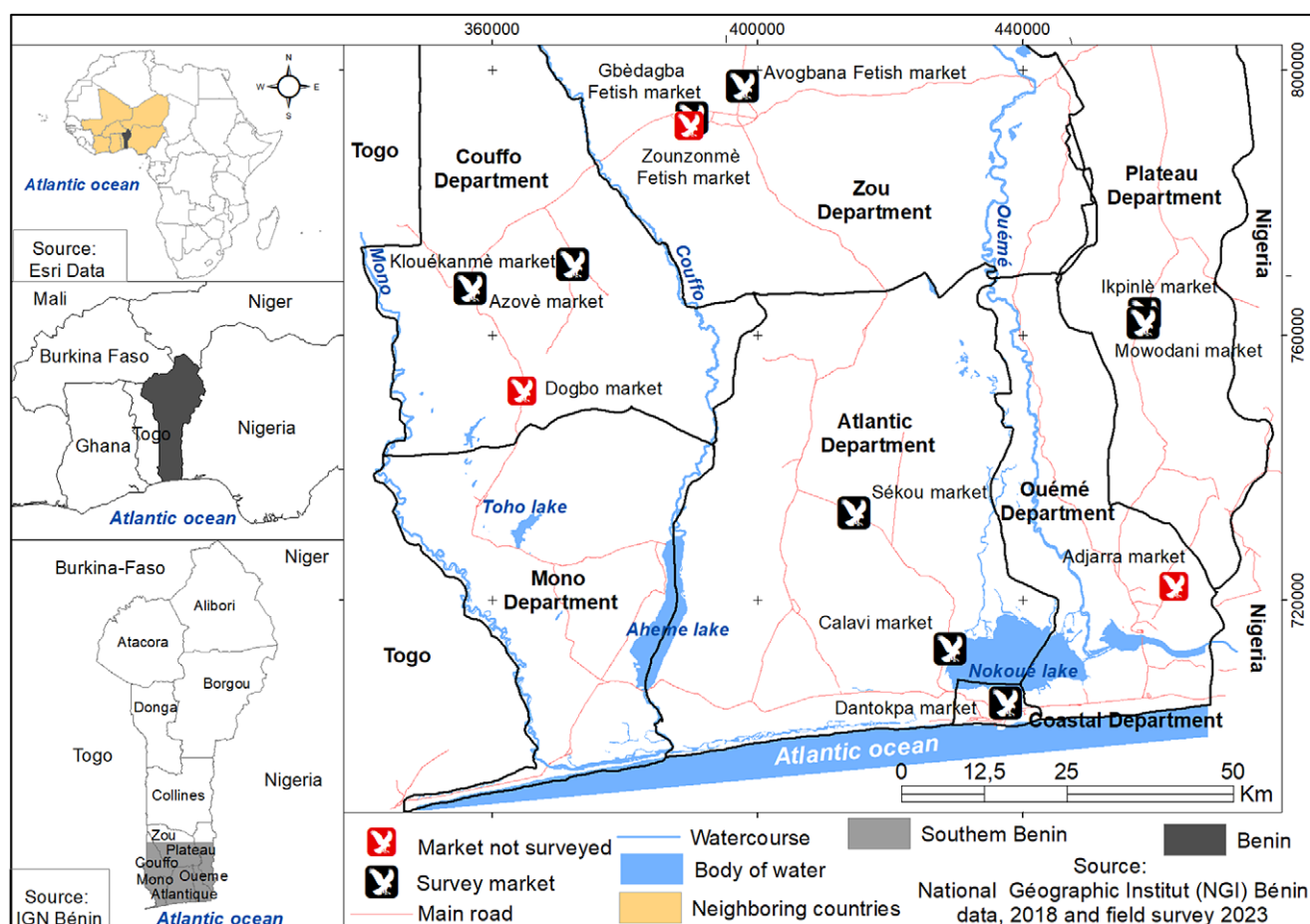
## Methods

### Study area

Benin is a highly biodiverse country in West Africa with habitats including wetlands, marshes, tropical forests, and woodland-

savannas (Figure 1). Pendjari and W National Parks, located in the northern part of the country, have regional protection as part of the W-Arly-Pendjari complex, which is home to multiple vulture species (Dowsett-Lemaire and Dowsett 2019), but the management of these parks is currently complicated by regional terrorist threats and political instability. Our research was carried out in the fetish markets of southern Benin (Figure 1), where vultures no longer exist in the wild but both captive, live birds and vulture carcasses and parts are sold for use in vodun rituals. According to Djagoun et al. (2013), 40 of Benin's 77 towns have at least one fetish market where wild plants and animals are sold. Markets were identified using the snowball method (Johnson 2014). We started with the Avogbana fetish market in the town of Bohicon, which ASC has known since childhood, where the president of the vendors' committee informed us of other fetish markets in towns further south.

In total, we identified 12 fetish markets and conducted surveys at nine of them (Table 1 and Figure 1). Some of these markets have been identified in previous research (Adjakpa et al. 2002; Koutchoro et al. 2024), while others, including Mowodani, Ikpinlè, Zounzonmè, Sékou, and Calavi, do not appear to have been the subjects of previous studies. Three markets were not included in our surveys; the Dogbo and Adjara markets had no vultures for sale at the time of our study, due to vendors' difficulties in procuring them during this time, although they had sold them in the past, and the Zounzonmè market was not



**Figure 1.** Study area in the Republic of Benin in West Africa indicating known fetish (vodun) markets surveyed in southern Benin. (Map source: National Géographique Institut Bénin: <https://ign.bj/ign/>)



**Table 1.** The locations of the 12 main fetish markets in southern Benin, 2023

Department	Municipality	Name of market	Surveyed (Yes or No)	Area (ha)
Zou	Abomey	Gbèdagba	Yes	0.49
	Abomey	Zounzonmè	No	0.82
	Bohicon	Avogbana	Yes	2.42
Atlantic	Allada	Sékou	Yes	3.32
	Abomey-Calavi	Calavi	Yes	6.10
Coast	Cotonou	Dantokpa	Yes	71.80
Couffo	Klouékanmè	Klouékanmè	Yes	2.85
	Dogbo	Dogbo	No	11.21
	Aplahoué	Azovè	Yes	8.11
Plateau	Adja-Ouèrè	Mowodani	Yes	7.19
	Adja-Ouèrè	Ikpinlè	Yes	3.73
Ouémé	Adjarra	Adjarra	No	6.27

discovered until after field data collection was completed. Some vendors operate stalls at several markets simultaneously, including at the Mowodani, Ikpinlè, Azovè, Klouékanmè, Sékou, and Calavi markets; while vendors may move between different markets on market days, stalls and merchandise remain fixed in the markets. Gbèdagba and Avogbana are exclusively fetish markets (Figure 2), focused only on selling animals and animal products, and are open every day. The other seven markets included in our surveys are mixed markets where fetish vendors also sell other products and are open on different days of the week, so that the same vendors may attend different mixed markets on different days of the week. Animals are openly displayed for sale in all these markets.

### Surveys

We requested and obtained authorisation from the management committees of each market prior to carrying out surveys. Surveys were conducted in accordance with local legislation and requirements, and all participants provided their informed consent to

participate in this study. Between 25 March and 2 April 2023, we met with the sales committee representatives of each market to explain the objectives of this study. We then carried out surveys from 10 April to 8 August 2023, with all data collection supervised by ASC. To obtain permission to conduct market surveys, ASC first identified specific markets and then sought out the relevant market associate authorities to explain the scope of these surveys. After identifying the president of the relevant market association, ASC explained the purpose of the surveys and the president in turn provided ASC with the conditions for the surveys: i.e. that certain payments would be expected by participating vendors, and the names of participating vendors should be withheld by default, unless participants wished to be identified. This process of asking permission and being granted conditional permission was followed in all markets, beginning with the presidents of market associations and then by asking permission from each vendor for an interview. As most vendors were not literate, this process of seeking and obtaining permission took place verbally, rather than in writing.

We counted all Hooded Vultures, including live birds, carcasses, and heads, present in the stalls of consenting vendors during the course of our interviews. Surveys were repeated at each market twice a month, when we counted any new stock to avoid double counting vultures counted previously. We documented the following information: (1) the number of Hooded Vultures on display and their body parts; (2) the origin of the vultures obtained for sale, according to vendors; (3) information on the demographics of the vendor; (4) information on the uses of vultures; (5) how much vendors paid for vultures (i.e. purchase price); (6) sale price for vultures asked by vendors; (7) how prices varied with seasonal changes in species availability; (8) vendors' awareness of vulture conservation legislation in Benin and vulture conservation status internationally. Interviews were conducted in French and Fon (the native language of the vendors) by four people (ASC, BFY, HML, and EEH) working in pairs; responses were recorded in French.

### Results

#### *Numbers and characteristics of vendors involved in the vulture trade*

In total, we counted 185 vendors selling vultures and vulture parts in all markets, including 29 people under the age of 18 years who were

**Figure 2.** Partial views of two fetish markets in southern Benin, 2023. From left to right: Gbèdagba fetish market in Abomey and Avogbana fetish market in Bohicon.

not included in requests for interviews. We requested interviews with all 156 adult vendors using a brief survey form (see Supplementary material [Tables S1](#) and [S2](#)). Of these, we interviewed 115 people, representing ~74% of vendors, without including identifying information on their responses to maintain confidentiality ([Table 2](#)). Despite measures taken to guarantee the anonymity of vendors, 41 (26%) vendors declined to be interviewed, expressing that they were afraid to be arrested or fined, given that our research focus on a species protected by national and international laws and regulations. As vultures at nearly a quarter of the stalls therefore could not be counted, our count data underestimate the actual number of vultures for sale.

To better understand the attributes of vendors in fetish markets in southern Benin, we recorded information on their age group, religion, language, gender, and other social and cultural variables ([Table 3](#) and [Tables S1](#) and [S2](#)). All vendors belonged the Fon ethnic group and the vast majority (95%) reported practising vodun. Nearly all vendors were male (99%) and most were aged 18–30 years old (85%). Most vendors had no formal education (58%) and most identified themselves as witch doctors or fetish priests (59%); the remainder identified themselves simply as merchants. To understand if vendors understood that trade of vultures was illegal, we asked if they were aware of legislation in place to protect vultures. The vast majority (92%) of vendors reported that they were aware of legislation protecting vultures; the remaining 8% stated they were not aware of such legislation.

### Numbers and origins of vultures and vulture parts sold in markets

Between 10 April and 8 August 2023, we counted live birds, carcasses, and heads representing a total of 522 Hooded Vultures on display in markets. Of these, 49 (9.4%) were alive and being fed, of which 32 (65.3%) were observed in the Avogbana and Abomey-Calavi markets ([Figure 3](#)). The majority of vulture products (73.4%) were whole carcasses, while 90 (17.2%) were heads. The carcasses are preserved by emptying the intestines and drying the body, which enables the vendors to keep the dead birds on the shelves for longer without decomposition. Numbers varied between markets, with the highest numbers of vultures found in the Avogbana

**Table 2.** Number of adult vendors ( $\geq 18$  years of age) surveyed per market in southern Benin, 2023

Name of market surveyed	Type of market	Total number of vendors	Number of vendors interviewed	Proportion of total vendors interviewed (%)
Gbèdagba	Fetish market only	22	18	81.8
Avogbana	Fetish market only	33	25	75.8
Dantokpa	Mixed market	43	22	51.2
Sékou	Mixed market	13	10	76.9
Calavi	Mixed market			
Klouékanmè	Mixed market	41	37	90.2
Azovè	Mixed market			
Mowodani	Mixed market	4	3	75
Ikpinlè	Mixed market			
<b>Total</b>		<b>156</b>	<b>115</b>	<b>73.7</b>

**Table 3.** Attributes of vendors in fetish markets in southern Benin, 2023. For comparison, the proportion of people belonging to each group across Benin are presented below (Institut National de la Statistique et de l'Analyse Economique 2016, 2017)

Socio-demographic characteristics	Number of vendors	Proportion of market vendors (%)	Proportion of Benin population (%)
<b>Age</b>			
Young: 18–30 years old	98	85.25	42.2
Adult: 31–60 years old	11	9.7	8.2
Older: $\geq 60$ years old	6	5.2	2.7
<b>Religion</b>			
Vodun	109	94.8	14.2
Christian	6	5.2	48.5
<b>Ethnic group</b>			
Fon	115	100	38.4
<b>Gender</b>			
Male	114	99.1	48.8
Female	1	0.9	51.2
<b>Social position in the home</b>			
Head of household	89	77.4	72.2
Household member (not head)	26	22.6	27.8
<b>Educational level</b>			
No formal education	67	58.3	40.4
Primary or secondary education	48	41.7	59.6
<b>Marital status</b>			
Married	78	67.8	47.8
Single	35	30.4	44.6
Widow(er)	2	1.7	3.3
<b>Profession</b>			
Animal vendor	47	40.9	No data available
Animal vendor and witch doctor (fetish priest)	68	59.1	No data available

and Klouékanmè markets ([Table 4](#)). Although vulture heads appeared less prevalent in markets than dried carcasses, vulture heads were reportedly sold more often than whole carcasses because they are easier to conceal and transport.

Hooded Vultures for sale in Benin came from at least 10 countries in addition to Benin ([Figure 4](#)), indicating the widespread conservation implications trade has on Hooded Vultures in West Africa. According to vendors, a quarter of Hooded Vultures for sale in fetish markets in southern Benin originated in central and northern Benin, while almost 60% of the vultures originated from Ghana, Burkina Faso, Nigeria, and Niger. Smaller numbers of vultures for sale were also reportedly obtained from Cameroon, Côte d'Ivoire (Ivory Coast), Gabon, Guinea, Mali, and Togo ([Figure 5](#)).





**Figure 3.** Examples of parts, carcasses, and whole vultures for sale at fetish markets in southern Benin, 2023. Top panel: whole carcasses and some heads of Hooded Vultures and White-backed Vultures in the fetish markets of Gbèdagba, Klouékanmè, and Avogbana. Bottom panel: Live Hooded Vultures found in the Avogbana and Abomey-Calavi markets.

**Table 4.** Number of Hooded Vultures recorded from fetish markets (from a total number of 522 over four months) in southern Benin, 2023

	Market								
	Gbèdagba	Avogbana	Klouékanmè	Calavi	Dantokpa	Sékou	Mowodani	Azovè	Ikpinlè
Number of vultures	89	147	101	49	78	21	11	17	9
Percentage of total (%)	17.1	28.2	19.4	9.4	14.9	4	2.1	3.3	1.7

#### *Vulture products sought, selling prices, and belief-based uses*

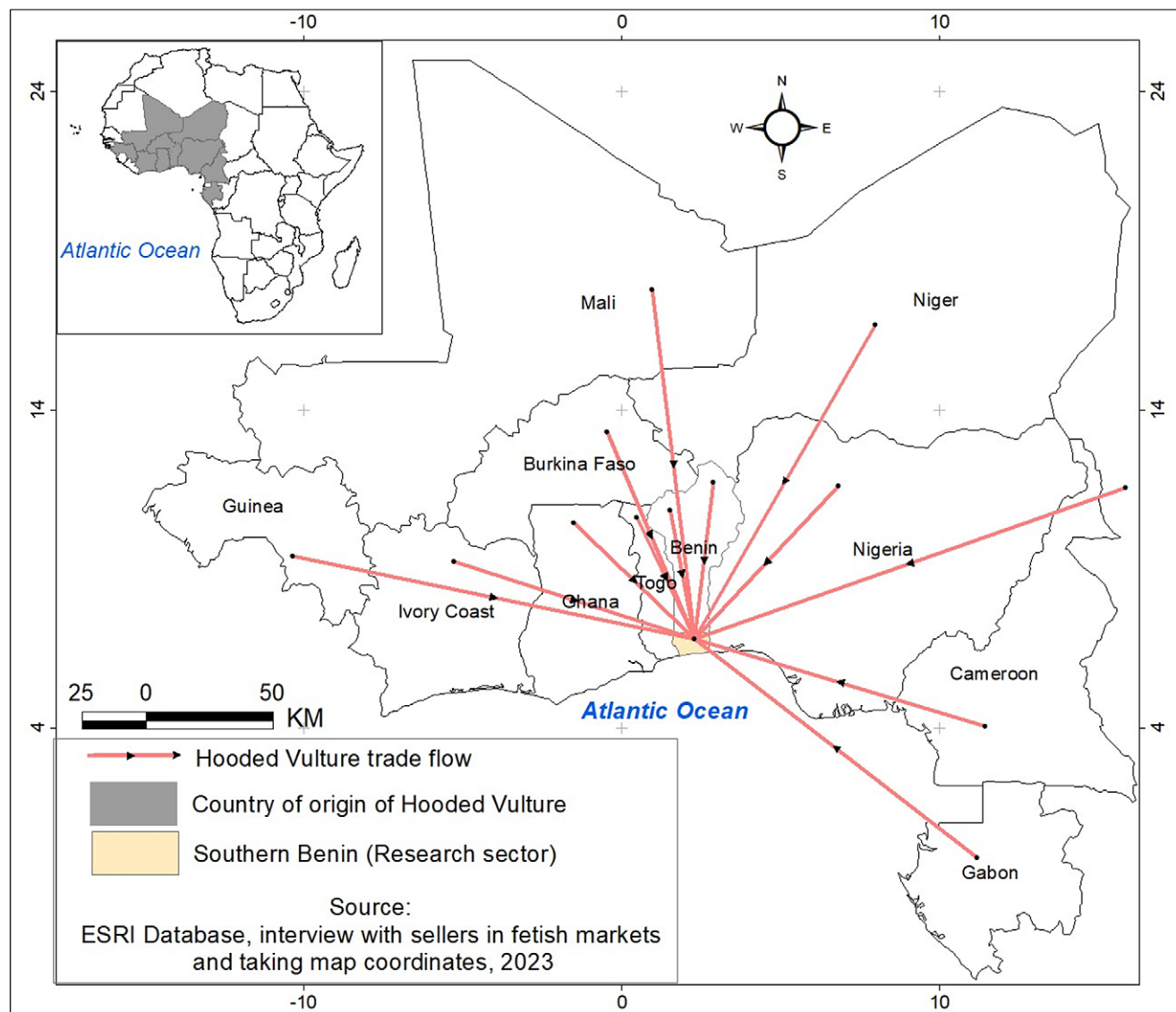
To understand the demand for Hooded Vulture products, we asked the 115 fetish vendors what people sought to buy. All said the primary demand of buyers is for whole vulture carcasses, while 64% also identified demand for vulture heads. Vendors also reported that live vultures were sold to buyers interested in consuming vultures' liver (19%), heart (17%), feathers (14%), and feet (6%). To understand the economic value of the trade in Hooded Vultures we asked vendors for information on the purchase and sale price of vultures (Table 5). While 40% (46/115) of vendors chose not to give information on the economic value of vultures, 69 vendors provided information on vulture sales. Both the purchase and sale prices of vultures varied seasonally, with prices generally being higher in the wet season compared with the dry season (Table 5).

Prices of vultures and vulture parts varied widely, from CFA 15,000 (US\$ 25) to as much as CFA 500,000 (US\$ 833) with an average of CFA 76,800 (US\$ 128) (16 March 2024, US\$1 =

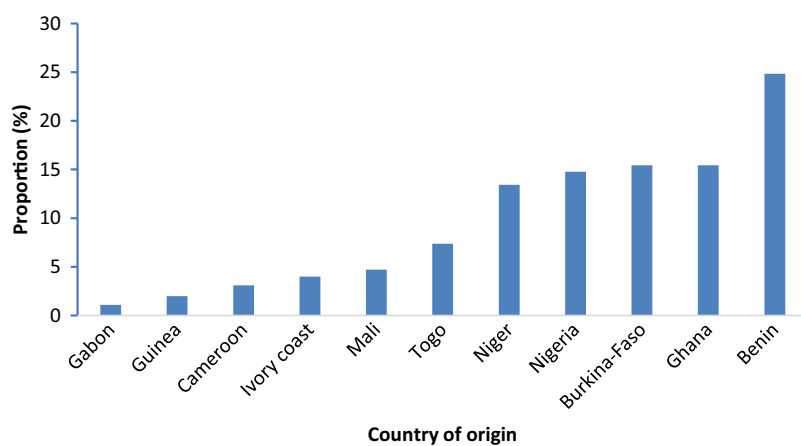
600 CFA). Profits (i.e. the difference between the purchase and sale price) made by vendors also varied widely; in the wet season, vendors can make as little as CFA 3,000 (US\$ 5) for a vulture head and as much as CFA 400,000 (US\$ 667) for a live vulture. The majority (~59%) of vendors also identified as witch doctors or fetish priests; these individuals also provided information on belief-based uses of vultures, including washing with soaps made with powdered vulture to elicit good fortune, as well as treatments that promised to increase users' wealth, work, and protection against witchcraft. Vodun treatments described also included displaying vulture parts in the house to repel evil spirits and the regular consumption of vulture meat to make one invulnerable to witchcraft.

#### **Discussion**

Despite legislation protecting Hooded Vultures in Benin, and the fact that most vendors are aware of such legislation, we found that Hooded Vultures are commonly traded illegally in the fetish



**Figure 4.** Countries of origin of Hooded Vultures sold in fetish markets of southern Benin, 2023. In total, 522 individual Hooded Vultures were counted for sale across 156 interviews with vendors (selling whole carcasses, live vultures, or their heads). (Map source: Esri: <https://www.esri.com/en-us/home>)



**Figure 5.** Origins of 522 Hooded Vultures for sale by 156 vendors in fetish markets of southern Benin, 2023. Vultures included whole carcasses, live birds or heads.

**Table 5.** Seasonal variation in prices for carcasses, heads, and live Hooded Vultures in fetish markets in southern Benin, 2023. All prices are given in West African CFA francs and US dollars (16 March 2024; CFA 605 = US\$ 1). The purchase price is the price paid by market vendors, and the sale price is the amount they are sold for in the markets. The wet season is from April to mid-July and mid-September to October. The dry season is from November to March and mid-July to mid-September (<https://climateknowledgeportal.worldbank.org/country/benin/climate-data-historical>)

	Dry season		Wet season	
	Purchase price	Sale price	Purchase price	Sale price
Whole vulture (dead)	15,000–30,000 US\$ 25–50	70,000–90,000 US\$ 117–150	20,000–70,000 US\$ 33–117	100,000–150,000 US\$ 167–250
Whole vulture (alive)	60,000–80,000 US\$ 100–133	100,000–150,000 US\$ 167–250	60,000–100,000 US\$ 100–167	100,000–500,000 US\$ 167–833
Vulture head	5,000–10,000 US\$ 8–17	7,000–20,000 US\$ 12–33	12,000–17,000 US\$ 20–28	15,000–20,000 US\$ 25–33

markets of southern Benin. Vultures sold in Benin are sourced from a wide geographical range including at least 10 foreign countries, and it is likely that this trade is causing population-level impacts over a significant area of the species' distribution. We recorded live birds, carcasses, and heads representing at least 522 individual vultures for sale in markets in southern Benin, all of which originated outside our study area (where no vultures are present in the wild), and most of which originated from across the region, including Ghana, Burkina Faso, Nigeria, and Niger. These results provide support for the hypothesis of Daboné et al. (2023b) that large number of vultures killed intentionally in Burkina Faso could be intended to meet international demand throughout the region.

#### *Numbers and characteristics of vendors involved in the vulture trade*

All 115 vulture vendors we interviewed belonged to the Fon ethnic group, which is the largest of Benin's approximately 42 ethnic groups, comprising approximately 38% of Benin's population (CIA 2024). Members of the Fon ethnic group also comprise all the vendors in the main fetish market in the capital of neighbouring Togo (N'kere 2016). Research in other West African countries, such as Nigeria and Senegal, have also found that the wildlife trade disproportionately involves members of particular ethnic groups, including Hausa, Yoruba, and Fulani people, who have communities and trade networks throughout West Africa (Copsey et al. 2022; Nikolaus 2011; Saidu and Buij 2013). For example, fetish markets in Nigeria appear to be run mainly by women from the Yoruba ethnic group (Nikolaus 2001).

Almost two-thirds of Benin's population is under the age of 25 (CIA 2024), which is representative of vulture vendors, most of whom were young men in their 20s. However, the fact that the vast majority (95%) of vulture vendors practise vodun places them in a distinct minority, as <12% of Benin's population practises vodun (CIA 2024). Most vulture vendors we interviewed had no formal education, in contrast to the average adult male in Benin who has received 12 years of formal education (CIA 2024); country-wide statistics indicate that 40% of the general population has not attended school (Institut National de la Statistique et de l'Analyse Economique 2017). This low education rate complicates the communication of conservation legislation and reduces the availability of alternative employment opportunities. However, the fact that the illegal vulture trade is undertaken almost entirely by males practising vodun reveals a sector of society where education efforts can be focused. Such efforts might highlight the negative and unsustainable implications of vulture trade and emphasizing alternatives, such as belief-based practices that have positive associations with

nature conservation, including the protection of sacred sites by the Fon in Benin (Janssen 2010).

#### *Numbers and origins of vultures and vulture parts sold in markets*

Previous research published nearly 10 years ago estimated an annual take of 975–1,462 Hooded Vultures across West Africa (Buij et al. 2016). Our counts of vultures for sale in Benin alone suggests that if the previous estimates are correct, the trade in vultures has grown significantly since then. Furthermore, because 26% of the vendors declined to be interviewed for this research, the numbers we have presented for our study underestimate the numbers of vultures and vulture products for sale present in the markets, and the actual numbers of vultures traded in these markets could be considerably higher. In addition to Hooded Vultures, we observed four other vulture species and 12 other raptor species offered in markets surveyed in this study, including the following: the Critically Endangered White-headed Vulture, White-backed Vulture, and Rüppell's Griffon Vulture the Endangered Lappet-faced Vulture, the Palm-nut Vulture *Gypohierax angolensis*, the Black Kite *Milvus migrans*, Black-shouldered Kite *Elanus axillaris*, African Goshawk *Aerospiza tachiro*, Shikra *Tachyspiza badius*, Lizard Buzzard *Kaupifalco monogrammicus*, African Harrier-Hawk *Polyboroides typus*, Gabar Goshawk *Micronisus gabar*, Barn Owl *Tyto alba*, African Wood-Owl *Strix woodfordii*, Vermiculated Fishing-Owl *Scotopelia bouvieri*, and Pearl-spotted Owlet *Glaucidium perlatus*. The prevalence of multiple endangered, rare, and vulnerable raptor species that are protected by law but nevertheless offered for sale in markets in Benin demonstrates the extensive nature of this trade and its impacts on threatened wildlife (Buij et al. 2016).

Vendors indicated that vulture prices are influenced by at least four factors: (1) vultures' origin in the wild (or distance from market); (2) the experience of the vendor or buyer (new or experienced); (3) the season (wet or dry); (4) the form of vulture being sold (alive, whole carcass, head only, and other parts). Although we only attempted to quantify the latter two factors, we understand that vultures coming from longer distances cost more. For example, vultures originating from Ghana, Côte d'Ivoire, and Mali are more expensive because of the increased risk that suppliers' take (e.g. risk of being arrested and/or fined by the police or foresters). The purchase and sale price of the species also varies depending on the experience of both the buyer and vendor. If the vendor is new or only sells occasionally, the sale price may be very low. However, if a vendor notices that a buyer is not a regular or former customer, or is a foreigner, the price could become very high. Vulture prices were higher during the rainy season, when vultures are reportedly harder to procure compared with the dry season. The dry season



(approximately October through March) in West Africa coincides with the breeding season for Hooded Vultures, when their congregation at nesting sites makes their locations more predictable and thus presumably more vulnerable to poachers.

### *Vulture products sought and selling prices, and belief-based uses*

The overall average sale price of a live Hooded Vulture, whole carcass, or vulture head exceeds the average monthly income in Benin, the sale of live vultures can fetch up to seven times as much as the average monthly income. The sale price of vulture carcasses in Benin is comparable to prices reported in Ghana, where carcasses in the northern city of Tamale were reportedly sold for US\$ 140, while the sale price of vulture heads (US\$ 12–33) was less than those reported in Ghana (US\$ 60) (Gbogbo et al. 2016). Between 2001 and 2021 in Nigeria the price for a whole vulture reportedly increased 100 times (UNEP-WCMC 2021), and prices paid in Ghana (Deikumah 2020) and Benin may be even higher, as our findings show. Whole vultures, particularly live vultures, commanded the highest prices. Captive vultures are usually fed beef, costing about CFA 1,000 (US\$ 1.67) for the meat for one vulture per day. However, a vendor can gain more from the sale of a living vulture compared with its carcass, as live vultures may be used in ritual sacrifices considered more powerful than ritual consumption of vulture parts. The sale prices of the heads, carcasses, and live vultures vary considerably with supply, demand, and sellers' assessments of how much a buyer might pay.

Most vultures were sold as whole carcasses (73.4%), while 17.2% were sold as heads; the latter value is slightly higher than that recorded by Saïdu and Buij (2013) in northern Nigeria (11%). Some preference for trade in vulture heads appears to be related to the desire to avoid detection by law enforcement authorities (Henriques et al. 2020). Daboné et al. (2023b) also found evidence of significant trade in vulture heads; out of 879 vultures found dead in poisoning events, 317 (36%) were decapitated, apparently due to the harvest of their heads for trade. Our findings are consistent with prior research that emphasised that vulture trade is motivated by belief-based use (Gbogbo et al. 2016; Ogada and Buij 2011; Petrozzi 2018; Saïdu and Buij 2013); in previous research on 7,819 vulture killings recorded in 26 countries, only 1% were killed for food (Ogada et al. 2016).

### *Belief-based uses in the context of tradition, religion, and conservation*

Our findings provide clear evidence of the negative impacts of belief-based practices on Critically Endangered wildlife, with implications stretching across West Africa and into Central Africa. In Benin, as well as in neighbouring countries such as Burkina Faso and Nigeria, fetish practices appear to be accepted or even promoted by national governments, whereas in countries, such as Guinea and Ghana, they have been discouraged by government policies but persist nevertheless (Nikolaus 2011). The expansion and increases in such practices mean that the fetish trade now represents a significant threat to avian biodiversity (Adeola 1992; Buij et al. 2016; Nikolaus 2011). While many belief-based uses may have roots in some African traditions (Nikolaus 2011), these have been transformed due to globalisation in ways that have allowed wildlife persecution and trade to rapidly increase and expand in ways that are now far from traditional. New technologies have enabled novel hunting and trapping methods, and access to modern

communications and markets has enabled a massive international trade that bears no resemblance to historical traditions and results in extirpations and extinctions of wildlife integral to African cultural and natural heritage. Moreover, increasing trade has accompanied new applications of fetish practices, such as to win the lottery or succeed in business or politics (Boakye et al. 2019). Accordingly, nearly half of buyers in the main fetish market in Togo, which is run by Fon traders from Benin, are businessmen and politicians seeking to increase their success and power (N'kere 2016).

The ritual consumption and sacrifice of vultures is promoted in vodun practices as providing protection against witchcraft, although these practices themselves are considered to a form of witchcraft. Previous research in Africa has found that people relying on belief-based approaches to their problems tended to be poor, unemployed, and have low health status, and that payments associated with visiting fetish priests tended to total >10% of their household budgets, a level of expense labeled "catastrophic" and considered to drive on-going poverty (Nxumalo et al. 2011). Consistent with this research, over a third of buyers in Togo's main fetish market comprised unmarried and unemployed people seeking successful marriage matches, employment or wealth (N'kere 2016). Paying the prices for vultures at fetish markets can have severe financial implications for vulnerable households, perpetuating a cycle of poverty among users, and policymakers should give attention to protecting residents from such crippling expenses (Nxumalo et al. 2011).

### *Study limitations and future directions*

Human perspectives are limited by definition and studies such as ours, which focus on interviews can represent a first step to evaluate the connections between human perspectives, behaviours, and real-world consequences (Agyare et al. 2024). In addition to its reliance on questionnaire data, our study was limited by our undercounting vultures due to the lack of participation of all vendors as well as to mortality, confiscation, and other attrition of vultures on the long journeys from source to market. Illegal phenomena are difficult to study by nature as they can be dangerous and many participants may refuse to provide information, such as as 26% of the vendors in our study. On the other hand, the effects of uncontrolled and illegal activities have powerful negative impacts, not only on nature and wildlife (Arcilla et al. 2015; Holbech et al. 2018), but also on human societies. As such practices involve organised crime and mafia-style politics, they are generally anti-social and anti-democratic, enabling the elite capture of public resources for the benefit of a few (Jusrut 2021), which in this case includes traders and middlemen. Previous studies have demonstrated the existence of major market hubs in West Africa for international commerce (Atuo et al. 2015; Boakye et al. 2019; Williams et al. 2014). Despite the significant threat to biodiversity, there appear to be relatively few scientific studies of the relationship between such trade in birds and the conservation status of species concerned (Buij et al. 2016; Petrozzi 2018).

Addressing conservation problems stemming from belief-based uses requires addressing core values in religion and culture. While evangelical religions such as Christianity have sometimes been blamed for the demise of traditional cultures, many of the world's languages that previously existed only in oral form have been written down, preserved, and promoted largely or solely through the efforts of Christian missionaries (e.g. Arcilla et al. 2025; Larson 1966; Skreftsrud 1873). Moreover, the assumption that every aspect

of traditional cultures must be protected becomes problematic when we consider that both human and animal sacrifice played important roles in West African traditions until recently, but are prohibited or restricted in most societies today. Previous research in Ghana has also found that Christians consistently assign greater importance to conservation outcomes than do those who identify with traditional African religious practices (Murray and Agyare 2018). On the other hand, sacred forests protected as a part of African religious practices can also protect ecosystems and benefit local communities (Sullivan *et al.* 2024; Franta *et al.* 2025). We suggest that future research further investigate the role of religious faith, practices, and values in wildlife conservation and their impacts, both positive and negative, on wildlife and nature protection strategies.

### Conservation implications

Republic of Benin laws (Decree No 2002-16, 18 October 2004; Decree No. 2011-394, 28 May 2011) establish terms of conservation and sustainable management of wildlife and wildlife habitat. Hunting, capture, possession, and trade of vultures are banned and any person infringing this provision is liable to jail sentences ranging from three months to three years and/or to a fine of CFA 100,000–500,000 (~US\$ 160–830) (Daboné *et al.* 2023a). However, this legal and regulatory system is poorly understood and mostly ignored by hunters in Benin (Chaffra 2022). Over half the population of Benin is illiterate (CIA 2024), and Benin's vulture vendors appear to have a higher-than-average rate of illiteracy due to their lack of formal education. In conversations with the vendors, we found that many vendors understood legislation pertaining to those who hunted or trapped vultures, rather than themselves (as vendors), particularly as many of the vultures are trapped and killed in other countries.

Better education, awareness, and law enforcement are required to halt the illegal trade in vultures in West Africa. The current lack of effectiveness of legislation in Benin is concerning but consistent with other research in West Africa. Although most vendors we interviewed in markets in southern Benin were aware of laws prohibiting vulture sales, this knowledge did not prevent their involvement in the vulture trade. Likewise, research in Ghana found residents prone to ignoring rules when doing so facilitated the achievement of their goals (Bonsu and Zwick 2007). Moreover, a study in Nigeria revealed a high prevalence of illegal behaviours in communities surrounding protected lands, and that community members' behaviour was more influenced by respondents' perceptions of acceptable behaviour within their social groups than concerns about wildlife regulations, such that perceived likelihood of community-level sanctions played a more salient role than the fear of arrest by government authorities (Atuo *et al.* 2020). Between September and November 2023, vendors of all ages were involved in a community outreach programme to raise awareness of the issues facing vultures as well as the laws and penalties for the capture and killing of Hooded Vultures.

### Conclusions

Our findings highlight the importance of cultural and religious practices in wildlife conservation (Maheshwari *et al.* 2024), which in the context of vodun rituals and sacrifices unfortunately drive a substantial and lucrative illegal wildlife trade associated with

culture declines (Nikolaus 2011). Despite laws protecting vultures from being captured, killed, or traded, we found evidence of 522 vultures sourced from at least 10 foreign countries across West and Central Africa offered for sale in fetish markets of southern Benin over a period of four months. Despite serious legal, conservation, and animal welfare concerns, wildlife trade for belief-based use is thriving and growing in West Africa (D'Cruze *et al.* 2020; Gbogbo *et al.* 2016; Muhammad and Mustapha 2020; Williams *et al.* 2014, 2021). The increase in belief-based use markets is partly attributed to globalization, novel hunting and communications technologies, and increased regional wealth enabling politicians and businessmen who look to fetish practices for success. In some regions, a majority of the population may have some involvement in the fetish trade (Atuo *et al.* 2015), while in others, trade may be driven by ethnic or religious minorities, such as the vodun practitioners in the current study. Targeted community outreach and education programs are urgently needed as part of a strategy to mitigate illegal wildlife trade that will otherwise drive declines and extirpations of Hooded Vultures from increasing areas of their native range. We also recommend further studies identify end users of vultures, educate them on wildlife laws and legal penalties, and build conservation capacity and awareness of current practices that threaten to diminish and destroy Benin's unique and impressive natural and cultural heritage.

Our findings also reveal that legislation aimed at protecting vultures in Benin currently appears to be ineffective. The establishment of laws and regulations protecting wildlife is a first step in addressing illegal wildlife trade, but additional actions are required to achieve conservation success (Challender *et al.* 2019; Kaboumba *et al.* 2025). To our knowledge there has never been a prosecution for illegal trade in vultures in Benin. However, elsewhere in West Africa, in Guinea-Bissau, a 2020 case in which >2,000 Hooded Vultures were intentionally poisoned (Henriques *et al.* 2020) resulted in a perpetrator's sentencing to more than four years in prison and a fine of CFA 900,000 (~US\$ 1,500) (Henriques, unpublished data). However, such prosecutions remain rare as financial stakes in illegal wildlife trade continue to grow. Moreover, profits made in vulture trade can easily exceed the costs imposed by any fines imposed, as the average sale price in Benin of 2,000 vulture carcasses would exceed a quarter million US dollars. Existing international agreements such as the Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia (CMS Raptors 2022) can be leveraged to bolster guidance and support to address the formidable, on-going conservation threats to Critically Endangered species posed by illegal but increasing international wildlife trade (Donald *et al.* 2024). We also emphasise the urgent need to monitor and address unsustainable and illegal trade through law enforcement, education, and cultural engagement.

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## References

- Adeola M.O. (1992). Importance of wild animals and their parts in the culture, religious festivals, and traditional medicine of Nigeria. *Environmental Conservation* **19**, 125–134. <https://doi.org/10.1017/S0376892900030605>
- Adjakpa J.B., Tchabi A. and Ogouvidé F.T. (2002). Oiseaux utilisés en pharmacopée traditionnelle au Bénin. *Malimbus* **24**, 1–14.
- Agyare A.K., Holbech L.H. and Arcilla N. (2024). Great expectations, not-so-great performance: Participant views of community-based natural resource management in Ghana, West Africa. *Current Research in Environmental Sustainability* **7**, 100251. <https://doi.org/10.1016/j.crsust.2024.100251>
- Akeredolu E., Routh A. and Louca V. (2018). Effect of traditional use on vulture populations in Lagos, Nigeria. Paper presented at the 5th European Congress of Conservation Biology. <https://doi.org/10.17011/conference/eccb2018/107776>
- Arcilla N., Holbech L.H. and O'Donnell, S. (2015). Severe declines of understory birds follow illegal logging in Upper Guinea forests of Ghana, West Africa. *Biological Conservation* **188**, 41–49. <https://doi.org/10.1016/j.biocon.2015.02.010>
- Arcilla N., Salazar Samecash B., Tsamajain Shiwig O., Su S. and Cooper R.J. (2025). What's in a bird's name? Bird records and Aguaruna names in Amazonian indigenous territories of Peru. *Birds* **6**, 2. <https://doi.org/10.3390/birds6010002>
- Atuo F.A., Abanyam P.U. and O'Connell T.J. (2015). An assessment of socio-economic drivers of avian body parts trade in West African rainforests. *Biological Conservation* **191**, 614–622. <https://doi.org/10.1016/j.biocon.2015.08.013>
- Atuo F.A., Fu J., O'Connell T.J., Agida J.A. and Agaldo J.A. (2020). Coupling law enforcement and community-based regulations in support of compliance with biodiversity conservation regulations. *Environmental Conservation* **47**, 104–112. <https://doi.org/10.1017/S0376892920000107>
- Bonsu S.K. and Zwick D. 2007. Exploring consumer ethics in Ghana, West Africa. *International Journal of Consumer Studies* **31**(6), 648–655. <https://doi.org/10.1111/j.1470-6431.2007.00616.x>
- Botha A.J., Andevski J., Bowden C.G.R., Gudka M., Safford R.J., Tavares J. et al. (2017). *Multi-species Action Plan to Conserve African-Eurasian Vultures*. CMS Raptors MOU Technical Publication No. 5. CMS Technical Series No. 35. Abu Dhabi: Coordinating Unit of the CMS Raptors MOU.
- Boakye M.K., Wiafe E.D., and Ziekah M.Y. (2019). Ethnomedicinal use of vultures by traditional medicinal practitioners in Ghana. *Ostrich* **90**(2), 111–118. <https://doi.org/10.2989/00306525.2019.1578834>
- Buechley E.R. and Şekercioglu Ç.H. (2016). The avian scavenger crisis: Looming extinctions, trophic cascades, and loss of critical ecosystem functions. *Biological Conservation* **198**, 220–228. <https://doi.org/10.1016/j.biocon.2016.04.001>
- Buij R., Nikolaus G., Whytock R., Ingram D.J. and Ogada D. (2016). Trade of threatened vultures and other raptors for fetish and bushmeat in West and Central Africa. *Oryx* **50**, 606–616. <https://doi.org/10.1017/S0030605315000514>
- Bukuluki P. (2014). Child sacrifice: Myth or reality? In *International Letters of Social and Humanistic Sciences* **41**, 1–11. doi:10.18052/www.scipress.com/ILSHS.41.1
- Bukuluki P. and Mpyangu C.M. (2014). The African conception of sacrifice and its relationship with child sacrifice. *International Letters of Social and Humanistic Sciences* **41**, 12–24. doi:10.18052/www.scipress.com/ILSHS.41.12
- Butchart S.H.M. (2008). Red List Indices to measure the sustainability of species use and impacts of invasive alien species. *Bird Conservation International* **18**, S245–S262.
- Byansi P.K., Kafuko A., Wandega A. and Bukuluki P. (2014). Responses to child sacrifice in Uganda. *International Letters of Social and Humanistic Sciences* **41**, 78–91. doi:10.18052/www.scipress.com/ILSHS.41.78
- Carrasco, D. (2013). Sacrifice/human sacrifice in religious traditions. In Jerryson M., Juergensmeyer M. and Kitts M. (eds), *The Oxford Handbook of Religion and Violence*. Oxford: Oxford University Press, pp. 209–225. <https://doi.org/10.1093/oxfordhb/9780199759996.013.0011>
- Central Intelligence Agency (CIA) (2024). The World Factbook: Benin. Available at <https://www.cia.gov/the-world-factbook/countries/benin/#people-and-society>.
- Chaffra A.S. (2022). Chasse villageoise et commerce des oiseaux d'eau dans les communes du bassin du bas-Ouémé et Lac Nokoué, Bénin. *Malimbus* **44**, 39–55.
- Challender D.W.S., Hinsley A. and Milner-Gulland E.J. (2019). Inadequacies in establishing CITES trade bans. *Frontiers in Ecology and the Environment* **17**, 199–200. <https://doi.org/10.1002/fee.2034>
- Charlier P., Bourdin V., N'Dah D., Kielbasa M., Pible O. and Armengaud J. (2024). Metaproteomic analysis of King Ghezo tomb wall (Abomey, Benin) confirms 19th century voodoo sacrifices. *Proteomics* **24**, 2400048. <https://doi.org/10.1002/pmic.202400048>
- CMS Raptors (2022). Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia. Available at <https://www.cms.int/raptors/en/news/building-capacities-local-authorities-guinea-bissau-stop-wild-life-poisoning-incidents> (accessed 24 January 2024).
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (2019). West African Vulture Trade and Conservation Management. Paper presented at the Eighteenth Meeting of the Conference of the Parties, Colombo (Sri Lanka), 23 May–3 June 2019.
- Copsey J., Botha A., Chandra S., Deikumah J., Henriques M. and Safford R. (eds) (2022). *West African Vulture Persecution Threat Analysis Report: Literature Review and Threat Mapping*. Apple Valley, MN: IUCN SSC Conservation Planning Specialist Group.
- Craig C.A., Thomson R.L. and Santangeli A. (2018). Communal farmers of Namibia appreciate vultures and the ecosystem services they provide. *Ostrich* **89**, 211–220. <https://doi.org/10.2989/00306525.2018.1435566>
- Daboné C., Adjakpa J.B., Dansi M.F., Thompson L.J., Dissou F.E. and Weesie P.D. (2023a). Hooded Vulture *Necrosyrtes monachus* is at risk of extinction in Benin: a result of its poaching for belief-based use and decreasing food availability. *Research Square* 1–24. <https://doi.org/10.21203/rs.3.rs-2996896/v1>
- Daboné C., Ouéda A., Thompson L.J., Adjakpa J.B. and Weesie P.D.M. (2023b). Trade in vulture parts in West Africa: Burkina Faso may be one of the main sources of vulture carcasses. *Bird Conservation International* **33**, e8. <https://doi.org/10.1017/S095927092100054X>
- D'Cruze N., Assou D., Coulthard E., Norrey J., Megson D., Macdonald D.W. et al. (2020). Snake oil and pangolin scales: insights into wild animal use at “Marché des Fétiches” traditional medicine market, Togo. *Nature Conservation* **39**,
- Deikumah J.P. (2020) Vulture declines, threats and conservation: the attitude of the indigenous Ghanaian. *Bird Conservation International* **30**, 103–116. <https://doi.org/10.1017/S0959270919000261>
- Di Vittorio M., Hema E.M., Dendi D., Akani G.C., Cortone P.G., Lopez-Lopez, P. et al. (2018). The conservation status of West African vultures: An updated review and a strategy for conservation. *Vie et Milieu – Life and Environment* **68**, 33–43.
- Djagoun C.A.M.S., Akpona H.A., Mensah G.A., Nuttman C. and Sinsin B. (2013). Wild mammals trade for zootherapeutic and mythic purposes in Benin (West Africa): Capitalizing species involved, provision sources, and implications for conservation. In Alves R.R.N. and Rosa I.L. (eds), *Animals in Traditional Folk Medicine*. Heidelberg: Springer Berlin Heidelberg, pp. 367–381. [https://doi.org/10.1007/978-3-642-29026-8\\_17](https://doi.org/10.1007/978-3-642-29026-8_17)
- Donald P.F., Fernando, E., Brown L., Busana M., Butchart S.H.M., Chng S. et al. (2024). Assessing the global prevalence of wild birds in trade. *Conservation Biology* **38**, e14350.
- Dowsett-Lemaire F. and Dowsett J.R. (2019). *The Birds of Benin and Togo: An Atlas and Handbook*. Sumène: Tauraco Press.
- Forte J.R. (2010). Black gods, white bodies: Westerners' initiations to Vodun in contemporary Benin. *Transforming Anthropology* **18**, 129–145. <https://doi.org/10.1111/j.1548-7466.2010.01090.x>
- Franta B., Kourdjouak Y., Kaboumba L.-E.M. and Arcilla N. (2025). Sacred Forest Degradation and Conservation: Resident Views of Nakpadjoak Forest in Togo, West Africa. *Conservation*, **5**, 21. <https://doi.org/10.3390/conservation5020021>
- Gbogbo F., Roberts J.S.T. and Awotwe-Pratt V. (2016). Some important observations on the populations of Hooded Vultures *Necrosyrtes monachus* in urban Ghana. *International Journal of Zoology* **2016**, 7946172. <https://doi.org/10.1155/2016/7946172>
- Goded S., Annorbah N.N.D., Boissier O., Rosamond K.M., Boakye Yiadom S., Mahama A. et al. (2023). Abundance and breeding ecology of critically



- endangered vultures in Mole National Park, Ghana. *Journal of Raptor Research* 57, 628–639. <https://doi.org/10.3356/JRR-22-54>
- Green R.E., Newton I., Shultz S., Cunningham A.A., Gilbert M., Pain D.J. et al. (2004). Diclofenac poisoning as a cause of vulture population declines across the Indian subcontinent. *Journal of Applied Ecology* 41, 793–800. <https://doi.org/10.1111/j.0021-8901.2004.00954.x>
- Henriques M., Buij R., Monteiro H., Sá J., Wambar F., Tavares J.P. et al. (2020). Deliberate poisoning of Africa's vultures. *Science* 370, 304. <https://doi.org/10.1126/science.abd1862>
- Holbech L.H., Annorbah N., Phalan B. and Arcilla N. (2018). Uncontrolled hunting and habitat degradation decimate and extirpate forest hornbills in Ghana, West Africa. *Biological Conservation* 223, 104–111.
- Institut National de la Statistique et de l'Analyse Economique (2016). *Principaux Indicateurs Socio Démographiques et Economiques (Recensement Général de la Population et de l'Habitation N°4) de 2013*. Rapport Publié. Février 2016. Cotonou: Institut National de la Statistique et de l'Analyse Economique.
- Institut National de la Statistique et de l'Analyse Economique (2017). *Synthèse des Analyses sur l'Etat et la Structure de la Population du Bénin*. Volume 1. Cotonou: Institut National de la Statistique et de l'Analyse Economique.
- Janssen H.T. (2010). Stewardship in West African Vodun: A Case Study of Ouidah, Benin. MA thesis, University of Montana, Missoula.
- Johnson T.P. (2014). Snowball sampling: introduction. *Wiley StatsRef: Statistics reference online*. <https://doi.org/10.1002/9781118445112.stat05720>
- Jusur P. (2021). Localization of elite capture in wood charcoal production and trade: implications for development outcomes of a forest management program in rural Senegal. *Forest Policy and Economics* 135, 102613. <https://doi.org/10.1016/j.forpol.2021.102613>
- Kaboumba L.-E.M., Di Lecce I., Afidemanyo K.M., Kourdjouk Y. and Arcilla N. (2025). Assessing threats to Fazao-Malfakassa National Park, Togo, using birds as indicators of biodiversity conservation. *Land* 14, 225. <https://doi.org/10.3390/land14020225>
- Koutchoro A.M., Amahowé O.I., Houéssou L.G. and Loubegnon T.O. (2024). Role of local markets in illegal wildlife trade and conservation efforts for trafficked species. *Global Ecology and Conservation* 54, e03110. <https://doi.org/10.1016/j.gecco.2024.e03110>
- Larson M.L. (1966). *Vocabulario Aguaruna de Amazonas*. Serie Lingüística Peruana 3. Yarinacocha: Ministerio de Educación and Instituto Lingüístico de Verano.
- Law, R. (1985). Human sacrifice in pre-colonial West Africa. *African Affairs* 84, 53–87. <https://doi.org/10.1093/oxfordjournals.afraf.a097676>
- Maheshwari A., Bhagwat S., Hoang L.V. and Karpate Y. (2024). How can faith-based approaches protect biodiversity? *Journal for Nature Conservation* 78, 126578. <https://doi.org/10.1016/j.jnc.2024.126578>
- Margalida A., Ogada D. and Botha A. (2019). Protect African vultures from poison. *Science* 365, 1089–1090. <https://doi.org/10.1126/science.aay7945>
- McClure C.J.W., Westrip J.R.S., Johnson J.A., Schulwitz S.E., Virani, M.Z., Davies R. et al. (2018). State of the world's raptors: Distributions, threats, and conservation recommendations. *Biological Conservation* 227, 390–402. <https://doi.org/10.1016/j.biocon.2018.08.012>
- Mensah O.A. (2015). Mythology of rituals and sacrifices in African-derived diaspora religions. In Aderibigbe I.S. and Medine C.M.J. (eds), *Contemporary Perspectives on Religions in Africa and the African Diaspora*. New York: Palgrave Macmillan, pp. 179–197. [https://doi.org/10.1057/9781137498052\\_15](https://doi.org/10.1057/9781137498052_15)
- Muhammad N.D. and Mustapha Z.K. (2020). Collapsing towards Extinction? Trade in birds carcasses for traditional medicine and the decline of vulture population in Katsina State, Nigeria. *Journal of Applied Science and Environmental Management* 24, 575–580. <https://doi.org/10.4314/jasem.v24i4.5>
- Murray G. and Agyare A. (2018). Religion and perceptions of community-based conservation in Ghana, West Africa. *PLOS ONE* 13, e0195498. <https://doi.org/10.1371/journal.pone.0195498>
- Naiden F. (2016). Sacrifice. In Eidinow E. and Kindt J. (eds), *The Oxford Handbook of Ancient Greek Religion*. Oxford: Oxford University Press, pp. 463–476. <https://doi.org/10.1093/oxfordhb/9780199642038.013.32>
- Nikolaus G. (2001). Bird exploitation for traditional medicine in Nigeria. *Malimbus* 23, 45–55.
- Nikolaus G. (2011). The fetish culture in West Africa: An ancient tradition as a threat to endangered bird life? In Schuchmann K.-L. (ed.), *Tropical Vertebrates in a Changing World*. Bonn: Zoologisches Forschungs-museum Alexander Koenig, pp. 145–155.
- N'kere N. (2016). Le marché aux fetiches (lantassime) d'Akodessewa a Lomé (Togo), un espace géographique aux fonctions multiples. *Journal de Recherche Scientifique de l'Université de Lomé* 18. <https://www.ajol.info/index.php/jrsul/article/view/148504>
- Nxumalo N., Alaba O., Harris B., Chersich M. and Goudge J. (2011). Utilization of traditional healers in South Africa and costs to patients: Findings from a national household survey. *Journal of Public Health Policy* 32(Suppl. 1), S124–S136. <https://doi.org/10.1057/jphp.2011.26>
- Ogada D., Shaw P., Beyers R.L., Buij R., Murn C., Thiollay J.M. et al. (2016). Another continental vulture crisis: Africa's vultures collapsing toward extinction. *Conservation Letters* 9, 89–97. <https://doi.org/10.1111/conl.12182>
- Ogada D., Virani M.Z., Marc J., Kendall C.J., Thomsett S., Odino M. et al. (2022). Evidence of widespread declines in Kenya's raptor populations over a 40-year period. *Biological Conservation* 266, 109361. <https://doi.org/10.1016/j.biocon.2021.109361>
- Ogada D.L. and Buij R. (2011). Large declines of the hooded vulture *Necrosyrtes monachus* across its African range. *Ostrich* 82, 101–113.
- Ogada D.L., Keesing F. and Virani M.Z. (2012). Dropping dead: causes and consequences of vulture population declines worldwide. *Annals of the New York Academy of Sciences* 1249, 57–71. <https://doi.org/10.1111/j.1749-6632.2011.06293.x>
- Parker J. (2021). *In My Time of Dying: A History of Death and the Dead in West Africa*. Princeton: Princeton University Press.
- Petrozzi F. (2018). Bird bushmeat and fetish trade in West Africa: A review. *Vie et Milieu – Life and Environment* 68, 51–64.
- Prakash V., Bishwakarma M.C., Chaudhary A., Cuthbert R., Dave R., Kulkarni M. et al. (2012). The population decline of Gyps vultures in India and Nepal has slowed since veterinary use of diclofenac was banned. *PLOS ONE* 7, e49118. <https://doi.org/10.1371/journal.pone.0049118>
- Safford R., Andevski J., Botha A., Bowden C.G.R., Crockford N., Garbett R. et al. (2019). Vulture conservation: the case for urgent action. *Bird Conservation International* 29, 1–9. <https://doi.org/10.1017/S0959270919000042>
- Saidu Y. and Buij R. (2013). Traditional medicine trade in vulture parts in northern Nigeria. *Vulture News* 65, 4–14. <https://doi.org/10.4314/vulnew.v65i1.1>
- Serratos J., Oppel S., Rotics S., Santangeli A., Butchart S.H.M., Cano-Alonso L. S. et al. (2024). Tracking data highlight the importance of human-induced mortality for large migratory birds at a flyway scale. *Biological Conservation* 293, 110525. <https://doi.org/10.1016/j.biocon.2024.110525>
- Shaw P., Ogada D., Dunn L., Buij R., Amar A., Garbett R. et al. (2024). African savanna raptors show evidence of widespread population collapse and a growing dependence on protected areas. *Nature Ecology & Evolution* 8, 45–56. <https://doi.org/10.1038/s41559-023-02236-0>
- Skrefsrud L.O. (1873). *A Grammar of the Santhal Language*. Benares: The Medical Hall Press.
- Su S., Gu D., Lai J.-Y., Arcilla N. and Su T.-Y. (2025). A novel deep learning-based bioacoustic approach for identification of look-alike white-eye (*Zosterops*) species traded in wildlife markets. *Ibis* 167, 41–55. <https://doi.org/10.1111/ibi.13309>
- Sullivan M.K., Browne L., Penagos Zuluaga J.C., Liu J., Surendra A. and Estrada-Villegas S. (2024). Sacred forest biodiversity conservation: A meta-analysis. *Conservation Science and Practice* 6, e13055. <https://doi.org/10.1111/csp2.13055>
- Thiollay J.-M. (2006). The decline of raptors in West Africa: long-term assessment and the role of protected areas. *Ibis* 148, 240–254. <https://doi.org/10.1111/j.1474-919X.2006.00531.x>
- Ullucci D.C. (2011). *The Christian Rejection of Animal Sacrifice*. Oxford: Oxford University Press.
- UN Environment Programme (UNEP)-World Conservation Monitoring Centre (WCMC) (2021). *West African Vultures: A Review of Trade and Sentinel Poisoning*. UNEP-WCMC Technical Report. Cambridge: UNEP-WCMC. Available at <https://www.cms.int/sites/default/files/document/West%20African%20vultures%20-%20a%20review%20of%20trade%20and%20sentinel%20poisoning.pdf> (accessed 5 February 2025).
- Williams M.M., Ottosson U., Tende T. and Deikumah J.P. (2021). Traditional belief systems and trade in vulture parts are leading to the eradication of

- vultures in Nigeria: an ethno-ornithological study of north-central Nigeria. *Ostrich: Journal of African Ornithology* **92**, 194–202. <https://doi.org/10.2989/00306525.2021.1929534>
- Williams V.L., Cunningham A.B., Kemp A.C. and Bruyns R.K. (2014). Risks to birds traded for African traditional medicine: A quantitative assessment. *PLOS ONE* **9**, e105397. <https://doi.org/10.1371/journal.pone.0105397>
- Zanvo S., Dognimon S., Djagoun C.A.M.S., Akpatchémè J., Azihou A.F., Djossa B. et al. (2024). Wildlife trade at the interface between deeply-rooted animal-based traditional medicine and unregulated harvesting of wild animals in West Africa. *Frontiers in Conservation Science* **5**. <https://doi.org/10.3389/fcosc.2024.1481791>