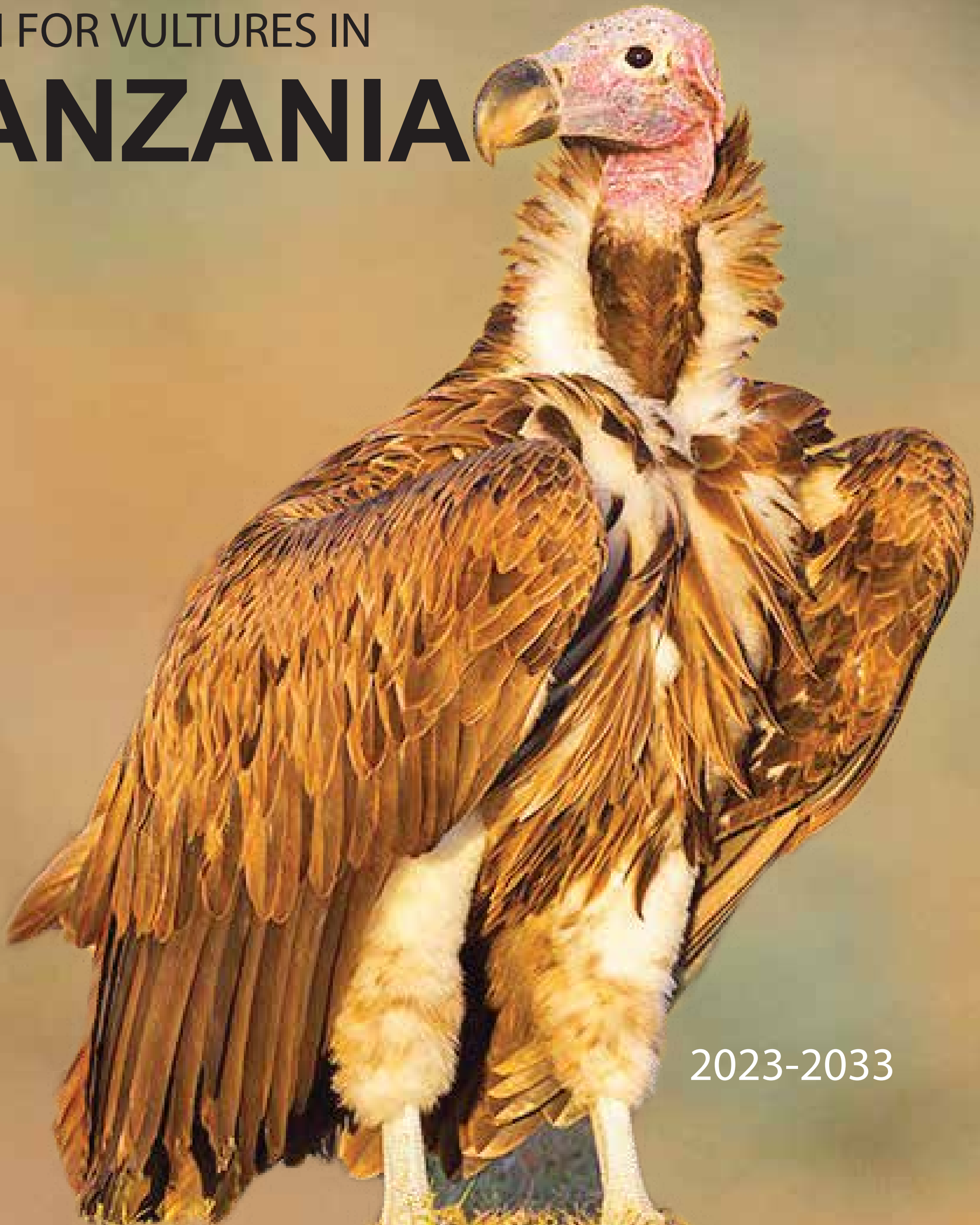
THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF NATURAL RESOURCES AND TOURISM

CONSERVATION AND MANAGEMENT PLAN FOR VULTURES IN TANZANIA



2023-2033

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ABBREVIATIONS AND ACRONYMS

AWBV	-	African White-backed vulture
AWPD	-	African Wildlife Poison Database
CITES	-	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	-	Convention on Migratory Species
DGO	-	District Game Officer
EIA	-	Environmental Impact Assessment
FAO	-	Food and Agricultural Organisation
GCLA	-	Government Chemist Laboratory Agency
GPS	-	Global Positioning System
GR	-	Game Reserve
GSM	-	Global System for Mobile Communications
HHPs	-	Highly Hazardous Pesticides
HV	-	Hooded vulture
HWC	-	Human-wildlife conflict
IUCN	-	International Union for the Conservation of Nature
LFV	-	Lappet-faced vulture
MNRT	-	Ministry of Natural Resources and Tourism
MoA	-	Ministry of Agriculture
MoH	-	Ministry of Health
MoU	-	Memorandum of Understanding
NC Zoo	-	North Carolina Zoo
NCAA	-	Ngorongoro Conservation Area Authority
NEMC	-	National Environmental Management Council
NGO	-	Non-governmental Organization
NSAIDs	-	Non-Steroidal Anti-Inflammatory Drugs
NIMR	-	National Institute for Medical Research
NP	-	National Park
PA	-	Protected Area
RV	-	Rüppell’s vulture
SOP	-	Standard Operating Procedure
TANAPA	-	Tanzania National Parks
TAWA	-	Tanzania Wildlife Authority
TAWIRI	-	Tanzania Wildlife Research Institute
TBA	-	Tanzania Bird Atlas
TMDA	-	Tanzania Medicines and Medical Devices Authority
TPHPA	-	Tanzania Plant Health and Pesticides Authority
TVCMP	-	Tanzania Vulture Conservation and Management Plan
WCS	-	Wildlife Conservation Society
WHO	-	World Health Organization
WHV	-	White-headed vulture
WMA	-	Wildlife Management Area

GLOSSARY

Afrotropical	A biogeographic realm that covers Trans-Saharan Africa and Arabia.
Belief-based poisoning	Intentional poisoning of vultures for the purposes of traditional beliefs, most often the removal of heads and feet.
Cere	A usually waxy protuberance or enlarged area at the base of the beak of a bird.
Commensal	Living in a relationship in which one organism derives food or other benefits from another organism without hurting or helping it.
Conspecific	Belonging to the same species.
Dispersal	The movement of an individual or multiple individuals away from the population in which they were born to another location, or population, where they will settle and reproduce
Flight feathers	Flight feathers are the long, stiff, asymmetrically shaped, but symmetrically paired feathers on the wings or tail of a bird that aid in the generation of both thrust and lift, thereby enabling flight. The flight feathers on the wings are split into primary and secondary based on their position along the wing. There are up to 11 primaries attached to the equivalent of the bird's hand and secondaries attached to the forearm. Primaries in birds of prey are typically finger-like.
Gregarious	Tending to flock or herd together; not habitually solitary or living alone.
Migratory	Large-scale movement of members of a species to a different environment. Migration is a component of the life cycle of many species e.g. often on a seasonal basis.
Monotypic species	A monotypic species is one that does not include subspecies or smaller, infraspecific taxa.
Obligate scavenger	Subsisting entirely or mainly on dead animals. Rare among vertebrates, due to the difficulty of finding enough carrion without expending too much energy.
Palearctic	The Palearctic region stretches across all of Europe and Asia (Eurasia) and North Africa.
Resident	Individuals or species living in an area for most of their life cycle.

Retaliatory poisoning	Unintentional poisoning of vultures usually linked to a human-wildlife conflict event e.g. where a predator has killed livestock.
Scavenger	An organism that consumes mostly decaying biomass, such as meat (or rotting plant matter).
Sedentary	Organisms that do not ever or often move from one position or place. Non-migratory.
Sentinel poisoning	Intentional poisoning of vultures to prevent rangers from finding poaching activities.
Sexually dimorphic	Sexes of the same species exhibit different morphological characteristics i.e. plumage/feather colour.
Trophic cascade	An ecological phenomenon triggered by the addition or removal of top predators and involving reciprocal changes in the relative populations of predator and prey through a food chain, which often results in dramatic changes in ecosystem structure and nutrient cycling.
Vagrant	An individual animal (usually a bird) that appears well outside its normal range.

ACKNOWLEDGEMENTS

The completion of this National Conservation and Management Plan for Vultures (2023-2033) marks a significant milestone in our collective efforts to address the declining numbers of vulture species. It is a product of nationwide cooperation, collaboration, and partnerships among government authorities, non-governmental organisations (NGOs), researchers, local communities and other stakeholders.

The government appreciates the support from various partners in terms of technical, logistics and guidance rendered during the development of this plan. The government further appreciates the financial support from the North Carolina Zoo that was instrumental in the development of this plan. Your tireless dedication to conservation initiatives adds a vital layer of perspective and effectiveness to this plan.

Finally, we look forward and are committed to collaborating with various local and international organisations to ensure that this plan is effectively implemented and that Tanzania remains a key country for African vulture populations. Your support and contributions will make this plan not just a document but a shared vision for conservation.

Dr. Hassan Abbasi Said
PERMANENT SECRETARY

FOREWORD

Tanzania is a country of exceptional biodiversity, diverse intact ecosystems and endemism. The value of her natural resources was acknowledged in the Arusha Manifesto in 1961 by Mwalimu Julius K. Nyerere *"The survival of our wildlife is a matter of grave concern to all of us in Africa. These wild creatures amid wild places they inhabit are not only important as a source of wonder and inspiration but are an integral part of our natural resources and our future livelihood and well-being."*

About 32.5% of Tanzania (945,087 km^2) is set aside for the protection of natural habitats and wildlife, with the recent gazettement of four new National Parks and seven Game Reserves. Vultures span most non-forested natural areas and are one of the most critical indicator species of a One Health approach. They play an essential role in regulating the spread of disease in the natural environment, as well as efficient waste disposal and nutrient cycling. As ecosystems face increasing threats from various man-made pressures, including climate change, decreased water flow regimes and increased incidence of zoonotic disease transfer, the roles of vultures in helping to mitigate and direct our attention towards related threats are becoming even more critical. However, as echoed across the globe, vultures are declining rapidly due to various forms of intentional and unintentional poisoning. Most species are seriously threatened with extinction. Whilst Tanzania is a stronghold country for vultures recent declines indicate that annual mortality rates of 25% far surpass that which can sustain a thriving and healthy vulture population.

This Vulture Conservation and Management Plan (2023-2033) sets out targeted actions needed to slow the decline of species. National-wide cooperation and collaboration by building partnerships between government authorities, NGOs, researchers, local communities and other stakeholders is critical to tackle the multitude of threats and subsequent solutions to reduce poisoning and mortality of vultures. Actions in the plan do not seek to duplicate partners' ongoing activities, particularly in human-wildlife conflict and coexistence. We acknowledge their work and focus on ways to strengthen partnerships. However, it is also necessary to work cross-sectorally to halt emerging threats, such as energy infrastructure schemes, which if not well considered, could push vultures more rapidly toward extinction. We need to look at the challenges of pesticide use and its legislation, which is also a severe health risk to humans. Vultures, as keystone species, are indicators of ecosystem health - their overarching role in highlighting threats is a warning we need to heed now before losing them.

We thank all organizations (local and international partners) involved in reviewing this document and look forward to joining forces to implement this plan and ensure Tanzania remains a key country for vulture populations in Africa

Statement of Endorsement

I hereby endorse this Conservation and Management Plan for Vultures in Tanzania and call upon all stakeholders to support its implementation.

Angellah J. Kairuki (MP)

MINISTER FOR NATURAL RESOURCES AND TOURISM

EXECUTIVE SUMMARY

Vulture populations are declining across their range in Africa, with declines of up to 90% for some species in the last 30 years. The current status of vultures in Tanzania is equally alarming, with multiple species facing dramatic declines predominantly due to poisoning linked to human-wildlife conflict, poaching and illegal trade in vulture parts. From long-term monitoring efforts, annual vulture mortality rates of ~25% have been detected since 2018 calling for immediate intervention. Historically, the importance of vultures, particularly their role in ecosystem services, has been underappreciated across their range. Yet, vultures are at the core of a One Health framework that goes beyond protected areas, as their rapid and efficient waste removal reduces the spread of mammalian diseases and mitigates climate change via a reduction in greenhouse gas emissions from carcass decomposition processes. The cost of losing vulture ecosystem services is well documented in India, which spent US$34 billion trying to rectify the cascading environmental and human health consequences of 99% vulture declines due to unintentional poisoning. Less than 1% of the cow carcasses were contaminated but this was enough to nearly wipe out the population, with annual mortality between 22-50%. Thirty years later, vulture populations are stable but only starting to recover. Like elephants, vultures' life history of long-lived and slow-breeding adults results in a very slow population recovery. Tanzania, as a country, is a stronghold for African vultures but with comparable annual mortality rates for at least the past five years, we must develop and implement interventions to reverse these declines before it is too late.

The urgent need for action to address the vulture crisis has led to the development of the Tanzania Vulture Conservation and Management Plan (TVCMP). Prioritizing interventions for the five vulture species most impacted by poisoning, the TVCMP is a pioneering initiative focused exclusively on outcomes directly affecting vultures, recognizing overlaps with broader conservation challenges like human-wildlife conflict (HWC). The plan aims to synchronize with existing conservation efforts, including the HWC Management Strategy and the Tanzania Wildlife Corridor Assessment, Prioritization, and Action Plan. A key focus of the plan is the mitigation of poisoning, particularly the illegal use of highly hazardous pesticides like carbofuran. Coordinated efforts across government sectors and on-the-ground practitioners are essential to enforce regulations and eliminate these toxic substances, with positive implications for both human and ecosystem health. Rapid detection and response to poisoning events, along with addressing the underlying motivations, are crucial to reduce vulture mortality and facilitate rehabilitation. Collaboration with stakeholders involved in human-wildlife coexistence is vital, particularly for addressing retaliatory poisoning targeting carnivores, unintentionally affecting vultures. The plan also engages with traditional healers to explore sustainable alternatives to the harvesting of vulture

body parts for traditional beliefs, focusing on scaling up plant-based alternatives. Additionally, measures to combat deliberate vulture poisoning related to illegal activities include improved resources for detection and response, as well as strengthened law enforcement capabilities.

The development of energy infrastructure, which has had a significant impact on vulture populations through collisions and electrocutions in other countries, is considered an ‘emerging’ threat to our vulture population. The plan aims to work with major stakeholders to ensure protocols and good practices consider the placement and construction of powerlines and windfarms in relation to minimising or avoiding mortalities of vultures, other raptors and large migratory birds. We have a unique opportunity to avoid the tragedies seen elsewhere. Little is known or understood about vultures, let alone their unique role in ecosystem services hence this plan aims to thrust vultures into the headlines in the country and stimulate funding initiatives to expand activities and commitment, as time is of the essence. In recognition of the importance of vultures, a technical team was constituted by the Ministry of Natural Resources and Tourism to develop a draft plan. Led by the Tanzania Wildlife Research Institute (TAWIRI), the team was comprised of wildlife authorities, conservation practitioners, and academics with Avian experience. The plan was validated with a broader audience of stakeholders.

This plan outlines a 10-year plan with a five-year mid-term review. It includes well-defined aims for continuous monitoring, developing mitigation strategies, establishing a threat response network within and outside Protected Areas (PAs), and a communication strategy to put vultures at the forefront of conservation issues. Key players were identified as essential to the plan’s success. It is organized around an overarching goal, supplemented by eight strategic objectives, ranked in order of priority: i) Reduce poisoning of vultures; ii) Community and public engagement; iii) Reduce illegal trade in vulture body parts; iv) Develop and implement a standardized monitoring system to assess vulture population status; v) Vulture research to improve conservation management; vi) Mitigate threat of energy infrastructure (powerline electrocution and collision, wind farm collision) to vultures; vii) Transboundary coordination, and; viii) Coordination of vulture conservation. Each objective is supported by specific, measurable targets, actions, and activities, along with performance and impact assessment indicators. Identified under eight key themes, the objectives form the plan’s backbone. Implementation will require resources totalling approximately US$ 7,944,000, which necessitates joint resource mobilization efforts and capacity building with other stakeholders. With a coordinated and well-funded effort, we can reverse this catastrophic decline and make significant strides in vulture conservation, ensuring their survival and, by extension, the health of the ecosystems they serve.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER ONE: BACKGROUND

Vultures are currently the fastest declining group of birds globally, with over 90% reduction in Africa over the past 30 years for some of the 15 species present in Africa. Recent work suggests that vultures are threatened across the continent (Ogada et al., 2012a, 2016), with most species now listed as Critically Endangered, Endangered or Near Threatened on the IUCN Red List. This resulted in the development of the Convention on Migratory Species' (CMS) Multi-Species Action Plan for African-Eurasian Vultures (MSAP) (Botha et al., 2017), used as a framework for practitioners of conservation management and to coordinate transboundary collaborations necessary for these wide-ranging species. This has prompted the development of various national-level conservation and management plans for vultures. Tanzania is a key area for the conservation of vultures (Botha et al., 2017) due to its large protected area network and significant wildlife populations; yet until the past decade, vultures have received limited research attention (Peters et al., 2022; Peters et al., 2023; Kendall et al., 2023). It is recognized as a stronghold for other wide-ranging large mammal species, such as various species of antelope and elephants (Lindsey et al., 2017), which are a significant part of vultures' diet (Houston, 1974a), further supporting the potential for it to be an important stronghold for these endangered species.

Eight vulture species are found in Tanzania, four of which are Critically Endangered (CR), two Endangered (EN), one Near Threatened and one Least Concern (Appendix 1). This conservation and management plan will focus on actions and activities that will reduce threats to all vultures considered to be affected by either human activities or climate change, species that are CR or EN. The plan will consider and propose conservation action in order to slow down the rate of decline and propose practical steps that can be done to significantly increase the population in the country. Setting actions for all threatened vultures will reduce further population size decline and promote recovery. Several unique adaptations of vultures allow the specialization of obligate scavenging but also account for their vulnerability to poisoning. Understanding these traits in the context of population dynamics, potential speed of population declines and slow population recovery is useful. Vultures are large-sized birds with late maturity (mostly around age six), can live for 20+ years, have low reproductive output (one egg laid every or every other year) and high adult survivorship (95% survival) (Mundy *et al.*, 1992), making population dynamics especially sensitive to high adult mortality caused by environmental and anthropogenic factors. Population recovery is also slow for the same reasons.

Vultures are uniquely adapted to a scavenging lifestyle, using soaring flight (instead of flapping flight) and thermals to travel long distances at minimal energetic cost whilst searching for carrion, which is ephemeral and patchily distributed (Ruxton and Houston, 2004). Foraging efficiency is increased through good eyesight and social foraging strategies, such as local enhancement, leading to greater success while foraging (Cortés-Avizanda *et al*., 2014; Harel *et al*., 2017). Local enhancement is the use of conspecifics to provide information about the position of food (Cortés-Avizanda *et al*., 2014). A study revealed that group foraging results in 90% success rates of finding a carcass versus 20% for individual foraging. Vultures, particularly *Gyps* species (African White-backed and Rüppell's vultures), also feed on carcasses in large numbers. However, this sociality also means many vultures can feed at a single poisoning event. Because carcasses are an irregular and unpredictable resource, vultures frequently experience long intervals between successive feedings, typically around three days, and are adapted to cope with fasting periods of up to one week without losing body condition (Mundy *et al*., 1992). Their size allows them to consume a large quantity of food at each carcass discovery, up to 1.5 kg for Rüppell's vultures, and carry greater body reserves, which is important given their ephemeral food supply.

Through soaring flight, vultures have a competitive advantage over mammalian scavengers in discovering a carcass quickly (Pennycuick, 1979). Their highly efficient scavenging behaviour means that African vultures typically consume far more carrion than mammals. For instance, in the Mara-Serengeti ecosystem, vultures have been documented to consume nearly 70% of available meat (Houston, 1979). Vultures consume >80% of their diet at non-predator killed carcasses (Houston, 1974b). While vultures often appear in large numbers at predator kills, they get little of their diet from such instances, where carnivores will eat most of the food available (Houston, 1974 a,b, Kendall *et al*., 2012). Instead, vultures obtain most of their diet from natural mortalities, such as starvation, disease, or other injuries. In addition, their long-distance flight means that vultures can be highly responsive to fluctuations in carrion from disease outbreaks or droughts while commuting back to their nests every few days (Pennycuick, 1979). This longer foraging radius is part of why vultures are so much more effective as scavengers than mammals, with some species, such as *Gyps* vultures, even being obligate scavengers. In addition, vultures greatly facilitate mammalian scavengers in carcass discovery and mammalian scavengers find carrion twice as fast when following vultures versus when they discover the food themselves (Kane and Kendall, 2017).

Species-specific differences in vultures' food preferences reflect variations in body size, beak morphology and search efficiency, allowing for high diversity of avian scavengers and unique interactions with mammalian carnivores. *Gyps* vultures prefer to use large ungulate carcasses (Kruuk, 1967; Houston, 1975; Kane and Kendall, 2017); therefore, hyenas, who also prefer feeding from large carcasses, preferentially use *Gyps* vultures to locate food (Mundy *et al*., 1992; Kane and Kendall, 2017). Jackals preferentially follow Lappet-faced vultures, which are more likely to feed at smaller non-predator-killed ungulate carcasses, also preferred by this smaller mammal species (Houston, 1979; Kane and Kendall, 2017). This suggests that ongoing vulture population declines may impact mammalian scavengers and potentially create trophic cascades (Kane and Kendall, 2017).

Research has also shown that carcasses are consumed three times faster when vultures occur versus when only mammalian scavengers arrive (Ogada *et al*., 2012b). In addition, when vultures don't occur at carcasses, a greater diversity of mammalian scavengers may appear and interactions between mammals at the carcass increase, which may facilitate disease spread. Vultures' highly efficient digestive systems with high stomach acidity also allow them to consume disease-ridden or rotting microbe filled carcasses without adverse health impacts (Houston and Cooper, 1975). As a result, it is believed that vultures can reduce disease spread, providing a valuable and little appreciated ecosystem service, and the potential for increased disease outbreaks in the absence of vultures is significant.

1.1. Species descriptions

The descriptions provided here are brief and based on information from the IUCN Red List and the CMS Multi-Species Action Plan for African and Eurasian vultures (Botha *et al*., 2017). More detailed information for each species and their IUCN Red List status can be found in Appendix 1. The species distributions presented in this plan utilize 40 years of sightings data from the Tanzania Bird Atlas (TBA), whilst species descriptions are taken from Mundy *et al*. (1992). Descriptions are of adults, as most species' juveniles are brown. More detailed information on range, connectivity and population trends will be presented after the species description.

1.1.1. African White-backed vulture *Gyps africanus*

Global status: Critically Endangered

Description

The smallest of the African *Gyps* species, weighing 5.5 kg with a 2.2 m wingspan. It is predominantly brown, with a characteristic white back in adults, a long neck with a black eye and a robust, hooked beak. Bird gets paler with age (Figure 1). Juvenile White-backed and Rüppell's vultures are hard to distinguish, particularly in flight.

Figure 1: Adult White-backed vulture

Distribution

African White-backed vultures are the most widespread in Africa, distributed throughout sub-Saharan Africa. It is declining across all of its range, particularly in West Africa (Thiollay, 2006), although serious declines have been recorded more recently in East and southern Africa (Ogada *et al*., 2016; Kendall *et al*., 2023). In Tanzania, African White-backed vultures tend to stay within protected areas throughout the country (Figure 2), where wildlife densities are highest and habitats for breeding are most suitable (Kane *et al*., 2022). This is not a migratory species, although juveniles are known to disperse, e.g., one tagged bird in Ruaha National Park travelled nearly 2,000 km through 8 countries from Tanzania to South Africa (Kendall and Bracebridge, per comms).

Habitat, Ecology and Breeding

This species is found primarily in open wooded savanna to grassland plains from 0 - 3,500 m above sea level, particularly in drier *Acacia* (now in the genus *Senegalia*) habitats, where there are large aggregations of ungulates and greater wildlife densities than associated with the moister *miombo* (*Brachystegia* spp*)* woodland/savannas. As a highly gregarious species, it congregates at carcasses, in thermals, at roost sites and favoured bathing sites. Its social foraging makes it highly vulnerable to poisoning, particularly as it preferentially feeds on large carcasses, consuming mainly soft muscle and organ tissue.

African White-backed vultures maximise foraging efficiency when soaring by monitoring other vultures' behaviour via visual cues, explaining why 50 vultures suddenly appear at a carcass within a few minutes of each other. African White-backed vultures prefer tall trees to nest in (>12 m), often along riverine areas, where there are species such *Senegalia, Vachellia* and *Ficus* species or palms such as *Hyphaene* (Houston, 1976). They may form loose colonies of around 10 pairs, usually with one nest per tree, often synchronous breeding (Mundy *et al*., 1992).

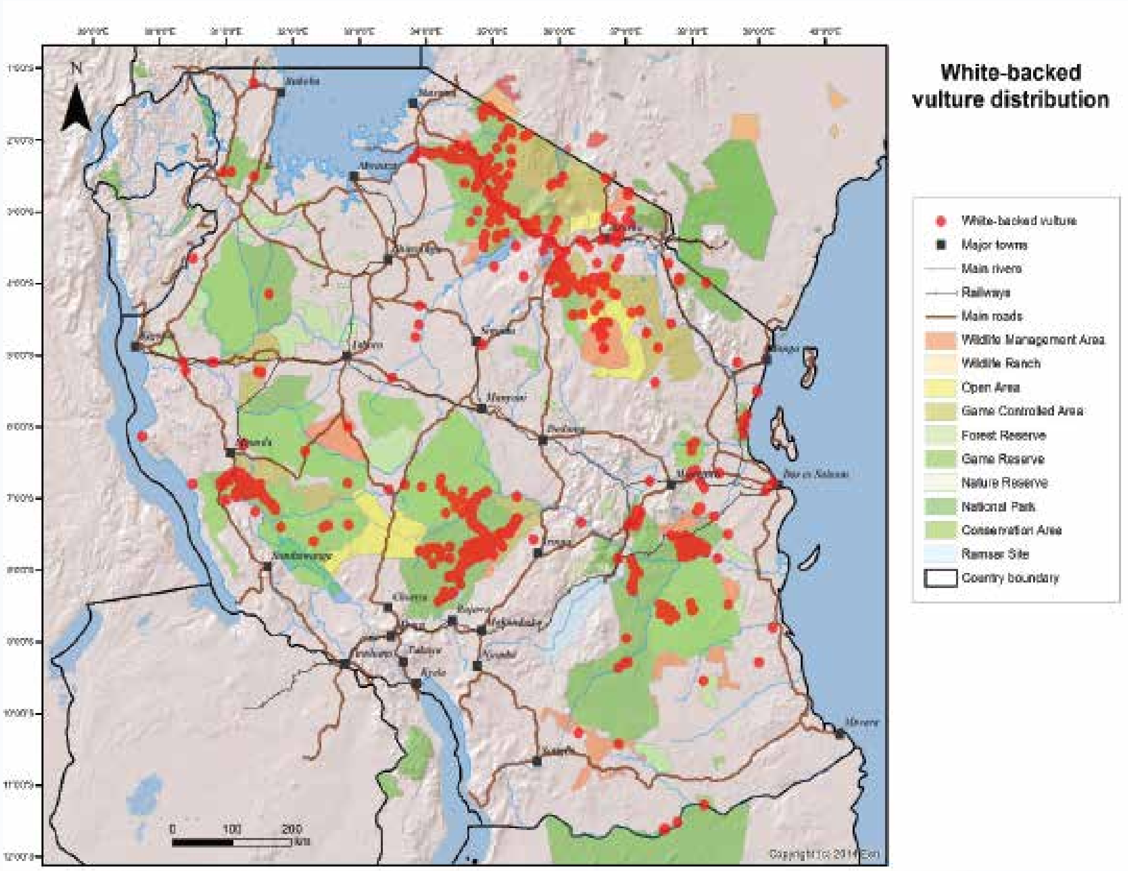

Figure 2: African White-backed vulture distribution from 2433 georeferenced TBA sightings over the past 40 years

Source: TBA

1.1.2. Rüppell's vulture *Gyps rueppellii*

Global status: Critically Endangered (CR)

Description

A large vulture weighing 7.5 kg with a 2.4 m wingspan. It is predominantly brown with white feather tips, giving a mottled appearance (making it easy to distinguish from the adult African White-backed vulture). It has a long neck and, in adults, a yellow eye and yellow robust, hooked beak. Juvenile Rüppell's and White-backed vultures are hard to distinguish, particularly in flight (Figure 3).

Figure 3: Adult Rüppell's vulture

Distribution

Rüppell's vulture occurs throughout the Sahel region of Africa and south through the savanna regions of East Africa in Kenya, Tanzania and Mozambique. Formerly abundant, the species has experienced extremely rapid declines in much of its range, particularly in West Africa. In the last 15 years, the species distribution has expanded with recordings of it far away from its breeding colonies, reaching the Iberian Peninsula in south-western Europe, possibly on an annual basis (Gutiérrez, 2003; De Juana, 2006; Ramírez *et al*., 2011), and north-eastern regions of South Africa (Kemp and Kemp, 1998; Ferguson-Lees and Christie, 2001; De Juana, 2006). It is most commonly seen in the Serengeti ecosystem, with far fewer seen in southern Tanzania (Figure 4).

Habitat, Ecology and Breeding

Rüppell's vulture inhabits open areas of *Senegalia* (formerly in the genus *Acacia*) woodland, grassland and montane regions within a broad range of elevations. It breeds on high cliffs, although there are more recent records of tree-nesting individuals (Gol Mountains in the Serengeti ecosystem may represent significant breeding sites). Cursory counts were conducted by Pennycuik in the 1970s in the mountains of the Serengeti ecosystem, which suggested potentially 3,000 nest sites, with around 2,000 nest sites in the Gol Mountains (Pennycuik, 1983).

The breeding season seems variable for Rüppell's vulture, with two breeding seasons documented in the Gol Mountains (Houston, 1990) and Kwenia, Kenya (Virani *et al*., 2012). Breeding was synchronised within the colony, but egg-laying timing varied considerably between years. The social foraging behaviour and preference for soft muscle and organ tissue of large carcasses is similar to the African White-backed vulture. These species can be seen together and as a slightly larger bird, Rüppell's vulture may dominate interactions when feeding at the carcass. It follows other vultures and migrant game or stock herds to locate much of its food (Del Hoyo *et al*., 1994).

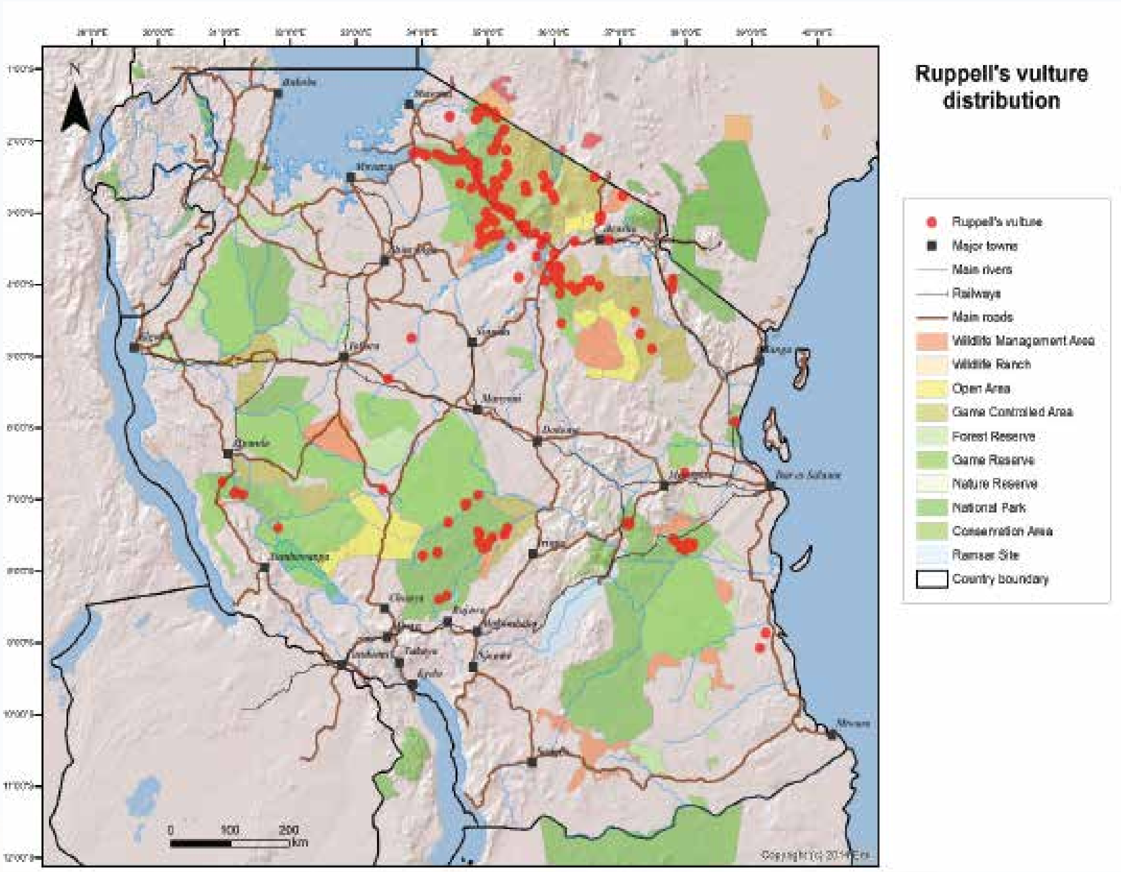

Figure 4: Rüppell's vulture distribution from 300 georeferenced TBA sightings over the past 40 years

Source: TBA

1.1.3. Hooded vulture *Necrosyrtes monachus*

Global status: Critically Endangered (CR)

Description

A small brown vulture weighing approximately 2 kg, with a 1.7 m wingspan. It has a fine, curved and dark beak, and in adults, a white feathered head and black pupil with blue iris. Facial skin is pale but changes to dark pink during social interactions (Figure 5).

Figure 5: Adult Hooded vulture

Distribution

Hooded vultures are widespread across sub-Saharan Africa. It occurs up to 4,000 m, but is most numerous below 1,800 m. It is more adaptable than other vultures, frequenting densely forested areas in Central Africa and open grassland, forest edge, wooded savannah, semi-desert and along coasts throughout its range (Ferguson-Lees and Christie, 2001). Hooded vultures are generally considered sedentary, with some dispersal of non-breeders and immature birds, especially in response to rainfall (Ferguson-Lees and Christie, 2001).

Habitat, Ecology and Breeding

Generally, it is a human commensal north of the equator, gathering in large numbers in urban areas (Ogada and Buij, 2011). For example, in West Africa and Uganda, it congregates at slaughterhouse disposal sites and rubbish dumps. South of the equator is generally more solitary and is primarily found in conservation areas where it relies on natural food for most of its diet (Anderson, 1999). In Tanzania, the Hooded vulture is only associated with protected areas across the country and not with areas of human settlement, although there were some historical records of it near Dar es Salaam (Figure 6). It is gregarious at larger carcasses but because of its smaller size is often dominated by larger species. It often breeds in large trees along river courses (Roche, 2006), usually with the nest tucked under the canopy, where it is less visible than African White-backed vulture nests built on top of the tree. There are not many nest records for the Hooded vulture in Tanzania.

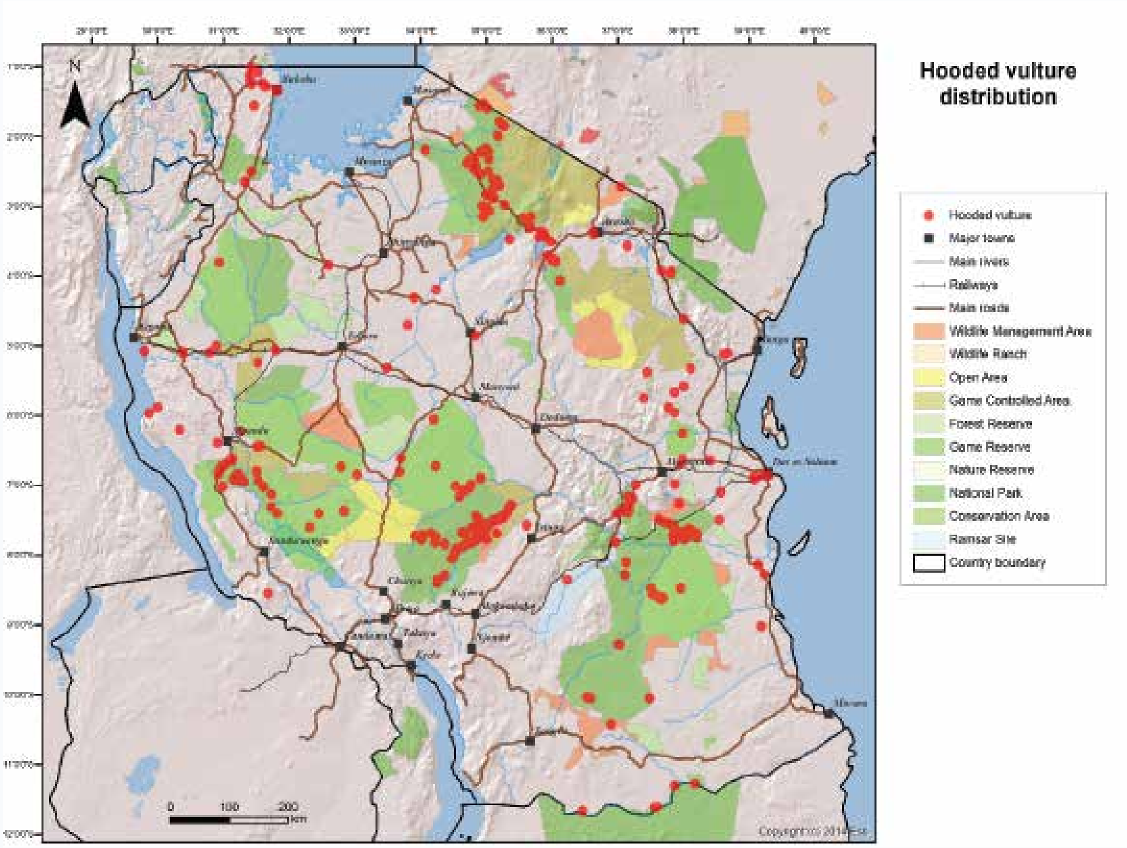

Figure 6: Hooded vulture distribution from 672 georeferenced TBA sightings over the past 40 years

Source: TBA

1.1.4. White-headed vulture *Trigonoceps occipitalis*

Global status: Critically Endangered (CR)

Description

The medium-sized White-headed vulture is a monotypic species and weighs 4.3 kg with a 2.2 m wingspan. It has a black eye in a square, white feathered head with a robust blue (at base) and pink (at tip) beak, capable of ripping off muscle and tendons from a carcass and killing small prey species. Adults have a brown body with a white chest and brown wings with a white line along the middle of the underwing. There is sexual dimorphism as the adult female has distinct white secondary wing feathers, absent in the adult male (Figure 7).

Figure 7: Adult female White-headed vulture

Distribution

White-headed vultures have a large overall range across sub-Saharan Africa but are found in low densities, with only a few areas noted as strongholds, including southern Tanzania (Murn *et al*., 2016) (Figure 8). An estimate of 1,893 pairs was calculated across 34 countries, with 489 pairs for Tanzania, which is 26% of the White-headed vulture population (Murn *et al*., 2016)

Habitat, Ecology and Breeding

White-headed vultures prefer mixed, dry woodland at lower altitudes, avoiding semi-arid thorn belt areas (Mundy *et al*., 1992). This species is highly sensitive to land use and concentrates in protected areas (Murn *et al*., 2016) (Figure 8). Adults are largely sedentary and considered long-lived residents who maintain a small territory (Murn and Holloway, 2014; del Hoyo *et al*., 1994, Hustler and Howells, 1988; Mundy *et al*., 1992). It is one of the few vulture species known to predate as well as scavenge (Murn, 2014). It feeds alone or in pairs, with rarely more than two pairs at larger carcasses. It nests and roosts in trees, most nests being in *Senegalia* spp. or baobabs *Adansonia digitata* (Mundy *et al*., 1992).

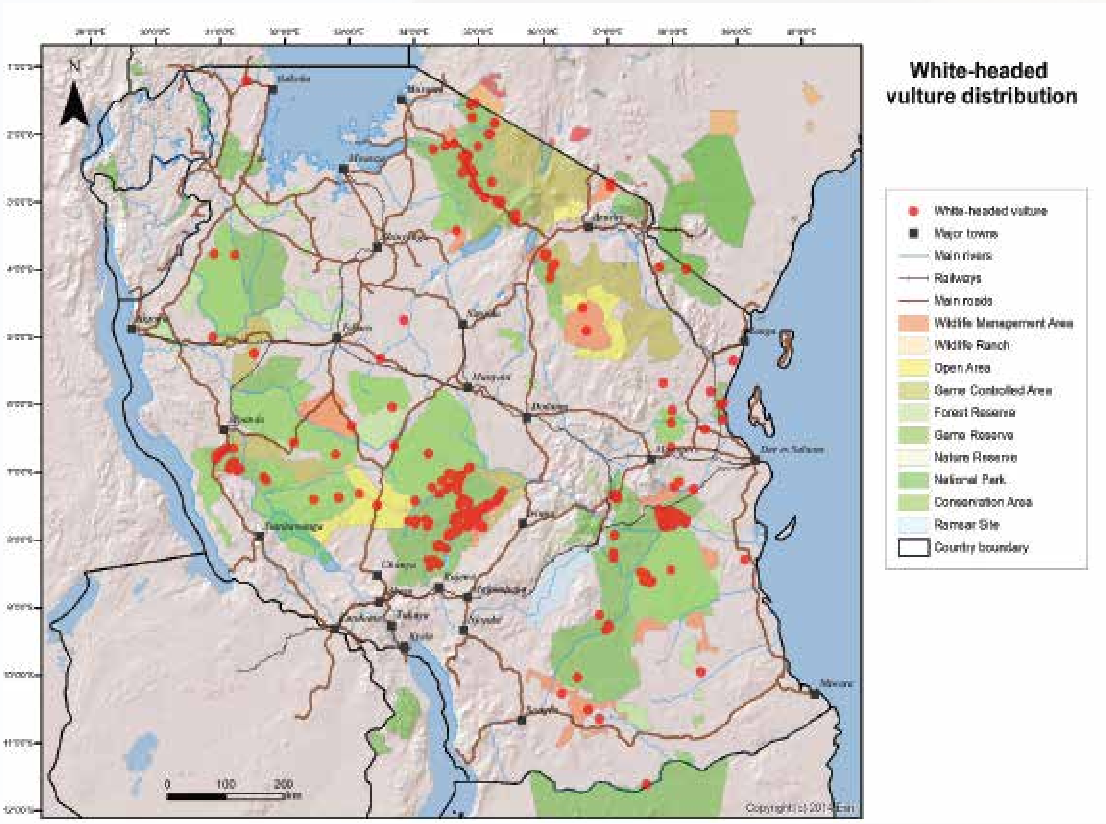

Figure 8: White-headed vulture distribution from 503 georeferenced TBA sightings over the past 40 years

Source: TBA

1.1.5. Lappet-faced vulture *Torgos tracheliotos*

Global Status: Endangered (EN)

Description

A large vulture weighing 6.8 kg with a 2.65 m wingspan (Figure 9). It has a distinct large pink head with wrinkled skin, no feathers, and a massive yellow beak, which can rip open small to medium carcasses. It is predominantly brown with white chest, long downy white feathers, and a white crescent line on the leading edge of the underwing.

Figure 9: Adult Lappet-faced vultures

Distribution

Lappet-faced vultures have a wide but fragmented distribution across Africa, from the west, across the Sahel into East Africa and further south. In Tanzania, they are most abundant in the Serengeti ecosystem (Figure 10).

Habitat, Ecology and Breeding

Lappet-faced vultures inhabit dry savannas, arid plains, deserts and open mountain slopes up to 3,500 m (Shimelis *et al*., 2005). Lappet-faced vultures are regarded as partial migrant that makes significant movements in response to rainfall (Bildstein, 2006). While they may maintain territories for breeding, they are known to range widely when foraging. As well as scavenging on varying sized carcasses, they are also known to hunt, taking a variety of small reptiles, fish, birds and mammals (Mundy *et al*., 1992). Although usually a more solitary species, with pairs seen at a carcass, guarding and taking turns to feed, several birds may aggregate at a large carcass e.g., 10-12 (Baker *et al*., 2019). It has a special role as the only species with a bill large enough to open larger carcasses. Lappet-faced vultures usually build solitary nests, often in small *Senegalia*, *Balanites* and *Terminalia* trees in the grassland plains.

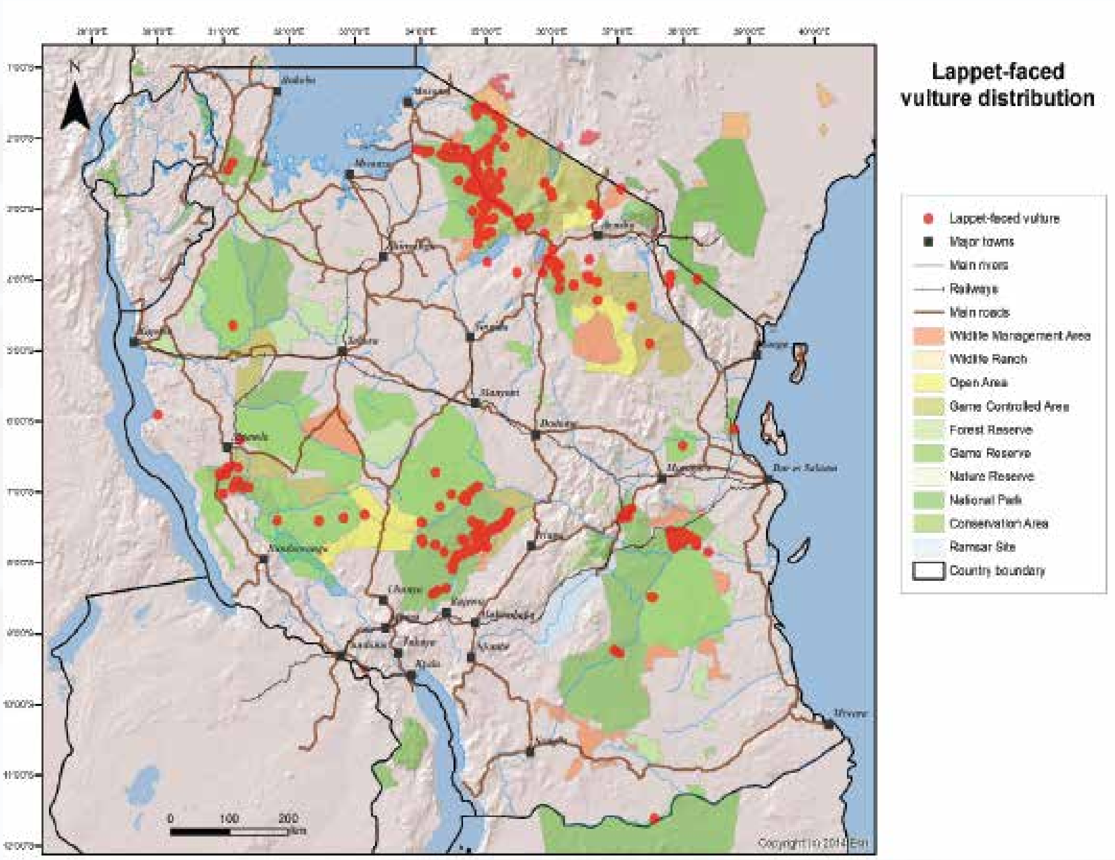

Figure 10: Lappet-faced vulture distribution from 671 georeferenced TBA sightings over the past 40 years

Source: TBA

1.1.6. Egyptian vulture *Neophron percnopterus*

Global Status: Endangered (EN)

Description

A small vulture, similar to the Hooded vulture, weighing 2.0 kg with a 1.7 m wingspan. As an adult, it is a striking bird with a white body and wings apart from black flight feathers. The white neck feathers are long and form a hackle, with a small bright yellow head and a narrow curved black beak. It has a distinct diamond-shaped tail (Figure 11).

Figure 11: Adult Egyptian vulture.

Distribution

The Egyptian vulture is a Palearctic, Afrotropical and western Indo-Himalayan species: a breeding (summer) migrant across the northern part of the range but with resident populations and non-breeding visitors further south. The African range is huge, concentrated along a broad band of the Sahel from Sudan (Nikolaus, 1984) and Ethiopia (Mundy *et al*., 1992), Somalia, Eritrea and Djibouti west to Senegal (Rondeau and Thiollay, 2004; Petersen *et al*., 2007; Wacher *et al*., 2013), south to Kenya and northern Tanzania (from Serengeti and Lake Eyasi to Kondoa, Arusha National Park and Moshi; Figure 12). Tanzania is at the southern limits of the migrant population in Africa and declines have led to few sightings in Tanzania in recent years and it is currently considered regionally extinct as a breeding species in South Africa (Taylor *et al*., 2015) and Namibia (Simmons *et al*., 2015). The Egyptian vulture's stronghold is in Europe, particularly Spain and Turkey (>2,000 pairs).

Habitat, Ecology and Breeding

It is resident in small numbers in open country with rocky crags, mainly in arid and semi-arid plateau country below 2,000 m, exceptionally as high as 3,000 m. There are reports of high mortality from electrical distribution systems and sub-stations in migration flyways. It usually occurs singly or in pairs, less commonly in small groups, and rarely in large groups of more than 100. It soars low in search of food and has a broad scavenging diet, including carrion (wild herbivores and domestic livestock), tortoises, organic waste, insects, young vertebrates, eggs and faeces (Margalida *et al*., 2012; Dobrev *et al*., 2015, 2016). It is known for its unusual behaviour of dropping rocks or stones to break eggs, including Ostrich eggs (Mundy *et al.,* 1992). It roosts on cliff faces or in dead trees and is rarely found far from nesting cliffs. It is less wary and more tolerant of humans than other vultures.

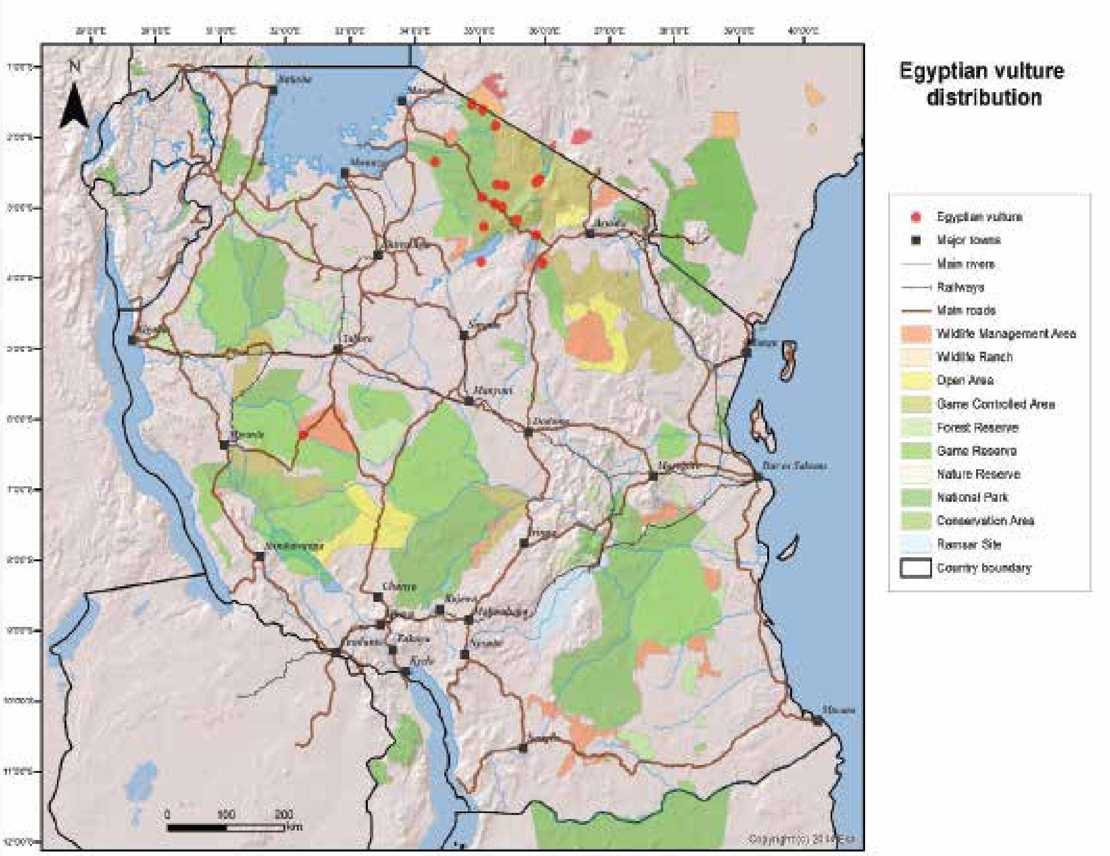

Figure 12: Egyptian vulture distribution from 12 georeferenced TBA sightings over the past 40 years.

Source: TBA

1.1.7. Bearded vulture *Gypaetus barbatus*

Global Status: Near Threatened (NT)

Description

An unusual looking vulture weighing 5.7 kg with a 2.6 m wingspan. It is more falcon-like with long narrow wings and tail. It has a fully feathered pale head and pale body with grey-black wings and tail. The eye is yellow with a broad red eye-ring and black feathers surround the eye and continue down the nostrils and cere and are also found on the lower jaw in a tuft or like a "beard". The birds are often coloured orange or rust on their head, breast, and leg feathers, which comes from dust-bathing, rubbing mud on their body, or drinking mineral-rich (i.e. ferrous) waters (Figure 13).

Figure 13: Bearded vulture

Distribution

In Africa, Bearded vultures occur in Ethiopia, Kenya and Tanzania (East Africa), Lesotho and South Africa (Southern Africa), and Morocco (North Africa). Following widespread declines in Europe during the last century, the Bearded vulture, which was found from the Pyrenees to West China, now has recovering populations in the Alps and Andalusia due to captive breeding programs and successful reintroduction campaigns. In northern Tanzania, there is a non-viable, declining population of about 10 breeding pairs, with viable populations still found in Ethiopia and South Africa. The species now is known to be restricted to Mt Kilimanjaro though previously recorded in other mountain ranges, such as at Mt Meru, Mt Kilimanjaro, the Crater Highlands, the Gol Mts, Longido and Mt Hanang (Figure 14).

Habitat, Ecology and Breeding

The species occupies remote mountainous areas with precipitous terrain, usually above 1,000 m, with vegetation being the distribution limiting factor (Hiraldo *et al*., 1979). In Africa, it is also restricted to higher altitudes, such as the Ethiopian highlands and the Ukuhlamba-Drakensberg, but in southern Africa, it is almost entirely dependent on livestock carcasses due to the near complete absence of wild ungulates over much of its range. As a scavenger, Bearded vultures consume prey remains left by predators or other scavengers – 70% of their diet comprises bones (Hiraldo *et al*., 1979). Bones too big to be swallowed whole are dropped onto a rocky surface from 20–70 m height, with the birds collecting the fragments and the marrow (Boudoint, 1976). This is also a cliff-nesting species, making large nests (averaging 1 m in diameter) composed of branches and wool on remote overhanging cliff ledges or in caves that are re-used over the years.

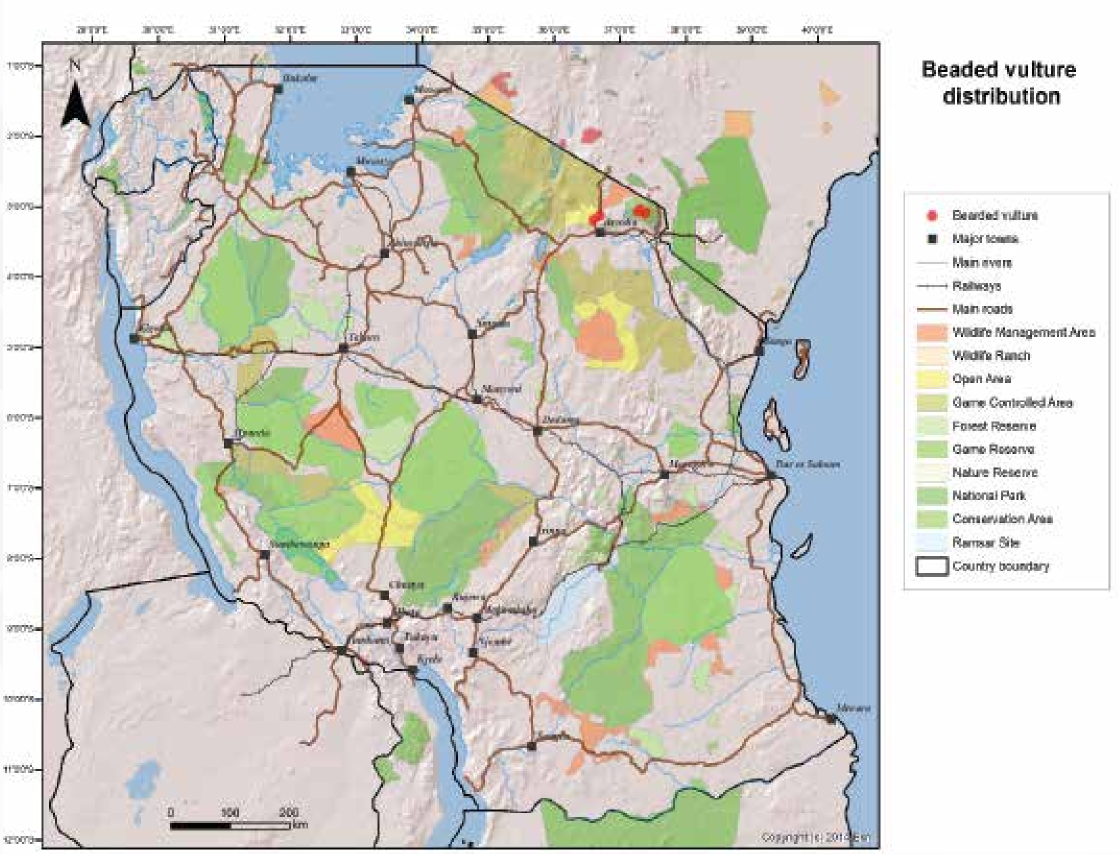

Figure 14: Bearded vulture distribution from 8 georeferenced TBA sightings over the past 40 years.

Source: TBA

1.1.8. Palm-nut vulture *Gypohierax angolensis*

Global Status: Least Concerned (LC)

This is the only species in Tanzania whose population is considered stable, with no reported threats (Figure 15).

Description

A small monotypic vulture, weighing 1.5 kg with a 1.5 m wingspan, also described as the vulturine fish-eagle. A distinct black and white bird, it has a white body and head, and black and white wings. The primary feathers are white with black tips, whilst the secondaries are black. The tail is black with white tips. It has a yellow eye with a bare red patch of skin around it and a pale-yellow hooked beak (Figure 15).

Figure 15: Adult Palm-nut vulture.

Distribution

It is an Afrotropical species, distributed throughout west and central Africa and as far south as north-east South Africa from altitudes ranging from sea level up to 1,800 m (Ferguson-Lees and Christie, 2001). It is restricted to coastal environments and riverine habitats and lakes in drier areas of East and southern Africa. In the northern and central latitudes of its range, it is common to abundant but becomes rarer in the south and east. In Tanzania, it is widespread where habitat is suitable, but high densities occur in the west in and around villages that cultivate oil palms (Figure 16).

Habitat, Ecology and Breeding

The species is sedentary, with adults not moving more than a few kilometres, whilst juveniles and immatures will wander vast distances; up to 400 km into the Sahel region and as far as 1,300 km further south than the most southerly breeding location (Ferguson-Lees and Christie, 2001). As the name would suggest, palm-nut vultures eat the fruits of oil and raffia palms as well as the fruits and grains of other plants, which collectively form up to 65% of their diet. It will also predate amphibians, fish and invertebrates, as well as larger prey such as small mammals, birds, and reptiles, and it will scavenge on small carcasses (Ferguson-Lees and Christie, 2001; del Hoyo *et al*., 1994). Nesting occurs in large stick nests 60-90 cm in diameter located in tall trees.

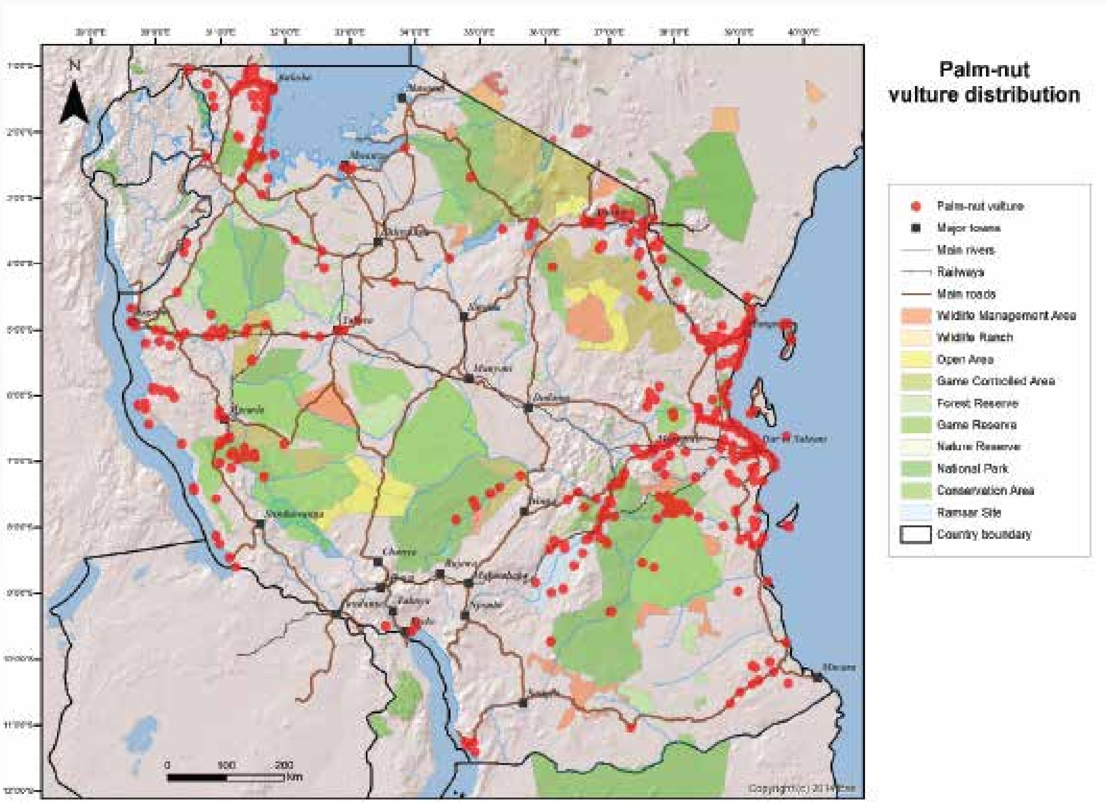

Figure 16: Palm-nut vulture distribution from 1904 georeferenced TBA sightings over the past 40 years.
Source: TBA

CHAPTER TWO: RANGING AND POPULATION STATUS

2.1. Ranging

Systematic research and monitoring of vultures in Tanzania spans the last decade. Telemetry studies, which started in the Ruaha-Katavi landscape in 2015, Selous Game Reserve (GR) (part of which is now Nyerere National Park) in 2018 and Serengeti National Park (NP) in 2021, provide a wealth of information to understand the vulture population ranging and connectivity within and outside the country. The Critically Endangered African White-backed vulture (AWBV) was the target species for telemetry studies, as it is a wide-ranging, social feeder, and more sensitive to the threat of poisoning. Solar-powered satellite tags were used to ensure daily GPS information downloads to enable real-time bird monitoring – most of Tanzania is too remote to rely on GSM tags. A total of 62 vultures were tagged in southern Tanzania, including 58 AWBV, two White-headed vultures (WHV) and two Hooded vultures (HV). Forty-one vultures were tagged in the Ruaha-Katavi landscape across five different protected areas, with the majority in Ruaha National Park (NP) (n=21), six in Rukwa Game Reserve (GR), five in Katavi NP, and nine in Lukwati-Piti GR. Twenty-one AWBV have been tagged in Nyerere NP/Selous (Kendall *et al*., 2023).

From these data, it is known there are three distinct AWBV populations in Tanzania, with two populations occasionally overlapping in the Serengeti ecosystem (Figure 17). Populations generally show remarkable fidelity to protected area boundaries and highlight connectivity between key areas (Figure 17). This large database of movement data provided critical information for developing the recently launched Tanzania Wildlife Corridor Assessment, Prioritization, and Action Plan (Ministry of Natural Resources and Tourism (MNRT), 2022), validating corridor areas that it was uncertain if still active. Thus, vulture movement provides unique insight into the presence and quality of the habitat in the corridors, as well as identifying potential areas of connectivity. Furthermore, the two southern AWBV populations rarely leave the country boundaries, with a few instances of the birds travelling no further than 200 km outside of the country boundary. There is one notable exception, where an AWBV juvenile dispersed a remarkable 2,000 km via 8 countries to South Africa (Figure 18). The three main AWBV populations are:

i. **Ruaha-Katavi population** (red in Figure 17): vultures generally stay within this vast 100,000 km^2 protected area network, with some occasional movement north via Moyowosi-Kigosi to Burigi-Chato NPs. One bird went as far north as Lake Mburo NP in Uganda for one month. No birds, with the exception of the dispersing juvenile, have moved south out of the Ruaha-Katavi landscape. Birds have never travelled east to the greater Selous ecosystem, as the Eastern Arc Mountain range acts as a geographical barrier for east-west movement (Peters *et al*., 2022). Movement patterns from birds tagged at different locations within Ruaha-Katavi are suggestive of a subpopulation structure.

ii. **Selous/Nyerere population** (blue in Figure 17): Tagged birds regularly fly to northern Tanzania throughout the year, although movement is more frequent during the wet season via the two corridor routes connecting Nyerere and Mikumi to the important Wami Mbiki Game Reserve and then north via the Wami Mbiki-Handeni corridor to forage in the Tarangire ecosystem. Occasionally, the tagged vultures move into Niassa, Mozambique and Tsavo, Kenya and in 2020, some AWBVs spent one month in Serengeti (Figure 17). AWBV tagged in Niassa by Endangered Wildlife Trust, regularly use the Selous-Nyerere ecosystem and have travelled north to Tarangire

iii. **Serengeti-Mara population** (yellow in Figure 17): Movement data suggest that the Serengeti-Mara population is largely distinct from the other two Tanzanian populations of AWBV. This is corroborated by data from 12 AWBV vultures tagged in the Masai Mara between 2009-2011 (Kendall *et al*., 2014). Whilst Mara-tagged birds used the Serengeti-Mara ecosystem, they also ranged further north into Kenya. It is likely that some vultures may form a resident population in the Serengeti ecosystem, as suggested by the preliminary results from a 2021 TAWIRI study tracking seven tagged AWBV (Mmassy, unpublished data). A transboundary population has implications and necessitates coordinated efforts towards vulture conservation, particularly in Kenya. Movement of the Mara tagged vultures showed significant seasonality with dry season feeding closely linked to the wildebeest migration, with high aggregations of vultures in northern Serengeti-Mara, but with wider-ranging movement beyond the migratory wildebeest herds during the wet season – this movement pattern was similar for three tagged species - 15 Rüppell's vultures, 12 Lappet-faced vultures and 12 AWBV (Kendall *et al*., 2014) (Figure 19).

With three main populations of AWBV vultures in Tanzania, this has implications for conservation and monitoring in each of the main ecosystems and understanding threats and needed interventions, which may vary depending on the location and particular population. While the population structure for other species is not as well known, it is likely that other vulture species (particularly

LFV, WHV, and HV) will mirror that of AWBV, given the effects of similar natural barriers. Beyond the three distinct subpopulations seen for AWBV, these species may have a further subdivision of populations, given that they tend to have smaller home ranges. RV are known to range even more widely than AWBV and are more rarely seen in the two southern population areas (i.e. Ruaha-Katavi and Selous-Nyerere landscapes). It might be expected that they have a single population across Tanzania and ranging into neighbouring counties.

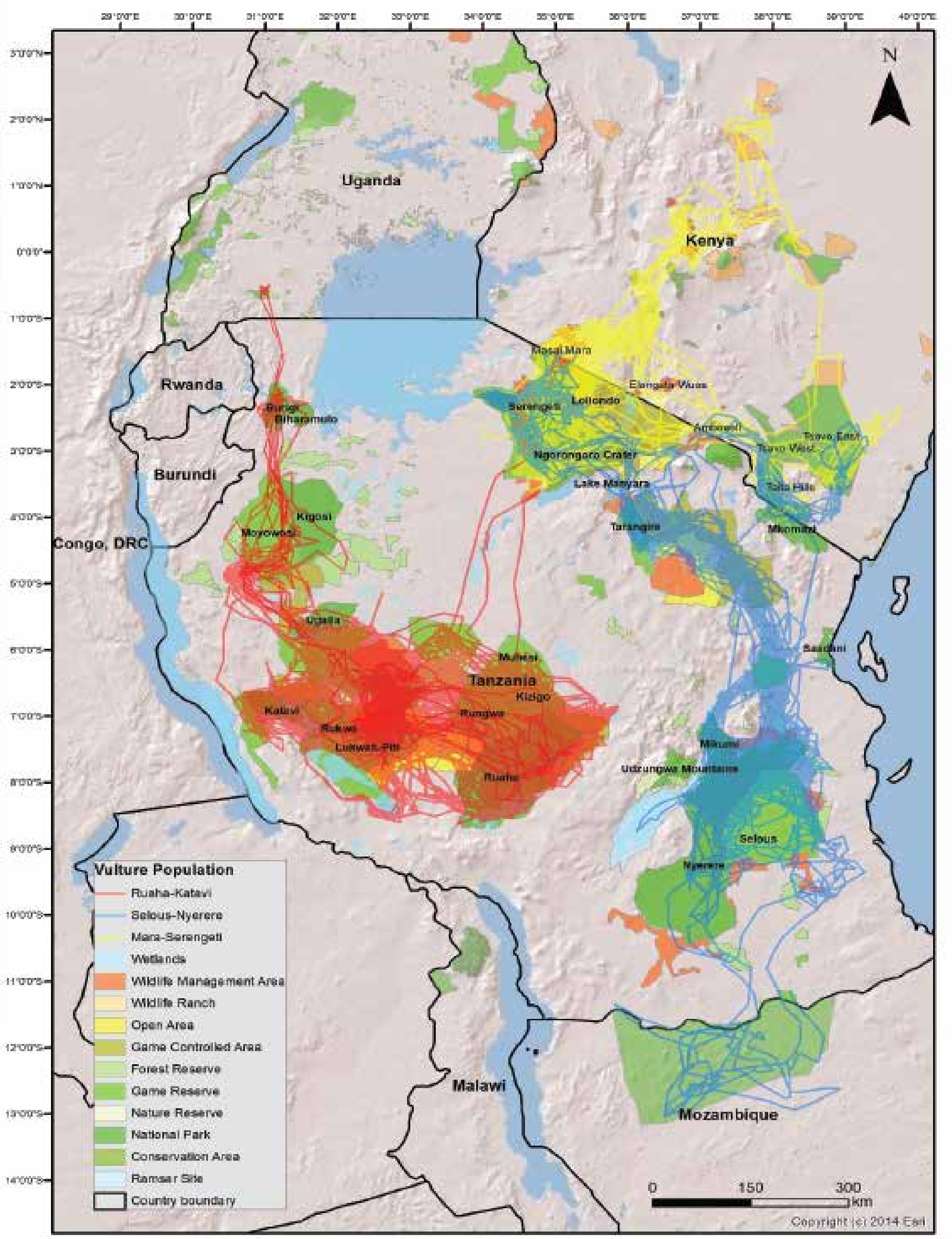

Figure 17: Movement patterns show 3 main African White-backed vulture populations - the Ruaha-Katavi (red; 37 tagged vultures), Selous-Nyerere (blue; 21 tagged vultures) and Mara-Serengeti (yellow; 12 tagged vultures).

Source: Kendall *et al.*, 2014; Kendall *et al.*, 2023

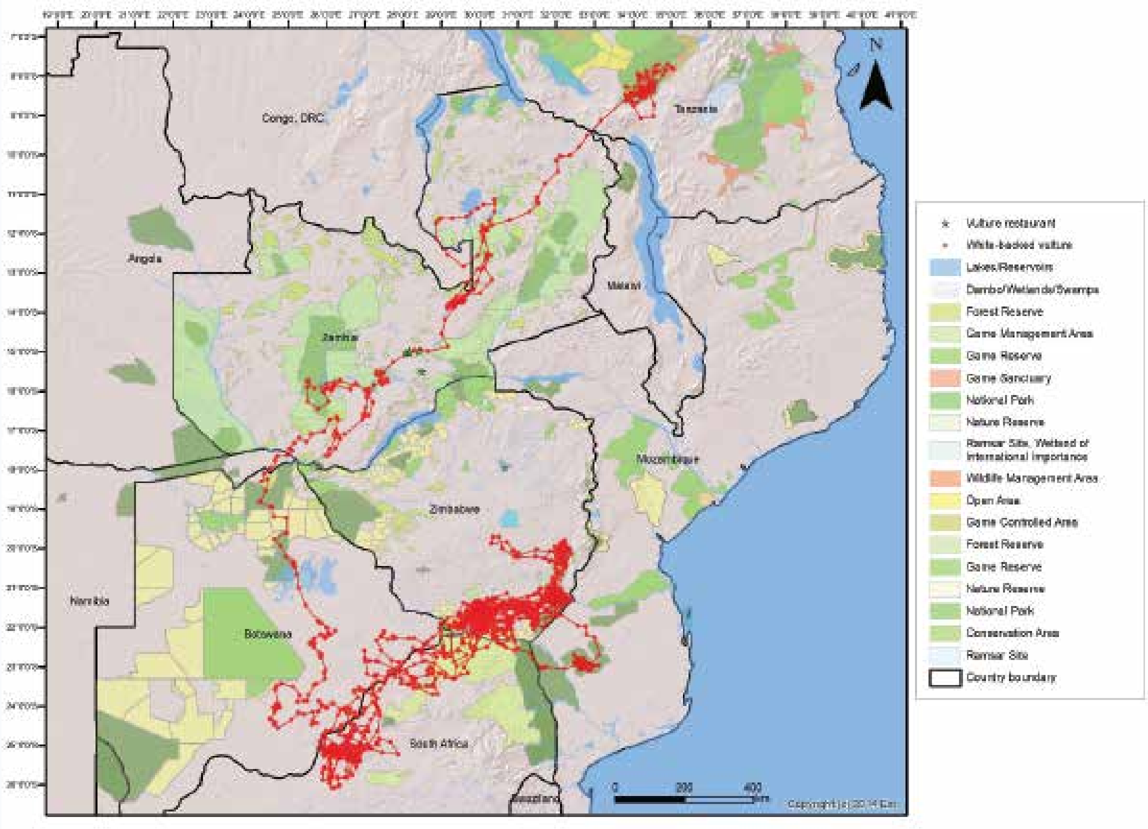

Figure 18: Juvenile African White-backed vulture's remarkable dispersal from Tanzania to South Africa.

Source: NC Zoo and WCS

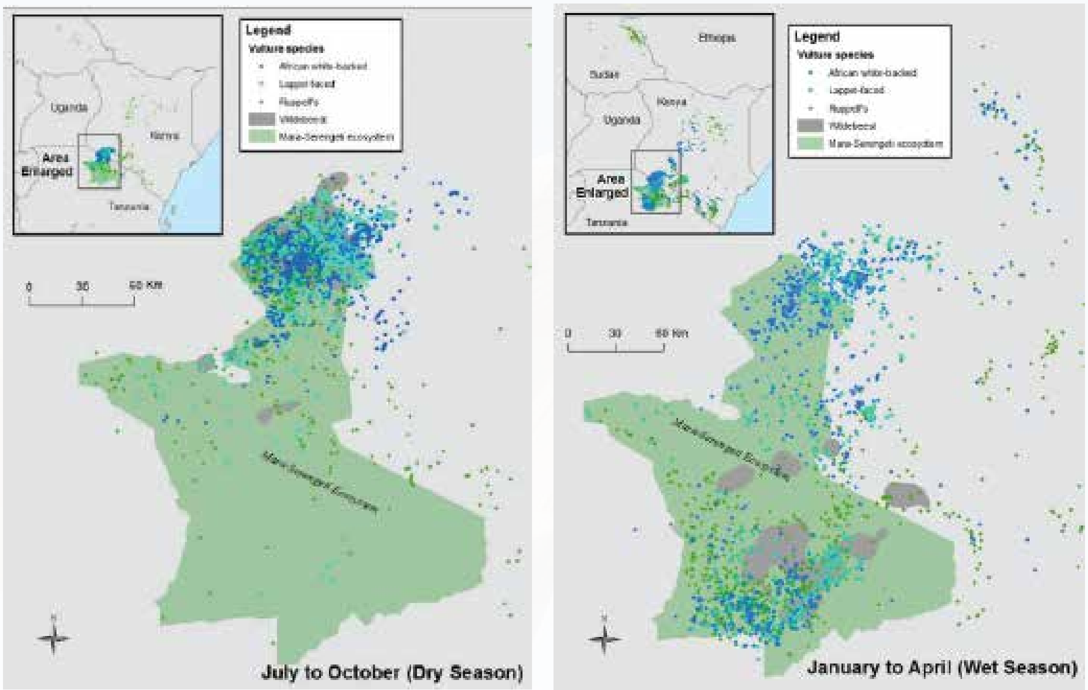

Figure 19: Movement patterns for 39 vultures tagged in the Masai Mara showing a transboundary population spanning the Serengeti-Mara ecosystem, with seasonal movement patterns linked to prey mortality rather than wildebeest migration

Source: Kendall *et al*., 2014

Ranging distances of the 62 tagged vultures in southern Tanzania are shown in Table 1. On average, AWBVs travel greater distances than other vulture species. There was a difference in the average monthly distance travelled by the Ruaha-Katavi (2,640 km) and Selous-Nyerere (1,822 km) AWBV populations. The longest monthly distance travelled by an AWBV was a remarkable 6,038 km. On average, the tagged Hooded vultures travelled 2,000 km per month – both were subadult non-breeding individuals.

Very little is known about White-headed vultures (WHV), as only a handful have been fitted with tags. The two WHV tagged in southern Tanzania were a non-breeding subadult female and an adult male. As this species is territorial (Hustler and Howells, 1988; Murn and Holloway, 2014; Mundy *et al*., 1992), the monthly average distance varied significantly between these individuals, with a monthly average of 2,204 km for the non-breeding female and 1,425 km for the breeding male. This was also seen in the home range size, with a much smaller range for the breeding male of approximately 2,500 km^2 with a core range of 200 km^2, centered on his regular nest sites. Pennycuik's data from the Serengeti defined territory size as 400 km^2 in East African savanna (Pennycuick, 1976). The subadult female's range was around 8 times as big at around 20,000 km^2 (Figure 20). WHV are sensitive to human disturbance and are most likely to have territories in core protected areas, which suggests they might be less exposed and at risk from poisoning incidents. In general, large-ranging distances of most vulture species make them vulnerable to poisoning incidents across the landscape.

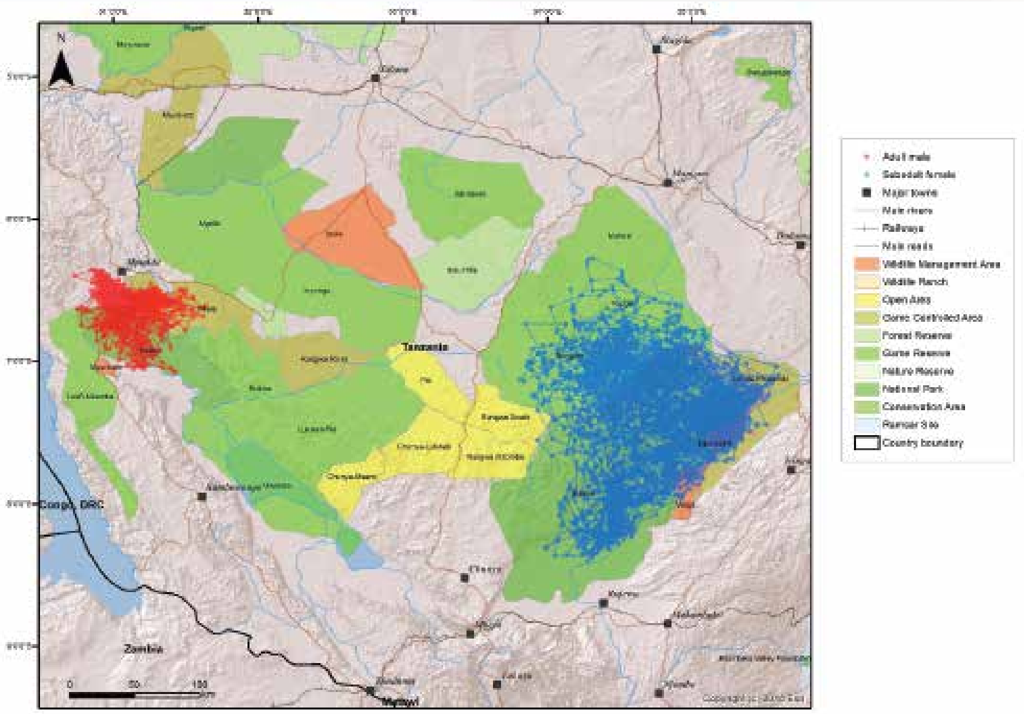

Figure 20: Ranges of two White-headed vultures: red is an adult male with a territory and blue is a subadult female who has not started breeding and has no territory.

Source: NC Zoo and WCS

Table 1: Summary of ranging distances from 62 tagged vultures across Ruaha-Katavi and Selous-Nyerere from October 2015-March 2023

Landscape	# birds	Daily distance (km)		Weekly distance (km)		Monthly distance (km)	
		Average	Range (min-max)	Average	Range (min-max)	Average	Range (min-max)
Ruaha-Katavi							
African White-backed vulture	37	**89**	11-201	**618**	77-1,409	**2,640**	340-6,038
Hooded vulture	2	**67**	12-109	**474**	91-760	**2,055**	364-3,256
White-headed vulture	2	**58**	27-102	**406**	190-703	**1,643**	761-3,056
Selous							
African White-backed vulture	21	**66**	7-146	**460**	46-1,020	**1,822**	201-4,515

A continent-wide study of three *Gyps* vulture species (AWBV, RV and the Cape vulture, the latter not occurring in East Africa) obtained data for 163 tagged vultures from 16 study sites, including from 33 AWBV vultures tagged in Tanzania (Kane *et al*., 2022). In East Africa, adult AWBVs had a mean home range (HR) of 23,649 km^2 (n=46) whilst immatures had a HR of 31,540 km^2 (n=13). Rüppell's vultures HR were 3.0-5.5 times the size of an AWBV with 75,441 km^2 for adults (n=15) and 172,450 km^2 (n=4). Across East Africa, home range overlap with protected areas was 69% and 71% for adult and immature AWBV respectively, and 58% and 52% for adult and immature RV respectively. More specifically in Tanzania, for AWBV, nearly 80% of the home range overlapped with protected areas, which should be beneficial for vulture conservation as there are already resources allocated to protect these areas from human illegal activities. However, the large range sizes also have significant implications for conservation efforts in terms of the need for large-scale, transboundary and collaborative efforts. It brings into question the feasibility of using Vulture Safe Zones (VSZ; Mukherjee *et al*., 2014) as a conservation tool for Africa suggested by the IUCN Multi-Species Action Plan for African-Eurasian Vultures (Botha *et al*., 2017).

2.2. Population Status

There have been very few systematic long-term studies on vultures in Tanzania, and generally, there are no historical baseline data. The first systematic research was started in 2013 by researchers, using roadside counts to monitor vultures in three national parks in southern Tanzania (Table 2). This work indicates that Tanzania is a stronghold for vultures compared to other East African countries (Table 2). Southern Tanzania is particularly important for African

White-backed, White-headed, and Hooded vultures, and the northern part is important for Lappet-faced and Rüppell's vultures (Table 2). The Mara is part of the Serengeti ecosystem and thus, data here represent northern Tanzania's vulture populations.

Table 2: Comparison of average encounter rates (number of birds per 100 km) by year/period for scavenging raptors from Tanzania with recent counts for protected areas (PAs) in Kenya and Uganda.

	Tanzania[1]			Kenya[2]	Uganda[3]
	Ruaha	Katavi	Nyerere	Mara	Several PAs
African White-backed Vulture	26.6	**52.0**	**42.9**	26.6	9.1
White-headed Vulture	1.4	**2.6**	1.9	3.0	0.5
Lappet-faced Vulture	4.9	2.4	3.3	**11.9**	0.9
Hooded Vulture	3.7	2.9	**4.1**	**5.0**	0.5
Rüppell's Vulture	0.0	0.0	0.0	**6.0**	0.0

[1] Kendall *et al*. (2023), showing an average ER from current data from 2019-2021, not the full dataset, as declines have occurred since 2018); [2]Virani *et al*. (2011); [3] Shaw *et al*. (2019).

2.2.1. Population status in Northern Tanzania

Whilst there have been no systematic surveys of vultures in northern Tanzania, riparian aerial surveys have been conducted along the Grumeti River in Ikorongo and Grumeti Game Reserves and Ikona Wildlife Management Area, including counts of active vulture nests (Goodman, 2013, 2014; Goodman and Mbise, 2016, 2019, 2021). Nest encounter rates have declined by 56% from 0.99 nests/km in 2013 to 0.43 nests/km in 2021 (Figure 21). This is extremely high given the 52% decline in the abundance of AWBV in the Mara over 30 years.

As a more extensive follow-up on the declines in nest numbers, ground surveys were conducted from 2021-2023 (Laizer *et al*. in press). Multiple checks of the same nests were conducted across each breeding season to monitor breeding success (Figure 22). The number of nests continued to decline, but more worrying was the low overall breeding success of 29.4% (number of eggs versus successfully fledged chicks; Laizer *et al*. inpress). There was a 28% reduction in riparian tree cover in the survey area between 2012 and 2020, and this might explain fewer active nests if preferred tall riverine trees were not available to AWBV. However, the low breeding success is harder to explain and needs further investigation. In general, AWBV breeding success is around 60% (Kemp and Kemp 1975, Mundy *et al*., 1992), although Houston recorded successes in the Serengeti as high as 80-90% (Houston, 1971). In Kenya, the Mara Raptor Project recorded greater breeding success in 2022 than Grumeti, at 48% for AWBV, 47% for LFV and 67% WHV (Hatfield, pers. comms.). Nest declines have been recorded elsewhere at AWBV breeding sites e.g., 26% decline in nesting numbers across 13 years in South Africa (Murn *et al*., 2017) and a 53% decline in Botswana over a decade (Leepile *et al*., 2020). This seems to suggest more broad spread vulture population decline, with poisoning as the most likely explanation.

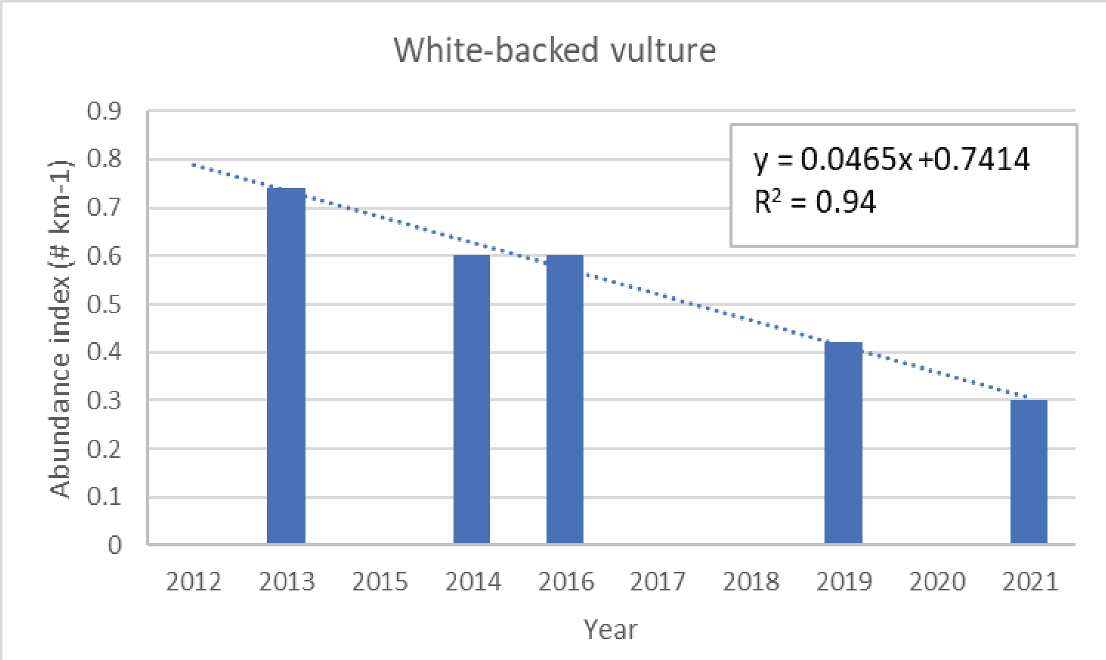

Figure 21: Declines of nesting White-backed vultures along the Grumeti River in the Serengeti ecosystem, northern Tanzania.

Source: Goodman, 2013, 2014; Goodman and Mbise, 2016, 2019, 2021

Figure 22: Nest monitoring at Grumeti: left, an AWBV egg in nest and right, a large AWBV chick.

In northern Tanzania in the Gol Mountains, there is likely a critical breeding area for the cliff-nesting Rüppell's vulture (RV), for which very little recent information exists. The only surveys were done in 1969–1970 (Houston, 1976) and 1973 (Pennycuick, 1983). Houston suggested there were 1,000 RV pairs (Houston, 1976), whilst Pennycuik suggested there were around 3,000 pairs, with the stronghold area having 2,000 pairs in the Gol group, around 1,000 pairs in the Msonoik group (to the east near Lake Natron) and another 65 from minor colonies (Pennycuik, 1983) (Table 3 and Figure 23). Therefore, it seems likely that the most important breeding site in East Africa for Rüppell's vultures could be in northern Tanzania. Resurveying this is a priority**.** Some of the cliff sites are located in the Ngorongoro Crater Conservation Area (Table 3 and Figure 23), but 54% of nest sites which were in the former Loliondo Game Controlled Area, including the impressive Grzimek's Gorge, is now unprotected land (Figure 24). The Kwenia Vulture Sanctuary model, partnering with local pastoralist groups for protection, monitoring and tourism would be worth consideration once survey results provide indications of current breeding pairs in northern Tanzania.

Table 3: Gol Mountain nest locations and counts by Pennycuik in 1973

	Location name	Latitude	Longitude	# of sites	Current Protected area status
Gol Group					
1	Olkarien & Olkarien S	2° 44' S	35° 32' E	204	Transition zone, Ngorogoro
2	Ngorika & Ngorika S	2° 41' S	35° 32' E	177	Transition zone, Ngorogoro
3	Losinoni	2° 40' S	35° 32' E	143	Unprotected land
4	Grzimek's Gorge	2° 37' S	35° 30' E	1125	Unprotected land
5	North Point	2° 31' S	35° 33' E	312	Unprotected land
6	Sonjo	2° 17' S	35° 37' E	27	Unprotected land
	Total Gol Group			**1,988**	
Mosonik Group					
7a	Mosonik West			721	Lake Natron GCA
7b	Mosonik Middle	2° 38' S	35° 52' E	72	Lake Natron GCA
7c	Mosonik East			142	Lake Natron GCA
	Total Mosnik group			**935**	
Minor Colonies					
8	Mto wa Mbu	3° 15' S	35° 53' E	45	Settlement and development zone, Ngorongoro CCA
9	Eyasi	3° 30' S	35° 03' E	20	Settlement and development zone, Ngorongoro CCA
Total Minor colonies				**65**	
Grand total nest sites				**2,988**	

Figure 23: Cliff nesting locations in Ngorongoro Crater Conservation Area, Lake Natron GCA and the former Loliondo GCA (part of which is now Pololeti Game Reserve).

Figure 24: Grzimek's Gorge, the main Rüppell's vulture breeding colony in the Gol Mountains in northern Tanzania. The whitewash shows how well and extensively this cliff is used. This location is within unprotected land (formerly part of Loliondo GCA).

2.2.2. Population status in Southern Tanzania

As with many species, vulture population trends have mostly been measured over long time periods (greater than 20 years), however in Tanzania, there is no historical baseline data. In 2012, at the Pan-African Ornithological Conference held in Arusha, southern Tanzania was recognized as a knowledge gap which was almost certainly significant for vultures. Line and roadside transect continue to be commonly used tools for vulture population monitoring, and systematic roadside counts in southern Tanzania started in 2013 and function as the baseline. Systematic roadside counts were conducted in 2013 in Ruaha and Katavi NPs and in 2018 in Nyerere NP (Kendall *et al*., 2023). Generally, the National Parks have higher wildlife densities and thus were chosen as presumed areas of importance for vulture foraging and monitoring within the landscape. Declines seen in protected areas are more likely to indicate overall population trends and predict future trends as protected areas retain wildlife and their accompanying scavengers longer term (Kendall *et al*., 2023).

2.3. Population Trends

Analysis of population trends over the short term (<10 years) can be useful to adapt conservation interventions, and any trajectories are likely to reflect a longer pattern of population change. Population trends were calculated using two methods: survival estimates from telemetry data of 62 tagged vultures (mostly AWBV) over 6 years (2015 to 2021) and transect counts conducted over 8 years (2013 to 2021) for seven scavenging raptors (five vulture species and two eagles that are often associated with carcasses) in the three protected areas (Ruaha, Katavi and Nyerere) (Kendall *et al*., 2023). Population declines were found in Ruaha and Nyerere from transects, but populations appeared stable in Katavi NP (Table 4). For AWBV, rates of decline ranged from 3.7% in Katavi to 17.9% in Ruaha to 26.5% for Nyerere NP (Figure 25). In particular, AWBV and WHV had a high probability of decline in Ruaha NP and AWBV, LFV and Bateleurs had a high probability of decline in Nyerere NP, but all were much less likely to decline in Katavi NP (Kendall *et al*., 2023). However, several mortalities of tagged vultures linked to confirmed poisoning events or other illegal human activities since 2021 suggest this may no longer be the case.

Table 4: Encounter rates (number of individuals per species per 100 km) for three monitoring locations in southern Tanzania during two time periods 2013-2018 (pre-decline) and 2019-2021 (post-decline).

Species	**Ruaha**		**Katavi**		**Nyerere**	
	2013-2018	2019-2021	2013-2018	2019-2021	2018	2019-2021
White-backed Vulture	46.20	26.60	74.17	52.03	83.60	42.86
Bateleur	18.88	21.77	15.18	15.83	26.75	12.74
Tawny Eagle	5.12	3.77	2.23	1.23	1.35	0.16
White-headed Vulture	3.12	1.40	2.90	2.60	1.30	1.88
Hooded Vulture	5.62	3.70	5.97	2.93	4.40	4.12
Lappet-faced Vulture	3.68	4.90	4.19	2.38	6.35	3.32

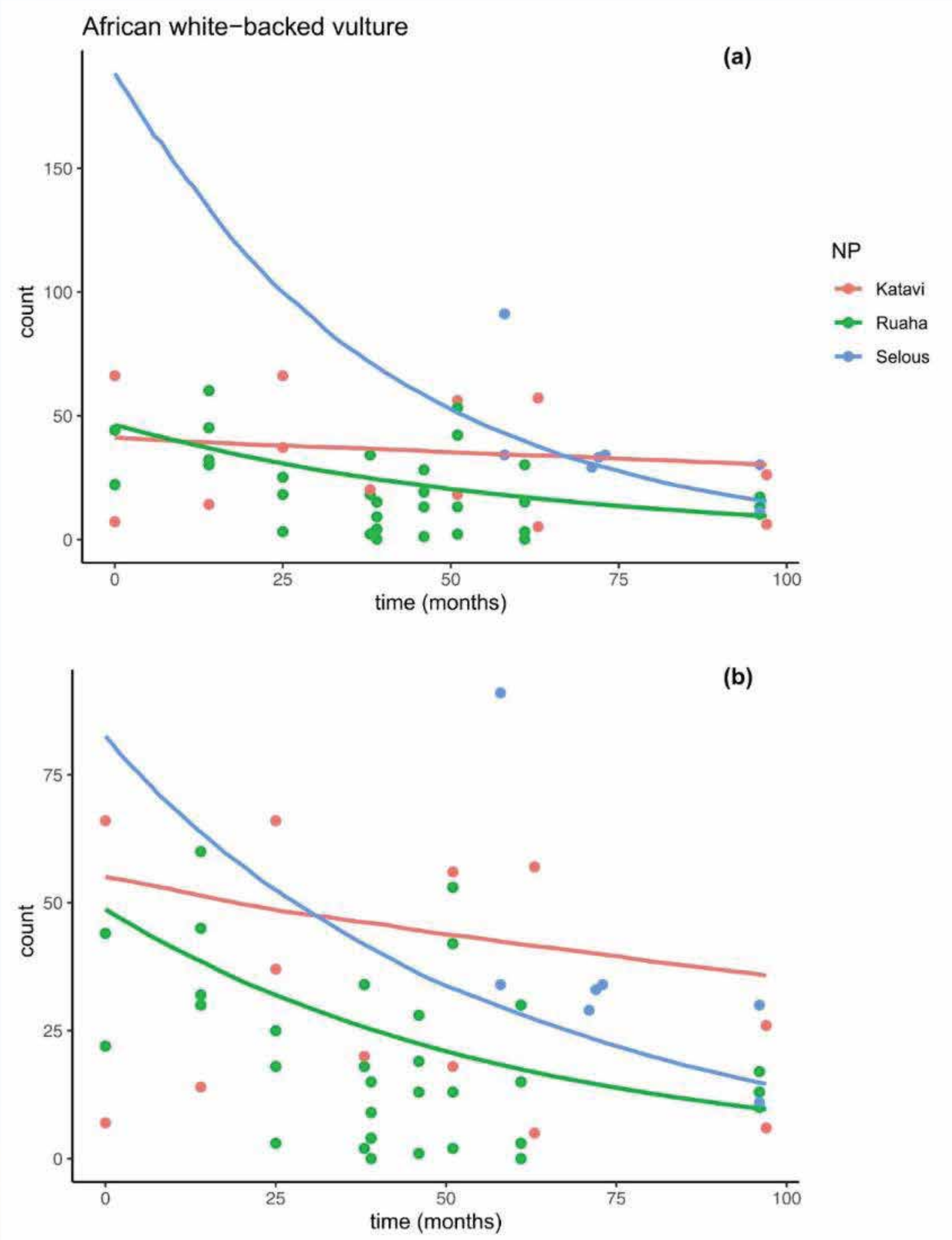

Figure 25: Conditional effects plot of regression model for counts of African White-backed vultures across time in the three national parks. (A) shows plot with default priors, (B) shows plot with informative priors (N~0,0.8) on the intercept terms. Month 0 represents the beginning of data collection in August 2013.

Source: Kendall *et al*., 2023

2.3.1. Survival analysis

For tagged birds, median survival was 951–1,702 days (Figure 26). Annual survival rate for each national park across two years after tagging was 89.4% for Ruaha NP, 61.6–83.7% for Katavi NP, and 80–85.4% for Nyerere NP (Kendall *et al*., 2023). These estimates were used in population models to extrapolate trends. Katavi had the lowest estimate of population growth (0.69–0.92), followed by Nyerere (0.89–0.94) and Ruaha the highest (0.98), though all were less than 1, suggesting a decline at the stable age distribution (Kendall *et al*., 2023). Detected annual mortality rates in southern Tanzania is 23-28%, similar to what has been found in the Mara-Serengeti ecosystem (~25%), an area that has suffered high poisoning rates (Kendall and Virani, 2012). Higher than expected mortality increased from 2018, which corroborates the declining trends found based on the transect data. Based on the VSZ analysis, annual survival needs to be 90% or greater to indicate a 'safe' area with a stable or growing vulture population. This level of annual mortality of tagged vultures in southern Tanzania requires attention. In sites with less human influence, survival for vultures tends to be considerably higher. Monadjem *et al*., (2013) found the annual survival of adult African White-backed vultures to be 99.9% in South Africa after the second year based on mark-recapture studies with wing tags. Other studies suggest similar high survival rates for adult *Gyps* vultures: 96.8% for vultures in less anthropized regions (Arrondo *et al*., 2020) and 91.3% (± 6.3%) for Cape vultures (Monadjem *et al*., 2014). Extinction in southern Tanzania is likely in the next 20-30 years with the high levels of annual mortality. With increasing migration of (agro-) pastoralists to the buffer zones of key protected areas, problems of coexistence will continue, with vultures as collateral damage.

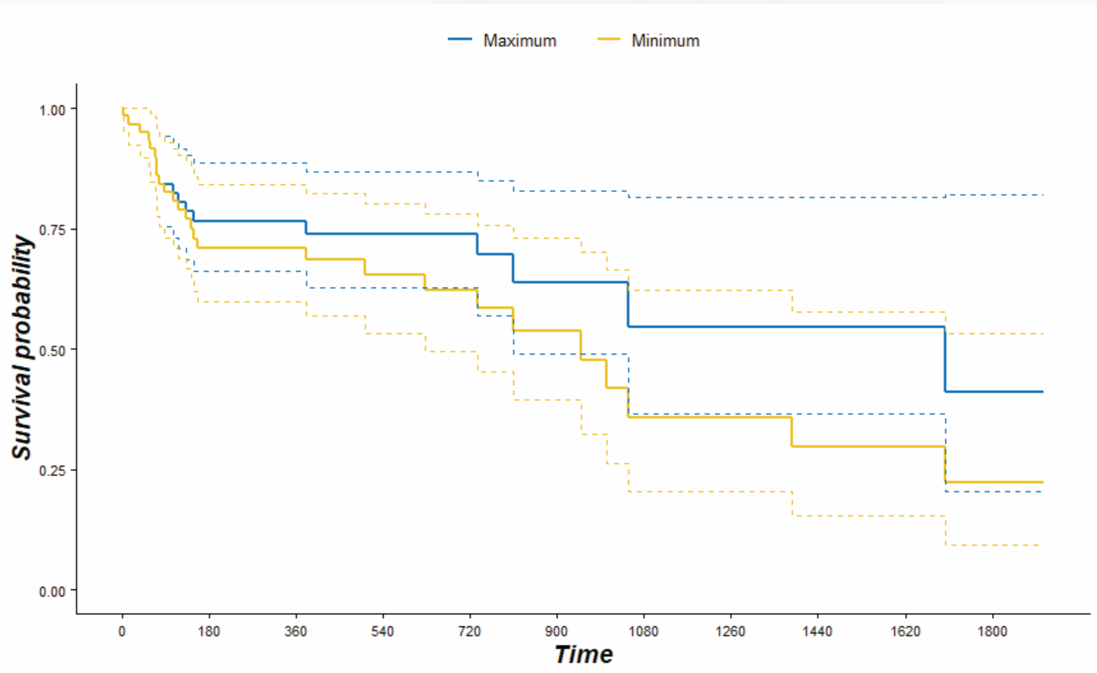

Figure 26: Kaplan-Meier survival curve for African White-backed vultures for time since tagged, reflecting maximum and minimum estimates. Dashed lines represent CI at upper and lower 95%.

Source: Kendall *et al*., 2023

CHAPTER THREE: THREATS TO VULTURES

3.1. Threats at Global and Regional Scales

A recent global review highlighted that the greatest threats to vultures are from toxins (53% of vultures), particularly from pesticides (such as organophosphates and carbamates; 48% of vultures), and trauma (41% vultures) from collisions with infrastructure, such as powerlines and associated electrocution, as well as from windfarms (23%) (Ives *et al*., 2022). Other threats, from disease and starvation accounted for 8% of vulture morbidity and mortality. In Africa, poisoning was similarly the main threat (61%), but illegal trade in vulture parts for traditional medicine (29%) is a particular problem on this continent (Ogada *et al*., 2016).

In East Africa, vulture declines have been severe (Ogada and Keesing, 2010; Virani *et al*., 2011; Ogada *et al*., 2022), with poisoning having the greatest impact rather than trauma (Kendall and Virani, 2012). Carbofuran (pesticide) is widely used to poison carrion, and efforts to ensuring that unauthorized pesticides are neither available in the local market nor used in Tanzania are ongoing. Studies have shown that few poisoned carcasses are needed to result in precipitous declines. In Asia, < 1% of consumed carcasses being contaminated resulted in the death of 99% of the three *Gyps* vulture species, resulting in annual mortality of between 22-50% (Green *et al*., 2004), whilst Murn and Botha (2018) estimated that vulture extinction in South Africa could occur in 50 years with just one elephant poisoning every two years.

Retaliatory poisoning against lions, hyenas and other carnivores for livestock predation has been the main driver of poisoning events for vultures across East Africa (Kendall and Virani, 2012; Ogada, 2014; Ogada *et al*., 2016). While lacing livestock carcasses with pesticides aims to eliminate carnivores, most often, large numbers of vultures are killed as well as, or instead of, the original target species. This is despite pastoralists generally having a positive attitude towards vultures (Didarali *et al*., 2022). Additionally, sentinel poisoning by ivory poachers has also become a more prevalent threat to Africa's declining vulture populations (Ogada *et al*., 2016). Because vultures can act as an early warning system to rangers for large poached carcasses, poachers intentionally poison elephant carcasses to reduce vulture populations and, in some cases, also collect vulture parts for belief-based use (Mateo-Tomás and López-Bao, 2020). Sentinel poisoning events linked to bushmeat poaching using large snare lines have been recorded in Selous Game Reserve (Kendall *et al*., 2023). The use of vulture parts in muthi and the bushmeat illegal trade is documented in Western where two thousand Hooded vultures were poisoned for belief-based illegal trade in 2019/2020 in Guinéa-Bissau (Henriques *et al*., 2020), but in East

Africa, it is less clear the extent to which harvesting is occurring and if parts are used locally or are part of international trade. In some cases, vulture parts may be collected opportunistically from sentinel and retaliatory poisoning events. However, vulture heads at poaching camps and missing body parts of dead vultures have been recorded in some parts of the country and more research and investigation are needed to understand the extent of belief-based illegal trade in hotspot areas.

In the framework of the climate crisis, reducing CO_2 emissions from energy generation will be critical. Moving away from fossil fuels to renewable energy with windfarms, solar energy, and more electrification has the potential to deliver more than 75% of energy-related reductions by 2050 (Edenhofer *et al*., 2011). Furthermore, in Africa, where there is rapid population growth and development, rural electrification needs are resulting in construction of more transmission and distribution lines, posing a risk to raptors (Ngila *et al*., 2023). Studies have shown an edge effect around PAs, where 60% of avian electrocutions occurred in a 5 km buffer around the PA of the East coast of the Iberian Peninsula (Perez-Garcia *et al*., 2011). Careful consideration needs to be given to the construction and placement of new energy infrastructure to avoid collisions and electrocutions of vultures, storks, cranes, flamingos, raptors and migratory birds (Figure 27).

Electrocutions and powerline collisions kill over 10 million birds per year in the US (Loss *et al*., 2014). Electrocutions in Ethiopia (Bakari *et al*., 2020) and South Sudan (Angelov *et al*., 2013) are thought to be a significant cause of decline for Egyptian vultures, as well as Cape vultures in South Africa (Boshoff *et al*., 2011). Encounter rates (dead birds/km) along a 5 km powerline length in Ethiopia predicted an annual vulture mortality of 66.5 individuals (Bakari *et al*., 2020). This did not account for carcass removal by scavengers. Scaled up to 1,000 km of high use powerline, this could kill 66,500 vultures in a year. For most endangered species of vultures, 60,000 represents more than their global population estimate, therefore it is clear how devastating powerline collisions and electrocutions will be to species already heading towards extinction due to poisoning.

The risk of powerlines for birds is still an underestimated reason for mortality in some countries and regions and, overall, the data are either missing or insufficient and poorly utilized for monitoring (García-Alfonso *et al*., 2021; Kettel *et al*., 2022). Where data are available, predictive modelling, considering the technical details of powerlines, has been effective in predicting raptor electrocution risk for large geographical areas to identify high priority areas for retrofitting of powerlines (Hernández-Lambraño *et al*., 2018; Ngila *et al*., 2023). A similar approach could be applied in Tanzania, ensuring bird collision and electrocution risk assessment forms part of any mandated environmental impact assessment under the National Environmental Management Council (NEMC). It is more cost-effective to fit bird-friendly powerlines from the outset, e.g., by placing them in appropriate locations and fitting Bird Flight Diverters (objects attached to power lines that are visible to birds and reduce collision risk; Figure 28). To protect bird populations, it is essential to consider important flyways/migratory corridor areas near nesting, roosting sites or colonies which are regularly used. Useful guidelines have been developed for preventing and mitigating mortalities related to electricity distribution networks, with protocols for best practices e.g. anti-collision devices should be placed every 10 m on top wires, or 20 m if on two wires, and installed on high-tension earth wires. On medium tension cables, devices should be installed on conductor lines. New planned infrastructure should comply with best practices in pole design and isolation:

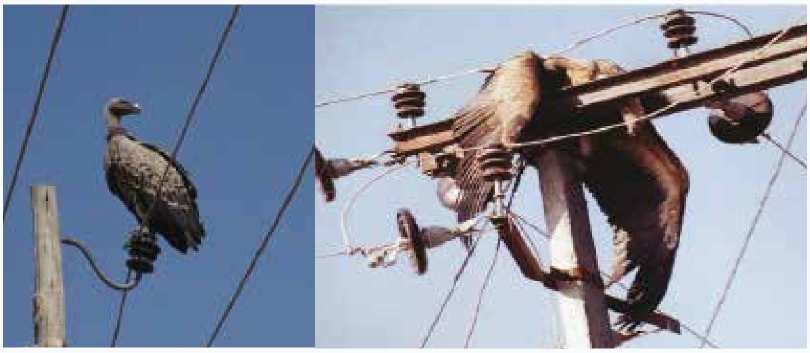

Figure 27: The threat from energy infrastructure. Left, Rüppell's vulture perched on an insulator on a distribution line; right, electrocuted eagle on top of the line. Images taken from incidences in one of the neighbouring countries.

Figure 28: The threat from distribution lines. Left: A safe horizontal low voltage line, with 3 conductors suspended below cross-arm with long insulators. Centre: a low voltage line which is unsafe. Right: Bird Flight Diverters that can be fitted or retrofitted to avoid collisions.

Source: AEWA 2012

Wind energy is a form of clean and renewable energy but without careful design, planning and construction may fall short of the environmentally friendly and 'green' concept, as birds and bats can collide with the turbine blades if placed in high-risk areas or without mitigation measures (Arnett *et al*., 2015, Carette *et al*., 2009, Carette *et al*., 2012, Telleria, 2009). In addition, indirect impacts might be due to functional habitat loss and barriers to movement due to poor siting and placement of the wind turbine and lack of consideration or availability of species-specific information to conduct risk assessments for decision-making (Zwart *et al*., 2016). For long-lived species with low productivity and slow maturation rates (e.g., raptors), even low mortality rates can significantly impact the population level (e.g. Carrete *et al*., 2009). Vultures are particularly vulnerable to collisions with wind turbines due to the use of thermals and orographic updrafts for soaring, low flight manoeuvrability (Barrios and Rodriguez, 2004), the height they fly at in relation to the blades, and their lack of forward visual field (Martin, 2012), further compounded by the speed of wind turbine blades and subsequent rotor blur. Vulture mortalities linked to wind farms have been well established in Europe, with potential for extirpation of local populations (Barrios and Rodriguez, 2004; Bellebaum *et al*., 2013; Carette *et al*., 2009; Carette *et al*., 2012). The best way to minimize wind farm impacts through collision mortality is to ensure they are placed away from nesting, roosting, core foraging areas or migration crossing points of vulnerable species (Zwart *et al*., 2016). Studies in southern Africa have used habitat use models with species telemetry data at proposed wind farm sites for sensitivity mapping of vultures to determine high risk areas (Rushworth and Kruger, 2014; Reid *et al*., 2015). Once appropriate siting has been completed, factors such as size of windfarm, i.e., number of turbines, the size of turbines and blades themselves, and ensuring positioning of turbines are parallel to the main flight direction, all need to be considered. Collision risk probability can be modelled per species around these specific parameters (Band *et al*., 2007).

Mitigation follows a well-established hierarchy, starting with avoidance of high-risk sites during the planning of wind-turbine facilities, followed by minimization measures during operations (which then need to be tailored to species at the specific site, which can be limited especially for bats), and compensating for unforeseen or unavoidable impacts through compensatory measures (Arnett and May, 2016; Bennun *et al*., 2021). Effective mitigation measures include bird detection using human biodiversity monitors or camera-based monitoring systems (e.g. DTBird or IdentiFlight) to automatically shut down the turbines or issue a warning sound. Automated monitoring systems are much more efficient than human biomonitors scanning the skies, with detection rates >85% (McClure *et al*., 2018, McClure *et al*., 2022). The disadvantage is that they don't help protect bats. Radar technology (e.g. Robin Radar Max and STRIX

BirdTrack) can detect birds (and some types also bats) from around 15 km away for automatic shutdown of the turbine, but it is usually very expensive and may be subject to national military or aviation regulations (Bennun *et al*., 2021). Turbine operations could also be restricted to certain times of day, seasons or specific weather conditions to minimize collision risk, but this may lead to loss of energy production (Marques *et al*., 2014). Visual methods to alert birds to the presence of turbines have been tried, such as painting one blade, using ultraviolet reflective paint for UV-sensitive species, or using pulsating lights for nocturnal species (Marques *et al*., 2014). As with electrocutions and collisions with powerlines, stringent EIAs should provide the foundation for sensitive decision-making, followed by consideration of mitigation measures if the project moves ahead.

3.2. Threats at a country scale

3.2.1. Poisoning

Whilst there must be many other undetected or detected but unreported cases of poisoning across Africa, the African Wildlife Poisoning Database (AWPD) provides a central repository for reported data, which allows comparisons of threats across countries and regions in Africa (https://www.africanwildlifepoisoning.org/ with data access at https://awpd.cloud/). Currently, there are 45,238 mortalities from a total of 1,564 poisoning incidents, most from the past 30 years, of which 35% (n=15,999) were vulture deaths, emphasizing a continent-wide problem that needs to be addressed (The Endangered Wildlife Trust and the Peregrine Fund 2023). Tanzania is listed sixth in total mortalities from poisoning in Africa. Of a total of 1,658 reported wildlife deaths in Tanzania, 87% were vultures (n=1,438) killed in 17 poisoning incidents. Most events were motivated by retaliatory poisoning (10 events and 310 deaths), with three sentinel (317 deaths) and four belief-based poisoning events (811 deaths). The poisoning that is intended to kill vultures i.e., sentinel and particularly belief-based poisoning, results in far more deaths overall, in comparison to when vultures are the unintended victim of conflict-related poisoning. A centralized database within the country would be helpful to aggregate information that could be used to assess and track trends and hotspots in poisoning.

Cause of death for tagged vultures in southern Tanzania

Of the 62 tagged vultures, there were 24 confirmed mortalities (38.7% of the total tagged birds) and 11 presumed mortalities (17.7%), many of which were associated with or close to human activity e.g. a poacher’s camp (Table 5 and

Figure 29). Whilst confirmed mortality of tagged vultures was similar across each landscape at 41.5% and 33.3% for Ruaha-Katavi and Nyerere-Selous respectively, the confirmed poisonings (i.e. where multiple individuals died) were more common in Nyerere-Selous, with 71.4% of confirmed mortalities being poisoning events in contrast to only 31.3% of confirmed mortalities in Ruaha-Katavi (Figure 31). While the number of confirmed large poisonings linked to tagged vulture mortality was small, many of the presumed mortalities (n=11) or those with unconfirmed cause (n=14) were suggestive of smaller poisoning events, based on tags having been removed or location near park boundaries (Kendall *et al*., 2023). This is particularly concerning given recent findings by Tsiakiris *et al*., (2021) which suggest that even small but frequent, poisoning events can have devastating consequences on vulture populations.

Table 5: Recorded mortalities (confirmed and presumed) from 62 tagged vultures in southern Tanzania.

Mortality Type	Nyerere-Selous	Ruaha-Katavi	Total
Retaliatory poisoning	3	4	7
Sentinel poisoning	2	0	2
Waterhole poisoning (secondary)	0	1	1
Confirmed mortality, cause unknown	2	12	14
Presumed mortality	4	7	11
Total	**11**	**24**	**35**

In southern Tanzania, carnivore-livestock conflict was the most common motivation for poisoning (Figure 29). Seven poisoning events were retaliatory, primarily occurring within buffer zones of the national parks, where the presence of pastoralism and vulture foraging likely overlap (Peters *et al*., 2023) (Figure 30). Two sentinel poisoning events were recorded in Nyerere NP, linked to bushmeat poaching (Figure 31). Challenges for mitigating retaliatory poisoning will be the growth of pastoral populations, particularly around the northeast buffer of Nyerere NP, and the nomadic nature of pastoralism in southern Tanzania (Kuiper *et al*., 2015, Beattie *et al*., 2020). There is anecdotal information that the pesticide carbofuran (nicknamed Number 7) is illegally available to buy at 'mnadas' (monthly markets for pastoralists which is a hub bringing in many people from a large area to trade and socialize). More investigation is needed around the source and illegal selling of this product at the black markets.

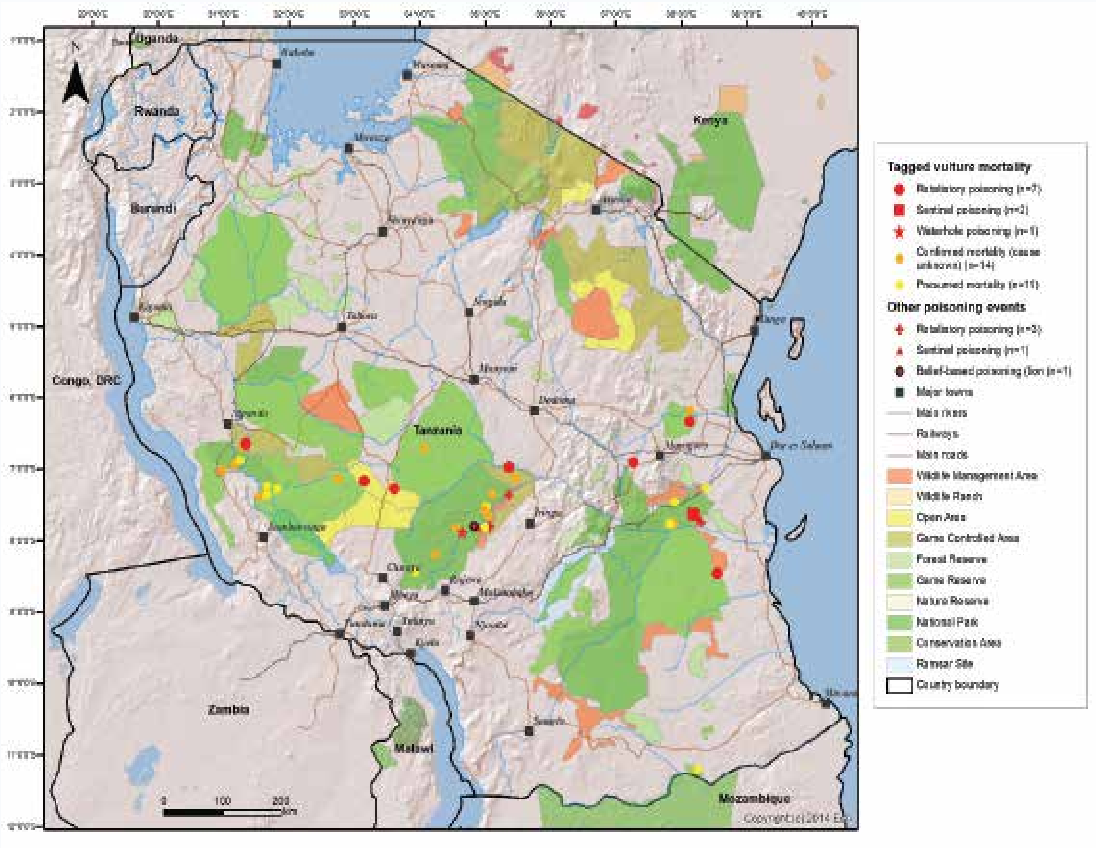

Figure 29: Vulture mortalities in southern Tanzania between 2015-2023.

Confirmed mortality (n=24 tagged vultures; red and orange circles and red triangle symbols) and inferred mortality (n=11 tagged vultures; yellow circle) from a total of 62 vultures tagged across southern Tanzania. In addition, red crosses, red triangles and red crosses in black circles show large-scale poisoning events in MBOMIPA WMA, Ruaha NP and east of Nyerere NP not detected from tagged vulture mortality.

Source: Kendall *et al*., 2023

In 2022, there were six mortalities of tagged vultures and an intensification of poisoning incidents with an annual mortality rate of 28.5%. In just three weeks, three retaliatory poisonings were confirmed with approximately 40 birds killed, 75% of which had heads taken for belief-based use. There is concern that belief-based use may be increasing and similar trends have been noted in other countries. The first vulture mortality that came from waterhole poisoning/ poachers was recorded in 2023 (often use small water sources to poison ground birds and mammals). In this case, an impala had drunk at the water hole and died, killing three White-backed vultures which fed from it. This is termed a secondary poisoning event.

Figure 30: Tagged vulture mortality in Wami Mbiki GR led to confirmation of 62 dead vultures – 60 AWBV and 2 HV.

Figure 31: Forty-three heads (37 AWBV and 6 HV) removed from 100 poisoned vultures at a sentinel poisoning event in Selous GR.

Two large-scale retaliatory poisoning events in response to carnivore depredation of livestock occurred in MBOMIPA WMA in 2016 (Figure 32) and 2018 killing a total of 130 vultures, two eagles, six lions, one hyena and one jackal. In addition, in 2023, a large-scale poisoning in Ruaha NP killed four lions and 76 vultures – the target was lion body parts for illegal trade, using a hippo as bait. The consequence was devastating and is another worrying indication of an increasing trend in demand for wildlife parts for traditional use.

Since 2015, by combining all the information for southern Tanzania, there have been 15 confirmed poisoning incidences killing vultures, resulting in 473 dead vultures (93% White-backed vultures), with 84 missing heads (18%). In contrast, 22 mammals (11 Lions, seven Spotted hyena and four Black-backed jackals) and three eagles died. This could be an underrepresentation of the true number of poisoning events, but it is important to note that poisoning occurs across the whole southern protected area landscape (Figure 29). Given that most poisoning events targeted carnivores and not vultures, it is a stark reminder that vultures are the main victims of challenges within the human-wildlife coexistence paradigm. This has ramifications for strategies and necessary partnerships if the extent and scale of poisoning is going to be effectively addressed and have a positive impact on vulture conservation.

Other known large-scale poisoning events are from northern Tanzania from Maswa GR (2009) and Serengeti NP (2023), with illegal trade in vulture body parts linked to bushmeat poaching. In 2009, 50 vulture heads and feet were found at a bushmeat poacher's camp, whilst in 2023, 90 vulture heads were harvested and found at a bushmeat poacher's camp that had killed approximately 200 vultures. Anecdotal information suggests the existence of a syndicate operational and a black market for vulture heads for traditional medicine and belief-based uses. Some community-based research about the use of vultures has been initiated in northern Tanzania and will continue as we understand the extent and drivers and develop appropriate strategies to reduce it.

Figure 32: Fifty-five White-backed vultures, 1 Hooded vulture, 2 Bateleur eagle, 1 Tawny eagle, 1 hyena and 1 jackal died at a retaliatory poisoning event in MBOMIPA in 2016.

3.2.2. Energy Infrastructure

In Tanzania, energy infrastructure is increasing, especially as part of rural electrification schemes which will take powerlines closer to protected areas or corridor areas (Figure 33). The current vulture data for Tanzania shows that declines due to poisoning are not sustainable and another high-level threat could extirpate some populations if left unmitigated. Powerline infrastructure in the country is an emerging threat, with no cited cases of collisions or electrocutions of vultures yet and there is a chance to prevent the vulture declines seen in other countries from this threat by establishing and ensuring policy and legislation provides mandates on bird-friendly best practices for new infrastructure. Considerations need to be made during initial environmental impact assessments, NEMC approval, and recommendations, and within the project design, construction, and operational phases, particularly around avoidance and minimization of collision risk (Bennun *et al*., 2021).

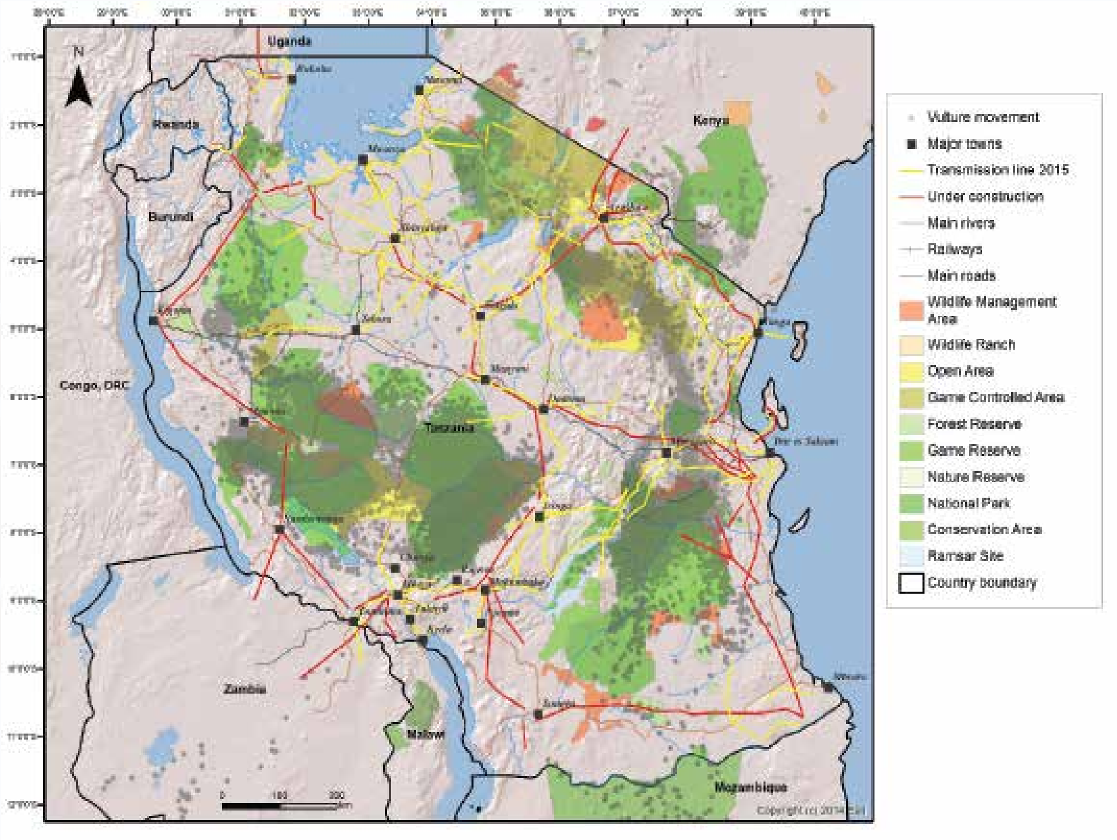

Figure 33: Vulture movement patterns in relation to established transmission lines and those under construction (to 2015 only).

3.2.3. Other Threats

The threat of poisoning must be mitigated, and the potential threat of wind farm collision, powerline collision, and electrocution must be prevented for the long-term survival of Tanzania's threatened vultures. Other threats discussed here merit further study and monitoring, but concerted efforts should be made to first address known and significant threats to conserve vultures. During the plans validation workshop, stakeholders suggested the following threats be considered minor at present, but plans should be in place to reconsider them during the action plan mid-term review at five years.

Lead poisoning

Although less is known about the impact and toxicity of lead on African vultures, Californian condors almost became extinct through direct ingestion of lead from hunted carrion carcasses (Rideout *et al*., 2012). It is also known to cause mortality and severe sub-lethal effects in gamebirds and waterfowl (Kim and Oh, 2013) and lead bullets have been banned in other countries. Lead bioaccumulates in vultures, i.e. lead levels build up slowly and are eventually deposited in the bone (Behmke *et al*., 2015). Clinical signs of toxicity are neurological signs, muscle wasting, weakness, anaemia and weight loss (Naidoo *et al*., 2017). Elevated lead levels have been found in African White-backed vultures (Kenny *et al*., 2015, Naidoo *et al*., 2017), and the main source is ammunition, where vultures ingest small pieces of lead from soft tissue in a carcass (Garbett *et al*., 2018). This is corroborated in studies from Spain, which found that lead poisoning was a significant cause of death, particularly for Griffon vultures (*Gyps fulvus*) and sub-lethal effects were found in vultures and other birds of prey (Descalzo *et al*., 2021), although most individuals, even with high exposure, did not shown clinical symptoms. Whilst African vultures appear quite tolerant of lead (Naidoo *et al*., 2017), sub-lethal effects can reduce overall fitness and reduce the reproductive output of raptors (Gil-Sánchez *et al*., 2018; Vallverdú-Coll *et al*., 2016). A 2018 study in Botswana looked at blood lead levels from 566 vultures from hunting and non-hunting PAs. As a comparison, albeit with small sample sizes (n=41), background lead exposure in Tanzania was low for the majority of samples (91.5%; NC Zoo and WCS, unpublished report) versus 30.2% from Botswana (Garbett *et al*., 2018). Only 8% of vultures tested in Tanzania had elevated-to-high lead exposure levels compared to 32.5% in Botswana. In Tanzania, lead comes from bullets within a recreational hunting industry, as well as homemade ammunition from muzzle loaders in illegal hunting. Compared to the threat and rapid impact of pesticide poisoning on vultures in Tanzania, lead poisoning is not considered a priority for immediate action, but monitoring should continue. In the future, legislation and policy should consider banning lead bullets and using copper bullets, which are a safer and more environmentally friendly option.

Diclofenac poisoning

From the mid-1990s, vulture populations declined precipitously across Asia (99% decline for three *Gyps* species) due to the treatment of cows with the veterinary drug diclofenac (Prakash *et al*., 2003). Less than 1% of the cow carcasses were contaminated with diclofenac, which nearly wiped out the population (Green *et al*., 2004). Since bans on diclofenac in Asia, vultures have slowly been recovering (Prakash *et al*., 2012, 2019). This situation was mostly attributable to different religious and cultural practices, where cows are sacred to Hindus and are not consumed by humans but left out for vultures to eat, and treatment of old and sick cows is also common. In Tanzania, religious and cultural beliefs are quite different, with cows almost certainly being consumed by humans and less likely to be treated with a Non-Steroidal Anti-Inflammatory Drug (NSAID), therefore, this type of toxicity is considered a low risk in Tanzania compared to poisoning from agriculture pesticides. Diclofenac is available in agrovet shops locally, as are proven vulture safe NSAIDs meloxicam and tolfenamic acid (Swarup *et al*., 2007; Chandramohan *et al*., 2022). In general, rural pastoralists seem to use meloxicam rather than diclofenac. Studies show that vultures feed and forage in low-density livestock areas in PA buffer zones (Peters *et al*., 2022), but shifts in pastoralist movement in relation to PAs may change the availability of dead cows to vultures in the future, particularly during years of drought. However, even where livestock carcasses become available to vultures, it is less likely that they will have been treated with diclofenac. It is worth re-evaluating any shifts in the use of NSAIDs on livestock at the mid-term review of this plan and the distribution and numbers of cows across the country in relation to PAs and vulture movement patterns.

Habitat loss and reduced nest and food availability

Tanzania has large tracts of natural habitat, of which approximately 35% falls within protected areas, where there are also higher wildlife densities than outside non- or less well protected areas. Vultures generally stay within protected areas and buffer zones (Kane *et al*., 2022; Peters *et al*., 2022), therefore, habitat loss and food availability are considered low threats for all vulture species. Wildlife aerial censuses are conducted every three years by TAWIRI in key protected areas, which allow monitoring of wildlife density changes in relation to food availability for vultures. In conjunction with this, monitoring of tagged vultures should also identify shifts in movement patterns, particularly away from key protected areas, which will alert to potential habitat loss, change in food availability or human disturbance in current high-use areas.

Human disturbance could affect tree or cliff nesting birds. Research has shown that White-headed vultures are very sensitive to disturbance (Murn *et al*., 2016). Tree loss may also be a factor for breeding in certain parts of the country. In the northern parts, in the vast Serengeti plains, preferred tall riverine trees are generally less abundant. Nest declines are already being seen in the north-western section of Serengeti, as well as reductions in overall breeding success (Laizer *et al*., in press). The causal factors of these declines are still being explored, but tree cover loss is one possibility. In the more wooded parts of southern Tanzania, habitat loss impacting tree availability and therefore, breeding is not considered a threat. Continued monitoring in Grumeti and expanding out to a greater area of the Serengeti ecosystem is important to see if habitat loss is impacting tree availability and breeding success of vultures in northern Tanzania. Table 6 ranks the threats to Tanzania's vultures from high to low risk as a way of prioritizing strategic objectives and actions for this vulture action plan.

Table 6: Threat category assessment by species for vultures in Tanzania, ranked from high to low risk.

Main threat category	Subcategory	Species							
		African White-backed vulture	Rüppell's vulture	Hooded vulture	White-headed vulture	Lappet-faced vulture	Egyptian vulture	Bearded vulture	Palm-nut vulture
IUCN status		CR	CR	CR	CR	EN	EN	NT	LC
Intentional poisoning	Sentinel	High	High	High	High	High	Medium	Low	Low
	Traditional use	High	High	High	High	High	Medium	Low	Low
Unintentional poisoning	Retaliatory	High	High	High	High	High	Medium	Low	Low
	Secondary	High	High	High	High	High	Medium	Low	Low
	Lead	Low	Low	Low	Low	Low	Low	Low	Low
Energy infrastructure (electric or wind)	Electrocution	High potential	High potential	High potential	Low	Medium	High potential	Low	Medium
	Collision	High potential	High potential	High potential	Low	Medium	High potential	Low	Medium
Habitat loss, degradation and fragmentation	Food resource	Low	Low	Low	Low	Low	Low	High	Low
	Disturbance or loss of breeding sites	Medium/High	Medium/High	Low	Medium	Low	Medium	Medium	Low
NSAIDS	Diclofenac	Low	Low	Low	Low	Low	Low	Low	Low

CHAPTER FOUR: LEGISLATION AND POLICY TOWARDS VULTURES

4.1. Domestic Policies and Legislation

The first Tanzania *Wildlife Policy* was developed in 1998 to guide the development of the wildlife sector. The wildlife policy was then revised in 2007 to consolidate the importance of protecting and managing endangered species and to address the increasing challenges of demand for wildlife products. The *Wildlife Conservation Act* was developed in 1974 and was revised in 2009 and 2022, providing the framework for the protection and conservation of wildlife resources (both habitats and species) in protected areas and sets policy around protected species and international obligations, as well as Convention on International trade in endangered species of wild fauna and flora (CITES). While none of these policies and Acts directly implicate vultures or their conservation management, general protected area management will protect vulture habitat and food sources. It is also clearly stated that any use of poison to kill wildlife is illegal and comes with fines and/or prison sentences for those who are caught and successfully prosecuted. The Act also allows the deployment of authorized officers to control problem animals causing loss of human life and properties, i.e., livestock depredation, which could reduce human-wildlife conflict and motivations behind retaliatory poisoning, thereby alleviating a major threat to vultures.

The Wildlife Conservation (Wildlife Corridors, Dispersal Areas, Buffer Zones and Migratory Routes) Regulations (2018) apply to areas designated under the Act as wildlife corridors, dispersal areas, buffer zones and migratory routes. This is relevant to vultures as they travel great distances between major ecosystems and key protected areas by using wildlife corridors. Corridor protection under the Wildlife Conservation Regulations (2018) will support vultures conservation given their wide-ranging behaviour. The Human-Wildlife Conflict (HWC) Management Strategy 2020-2024 (MNRT, 2020) contains activities that supports vulture conservation. For instance, the HWC mitigation unit and response teams, free HWC hotline and HWC monitoring teams (DGOs) should help to reduce HWC and the motivations behind poisoning as a retaliatory action.

With regard to the threat from energy infrastructure projects for collisions and electrocutions of large raptors and other birds such as storks and flamingos, the Ministry of Energy develops policy relevant to risk management, mitigation measures and ensuring standardized best practice protocols. The *National Energy Policy (2003)* was established to encourage private investment in development projects based upon the rational exploitation and management of resources, and the protection of the environment. This did not focus on renewable energy development. The Energy and Water Utilities Regulatory Authority (EWURA) oversees technical and economic regulation of the electricity, petroleum, natural gas and water sectors, including of the Tanzania Electric Supply Company Limited (TANESCO), a government-owned parastatal, and the Rural Energy Agency (REA), who are responsible for financing of rural electrification projects. Their activities are guided by the *Rural Energy Act (2008)* and *Electricity Act (2008)*. For development of new energy projects, it is the National Environmental Management Council (NEMC) who evaluates environmental impact assessment (EIA) mitigation measures, which are approved under the Vice President's office. The *Environmental Impact Assessment and Audit Regulations (2005)* provides guidelines for EIAs, including who can conduct an EIA (i.e. must be registered under the Environmental Regulations) and schedule 1 (14) states that an EIA is mandatory for "production and distribution of electricity", for hydropower projects and for large scale renewable energy projects (it does not mention windfarms), as well as all thermal power development (i.e. coal, etc.). For any infrastructure projects, particularly with international funding, the Performance Standard 6 of the International Finance Corporation must be applied. This is guided by the Convention on Biological Diversity (CBD), which states that "*as a matter of priority, the client should seek to avoid impacts on biodiversity and ecosystem services. When avoidance of impacts is not possible, measures to minimize impacts and restore biodiversity and ecosystem services should be implemented. Given the complexity in predicting project impacts on biodiversity and ecosystem services over the long term, the client should adopt a practice of adaptive management in which the implementation of mitigation and management measures are responsive to changing conditions and the results of monitoring throughout the project's life cycle*".

4.2. International Legislation

In 1981, Tanzania became a member of IUCN to safeguard all endangered species and later, in 1996, ratified the Convention on Biological Diversity (CBD), committing to sustainable development. Furthermore, Tanzania has ratified several international agreements, conventions and protocols that relate to biodiversity conservation and thus should benefit vultures. Tanzania is a signatory of CITES ('Convention on International Trade in Endangered Species of Wild Fauna and Flora'), ratified in 1979. Governments are legally bound to implement the Convention's Articles, and failure to do so can lead to sanctions being imposed, rendering a country unable to import or export CITES-listed species. All vulture species found in Tanzania are in CITES Appendix II.

The *Convention on the Conservation of Migratory Species of Wild Animals (CMS)* has developed several instruments to support conservation. The country ratified the CMS Agreement on the Conservation of African-Eurasian Migratory Water Birds (AEWA) in 1999, which protects Tanzania's Important Bird areas and gives protection to migratory birds like the Lesser Flamingo. However, it is not a signatory of the *CMS Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia (Raptors MOU)* which would be beneficial to vulture conservation as the Raptors MOU aims to promote internationally coordinated actions to achieve and maintain the favourable conservation status of migratory birds of prey throughout their range in the African-Eurasian region and to reverse their decline when and where appropriate.

The *East African Community Strategy to Combat Poaching, Illegal Trade, and Trafficking of Wildlife and Wildlife Resources (2017-2022)* have mechanisms for agreed cross-border collaborations on operations and intelligence and ways to address human-wildlife conflict and engage communities. This should be leveraged to incorporate relevant transboundary collaboration of the threats faced by vultures.

In 1985, the International Code of Conduct on the Distribution and Use of Pesticides was adopted by the United Nations Food and Agriculture Organization (FAO) in response to the growing evidence of human and environmental risks and harm associated with the use of pesticides. The Code Article 5.2.3 stated that "*industry should halt sale and recall products when handling or use pose an unacceptable risk under any use directions or restrictions*". Serious declines in biodiversity are linked with increased use of pesticides, along with other practices in modern, intensive farming (Geiger *et al*., 2010). Since the 1980s, a number of international instruments and guidelines have been adopted to tackle pesticide related problems. Two of these are the *Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals* and *Pesticides in International Trade (1998)* and *Stockholm Convention on Persistent Organic Pollutants (POPs) (2001)*. The country ratified the *Stockholm Convention on Persistent Organic Pollutants (POPs)* in 2004. It is a global treaty to protect human health and the environment from chemicals. POPs can be defined *as chemical substances that persist in the environment, bio-accumulate through the food web, and pose a risk of causing adverse effects to human health and the environment.* The Stockholm Convention requires its parties to eliminate or reduce the release of POPs into the environment.

The *Rotterdam Convention*, which the country ratified in 2002, focuses on prior informed consent as a key tool for developing countries to make informed decisions on the import and use of highly toxic chemicals. It provides a database of chemical characteristics and enables member governments to exchange information on banned or severely restricted chemicals and to prevent unwanted trade in certain chemicals. Annex III lists the pesticides that have been banned or severely restricted for health or environmental reasons. It includes organophosphates and carbamates. Carbofuran, a carbamate, is a *Class 1b Highly Hazardous Pesticides (HHPs)* (WHO 2020), used to control insects on crops, and together with aldicarb, commonly used to deliberately kill wildlife by lacing bait (Otieno *et al*., 2010, López-Bao and Mateo-Tomás 2022). Eighty-three countries have restrictions on carbofuran use with total bans in Europe because when consumed it can cause serious health issues and sometimes acute death. Carbofuran essentially acts like a nerve agent inhibiting the neurotransmitter acetylcholinesterase, which causes serious symptoms such as muscular paralysis, convulsions, bronchial constriction, and death by asphyxiation. The long-term effects of pesticide exposure are birth defects, miscarriages, infertility in both men and women, developmental neurobehavioral issues, neurological diseases and cancer (Bassil *et al*., 2007; Chilipweli *et al*., 2021; Edelson, 2022; Frazier, 2007; Kempurai *et al*., 2022).

The World Health Organisation recommends that Class 1a and 1b pesticides are clearly labelled with a symbol indicating a high degree of hazard (usually a type of skull and crossbones) and a signal word or phrase, e.g. POISON or TOXIC (in the appropriate language). The Tanzania Plant Health and Pesticides Authority (TPHPA) is a government authority mandated to regulate all pesticides in the country under the *Plant Health Act* No.4 (2020). It is responsible for the registration of pesticides to be used in Tanzania. According to the current list of registered pesticides in the TPHPA database for Pesticide Stock Management System (PSMS) Carbofuran is not legally authorized to be used in the United Republic of Tanzania. The presence of carbofuran in Tanzania may be coming through unofficial entry points. Therefore, a joint effort is needed among stakeholders such as government organizations, international organisations, NGOs, and individuals to collaborate with TPHPA to eliminate carbofuran and other unauthorized HHPs in the country to protect biodiversity. Creation of awareness in the community on the effects of HHPs should also be part of joint efforts towards the protection of human health, the ecosystem and the environment in general. A study found that the risk of acute pesticide poisoning was reduced by 55% in farmers who were educated about protective equipment and pesticide exposure risk (Ye *et al*., 2013). From both a human health and environmental perspective, the presence and use of carbofuran and other illegal pesticides need urgent and collective attention.

CHAPTER FIVE: PLAN PREPARATION, EVALUATION AND STRUCTURE

5.1. Plan Formulation Process

i. Permission from the Permanent Secretary, MNRT in January 2023 to nominate the vulture technical working committee from each wildlife agency to develop the plan roadmap;

ii. Formulation of a 16-member technical team in March 2023 from TAWA, NCAA, WD, TANAPA, University of Dar es Salaam, College of African Wildlife Management and Avian researchers, led by TAWIRI;

iii. Technical committee meeting held in May 2023 to review current data in the country, assess threats, and develop a plan with clear objectives, targeted actions, actions, indicators, timeline and projected budget;

iv. First draft of the action plan shared with the technical team in August 2023 for revisions and comments;

v. Circulation of the draft plan by email to key individuals, conservation NGOs and other groups in October 2023 with interests in vulture monitoring, conservation and management authorities to provide input into plan development;

vi. A national stakeholder workshop comprising the relevant government authorities, local and international conservation organizations, private sector, and researchers, among others (led by TAWIRI), was held at the end of October in Dodoma to validate and finalize the development of the plan;

vii. Collation of stakeholders' views and the review of documents combined in a briefing document for the finalization of the plan by a small technical team;

viii. Presentation of the draft plan to the heads of TAWA, TAWIRI, TANAPA and NCAA for their input in November;

ix. Finalization, printing and launch of the final Vulture Conservation and Management Plan (2023-2033), followed by circulation of the plan document to the relevant agencies and conservation organizations for implementation; and

x. Launching of the plan at the 13th TAWIRI Scientific Conference on 06 December 2023.

5.2. Structure of this Plan

The logical structure of this Conservation and Management Plan is shown in Figure 34. The Vision sets out the desired situation of the vulture action plan to be achieved in the future. This ten-year plan sets a measurable goal. By achieving this goal, progress towards realising the set Vision will have been met.

The plan identifies eight Strategic Objectives as listed below to realise the goal, ranked in order of priority:

1. Reduce poisoning of vultures;
2. Community and public engagement;
3. Reduce illegal trade in vulture body parts;
4. Develop and implement a standardized monitoring system to assess vulture population status;
5. Vulture research to improve conservation management;
6. Mitigate threat of energy infrastructure (powerline electrocution and collision, wind farm collision) to vultures;
7. Transboundary coordination, and;
8. Coordination of vulture conservation. .

The Plan also lists 25 targets that are measurable and describes what needs to be achieved. Each target is also specified with a list of 82 activities that need to be implemented to achieve a particular target. Finally, the Indicators which are measures of the success of each Action/Activity are defined. The timeframe to achieve each action successfully is stated, including the actors/implementers, which are organisations, specific officers, or individuals responsible for implementing particular activities.

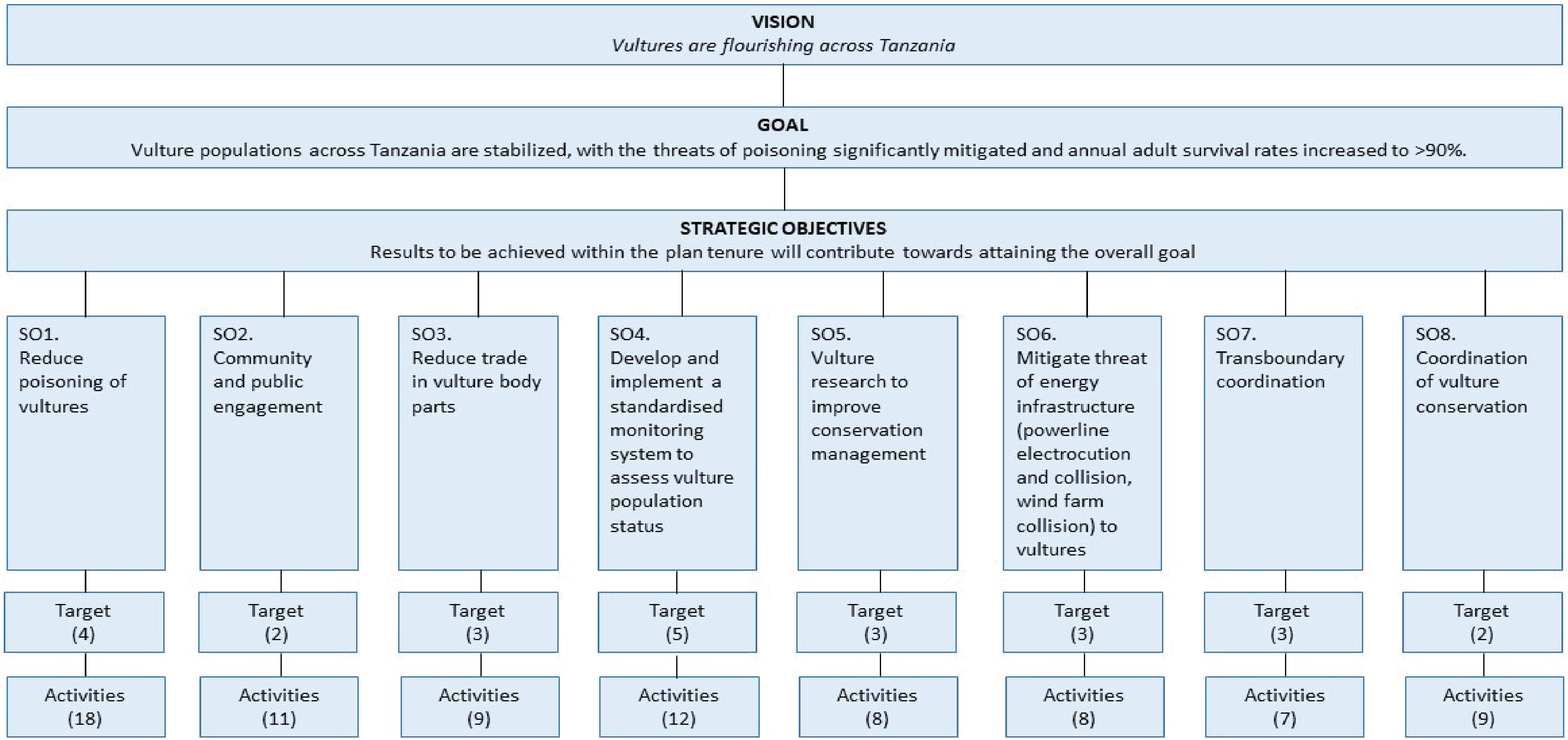

Figure 34: Logical structure of the vulture action plan

CHAPTER SIX: THE LONG-TERM VISION AND GOAL

The long-term vision is an inspirational and relatively short statement of the envisioned status of the vulture species of Tanzania, while the overall goal is one that can be realistically achieved over the lifetime of the conservation and management plan. By meeting the overall goal, significant progress is made towards achieving the long-term vision.

a) Long-term Vision

To be the world's leading vulture stronghold.

This vision recognizes Tanzania's important role and opportunity in the conservation of African vultures at national and international levels.

b) Goal

Vulture populations across Tanzania are stabilized, with the threats of poisoning significantly mitigated and annual adult survival rates increased to >90%.

6.1. Rationale

Vultures are highly indicative species of a One Health framework, providing critical ecosystem services that are difficult to mimic or replace once lost. As obligate scavengers, vultures play a critical role in disease control, preventing the spread of infectious diseases by removing decomposing organic material (Sekercioglu 2006, Sekercioglu *et al*., 2004; Plaza *et al*., 2020). Without vultures' efficiency at carcass consumption (compared to mammalian scavengers), there may be a risk of either persistence or increase of harmful diseases within the ecosystem (Van Den Heever *et al*., 2021). In a study in the Serengeti, vultures consumed 70% of all carcasses, with the remaining 30% being eaten by mammalian scavengers (Houston, 1974a,b). The fast consumption of a carcass by vultures limits the breeding of blowflies and other insects that spread diseases and accelerate nutrient cycling back into the environment. In East African countries, vultures are important in reducing disease transmission between mammals (Ogada *et al*., 2012b) and providing free disposal services, reducing costs. These disposal services also contribute directly to climate change by mitigating greenhouse gas emissions. As vultures rapidly consume a carcass, it prevents the release of greenhouse gases into the atmosphere by natural decomposition and reduces the need for other artificial animal disposal methods which release even more CO_2. Plaza and Lambertucci (2022) calculated that avoided emissions, when scaled to the estimated global vulture population of 134-140 million individuals, could prevent the generation of 13.02 metric tons of CO_2 per year for carcasses naturally decomposing in the environment–this is the equivalent of Tanzania's annual CO_2 emissions (Friedlingstein *et al*., 2020). Playing an unrecognized role in climate change mitigation, the decline in vultures has led to a 30% decrease in their capacity to mitigate greenhouse gas emissions (Plaza and Lambertucci, 2022).

As a stark reminder of the potential cascading impacts to an ecosystem when a keystone species is removed, the absence of vultures at carcasses has had huge ramifications elsewhere. In India, vulture declines contributed to increased feral dog populations and increased rabies and bites to humans, leading to an estimated $34 billion in human health costs over 14 years (Markandya *et al*., 2008). In African savannah ecosystems, reducing vultures is likely to increase hyena and jackal numbers, potentially exacerbating predation pressures on domestic livestock and increasing human-wildlife coexistence changes.

Vultures are also important bio-indicators of ecosystem health. Given large range sizes and dependence on high wildlife density, vultures indicate ecosystem health at the landscape scale (Sekercioglu *et al*., 2004; Ogada *et al*., 2012a). Because vulture populations are likely more sensitive to poisoning than lions, they are important indicators of environmental contamination by chemical toxins. In particular, African White-backed vultures act as an umbrella species for other scavengers (Thompson *et al*., 2021), as their wide-ranging and gregarious feeding makes them most at risk from poisoning events. Continued vulture monitoring and subsequent conservation efforts are critical for vultures and can benefit a range of other highly threatened species that are a priority to Tanzania e.g., elephants, rhinos and lions.

CHAPTER SEVEN: STRATEGIC OBJECTIVES (SOS)

This plan lists eight Strategic Objectives (SOs) to be achieved by the end of 2033. The SOs collectively contribute to attaining the overall goal. Each SO has a rationale for its consideration and a matrix for implementing specific targets and activities where targets refer to statements of SO's results or logically related clusters of activities which help to promote implementation. The activities in every SO's matrix have timelines for their completion, lead actors responsible and indicators of success, i.e., measures of conditions that would show whether or not a particular activity is successfully implemented. Critical to the successful implementation of the plan is coordination amongst all the key stakeholders to address the complexity of threats vultures face. The designation of a National Vulture Coordinator under the Ministry of Natural Resources and Tourism will be the first step towards ensuring successful vulture conservation and is critical in coordinating, liaising and ensuring collaboration between all stakeholders.

Review at the 5-year mid-term point will not only assess if the action plan is on target for actions outlined below to meet targets and goals but also assess the situation of threats that currently are considered low priority (Table 6) but which might have changed over time. These include other types of poisoning threats such as lead exposure and the use of diclofenac to treat livestock, disturbance at nest sites, reduction of food availability and habitat loss. Furthermore, as we focus on five of eight species present in Tanzania, which are most impacted by poisoning threats (Table 6), we will review the status of the Bearded, Egyptian and Palm-nut vultures in Tanzania and prioritize actions if necessary and appropriate.

7.1. SO.1 Reduce poisoning of vultures

Mitigating poisoning is crucial to reversing the significant decline of vultures in Tanzania and Africa at large. Unauthorized hazardous pesticides, especially carbofuran, are a major concern, requiring strict law enforcement and monitoring. The FAO's Global Action Plan on Highly Hazardous Pesticides (2021) aims to eliminate risks from such pesticides by 2030, emphasizing their threat to both wildlife and human health (Boedeker *et al.*, 2020). Approximately 44% of farmers worldwide, particularly in South-East Asia and East Africa, experience pesticide poisoning annually, with serious implications for public health (Boedeker *et al.*, 2020; Calista *et al.*, 2022). Carbofuran, though not registered for pest control in Tanzania, faces illicit usage. Stringent law enforcement, monitoring in local markets, and dismantling black-market networks are essential (Pesticide Action Network International 2021; Lopez-Bao and Mateo-Tomas 2022). Collaboration with the Tanzanian Plant Health and Pesticides Authority (TPHPA) using the National Plant Health Act. No. 4, 2020, Plant Health Regulation of 2023 and international guidelines for pesticide management is crucial for eradicating unregistered HHPs in Tanzania.

Removing HHPs does not threaten food production, as seen in the banning of 14 HHPs in Kerala, India (Sethi *et al.,* 2022). The economic costs of pesticide use in African smallholder farmers here estimated at US$ 97 billion by 2020 (UNEP, 2013). The control of illegal carbofuran, a highly toxic substance to humans and the environment, would have broader benefits. Reducing poisoning events involves engaging multiple stakeholders, raising awareness, and education, including ranger training. Improved detection and rapid response are critical to prevent secondary poisoning. Standardized Standard Operating Procedures (SOPs) and prioritization at the site-level, particularly around protected areas, are necessary. Preventing poisoning requires a participatory approach, understanding motivations, and coordinating with projects addressing human-wildlife conflict, such as carnivore conservation. Integration with the National Human-Wildlife Conflict Management Strategy enhances alignment and coordination (MNRT, 2020). Engaging communities with multifaceted approaches and aligning efforts will contribute to the success of the conservation plan.

Table 7: SO.1 Reduce poisoning of vultures

Target	Activities	Actors*	Timeline	Indicators
SO1. Reduce poisoning of vultures				
1.1. Reduced availability and use of HHPs	1.1.1. Obtain and provide data on the availability, sales and use of HHPs, particularly carbofuran	MNRT*, TAWIRI, TPHPA, Ministry of Agriculture, partners	2024-2025	Report in place
	1.1.2. Develop a government Policy Brief from a One Health perspective on the impacts of HHPs on human and wildlife health	MNRT*, TAWIRI, TPHPA, Ministry of Agriculture, Ministry of Health	2024	Policy brief in place and shared with key stakeholders
	1.1.3. Conduct a workshop on the effect of HHPs (particularly carbofuran) for Directors of Ministries and institutions	MNRT*, TAWIRI, TPHPA, TMDA, NIMR, GCLA, Ministry of Health, Ministry of Agriculture, One Health Office in Prime Minister's office	2024	Workshop completed

Target	Activities	Actors*	Timeline	Indicators
SO1. Reduce poisoning of vultures				
	1.1.4. Engage with drug and pesticide authorities to highlight concerns of HHPs on human and wildlife health and ensure that unauthorized pesticides are neither available in the local market nor used in Tanzania	MNRT*, TPHPA, NIMR	2023-2033	Medium-term: Improved oversight of highly toxic carbofuran Penalties for illegal sales and misuse of carbofuran Long-term: Change in legislation banning the sales and use of carbofuran
	1.1.5. Establish guidelines for safe removal and/or disposal of HHPs, especially carbofuran	MNRT	2024	Approved guidelines in place
	1.1.6. Work with pesticide manufacturers and distributers to find alternatives to HHPs	MNRT*, TAWIRI, TPHPA, Ministry of Agriculture, Bayer, Syngenta, Corteva, BASF	2025-2027	Meeting proceedings in place
1.2. Monitor availability and sales of illegal HHPs in shops and local mnadas	1.2.1. Understand the network chain of illegal HHPs distribution and sales	TPHPA*, MNRT, TRAFFIC	2024-20233	Report on network chain in place
	1.2.2. Train local government officers e.g. Agricultural and Livestock extension officers, to conduct regular and spot-check inspections of HHPs distribution and sales	Ministry of Agriculture*, TPHPA, local government authorities	2024-2025	Training Report in place Number of people trained

Target	Activities	Actors*	Timeline	Indicators
SO1. Reduce poisoning of vultures				
	1.2.3. Improved detection of illegal HHPs sales, confiscation of HHPs products and prosecution of sellers	TPHPA, local government authorities, police, TAWA, TANAPA, NCAA		Number of HHPs confiscations Number of arrests Amount (kg) of HHPs safely disposed of
1.3. Effective rapid response to poisoning or tagged vulture mortality	1.3.1. Develop SOP for response to poisoning events in and outside of PAs (English and Kiswahili versions)	TAWIRI*, MNRT, TAWA, TANAPA, NCAA, TPHPA, TFS Conservation NGOs	2024-2026	SOP created and in use at site level Spot check on SOP access per site
	1.3.2. Integrate SOP into PA operations	MNRT*, TAWA, TANAPA, NCAA, TFS	2024-2026	Robust SOPs in place
	1.3.3. Provide poison response training and refresher training in known poisoning hotspots	TAWIRI*, TPHPA, TAWA, TANAPA, NCAA, conservation NGOs	2023-2033	1000 people trained (e.g. 100 per year)
	1.3.4. Ensure resources are available for rapid poison response	MNRT*, TAWA, TANAPA, NCAA, conservation NGOs	2023-2033	Ministry and Institutions budgets # poisonings reported versus responded to
	1.3.5. Set up and capacitate/train existing or new rapid response teams to follow up on poisoning in relevant PAs	MNRT*, TAWIRI, TAWA, TANAPA, NCAA, conservation NGOs	2023-2033	Rapid response teams in place

Target	Activities	Actors*	Timeline	Indicators
SO1. Reduce poisoning of vultures				
	1.3.6. Establish a centralized and standardized database for poisoning events	TAWIRI*, MNRT, TAWA, TANAPA, NCAA, Conservation NGOs, Researchers	2023-2033	A centralized database in place
	1.3.7. Incorporate poison response training into the curriculum of wildlife ranger training colleges	TAWIRI*, Mweka, Pasiansi, Lekuyu Sekamaganga, other higher learning institutions	2026-2033	Robust training curricula in place 1000 people trained per year
1.4. Ensure appropriate care is provided for poisoned vultures	1.4.1. Provide workshop to train vets to address vulture poisoning cases (including wildlife authority, district vets, vet schools, and ecologists)	TAWIRI*, TAWA, TANAPA, NCAA, Vet training colleges, District vets	2025-2026	The number of trained vets
	1.4.2. Establish rehabilitation facilities that can care for poisoned vultures	TAWIRI*, TAWA, TANAPA, NCAA, Conservation NGOs, Researchers	2026-2027	The number of available facilities (2 facilities available)

*Lead Institution

7.2. SO.2 Community and Public Engagement

Generally, while people may be aware of vultures' existence, they are most likely unaware of their ecological importance and perilous population status. The likelihood of vulture awareness is increased if they work in a protected area, live near one or visit as a tourist. Vultures are underrepresented in wildlife documentaries, with the focus on charismatic and attractive animals such as lions and elephants. There needs to be a focused strategy to increase people's awareness of vultures' importance and plight, aiming for a knowledge and attitudinal shift trending towards a growing appreciation for vultures. Ultimately, the last phase will create a sustainable sense of stewardship for vultures.

A multi-pronged strategy is needed to integrate vulture conservation and the dangers of pesticide use into existing project activities. Working with partners already operating in likely poisoning hotspots will be key to this objective, and the development of a ‘vulture pack’ of educational materials will enable them to integrate additional materials into their existing work. However, relying on conservation education alone is insufficient to move the needle on national attitudes. Children also need to be engaged through schools and adults through targeted and creative outreach campaigns. As there is an International Vulture Awareness Day in September each year, the country should adopt this as a national day of raising vulture awareness to target the nationwide audience and hold events at a local site. National media coverage would also focus on the local event to raise awareness using carefully selected media sources (Tv, radio and social media outlets). An awareness-raising film should be made and a media strategy with some of the larger media organizations should be developed, enabling more regular and repeatable programming, such as videos on buses and safari channel coverage. These could also be used in schools to educate the next generation, taking the action plan’s vision beyond the 10 years.

From initial research, it seems the traditional healers are also critical stakeholders to engage with in regard to stewardship and vulture protection. Content should be made to engage with traditional belief systems, events and ceremonies to try and shift perceptions of vultures to encourage their role as stewards and protectors. Materials (pamphlets, fliers, films, music) should be made with them in mind specifically and should involve deep consultation with practitioners of traditional medicine and with elders.

Table 8: SO.2 Community and Public Engagement

Target	Activities	Actors*	Timeline	Indicators
SO2. Community and Public Engagement				
2.1. Enhanced knowledge and appreciation of vultures	2.1.1. Create ‘vulture pack’ of educational content that can be integrated into conservation education programs to incorporate vulture conservation and the dangers of pesticides into their programs	MNRT*, conservation NGOs	2023-2033	10 programs incorporate vulture conservation materials; 100,000 people educated

Target	Activities	Actors*	Timeline	Indicators
SO2. Community and Public Engagement				
	2.1.2. Conduct community awareness meetings in areas adjacent to PAs with incidences of vulture poisoning and illegal trade	TANAPA*, TAWA*, NCAA*, Local Government Authorities, Conservation NGOs	2025-2027	Number of community awareness meetings Number of people attending
	2.1.3. Determine opportunities to integrate vulture-focused content into the national curriculum (Primary and Secondary Schools)	MNRT*, Ministry of Education, Science and Technology, TAMISEMI	2024	Assessment of the possibility of education integration to be completed by the end the of 2024
	2.1.4. Explore the feasibility of creating a children's book to teach appreciation for vultures	Education Consultant	2024-2025	Assessment of the possibility of book creation to be completed by the end of 2025
	2.1.5. Identify Seven companies/ parastatal organizations with a reach of many people to explore outreach potential	MNRT	2024-2025	Assessment of potential collaborators done by the end of 2025
	2.1.6. Celebration of Tanzanian vulture awareness day annually	MNRT	2023-2033	2,000 people educated annually at a local event 10,000,000 people reached via national media

Target	Activities	Actors*	Timeline	Indicators
SO2. Community and Public Engagement				
2.2. Increased vulture presence in national media	2.2.1. Develop media and communications strategy to increase knowledge about vultures and their declines to include traditional and non-traditional sources	MNRT*, media companies, Education consultant, Conservation NGOs	2023-2033	Strategy completed by end of 2024
	2.2.2. Conduct a One Health awareness campaign on hazards of HHPs	MNRT*, conservation NGOs, media companies	2025-2027	Number of campaign materials developed and distributed
	2.2.3. Conduct an outreach event for journalists with story preparation for national media	MNRT*, media companies	2024-2025	Outreach event completed Number of national media stories on vultures
	2.2.4. Creation and dissemination of short film for TV programs, social media, buses, local cinema nights	MNRT*, Filmmakers, media companies, bus companies, Conservation NGOs	2023-2033	Film completed by end of 2024 Film played by 2 TV channels, 10 conservation programs, on 5 bus companies by 2026
	2.2.5. Preparation and dissemination of materials for NaneNane, SabaSaba and other national outreach events	MNRT*, Ministry of Agriculture, Ministry of Health,	2025-2033	Materials completed by 2025 Use of materials at 3 national events annually

7.3. SO.3 Reduce Illegal Trade in Vulture Body Parts

Illegal trade in vulture body parts for traditional medicine use and witchcraft is known to have decimated vulture populations in West Africa. There seems to be an increase in removal of vulture body parts (mainly heads), particularly linked to bushmeat poaching in certain areas in the country. It is yet unclear if the demand is within or outside of the country, and the extent of the trade. More research is required to understand and monitor the drivers behind the trade from a consumer perspective, map markets linked to illegal trade, understand the traditional healer's perspective and identify hotspots of poisoning and trading locations. No information is available on this type of trade yet, despite vultures being endangered and listed as CITES Appendix II. It should be incorporated into evidence-gathering work and potential awareness raising on the importance of vultures to conservation, whilst the National Task Force should be able to conduct appropriate intelligence-led information gathering on the movement of vulture parts. Additionally, measures to combat poaching and illegal trade in vultures should be implemented in line with the National Anti-poaching Strategy 2023–2033. This Strategy is aimed at combating poaching and illegal wildlife trade in Tanzania and across its transboundary ecosystems for sustainable management and conservation of wildlife resources by reducing poaching incidents of keystone species, bush-meat poaching and trade incidents, domestic illegal wildlife seizure incidents and achieving zero international seizures of illegally traded wildlife products originating or transiting through Tanzania by 2033.

Table 9: SO.3 Reduce illegal trade in vulture body parts

Target	Activities	Actors*	Timeline	Indicators
SO3. Reduce illegal trade in vulture body parts				
3.3. Improved understanding of the motivations and markets for illegal trade in vulture parts	3.1.1. Undertake study on customer demand for vulture body parts locally, regionally and internationally	TAWIRI*, researchers, TRAFFIC, conservation NGOs, traditional healers	2024-2026	Study completed by 2026
	3.1.2. Undertake study to map markets of illegal wildlife trade specific to vultures with a focus on establishing the extent of illegal trade within and outside of the country	MNRT*, TAWIRI, researchers TRAFFIC, CITES, National Task force, Traditional leadership per zone, traditional healers	2024-2026	Report in place on the markets in vulture body parts Illegal wildlife trade in hotspots monitored

Target	Activities	Actors*	Timeline	Indicators
SO3. Reduce illegal trade in vulture body parts				
	3.1.3. Establish a database of illegal vulture trade	TAWIRI*, TRAFFIC	2024-2025	Database completed Annual analysis of trends in illegal vulture trade and market hotspots
3.2. Monitor illegal trade in vulture body parts	3.2.1. Identify and monitor hotspots of demand for illegal trade	MNRT*, TRAFFIC, CITES, National Task force	2023-2033	Map of hotspots for market and illegal trade produced annually
	3.2.2 Identify and monitor hotspots of illegal trade-based poisoning	TAWIRI*, researchers, TAWA, TANAPA, NCAA, conservation NGOs	2023-2033	Map of hotspots of trade-based poisoning produced annually
3.3. Reduce use of vulture body parts in traditional medicine	3.3.1. Identify and work to register all users of natural medicine	TAWIRI*, Conservation NGOs	2023-2033	Database of traditional healers completed
	3.3.2. Work with registered traditional healers to share knowledge about vulture conservation and encourage them not to use vulture parts and derivatives	TAWIRI*, MNRT, conservation NGOs, traditional healers	2023-2033	Traditional healers reduce use of vulture body parts by 70% in 3 years

Target	Activities	Actors*	Timeline	Indicators
SO3. Reduce illegal trade in vulture body parts				
	3.3.3. Establish a network of traditional healer leaders to champion and monitor the uptake of plant-based alternatives	TAWIRI*, MNRT	2023-2033	100% conversion to plant-based alternative in 5 years
	3.3.4. Establish plant nurseries for sustainable supply of the plant-based alternative	TFS*, MNRT	2023-2033	

*Lead Institution

7.4. SO.4 Develop and Implement a Standardized Monitoring System to Assess Vulture Population Status

As demonstrated by the current monitoring of vultures in Tanzania, declines have been recorded. Since 2018, detected rates of mortality per year of between 23-28% (i.e. annual survival is only 72-77%) are not sustainable (Kendall *et al*., 2023) when a stable or increasing population has >90% survival (Green, 2023). To be able to measure the impact of conservation and management interventions to achieve the goal of this action plan, this SO provides a standardised monitoring system to be scaled up across the country in key vulture areas. A Standard Operating Procedure (SOP) will be developed with details on how to conduct and analyse well established monitoring methods, such as repeatable roadside transects, telemetry and monitoring breeding, as well as information on populations via genetic work. These are easy to replicate across multiple sites for comparing trends across time, i.e. changes in vulture abundance, annual mortality rates of tagged vultures and breeding success rates. This will involve collaboration of several institutions to coordinate the monitoring and provide commitment for at least the next decade, but ideally for the next 30+ years.

Table 10: SO.4 Develop and implement a standardized monitoring system to assess vulture population status

Target	Activities	Actors *	Timeline	Indicators
SO4. Develop and implement a standardized monitoring system to assess vulture population status				
4.1. Effective monitoring protocol of vultures	4.1.1. Develop SOP for monitoring vultures across Tanzania	TAWIRI*, conservation stakeholders	2024	SOP completed
	4.1.2. Integrate SOP within actors' strategic plans	MNRT*, TAWIRI, TAWA, TANAPA, NCAA, researchers, conservation NGOs	2024-2025	Report by actors of SOP integration into their strategic plan
	4.1.3. Train in monitoring protocols at site level	TAWIRI*, TAWA, TANAPA, NCAA, researchers, conservation NGOs	2024-2029	Number of people trained Number of sites completing training Training reports submitted
4.2. Centralised database storing all vulture monitoring data developed and implemented	4.2.1. Establish national vulture monitoring database	TAWIRI*, MNRT	2025	Database created and available online at TAWIRI website for registered users Monitoring data submitted from all sites
	4.2.2. Establish database management system	TAWIRI*, MNRT	2025	Quarterly report on number of surveys and sites conducted
4.3. Vulture population monitoring	4.3.1. Establish and continue ground surveys in and around PA networks	TAWIRI*, TAWA, TANAPA, NCAA, conservation stakeholders and higher learning institutions	2023-2033	Minimum of 250km transects per site completed every 2 years; Trend report every five years.

Target	Activities	Actors *	Timeline	Indicators
SO4. Develop and implement a standardized monitoring system to assess vulture population status				
	4.3.2. Set baseline ground surveys for key vulture population areas prioritized from existing knowledge	TAWIRI*, TAWA, TANAPA, NCAA, conservation stakeholders and higher learning institutions	2023-2033	Minimum of 250km transects per site completed every 2 years; Trend report every five years.
4.4. Monitor mortality and threats to vultures	4.4.1. Tag minimum of 25 individuals over 2 years across Tanzania	TAWIRI*, researchers, TAWA, TANAPA, NCAA, conservation NGOs	2023-2033	Number of vultures per population Adult survival analysis completed every two years
	4.4.2. Follow up on telemetry-based vulture mortality	TAWIRI, researchers, TAWA, TANAPA, NCAA, conservation NGOs	2023-2033	75% of reported tagged vulture mortality is responded to within 3 days
	4.4.3. Follow up on non-telemetry vulture mortality	TAWIRI, researchers, TAWA, TANAPA, NCAA, conservation NGOs	2023-2033	Vulture mortality reported and data entered to central database
4.5. Monitor vulture breeding	4.5.1. Systematic counts at important vulture cliff-nesting sites	TAWIRI*, TAWA, TANAPA, NCAA, researchers	2023-2033	Counts conducted every three years
	4.5.2. Systematic counts at important vulture tree-nesting sites where feasible	TAWIRI*, TAWA, TANAPA, NCAA, researchers	2023-2033	Yearly reports on nest surveys in place

*Lead Institution

7.5. SO.5 Vulture Research to Improve Conservation Management

An important aspect of vulture ecology is their function in ecosystem services with disease removal via fast disposal of carcasses and the high pH of their stomach acid which can kill most diseases. This fast waste disposal service also contributes to reduction in greenhouse gas emissions from decomposing carcasses. To improve knowledge to promote vulture conservation within a One Health framework, the plan aims to quantify further vultures' role in disease dynamics and the cost if they were to disappear. In addition, it will explore the risk to vultures of exposure to other toxins, such as lead and diclofenac, which are currently considered low risk threats when compared with carbofuran poisoning, but could change over time.

Table 11: SO.5 Vulture research to improve conservation management

Target	Activities	Actors*	Timeline	Indicators
SO5. Vulture research to improve conservation management on				
5.1. Improve understanding of the role of vultures in ecosystem services	5.1.1. Undertake study to assess vulture role in disease dynamics	TAWIRI*, researchers, conservation NGOs	2024-2028	Study completed
	5.1.2. Undertake study to quantify the economic and health value of vultures to Tanzania's ecosystem service provision	TAWIRI*, researchers, conservation NGOs	2024-2026	Study completed
	5.1.3. Conduct a study on the feasibility of the use of Vulture Carbon Credits for conservation	TAWIRI*, researchers, conservation NGOs	2025-2026	Study completed
5.2. Improved understanding of the perception towards vultures	5.2.1. Undertake study to investigate local community perception of vultures	TAWIRI*, researchers, conservation NGOs	2025-2026	Study completed
5.3. Improved understanding of other toxin risks to vultures	5.3.1. Investigate the lead levels in vultures via blood samples to determine risk of lead poisoning to vultures	TAWIRI*, Researchers, Conservation NGOs	2025-2026	Study completed

Target	Activities	Actors*	Timeline	Indicators
SO5. Vulture research to improve conservation management on				
	5.3.2. Investigate the availability and use of vulture safe and unsafe NSAIDs (diclofenac, meloxicam and tolfenamic acid) for treatment of livestock to assess the risk of diclofenac poisoning to vultures	TAWIRI*, researchers, local vets	2025-2026	Study completed

*Lead Institution

7.6. SO.6 Mitigate Threat of Energy Infrastructure (Powerline Electrocution and Collision, Wind Farm Collision) to Vultures

Sixty-four percent of Tanzanians live in rural areas, with only 24% having access to electricity (based on data from 2021). Understandably rural electrification schemes are a priority, also meaning large birds living inside or moving between protected areas via corridor/migratory routes may be at increased risk from collisions and electrocutions. In countries with more energy infrastructure already in place, bird mortalities are high. In Tanzania, where vultures already face threats that are leading them towards extinction, there is a chance to stop an emerging threat before devastating consequences occur. Bird-friendly powerlines and bird flight diverters are available and widely used elsewhere and are cheaper to implement at the construction phase rather than mitigate via retrofitting. Environmental Impact Assessments (EIA) need to be stringent in relation to energy infrastructure hazards to birds and during the National Environmental Management Council (NEMC) reviews. Best practices need to be shared with TANESCO for new transmission and distribution lines. With vulture telemetry data and known raptor migratory routes, there is an opportunity to map high risk zones, also in relation to important nesting, roosting and feeding areas of key species. Where high risk zones are identified for existing infrastructure, appropriate retrofitting should be applied or relocation of the site if possible. Monitoring of existing powerlines in some focal areas needs to be conducted to ascertain baseline information before and after mitigation measures. Similar procedures are needed for wind farms with stringent EIAs taking place and using expert knowledge to consider placement and scale of wind farm projects.

Table 12: SO.6 Mitigate threat of energy infrastructure (powerline electrocution and collision, wind farm collision) to vultures

Target	Activities	Actors*	Timeline	Indicators
SO6. Mitigate threat of energy infrastructure (powerline electrocution and collision, wind farm collision) to vultures				
6.1. Raptor-friendly powerline construction implemented for new transmission and distribution lines	6.1.1. Best practices shared with TANESCO	TAWIRI*, MNRT, TANESCO	2024-2026	New transmission and distribution lines are raptor-friendly Old transmission and distribution lines retro-fitted
	6.1.2. Review and strengthen EIA guidelines for new infrastructure projects in relation to raptors and migratory birds	TAWIRI*, MNRT, NEMC	2024-2025	New EIA guidelines produced
	6.1.3. Establish and share the key flyways for raptors and migratory birds with TANESCO and NEMC for infrastructure planning	TAWIRI*, researchers, TANESCO, NEMC	2023-2033	Flyway maps produced and overlaid with current and planned powerlines
6.2. Mitigate vulture mortality from existing powerlines as needed	6.2.1. Monitor existing powerlines for vulture mortality in key areas	TANESCO*, TAWIRI	2023-2033	20 km per site monitored a minimum of four times per year (dry and wet season when migrants are around) Number of mortalities per by species per survey, comparing seasonal and annual trends.

Target	Activities	Actors*	Timeline	Indicators
SO6. Mitigate threat of energy infrastructure (powerline electrocution and collision, wind farm collision) to vultures				
				A 65% reduction in mortality after retrofitting of infrastructure
	6.2.2. Implement mitigation in problem areas along existing infrastructure	TANESCO	2023-2033	Appropriate retrofitting to establish bird-friendly infrastructure is completed. Monitoring measures established and assessed as in Activity 4.2.1
6.3. Mitigate wind farm collisions for vultures	6.3.1. Share the key flyways for raptors and migratory birds	TAWIRI*, researchers, TANESCO	2023-2033	Maps of flyways produced
	6.3.2. Appropriate EIA conducted for vultures and proposed new wind farm construction	NEMC* TANESCO, MNRT, TAWIRI,	2023-2033	EIA completed incorporating explicit assessment of risk to birds
	6.3.3. Establish appropriate mitigation measures at high-risk wind farm sites	NEMC*, TANESCO, MNRT, TAWIRI	2023-2033	Bird-friendly wind farm construction completed OR relocation to low risk site

*Lead Institution

7.7. SO.7 Transboundary Coordination

Multiple studies have shown that vultures are a transboundary species, regularly crossing national boundaries. Effective collaboration will be critical to reduce threats from poisoning and illegal trade throughout a species or populations range. This should be targeted around integrating vulture monitoring into any established transboundary monitoring activities and coordinated transboundary actions and responses around poisoning and illegal vulture trade, particularly close to the country borders where there might be movement of vulture parts. Information should be shared subject to agreements on confidentiality of sensitive information via institutions. Coordination will be managed by the National Vulture Coordinator. Agreements such as the East African Community Strategy to Combat Poaching, Illegal Trade, and Trafficking of Wildlife and Wildlife Resources (2017-2022) may provide a framework under which to work and Lusaka Agreement on Co-operative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora.

Table 13: SO.7 Transboundary coordination

Target	Activities	Actors	Timeline	Indicators
SO7. Transboundary coordination				
7.1. Transboundary coordination and collaboration improved	7.1.1. Identify key partners for transboundary coordination and collaboration	MNRT	2024	List of key partners completed
	7.1.2. Initiate formal collaboration agreements	MNRT	2024	Signed MoU agreement
	7.1.3. Conduct annual meetings with partners	MNRT	2025-2033	Number and minutes of meetings
7.2. Coordinated conservation activity around poisoning and illegal vulture trade between Tanzania and other key countries	7.2.1. Incorporate vulture illegal trade and poisoning issues into existing transboundary activities	MNRT *, TAWA, TANAPA, NCAA, conservation NGOs, other country wildlife agencies	2023-2033	Transboundary poisoning and illegal trade reports shared annually
	7.2.2. Ensure information sharing utilises the East Africa Wildlife Poisoning Network where appropriate	WD*, TAWA, TANAPA, NCAA, conservation NGOs	2023-2033	Reports in place
7.3. Coordinated vulture monitoring across boundaries relevant to Tanzanian vulture biology	7.3.1. Share vulture monitoring SOPs with transboundary partners	MNRT/WD* TAWIRI, TAWA, TANAPA	2024-2025	Shared SOPs in place
	7.3.1. Incorporate vulture monitoring protocols into existing transboundary monitoring activities	MNRT/WD* TAWIRI, TAWA, TANAPA, NCAA	2023-2033	Transboundary monitoring reports shared annually

7.8. SO.8 Coordination of Vulture Conservation

As effective landscape monitors, information that vultures can provide about an ecosystem overarches other species and landscape conservation management efforts. Coordination to enable actors on the ground to act rapidly to information provided by tagged vultures should be clarified and strengthened across projects to reduce human-wildlife conflict and enable rapid response to poisoning. This means a commitment from actors to prioritise response to information, especially suspected poisoning events, as part of their own project strategy. Key to this will be the establishment of a coordination structure with designation of the National Vulture Steering committee, Technical Committee and National Vulture Coordinator. The National Vulture Coordinator will link to designated focal people in each wildlife authority and to site-level, potentially making use of the MIKE personnel already established in each PA.

Table 14: SO.8 Coordination of vulture conservation

Target	Activities	Actors	Timeline	Indicators
SO8. Coordination of vulture conservation				
8.1. Effective coordination structure set up to implement the plan	8.1.1. Establish a National Vulture Steering committee	MNRT*, TAWA, TANAPA, NCAA, TAWIRI	2024	National Steering Committee with terms of reference
	8.1.2. Establish a National Vulture Technical Committee	MNRT*, TAWA, TANAPA, NCAA, TAWIRI, conservation NGOs, private sector	2024	National Technical Committee with terms of reference
	8.1.3. Establish a National Coordinator to implement the plan	MNRT	2024	National Coordinator appointed with terms of reference
	8.1.4. Appoint a vulture focal person in all wildlife agencies	MNRT, TAWA, TANAPA, NCAA, TAWIRI	2024	Vulture focal person in place
	8.1.5. Integrate site-level vulture coordination into MIKE officer duties	MNRT, TAWA, TANAPA, NCAA, TAWIRI	2024	Vulture focal person in place in each PA

Target	Activities	Actors	Timeline	Indicators
SO8. Coordination of vulture conservation				
	8.1.6. Establish a National Vulture Forum	MNRT*, TAWA, TANAPA, NCAA, TAWIRI, conservation NGOs, private sector	2024	National Vulture Forum and membership criteria Number of annual meetings
8.2. Improve coordination with other conservation programs that overlap with vulture conservation	8.2.1. Coordinate with other groups working on anti-poaching to capture vulture mortalities when they occur in relation to poaching activities	TAWA, TANAPA, NCAA, Conservation NGOS	2023-2033	Number of projects integrating vulture conservation Number of vulture mortalities reported
	8.2.2. Coordinate with other groups working on human-carnivore or human-elephant conflict and enhance visibility of vulture poisoning issues	Conservation NGOs, TAWA, TANAPA, NCAA	2023-2033	% of identified groups that include vulture content
	8.2.3. Coordinate with other groups to ensure poisoning hotspot areas have human-wildlife conflict mitigation programs	TAWA, TANAPA, NCAA, Conservation NGOS	2023-2033	2 programs created on human-carnivore conflict in poisoning hotspots lacking this work

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LIST OF APPENDICES

Appendix 1: Vulture species present in Tanzania with IUCN status, global population estimates and presence in Tanzania

Species	IUCN Red List status	Global estimation # mature individuals	Presence in Tanzania		
			North	South	Comment
African White-backed vulture *Gyps africanus*	CR (decreasing) (2021)	270,000 individuals in 1992, but no estimate of mature individuals[a]; 81% decline in 3 generations[b]	Y	Y	
Rüppell's vulture *Gyps rueppellii*	CR (decreasing) (2021)	22,000; Declines equating to 92.5% (range: 88-98%) over 3 generations[b]. Estimated 3,000 pairs in Tanzania[a]. Declines in Tanzania (J. Wolstencroft in litt. 2006)	Y	Y	Low abundance in south as it is the limit of southern range
Hooded vulture *Necrosyrtes monachus*	CR (decreasing) (2016)	Maximum of 197,000 individuals. Declining rapidly with an estimated 83% decline (range 64-93%) over 3 generations[b]	Y	Y	
White-headed vulture *Trigonoceps occipitalis*	CR (decreasing) (2022)	5,500 individuals[c]. Decline of 88% (range: 59-94%) over 3 generations[b]	Y	Y	South is an African stronghold
Lappet-faced vulture *Torgos tracheliotos*	EN (decreasing) (2021)	9,200 individuals, of which c.6530 are mature individuals. c.2,000 individuals in Tanzania[e]. Decline of 79% over 3 generations (range: 64-87%)[b,d]	Y	Y	Higher abundance in the north due to habitat
Egyptian vulture *Neophron pernopterus*	EN (decreasing) (2021)	18,000 -57,000, of which 12,400-36,000 mature individuals (up to 50% in Europe). Resident populations within Africa have declined 91% over 3 generations[b]	Y	N	Rarely seen
Bearded vulture *Gypaetus barbatus*	NT (decreasing) (2021)	1,675-6,700. In 2011, there were only six or more nest-sites in Tanzania (S. Thomsett in litt. 2011).	Y	N	Rarely seen, limited to Mt Kilimanjaro
Palm-nut vulture *Gypohierax angolensis*	LC (Stable) (2016)	The population is suspected to be stable in the absence of evidence for any declines or substantial threats.	Y	Y	Widespread, especially in areas with palm plantations

a = Mundy *et al*. 1992; b = Ogada *et al*. 2016; c = Murn *et al*. 2016; d = Bird *et al*. 2020; e= Shimelis *et al*. 2005

Appendix 2: Terms of Reference for the National Vulture Coordinator and the various Committees

A. Terms of Reference for the National Vulture Steering Committee (NVSC)

The NVSC will comprise of five members who will include the Director of Wildlife as the chair the committee and Conservation Commissioners from TAWA, TANAPA, NCAA and the Director General of TAWIRI. The functions of the NVSC will include among others:

i. To make decisions beyond the limit of the National Vulture Coordinator and National Vulture Technical Committee.
ii. To appoint members of the National Vulture Technical Committee.
iii. To appoint the National Vulture Coordinator.
iv. To report to the Permanent Secretary (MNRT) matters to do with vulture conservation and management.
v. To meet at least twice per year but could also meet depending on the need basis.
vi. To receive progress reports from the National Vulture Coordinator and the National Vulture Technical Committee.

B. Terms of Reference for National Vulture Coordinator (NVC)

A fully functional NVC Office will have support staff managed by the NVC who will be appointed competitively by the National Vulture Steering Committee and should be non-aligned. The NRC will receive all vulture related information as required from across the vulture sites in the country.

i. To report to the National Vulture Steering Committee on implementation progress of activities in all vulture conservation areas.
ii. To chair the National Vulture Technical Committee meetings.
iii. To oversee fund raising for implementation of the Vulture Conservation and Management Plan.
iv. To oversee the implementation of the vulture conservation and management plan as described in the Conservation and Management Plan, 2023-2033.
v. To provide technical support to all vulture sites.
vi. To produce quarterly and annual reports on the progress of implementation of the plan.
vii. To maintain and keep up to date the national vulture database and other relevant data.
viii. To take decisions at the vulture site level to ensure timely implementation of activities.

ix. To ensure harmony with other species strategies at the local level (through liaison with Heads (Commissioner) of National Parks and Game Reserve Managers.

x. To participate in all International and National Forum concerning vulture conservation.

C. Terms of Reference for the National Vulture Technical Committee (NVTC)

The NVTC will comprise of the: National Vulture Coordinator who will chair the meetings, and technical members from TANAPA, TAWA and NCAA, NGOs and the private sector working actively and supporting vulture conservation will be co-opted as committee members. The functions of the NVTC will include:

i. To oversee, coordinate and drive the implementation of the vulture conservation and management plan.
ii. To make technical decisions that are beyond the vulture sites level.
iii. To make decisions on timely implementation of the Vulture Plan.
iv. To review and update the implementation status of the Vulture Plan regularly.
v. To meet at least three times per year to review the progress of implementation of the Vulture plan.
vi. To report/communicate to all Vulture stakeholders on Plan implementation progress.
vii. To convene at least one meeting with all the Vulture stakeholders each year.

D. Terms of Reference for a National Vulture Forum (NVF).

The NVF will be coordinated by the NVC and will meet annually. The forum will be attended by all Vulture practitioners in Tanzania and experts from outside the country. Specifically, it will comprise of vulture focal people and scientists from the wildlife agencies, conservation NGOs, private sector and policy makers. The functions will include:

i. To share research findings related to vulture conservation.
ii. To share experiences and lessons learned by vulture experts.
iii. To share the status of implementation of the vulture conservation and management plan.
iv. To publish proceedings and share widely.
v. To come up with policy briefs that will oversee effective vulture conservation and management.

Appendix 3: Indicative Budget for the implementation of the conservation and management plan for vultures in Tanzania 2023-2033

ACTIVITY DESCRIPTION	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	All numbers are in '000 USD									
STRATEGIC OBJECTIVE 1: REDUCE POISONING OF VULTURES										
Target 1.1. Reduced availability and use of HHPs										
1.1.1. Obtain and provide data on the availability, sales and use of HHPs, particularly carbofuran	24	16								
1.1.2. Develop a Policy Brief from a One Health perspective on the impacts of HHPs on human and wildlife health	7				7					
1.1.3. Conduct a workshop on the effect of HHPs (particularly carbofuran)	11									
1.1.4. Engage with drug and pesticide authorities to highlight concerns of HHPs on human and wildlife health to ensure that unauthorized pesticides are neither available in the local market nor used in Tanzania	5	5	5	5	5	5	5	5	5	5
1.1.5. Establish guidelines for safe removal and/or disposal of HHPs, especially carbofuran	11									
1.1.6. Work with pesticide manufacturers and distributers to find alternatives to HHPs		3	5	3						
Subtotal	58	24	10	8	12	5	5	5	5	5
Target 1.2. Monitor availability and sales of illegal HHPs in shops and local mnadas										
1.2.1. Understand the network chain of illegal HHPs distribution and sales	8	8	8	8	8	8	8	8	8	8
1.2.2. Train local government officers e.g. Agricultural and Livestock extension officers, to conduct regular and spot check inspections of HHPs distribution and sales	11	21								
1.2.3. Improved detection of illegal HHPs sales, confiscation of HHPs products and prosecution of sellers	10	10	10	10	10	10	10	10	10	10
Subtotal	29	39	18	18	18	18	18	18	18	18

ACTIVITY DESCRIPTION	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	All numbers are in '000 USD									
Target 1.3. Effective rapid response to poisoning or tagged vulture mortality										
1.3.1. Develop SOP for response to poisoning events in and outside of PAs (English and Kiswahili versions)	4	5	11							
1.3.2. Integrate SOP into PA operations	4	3	2							
1.3.3. Provide poison response training and refresher training in known poisoning hotspots	18	18	18	18	18	18	18	18	18	18
1.3.4. Ensure resources are available for rapid poison response	230	230	230	230	230	230	230	230	230	230
1.3.5. Set up and capacitate/train existing or new rapid response teams to follow up on poisoning in relevant PAs	18	18	18	18	18	18	18	18	18	18
1.3.6. Establish a centralized and standardized database for poisoning events	66	66	66	66	66	66	66	66	66	66
1.3.7. Incorporate poison response training into the curriculum of wildlife ranger training colleges			31							
Subtotal	340	340	376	332	332	332	332	332	332	332
Target 1.4. Ensure appropriate care is provided for poisoned vultures										
1.4.1. Provide workshop to train vets to address vulture poisoning cases (including wildlife authority, district vets, vet schools, and ecologists)		21	11							
1.4.2. Establish rehabilitation facilities that can care for poisoned vultures			50	55						
Subtotal	-	21	61	55	-	-	-	-	-	-
Total budget for Strategic Objective 1	**426**	**423**	**464**	**413**	**362**	**355**	**355**	**355**	**355**	**355**

ACTIVITY DESCRIPTION	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	All numbers are in ‘000 USD									
STRATEGIC OBJECTIVE 2: COMMUNITY AND PUBLIC ENGAGEMENT										
Target 2.1. Enhanced knowledge and appreciation of vultures										
2.1.1. Create ‘vulture pack’ of educational content that can be integrated into conservation education programs to incorporate vulture conservation and the dangers of pesticides into their programs	10	10	10	10	10	10	10	10	10	10
2.1.2. Conduct community awareness meetings in areas adjacent to PAs with the incidence of vulture poisoning and illegal trade		14	14	14						
2.1.3. Determine opportunities to integrate vulture-focused content into the national curriculum (Primary and Secondary Schools)	21									
2.1.4. Explore the feasibility of creating a children’s book to teach appreciation for vultures	11	21								
2.1.5. Identify 7 companies/parastatal organizations with a reach of >15,000,000 Tanzanians to explore outreach potential		21								
2.1.6. Celebration of Tanzanian Vulture Awareness Day annually	7	7	7	7	7	7	7	7	7	7
Subtotal	48	72	31	31	17	17	17	17	17	17
Target 2.2. Increased vulture presence in national media										
2.2.1. Develop media and communications strategy to increase knowledge about vultures and their declines to include traditional and non-traditional sources	21									
2.2.2. Conduct a One Health awareness campaign on hazards of HHPs		10	10	10						
2.2.3. Conduct an outreach event for journalists with story preparation for national media		14								
2.2.4. Creation and dissemination of short film for TV programs, social media, buses, local cinema nights	18									
2.2.5. Preparation and dissemination of materials for NaneNane, SabaSaba and other national outreach events		10	10	10	10	10	10	10	10	10
Subtotal	39	34	20	20	10	10	10	10	10	10
Total budget for Strategic Objective 2	**86**	**105**	**50**	**50**	**26**	**26**	**26**	**26**	**26**	**26**

ACTIVITY DESCRIPTION	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	All numbers are in ‘000 USD									
STRATEGIC OBJECTIVE 3: REDUCE ILLEGAL TRADE IN VULTURE BODY PARTS										
Target 3.3. Improved understanding of the motivations and markets for illegal trade in vulture parts										
3.1.1. Undertake a study on customer demand for vulture body parts locally and across Tanzania, and regionally, e.g. East Africa, Southern Africa, West Africa and beyond	14	27	27							
3.1.2. Undertake a study to map markets of illegal wildlife trade specific to vultures with a focus on establishing the extent of illegal trade within and outside the country	14	27	27							
3.1.3. Establish a database of illegal vulture trade	7	14								
Subtotal	34	68	54	-	-	-	-	-	-	-
Target 3.2. Monitor illegal trade in vulture body parts										
3.2.1. Identify and monitor hotspots of demand for trade	5	5	5	5	5	5	5	5	5	5
3.2.2 Identify and monitor hotspots of trade-based poisoning	5	5	5	5	5	5	5	5	5	5
Subtotal	10	10	10	10	10	10	10	10	10	10
Target 3.3. Reduce the use of vulture body parts in traditional medicine										
3.3.1. Identify and work to register all users of natural medicine	24	17	10	10	10	7	7	4	4	4
3.3.2. Work with registered traditional healers to share knowledge and encourage use of the identified plant-based alternative to vulture parts	23	23	23	23	23	23	23	23	23	23
3.3.3. Establish a network of traditional healer leaders to champion and monitor the uptake of plant-based alternatives	27	27	27	27	27	27	27	27	27	27
3.3.4. Establish plant nurseries for sustainable supply of the plant-based alternative	12	12	12	12	12	12	12	12	12	12
Subtotal	85	78	71	71	71	68	68	65	65	65
Total budget for Strategic Objective 3	**129**	**156**	**135**	**81**	**81**	**78**	**78**	**75**	**75**	**75**

ACTIVITY DESCRIPTION	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	All numbers are in '000 USD									
STRATEGIC OBJECTIVE 4: DEVELOP AND IMPLEMENT A STANDARDISED MONITORING SYSTEM TO ASSESS VULTURE POPULATION STATUS										
Target 4.1. Effective monitoring protocol of vultures										
4.1.1. Develop SOP for all eight species' monitoring across Tanzania	11									
4.1.2. Integrate SOP within actors' strategic plans	8	7								
4.1.3. Train in monitoring protocols at site level	13	13	13	13	13	13				
Subtotal	31	19	13	13	13	13	-	-	-	-
Target 4.2. Centralised database storing all vulture monitoring data developed and implemented										
4.2.1. Establish a national vulture monitoring database		17								
4.2.2. Establish database management system		12								
Subtotal	-	28	-	-	-	-	-	-	-	-
Target 4.3. Vulture population monitoring										
4.3.1. Establish and continue ground surveys in and around PA networks	12	12	12	12	12	12	12	12	12	12
4.3.2. Set baseline ground surveys for key vulture population areas in Tanzania prioritized from existing knowledge	12	12	12	12	12	12	12	12	12	12
Subtotal	23	23	23	23	23	23	23	23	23	23
Target 4.4. Monitor mortality and threats to vultures										
4.4.1. Tag a minimum of 25 individuals over 2 years across Tanzania	49	49	27	27	27	49	49	27	27	27
4.4.2. Follow up on telemetry-based vulture mortality	23	23	23	23	23	23	23	23	23	23
4.4.3. Follow up on non-telemetry vulture mortality	23	23	23	23	23	23	23	23	23	23
Subtotal	95	95	73	73	73	95	95	73	73	73
Target 4.5. Monitor vulture breeding										
4.5.1. Systematic counts at important vulture cliff-nesting sites	12	12	12	12	12	12	12	12	12	12
4.5.2. Systematic counts at important vulture tree-nesting sites where feasible	12	12	12	12	12	12	12	12	12	12
Subtotal	23	23	23	23	23	23	23	23	23	23
Total budget for Strategic Objective 4	**171**	**188**	**132**	**132**	**132**	**153**	**141**	**119**	**119**	**119**

ACTIVITY DESCRIPTION	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	All numbers are in '000 USD									
STRATEGIC OBJECTIVE 5: VULTURE RESEARCH TO IMPROVE CONSERVATION MANAGEMENT										
Target 5.1. Improve understanding of the role of vultures in ecosystem services										
5.1.1. Undertake a study to assess vulture role in disease dynamics	7	7	7	7	7	-				
5.1.2. Undertake study to quantify the economic and health value of vultures to Tanzania's ecosystem service provision	7	7	7							
5.1.3. Conduct a study on the feasibility of the use of Vulture Carbon Credits for conservation	7	7	7							
Subtotal	21	21	21	7	7	-	-	-	-	-
Target 5.2. Improved understanding of the perception towards vultures										
5.2.1. Undertake a study to investigate the local community perception of vultures	4	4								
Subtotal	4	4	-	-	-	-	-	-	-	-
Target 5.3. Improved understanding of other toxin risks to vultures										
5.3.1. Investigate the lead levels in vultures via blood samples		11	11							
5.3.2. Use results of the lead study to assess the risk of lead poisoning to vultures					5					
5.3.3. Investigate the availability and use of vulture safe and unsafe NSAIDs (diclofenac, meloxicam and tolfenamic acid) for the treatment of livestock		7	7			-	-	-	-	
5.3.4. Use outcomes of the NSAID study to assess the risk of diclofenac poisoning to vultures			4	4						
Subtotal	-	18	22	4	5	-	-	-	-	-
Total budget for Strategic Objective 5	**25**	**43**	**43**	**11**	**12**	**-**	**-**	**-**	**-**	**-**

ACTIVITY DESCRIPTION	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	All numbers are in '000 USD									
STRATEGIC OBJECTIVE 6: MITIGATE THREAT OF ENERGY INFRASTRUCTURE TO VULTURES										
Target 6.1. Raptor-friendly powerline construction implemented for new transmission and distribution lines										
6.1.1. Best practices shared with TANESCO	3	2	2							
6.1.2. Review and strengthen EIA guidelines for new infrastructure projects in relation to raptors and migratory birds	4	4								
6.1.3. Establish and share the key flyways for raptors and migratory birds with TANESCO and NEMC for infrastructure planning	2	4	4	1	1	3	2	2	1	1
Subtotal	8	9	6	1	1	3	2	2	1	1
Target 6.2. Mitigate vulture mortality from existing powerlines as needed										
6.2.1. Monitor existing powerlines for vulture mortality in key areas	2	4	4	1	1	3	2	2	1	1
6.2.2. Implement mitigation in problem areas along existing infrastructure	5	4	5	3	3	5	5	3	5	3
Subtotal	7	7	9	4	4	7	7	5	6	4
Target 6.3. Mitigate wind farm collisions for vultures										
6.3.1. Share the key flyways for raptors and migratory birds	2	4	4	1	1	3	2	2	1	1
6.3.2. Appropriate EIA conducted for vultures and proposed new wind farm construction	9	9	9	9	9	9	9	9	9	9
6.3.3. Establish appropriate mitigation measures at high-risk wind farm sites	9	9	9	9	9	9	9	9	9	9
Subtotal	20	22	22	19	19	21	20	20	19	19
Total budget for Strategic Objective 6	**35**	**38**	**36**	**24**	**24**	**30**	**29**	**27**	**26**	**24**
STRATEGIC OBJECTIVE 7: TRANSBOUNDARY COORDINATION										
Target 7.1. Transboundary coordination and collaboration improved										
7.1.1. Identify key partners for transboundary coordination and collaboration	7									
7.1.2. Initiate formal collaboration agreements	7									

ACTIVITY DESCRIPTION	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	All numbers are in '000 USD									
7.1.3. Conduct bi-annual meetings with partners		20	20	20	20	20	20	20	20	20
Subtotal	14	20	20	20	20	20	20	20	20	20
Target 7.2. Coordinated conservation activity around poisoning and illegal vulture trade between Tanzania and other key countries										
7.2.1. Incorporate illegal vulture trade and poisoning issues into existing transboundary activities	7	7	4	4	4	4	4	4	4	4
7.2.2. Ensure information sharing utilises the East Africa Wildlife Poisoning Network where appropriate	7	7	7	7	7	7	7	7	7	7
Subtotal	14	14	11	11	11	11	11	11	11	11
Target 7.3. Coordinated vulture monitoring across boundaries relevant to Tanzanian vulture biology										
7.3.1. Share vulture monitoring SOPs with transboundary partners	7	7								
7.3.2. Incorporate vulture monitoring protocols into existing transboundary monitoring activities	14	7								
Subtotal	21	14	-	-	-	-	-	-	-	-
Total budget for Strategic Objective 7	**49**	**48**	**31**	**31**	**31**	**31**	**31**	**31**	**31**	**31**
STRATEGIC OBJECTIVE 8: COORDINATION OF VULTURE CONSERVATION										
Target 8.1. Effective coordination structure set up to implement the plan										
8.1.1. Establish a National Vulture Steering committee	10									
8.1.2. Establish a National Vulture Technical Committee	10									
8.1.3. Establish a National Coordinator to implement the plan	20	20	20	20	20	20	20	20	20	20
8.1.4. Appoint a vulture focal person in all wildlife agencies	5									
8.1.5. Integrate site-level vulture coordination into MIKE officer duties	10									
8.1.6. Establish a National Vulture Forum	5									
Subtotal	60	20	20	20	20	20	20	20	20	20
Target 8.2. Improve coordination with other conservation programs that overlap with vulture conservation										
8.2.1. Coordinate with other groups working on anti-poaching to capture vulture mortalities when they occur in relation to poaching activities	9	9	9	9	9	9	9	9	9	9

ACTIVITY DESCRIPTION	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	All numbers are in '000 USD									
8.2.2. Coordinate with other groups working on human-carnivore or human-elephant conflict and enhance the visibility of vulture poisoning issues	9	9	9	9	9	9	9	9	9	9
8.2.3. Coordinate with other groups to ensure poisoning hotspot areas have human-wildlife conflict mitigation programs	9	9	9	9	9	9	9	9	9	9
Subtotal	27	27	27	27	27	27	27	27	27	27
Total budget for Strategic Objective 8	**87**	**47**	**47**	**47**	**47**	**47**	**47**	**47**	**47**	**47**
GRAND TOTAL	**1,007**	**1,046**	**936**	**787**	**713**	**720**	**706**	**679**	**678**	**676**

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