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Abstract

Purpose: This study aimed at analysing the perceptions of the local population and the impact of their activities on the conservation of vultures.

Methodology: This study was conducted at the periphery of Manda National Park (MNP) in the province of Moyen-Chari, in southern Chad. Semi-structured questionnaires were administered in 24 villages and involving 300 people belonging to 7 different ethnic groups (Sara, Gouleye, Mbaye, Ndaye, Ngambaye, Peul and Sarakaba). A stratified random sampling was carried out for this purpose. Chi-square test was used to compare the different levels of local population perception.

Findings: This study found that six (6) species of vultures were encountered in the study area, all belonging to the family Accipitridae, Order Accipitriformes with a predominance of Hooded Vulture, *Necrosyrtes monachus* (52.33%). Agricultural (70.32%), logging (24.4%) and pastoral (19.32%) practices were mainly prevalent in the local populations. The main threats to vulture populations in the study area include: food scarcity (95%), deforestation (57.33%), poaching (9.33%), use of vultures in the tradition (fetishes, cultural events) (7.66%) and the consumption of vultures (7%).

Contribution to theory and practice: This study made it possible to show the attachment of the population bordering the MNP to certain species of vultures in particular the white-headed vulture, *Trigonoceps occipitalis* and *N. monachus* of the study area through the totem, the myths and other clan or religious prohibitions; a factor that contributes to good human-bird cohabitation. This study also made it possible to assess the impact of human activities on vultures and offers opportunities to improve vulture conservation methods by involving local populations in conservation plans. The local populations of the PNM should be sensitized by the authorities in charge of wildlife management, on the importance of vultures in cleaning the environment, essential for health, and on the ecological importance of this taxon.

Keyword: *Perception, impact, human activity, vulture, conservation, Manda*

1.0 INTRODUCTION

Vultures are the only terrestrial vertebrates, obligatory scavengers and are migratory birds, scavengers, (Ruxton & Houston, 2002). Sometimes revered and often hated, vultures have fascinated people for a long time. Raptors or flesh-eating birds, vultures are a source not only of aesthetic pleasure by adding life, sound and colour to our existence, but also a source of economic growth, providing income and motivation for conservation through ecotourism (Saidu, 2013). They take on cultural significance in myths, legends, symbols, rituals (such as the ceremonial use of feathers), art and names (Botta, 2017). More importantly, vultures have undeniable ecological values, through their role as natural renderers, they participate in the recycling of nutrients and avoid the spread of diseases, in particular those linked to ungulates, wild or domestic, which constitute their main diet and they quickly disposing of carcasses (Ogada & Shaw, 2016). However, despite the multidimensional role played by vultures, they unfortunately encounter multiple problems in their environment (Ogada *et al*., 2016).

Enormous pressure is exerted on avian fauna including vultures which are threatened with extinction due to numerous human activities (BirdLife International, 2016). In particular, intentional or unintentional poisoning resulting from the rapid increase in the poaching crisis of elephants and rhinos across Africa (Jean-Pierre, 2011); poisoning by veterinary drugs (Pfeiffer, 2016); the degradation of their habitat and range; reduced availability of food resources. The decline of vultures is also attributed to urbanization and improved sanitation in slaughterhouses and waste disposal in some areas (Nikolaus, 2011). It should also be noted that intensive and illegal hunting for the skin, eggs, head and certain parts of their body in traditional medicine is particularly widespread in West, Central and Southern Africa leading to the decline of the species (Botha *et al*., 2017).

Of the 7 species of vultures found in Chad, 6 are threatened with extinction (CMS, 2016). Although, scarce number of studies have been done on the vulture; this is the case of work on the perception of local populations on vultures and the impact of human activities on the survival of the taxon. It has been shown that studies using the perceptions of local people can provide important information about the social impacts and ecological outcomes of conservation, and at the same time provide a better understanding of the conservation implications of human behaviours and enable us to an action for more solid conservation (Martin-Lopez, 2012). Social perceptions have also been used to address wildlife conservation issues, which in the case of vultures included identifying threats (Pfeiffer *et al*., 2015) and in particular understanding the prevalence of secondary poisonings (Santagali *et al*., 2016), or the perception of the value of vultures for the ecosystem services they provide and their importance for conservation (Morales-Reyes *et al*., 2018). Vultures are a taxon with high tourist potential, and with proven ecological importance. The lack of conservation policies, human pressure, coupled with the very low prolificacy of these birds will lead to the disappearance of most vulture species in the near future. A better knowledge of the species of vultures encountered in Chad, their ecology, the assessment of the impact of threats on their abundance would provide necessary and appropriate information for the conservation of these birds in Manda and its periphery in particular, and in Chad in general.

This work was therefore initiated with the objective of assessing the state of knowledge of local population on vultures and the impact of their activities on the conservation of this taxon in the study area. This specifically involves: identifying the different species of vultures encountered in the peripheral zone; to identify and assess the impact of the different types of use of vultures in the periphery of the MNP; and to assess the impact of different threats on vulture conservation in Manda.

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2.0 METHODS

2.1 Study Area

The study area includes the Manda National Park (MNP) located in the province of Moyen-Chari in the south-east of Chad between 9°12' and 9°38' north latitude; and between 17°48' and 18°16' East longitude (Figure 1). It was classified as a National Park in 1965, and covers an area of 1140 km². It is at the north-eastern limit of the city of Sarh, bounded to the West by a national road and the Chari River to the East. Its natural habitat is representative of Sudanese biotopes and is still relatively preserved. It is Chad's second National Park and classified in IUCN (International Union for Nature Conservation) category II (IUCN, 2008).

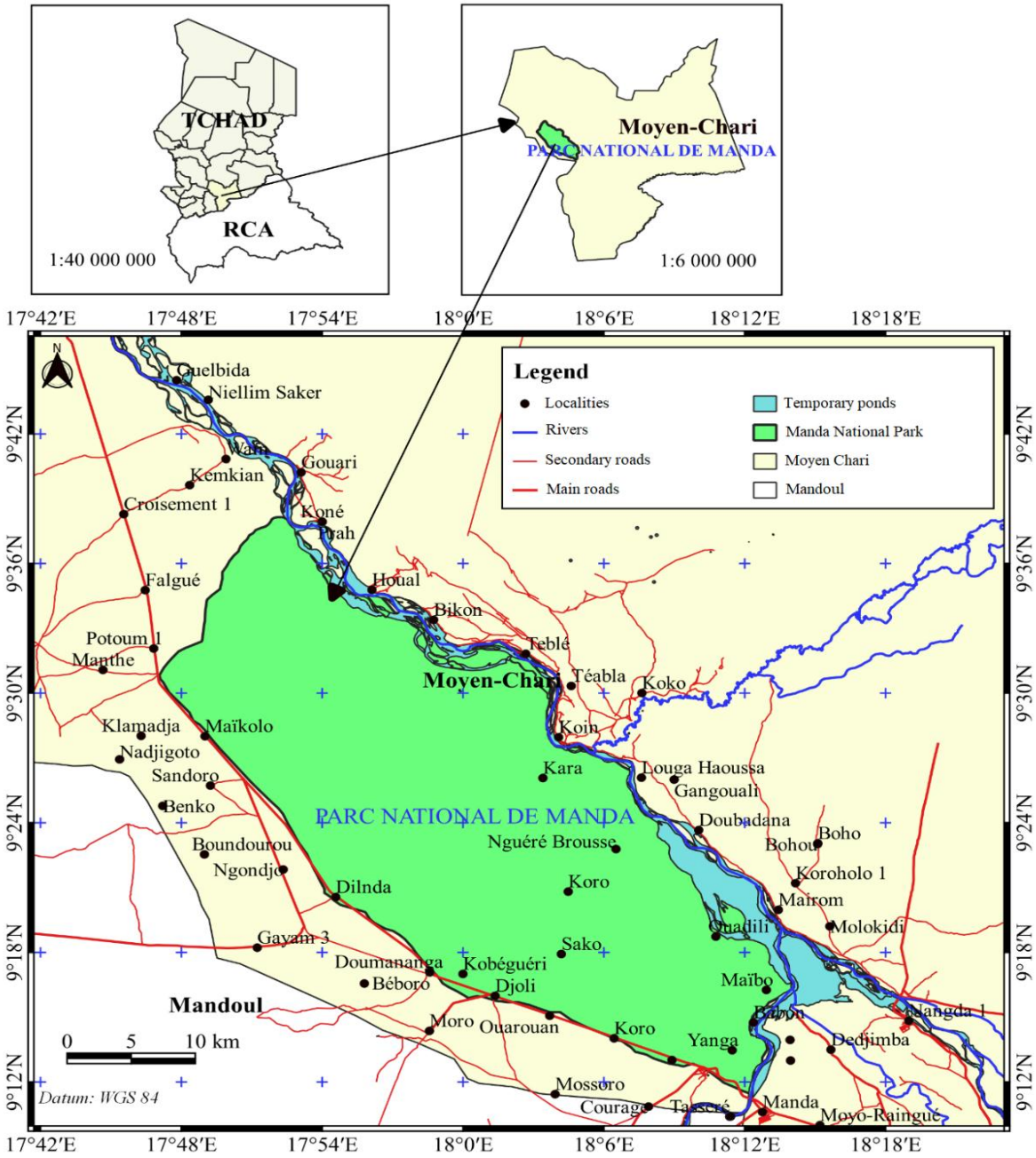

Figure 1: Map of the study area (SOGEFI Data base, 2021; World Database on Protected Areas, 2020)

2.2 Data Collection and Analysis

2.2.1 Data collection through Surveys

The pre-survey period took place from July 15 to 30 and data collection from 01 August to 30 October 2021 in localities bordering the MNP. The activities consisted first of making contact with the administrative and traditional authorities to explain to them the objective of the study, identifying the villages concerned and the framework for data collection, but also testing the investigation tools, namely the questionnaire sheets. The questionnaire survey method was therefore used to collect data from the local population of the MNP, direct observations were also made on the field using a binocular. It was during this same period that the choice of villages for the survey was made. To this end, twenty-four (24) villages were chosen according to the size of their population, and in such a way that they are located all around the park to maximize the nature of the information collected (species of vultures encountered, diversity in the perception of local residents on the use of vultures, the threats to these birds, etc.). The peripheral zone here consists of the villages located within a radius of 10 km beyond the limits of the park. The SOGEFI (Optimized Space Management Service France and International) (2021) database for Chad, QGIS software version 3.20 and Google Earth Pro version 7 were used for planning and producing the sampling map (Figure 2).

The field surveys were carried out between 8 a.m. and 6 p.m. by a team made up of a team leader (researcher), two assistants (a tracker and an eco-guard). Geographical coordinates of the survey points were recorded using a Garmin etrex 10 GPS. A semi-structured questionnaire (300 in total) was administered to each resident, regardless of gender, aged at least 20 years and residing in the area for at least ten years. This questionnaire was administered to the major socio-professional groups, such as farmers, breeders, loggers, traders, civil servants (administrative authorities, park conservation staff, etc.), butchers and traditional healers. Respondents were interviewed individually, to allow our interlocutors to express themselves more freely in anonymity without any form of pressure. The main information targeted during the surveys was: knowledge and use of vultures, the different species probably encountered in the study area, services, main threats to vultures, inconvenience, nuisances of vultures, and causes of disappearance vultures.

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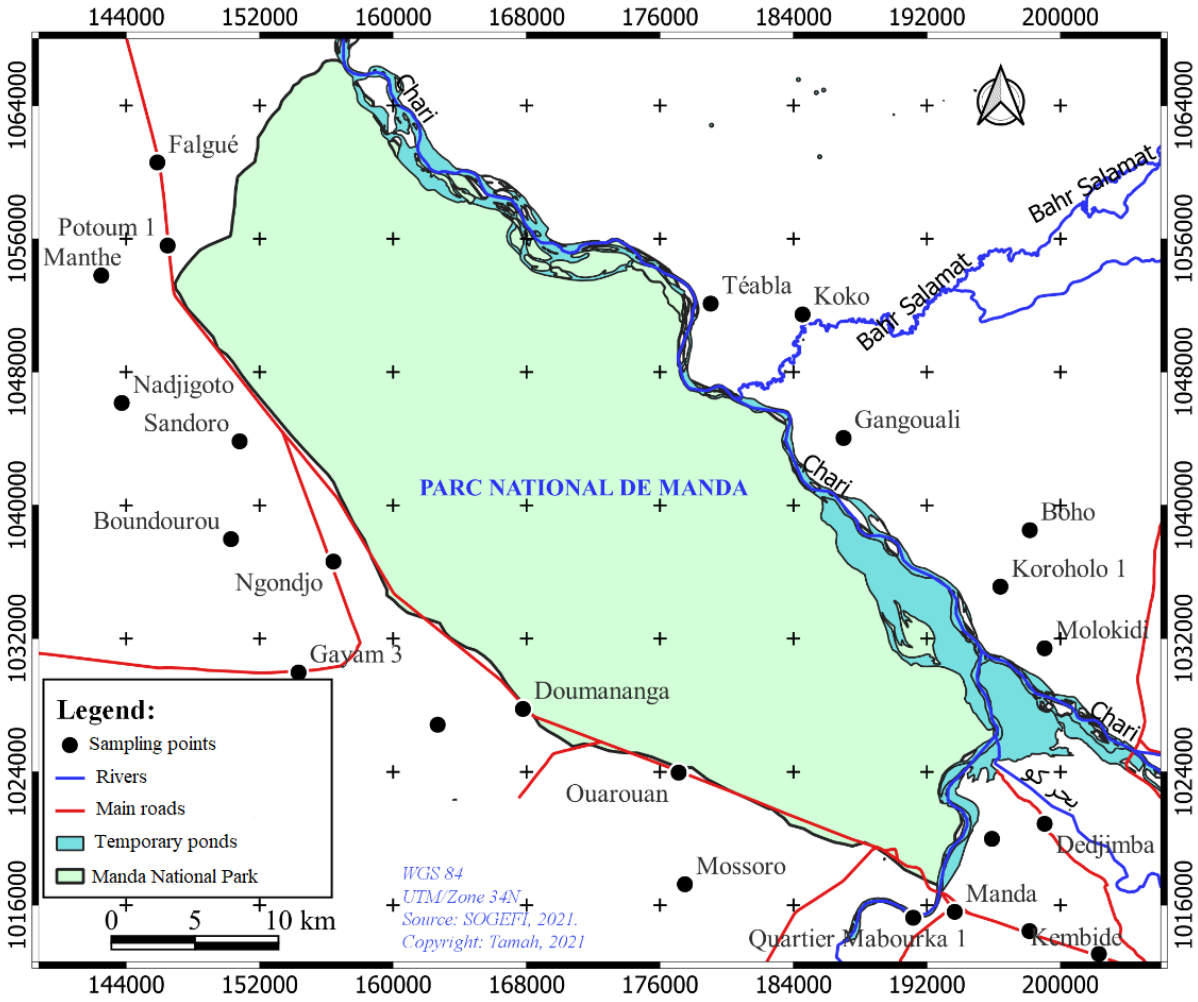

Figure 2: Location map of the different villages for the survey (SOGEFI Data base, 2021; World Database on Protected Areas, 2020)

2.2.2 Identification of vulture species

In order to facilitate the identification of the different species of vultures by the respondents, colour photos of the species potentially present in the area were used. Each respondent was asked to choose if he recognized the photo of the species of vulture encountered. Olympus binoculars (10x50) were also used to confirm certain information given by local residents. The West African Birds Identification Guide was the main support for the identification of the vulture species present (Borrow and Demeny, 2014).

2.2.3 Identification and evaluation of the different uses of vultures and their impacts on bird conservation

Farmers, forestry agents, breeders (nomadic and sedentary), witch doctors, butchers, gardeners and traders were interviewed in order to collect their perceptions on the different types of use of vultures and those that have negative effects for the conservation of this avifauna. The opinions of the notables of the village chiefs and land chiefs who belonged to one of the above-mentioned socio-professional categories were of paramount importance because it made it possible to appreciate the influence of tradition and local governance on conservation of vultures. Types of vulture use that negatively impact vulture conservation were also noted, an effort to see if there is a peaceful coexistence between humans and vultures in the area.

2.2.4 Determination of threats and their influences on the survival of vultures

The determination of the threats was essentially based on the identification of signs of anthropogenic disturbance such as agricultural occupation (field or farms), logging (harvesting of dead wood/heating), poaching (traps, presence of carcasses or remains of killed animals, traces or physical presence of poachers), the practice of traditional medicine (or healer, quacks), livestock farming, food shortage, transhumance (any presence of domestic livestock, pruning of ligneous) and camp of old or current stockbreeders. All this information was collected by noting the perception of the populations during the survey.

2.2.5 Data analysis

Excel software was used to record all the collected informations. This information was grouped according to the objectives of the study, and descriptive analyses were carried out. The results from these analyses were presented in the form of tables, graphs and figures. QGIS 3.20 software was used to map the study area and the sampling sites (villages). Some information collected was coded or translated into numbers (0=no and 1=yes) to facilitate processing. The non-parametric ANOVA test, in particular the Kruskal-Wallis's test, used for the comparison of the averages of the activities carried out by the respondents, in particular: agriculture, livestock, logging, and small trade, threshold of probability P= 0.05. The chi-square test was used to compare the differences in perceptions of local population. The generalized linear model allowed us to know the influence of threat on the abundance of vultures in the study area.

3.0 RESULTS

3.1 Socio-demographic and Socio-economic Characteristics of Respondents

Table 1 presents the identity profile of the people surveyed in the selected villages.

Table 1: Socio-demographic characteristics of respondents

		Ethnic groups							
Parameters	**Modalities**	**Gouleye**	**Mbaye**	**Ndaye**	**Ngambaye**	**Peul**	**Sara**	**Sarakaba**	**Total**
Sex	Female	0,33	1,33	0,00	2,00	0,33	5,66	1,00	10,68
	Male	3,00	9,0	6 ,00	7,33	3,66	54,00	6,33	**89,32**
	Total	3,33	10,33	6,00	9,33	3,99	59,66	7,33	100,00
Marital status	Married	2,66	8,33	5,00	7,00	2,66	49,33	5,00	**79,98**
	Single	0,33	1,00	0,33	1,66	1,00	6,33	1,33	11,98
	Widower	0,00	0,33	0,00	0,33	0,33	1,33	0,33	2,65
	Widow	0,33	0,66	0,66	0,33	0,00	2,66	0,66	5,30
	Total	3,32	10,32	5,99	9,32	3,99	59,65	7,32	100,00
Age	20-29	0,33	3,33	0,33	4,00	1,00	13,66	2,33	**24,98**
	30-39	2,00	2,33	2,33	0,66	1,00	18,33	2,00	**28,65**
	40-49	0,33	2,00	1,00	3,33	0,66	14,33	0,66	**22,31**
	50-59	0,00	2,00	0,66	1,00	0,33	7,33	1,00	12,32
	60-69	0,33	0,33	1,00	0,00	1,00	3,66	1,33	7,65
	70-79	0,33	0,33	0,33	0,33	0,00	1,66	0,00	2,98
	80-89 ;	0,00	0,33	0,00	0,00	0,00	0,66	0,00	0,99
	Total	3,32	10,65	5,65	9,32	3,99	59,63	7,32	100,00

These respondents were exclusively adults whose age varied between 20 and 82 years. The large number of respondents was found between 20-29 and 30-39 with respectively 24.98% and 28.65%. However, the age of the respondents did not vary significantly according to ethnicity according to the ANOVA test (F = 0.734, df = 3, P = 0.05). Regarding the distribution of respondents by gender, we found that men were dominating (Chi^2=141.78; df= 3, P=0.000). It appears that the majority of respondents were married people (79.98%), followed by single people with 11.98% (ANOVA test F= 73.2; df=1; P< 0.05). Widows and widowers came last in the represented respectively with 5.3% and 2.65%. According to the Chi-square test, the marital status of the respondents varies very significantly according to the ethnic groups of the respondents (X^2= 38.69, P=0.0001).

A total of 6 different activities were carried out by the 7 ethnic groups to which the Manda population belongs. The Sara ethnic group was the most represented in all the activities.

Table 2: Distribution of the main activities of respondents and according to ethnicity

	Activities (en %)					
Ethnicities	**Breeder**	**Farmer**	**Butcher**	**Veterinary nurse**	**Logger**	**Trader**
Gouleye	1,00	3,00	0,00	0,00	0,00	0,00
Mbaye	1,33	8,66	0,33	0,00	3,33	1,00
Ndaye	0,00	4,33	1,00	0, 33	1,33	0,33
Ngambaye	2,00	6,00	0,00	0,33	3,00	0,33
Peul	3,00	1,00	0,00	0,00	0,66	0,33
Sara	**10,33**	**43,33**	**2,66**	**2,33**	**15,66**	**3,33**
Sarakaba	1,66	4,00	0,66	0,33	0,66	0,66
Total	**19,32**	**70,32**	**4,65**	**3,32**	**24,64**	**2,98**

Agriculture ranks first among the Sara, and represents 43.33% (i.e., 130/300) of all respondents. Logging, animal husbandry, small trade are remarkable secondary activities in all the groups surveyed, and were the most noted human activities in the 7 ethnic groups investigated. The ANOVA test shows a very significant difference between the main activities carried out by the respondents (P < 0.05).

3.2 List of Species Encountered

In the study area, there were 6 species of vultures (Table 3) according to statements by local residents. Direct observations confirmed the presence of a large numbers of hooded vultures (*Necrosyrtes monachus*) around dwellings and livestock slaughterhouses.

Table 3: List of species encountered

Species	Number	%	IUCN status
Torgos tracheliotos (Forster, 1791)	71	23,66	Endangered
Gyps africanus (Salvadori, 1865)	40	13,33	Critically endangered
Trigonoceps occipitalis (Burchell, 1824)	65	21,66	Critically endangered
Necrosyrtes monachus (Temminck, 1823)	157	52,33	Critically endangered
Neophron percnopterus (Linnaeus, 1758)	14	4,66	Endangered
Gyps fulvus (Hablizl, 1783)	79	26,33	Least concern

Hooded Vultures (*Necrosyrtes monachus*) are the most observed by respondents with 52.33% (i.e. 157/300) of the total number of species encountered in the study area. Then come the Eurasian Griffon (*Gyps fulvus*) and Lappet-faced Vulture (*Torgos tracheliotos*) which represented 26.33% and 23.66% (i.e. 79/300 and 74/300) followed by the White-headed Vulture (*Trigonceps occipitalis*) with only 21.66% (i.e. 65/300) which are rarely encountered by respondents. We observed that, the White-backed Vulture (*Gyps africanus*) and the Egyptian Vulture (*Neophron percnopterus*) are very little observed with respectively 13.33% and 4.66% (i.e. 40/300 and 14/300) of the perception of the residents surveyed. Vulture species are found in towns, villages, around fishmongers (place where fish is sold), slaughterhouses and in all environments where livestock are found.

Figure 3 shows the Hooded Vulture encountered in the study area.

Figure 3: Species of vulture in the study area.

A: *Necrosyrtes monachus* on the ground, B: *N. monachus* perched on the *Khaya senegalensis*.

3.2.1 Frequency of observations of vultures in the slaughter areas by the respondents

Figure 4 shows the frequency of observation of vultures in the slaughterhouses according to the respondents. The figure shows that 76% of local residents confirm the presence of vultures on a daily basis in the slaughter structures (slaughtering areas, laughter houses and slaughterhouses) against 4% who affirm that the vultures frequently visit the slaughter structures once every 3 months compared to the 1% of people who reported observing vultures just once a year.

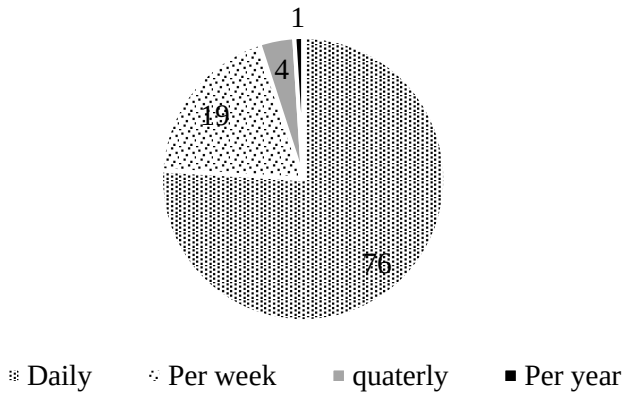

Figure 4: Frequency of observation of vultures by the respondents

3.2.2 Perception of local populations on the number of species of vultures encountered according to ethnicities

In almost all ethnic groups in the area, six species of vultures were reported (Figure 5). It appears that the six species of vultures are more frequent whereas, the Hooded Vulture is the most observed species for the Sara ethnicity which is followed by the Mbaye, Sarakaba Ngambaye and Ndaye, Peul and Ngouleye ethnic groups respectively.

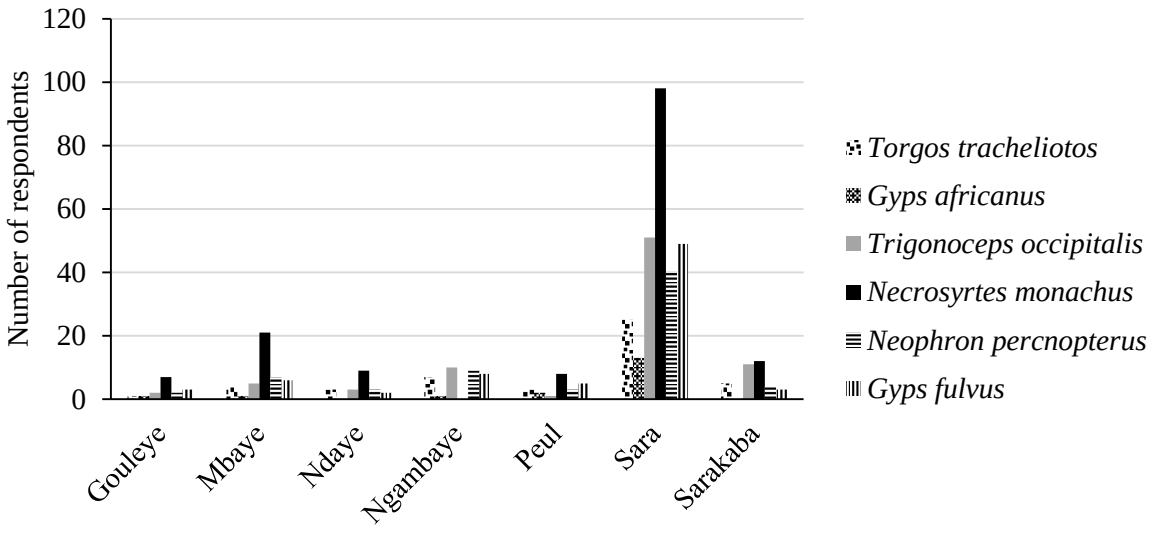

Figure 5: Variation in observations of vulture species according to ethnicity

3.3 Use of Vultures by Populations Living Near Manda Park

Global use of vultures

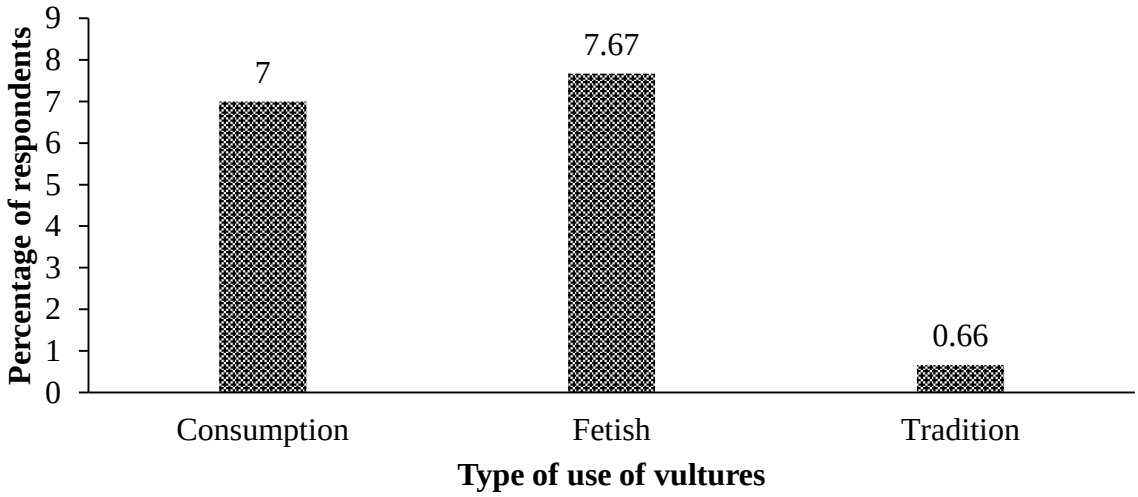

Figure 6: Main uses of vultures in the study area

The interviewed inhabitants described that vultures are used more for fetishes (7.66% or 23/300). Then comes the consumption of vultures (7% or 21/300) and finally in fetishism represents only 0.66% (or 2/300). The results of the Kruskal-Wallis test show no significant difference between the types of use (F=2; H=2; P=0.3679).

3.3.1 Use of vultures in the ethnic groups

In all the ethnic groups of the study area, vultures were used (Figure 7) either for the consumption (7.66%), in culture (7%) or for the realization of fetishes (0.66%). The Sara group (4.66% or 14/300) comes first in the consumption of vultures followed by the Ngambaye, Mbaye and Sarakaba respectively 1% (i.e. 3/300), 1% (i.e. 3/300) and 0.33 % (i.e. 1/300) at the last position. It also appears that the Sarakaba and Sara groups use vultures in their cultures (initiation rite and veneration of the vulture). On the other hand, the other groups do not use vultures in their cultures. Moreover, the ANOVA test shows high significant differences (F=2.169; df=8.156; P=0.1756) in the way of use in different ethnic groups.

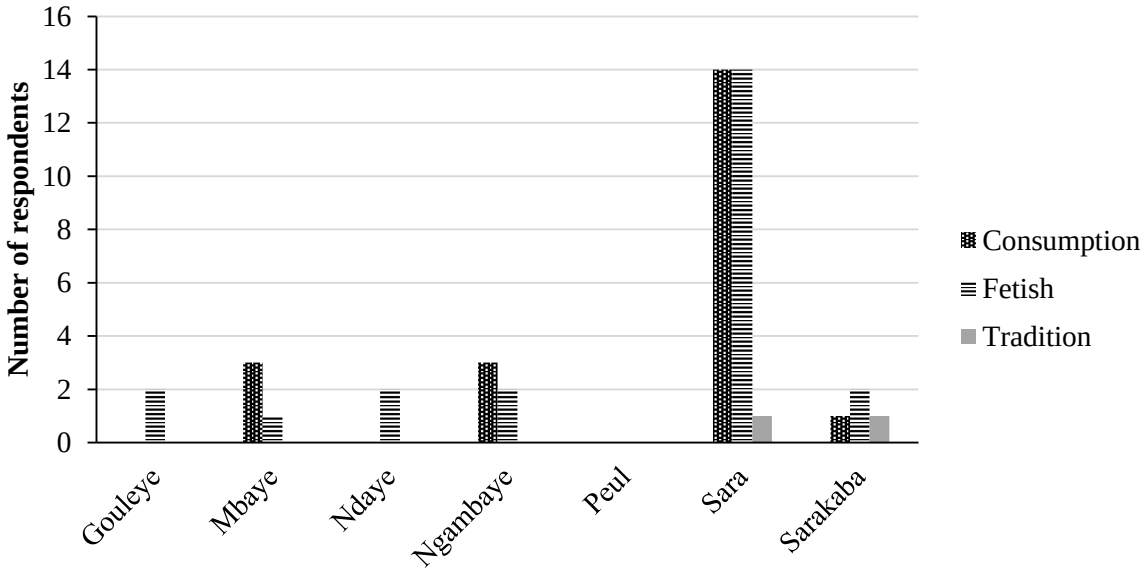

Figure 7: Types of uses of vultures according to ethnic groups

3.4 Threats to Vultures in the Study Area

3.4.1 Type of threats

Lack of food: main threat encountered in the study area, it is noticeable by the hygienic improvement of slaughterhouses. The low probability of finding dead wild animals in the wild.

Fetish: it presents itself as the least noticed threat in the study site. It results in the use of certain organs of the vultures (heads and legs) in many practices, such as the healing treatment in case of burns, epilepsy and sterility also as a luck. The feathers and claws of vultures are used to embellish the hats of land, canton and village chiefs.

Poisoning: threat that is very rare in the study area.

Poaching: clues explaining poaching in the study area by the presence of hunters and homemade vulture traps.

Deforestation: the most common threat in the study site. It is noticed by the cutting of various woods, the pruning for cattle and charcoal activities and also for agricultural activities, in particular the cultivation of corn, sorghum and millet.

Consumption as a source of protein is the least identified threat in the study area.

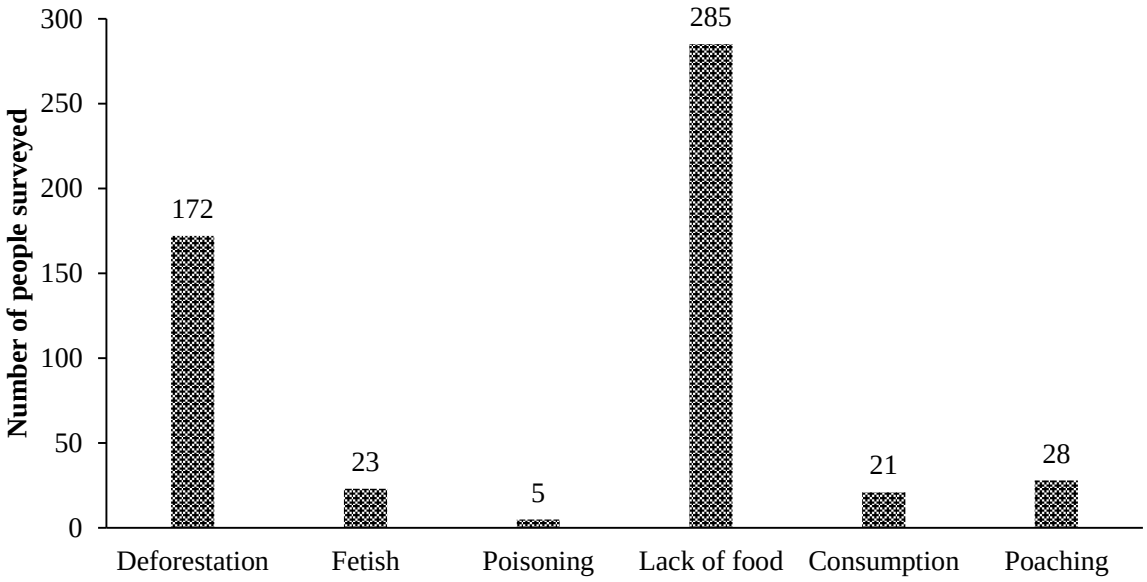

Figure 8: Main threats to vultures in the study area

Analysis of this graph shows that lack of food is the greatest threat (95%) faced by vultures in the study area according to respondents, followed by deforestation (57.33%). Next come respectively poaching, making fetishes and capturing for consumption with 9.33%; 7.66% and 7%. Poisoning comes last with 1.66%. The ANOVA test showed a highly significant difference between different threat categories (F=7.407; df=723.7; p=0.000).

3.3.2 Influence of threats on the survival of vultures in the study area

Figure 9 represents the evolution of species with respect to threat indices. This figure shows a gradual decrease in vulture abundance with an increase in threat indices. As the threats increase, the abundance of vulture species decreases. The probability of the naked model shows a highly significant difference (p= 1.924E-45). This explains why the threats negatively influence the survival of vultures in the study area.

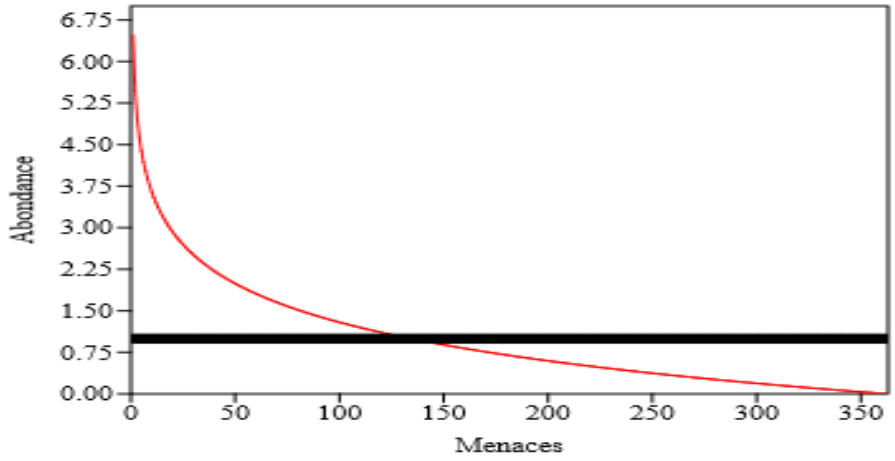

Figure 9 : Impacts of threats on vulture abundance

4.0 DISCUSSION

4.1 Socio-demographic Profile

The analysis of the socio-demographic profile of the surveyed populations shows that most of the population of Manda is between 20 and 49 years old, representing nearly 75% of the sample. The dynamic youth mainly practices extensive and semi-intensive agriculture (70.32%) and a small part (24.64%) engages in logging (firewood, charcoal, crafts and construction). These activities are known to affect wildlife and their habitat in the study area, were large scale agricultural expansion, illegal hunting, overgrazing, habitat loss, cereals cultivation in the area and bush fire (Legas and Taye, 2019). Similar findings were reported in Cameroon (Kougoum *et al*,. 2020) in which the major threats to biodiversity were illegal trade and killing of wildlife for bush meat, recent agricultural expansion and other incompatible land use changes. Large scale agricultural expansion is the major anthropogenic factor recorded as a major cause of species extinction (Kougoum *et al*., 2020).

4.2 Different Species of Vultures Encountered in the Study Area

Six (6) species of vultures, all from the Accipitridae family, have been recognized as present in the study area according to residents of the MNP and several species are now listed as critically endangered (IUCN, 2016). These are the Egyptian vulture *Neophron percnopterus*, Eurasian Griffon *Gyps fulvus*, Lappet-faced Vulture *Torgos tracheliotos*, White-backed Vulture *Gyps africanus*, Hooded Vulture *Necrosyrtes monachus* and White-headed Vulture *Trigonoceps occipitalis*. This number is close to the estimate of species richness made by Ogada (2016) and Salekwski (2017) who estimated that all West African vulture species (7) were also found almost throughout the Central Africa. In fact, the estimation by Ogada (2016) and Salekwski (2016) was essentially based on the results of surveys of local populations and on previous fieldwork in the same area. West African vultures are migratory and also endangered birds, which lead them to move all over Africa in search of food and breeding sites, which is why they are found in several African countries. Some species are even found outside their ranges, largely because of the degradation of their habitats and changes in behavior, especially the types of food. Among the species of vultures encountered, *Necrosyrtes monachus* is the species that has been commonly observed. The five other species of vulture were rarely observed or would probably have migrated to other areas or the interviewees would have misidentified the different species of vultures through the color photographs of the birds presented. The peripheral zone, which does not benefit from the same protection status as the MNP, is subject to significant anthropogenic pressures such as deforestation, agriculture and livestock farming. This could explain the rarity of other species of vultures by direct observation. The large flocks of *Necrosyrtes monachus* near human dwellings would be linked to the adaptation of the species which feeds on a wide variety of food debris discarded by humans. The local population consider the natural environments and the avian resources as a source of food, traditional pharmacopoeia, economically and culturally beneficial (Adjakpa, 2002).

4.3 Knowledge and use of Vultures by Residents of Manda National Park

The evaluation of knowledge on the consumption of vultures by the respondents shows that the population of the area rarely consume vultures. For most of them, the low rate is explained by the fact that vultures are repulsive and odd-looking birds. Consumption, poisoning and certain belief or the use of certain organs of vultures in the study area are not too noticeable. However, some respondents mentioned that vultures are used in tradition. This can be explained by the songs, tales and legends at night around the bonfire about the vultures. Interestingly, during our investigations, we could not find any collection of tales or songs. Also no feathers, heads or

legs of the vultures were seen in the garbage cans of the study area. Some interviewees claim that vulture body parts such as vulture heads and intestines are used as a healing charm, in refreshing memory by consuming with certain ingredients. The head of vultures is used in collective hunting ceremonies and initiation rituals. For the collective hunt, during the ritual ceremony where the people designated for the collective hunt are grouped together, the land or village chief sacrifices the vulture and applies its blood to the people designated for the hunt or to their hunting equipment and implores the clemency of the sky and the favour of the ancestors, so that the forest gives abundant game for the happiness of the community.

The head of the vultures is also used in the initiation ritual and traditional rites of which the respondents refuse to give full explanations. Ethnic groups in the study area admit that avian fauna is well taken into account and also vultures in certain cultures. The study shows the presence of several categories of use of vultures, namely: consumption (7%) as a source of protein, fetish (7.6%) and in culture or in tradition (0.66%). Moreover, these results do not corroborate with other works elsewhere in West Africa where Nikolaus (2011) demonstrated that the vulture constitutes an important ingredient used by the practitioners of traditional medicine for the preparation of drugs to treat the diseases in Ghana. It so happens that the head, brain, claws, beak, bones and feathers have been identified as the body parts of the vulture used in traditional medicine.

The main diseases cured by the body parts of the vulture are: rheumatism, headaches, bedwetting and diabetes; while protection against witchcraft is the main spiritual evil for which the body parts of the vulture are used. Indeed, Williams *et al*. (2014) estimate that in West Africa, vultures, and in particular the Hooded Vulture, are hunted for food (e.g. bushmeat) in West Africa by certain ethnic groups. Hooded vulture meat is sold as chicken in some places, although the consequences of this practice are unknown. Trade in vultures as bushmeat may be linked to belief-based use such as the use of vulture heads as a positive virtue, bringing good luck. Many species are sold for belief-based uses alongside those sold for their meat in the same markets, or are sold for other purposes. In Nigeria, a survey of medicine vendors revealed that Hooded Vulture was the most commonly traded vulture species, with 90 outlets selling parts of this species compared to other species (Saidu & Buij, 2013).

Vultures are increasingly hunted for traditional medicine and fetishism to increase the success of commercial ventures, to increase the income of gamblers and to improve the results of school children. They further believe that across West and Central Africa the species is one of the most sold, with an estimated 5850-7772 individuals sold over a six-year period in West Africa. (Saidu et al., 2013). They demonstrated that Rueppell's Vulture has been heavily exploited for trade, with vultures commonly sold in fetish markets. It is one of the most sold vultures in West African markets. In South Africa the white-headed vulture is captured for belief-based use and in Zambia the white-headed vultures have been intentionally killed for use in witchcraft practices.

4.4 Anthropogenic Threats to Vultures in the Study Area

The search for anthropogenic factors likely to affect the functioning and future of vultures is one of the major challenges in conservation biology. Many human activities can negatively impact the conservation of vultures in the study area. It appears from the results that 6 anthropogenic activities were identified with unequal frequencies. The perception of local population vis-à-vis these threats showed a significant difference (ANOVA test, F=7.407; df=723.7; p=0.000). The analysis of the data concerning the indices of threats reveals that the lack of food is the main threat (95%), this is accentuated by the low rate of slaughter of cattle

and the rarity of dead animals in the wild. The lack of available food followed by deforestation (57.33%) are the major threats and were mostly perceived more or less negatively by the people questioned. This result is close to that of Thiollay (2006) who considered that the reduction in the availability of food constitutes a major threat to vultures. He says lack of food due to overhunting, changes in livestock husbandry and habitat changes are affecting prey availability, and are having major impacts on vultures and wild ungulate populations on which the vultures depend on. This would explain the precipitous decline of vulture population throughout East Africa and West Africa, even in protected areas as well. Indeed, the decline of Hooded Vultures has also been attributed to land conversion due to the development and improvement of slaughterhouse hygiene as well as waste disposal in some areas (Ogada & Buij, 2011).

The deforestation mentioned in our study area through agriculture, logging and also slash and burn agriculture are best known for their negative impact on vulture conservation. Habitat degradation strongly affects bird communities (Meyburg, 2004). These results are close to those of Ogada *et al*. (2016) and Thiollay (2006) who believed that the main threats to vultures were: the considerable reduction of green areas and the degradation of habitats. This loss of habitat through deforestation in different forms inevitably leads to the specific and quantitative impoverishment of vultures. The perception of local residents on poaching through indices such as the trace of activity or the presence of hunters, artisanal traps in the area, shows that this activity is little practiced with a rate of 5.24% and exclusively by men less than 20 years old.

For the respondents, poaching as currently practiced would have a low impact on vulture populations, which is contrary to the studies carried out on West African vultures by Ogada (2016) who estimated that poaching is the flagship threat to vultures. He finds that elephant poachers deliberately kill and poison vultures on elephant carcasses because their aerial patrols betray the presence of their illegal activities and thus limit the risk of alerting the authorities. Thiollay's (2006) work on West African vultures showed that poisoning of its birds is recorded as the greatest threat that reduces the specific and quantitative diversity of this taxon. In East Africa, unintentional secondary poisoning is a large and widespread problem that occurs mainly outside protected areas. Many farmers use poisons in response to human-wildlife conflict or to control pests, including strychnine to control predators and poisoned livestock bait to kill carnivores such as jackals, lions and hyenas (Buij *et al*., 2016). In addition, according to local residents, a certain number of dangers, do not constitute threats for vultures in the study area. These are road infrastructure or electrical networks for electrocution, intentional or unintentional poisoning for purposes of belief and commercialization of vultures which are almost non-existent in the study area.

4.5 Implications of the Local Residents in the Conservation of Vultures in Manda

The local population is aware of the phenomena of environmental degradation. They all have the same perception of the disappearance of vultures in the study area. On the whole, they recognize vultures as repulsive birds, therefore hated by most of the interviewees. They are perceived as dirty birds with a negative image due to their eating behaviours and acts of unpleasantness. Indeed, local residents chase them at each contact. The attitude and perception of the population are diverse depending on the gender and the ethnicity of the person. It is observed that the females seem to have tender attitudes towards the vultures while the males have hostile attitudes. However, the majority of young respondents had more negative attitudes towards vultures. Relatively, the attitude of environmental degradation of local population through subsistence activities mainly involving agriculture, logging, livestock breeding makes it difficult for vultures to reproduce, either for individuals to meet, or to find enough food acts very unfavourably on the survival of the vultures.

Also, high population growth which increases the need for additional land for agriculture of the respondents was identified as a serious negative attitude which could very significantly influence the survival of vultures in the long term. Indeed, local residents keep a wary eye on vultures because these birds can attack domestic hens or small game or even isolated new-borns. This prevents vultures from settling or feeding near the human habitations and therefore the survival of the vultures at this place is also difficult. The practice of local residents of burying livestock that died of disease, in order to avoid contamination, prevents vultures from having access to these carcasses is perceived as a negative attitude and could have negative effects on vultures in the long term. The lack of esteem for vultures by local residents affects their attitudes and is likely to lead to difficult survival or even the disappearance of vultures in the long-term study area. However, some residents have favorable and respectful attitudes towards vultures for cultural reasons.

5.0 CONCLUSION

In short, it appears that the Manda area is made up of six species of vultures, of which the scavenger vulture *Necrosyrtes monachus* was the only species observed in the slaughter structures during sampling. This number varies according to the perception of the people surveyed according to ethnicity and according to their socio-economic activities. Related to Ethnic knowledge, some respondents have important knowledge about vultures which they would not like the total disappearance of the species. In some ethnic groups surveyed, the use of vultures in various forms has been observed, particularly in cultivation and consumption. Human pressure in the study area is real and constant. Threats encountered by vultures during sampling include severe lack of food, deforestation, poaching and poisoning. The human activity that has the most negative effects on vultures is deforestation in all forms, leading to the disappearance of forest areas. The sampling made it possible to understand that bird species in general and vultures in particular are subject to considerable threats in their living environment. This study has thus generated useful information that could enlighten the national or international opinion for awareness and a decision in favour of the community conservation of the biodiversity of the MNP.

The local populations of the PNM should be sensitized by the authorities in charge of wildlife management, on the importance of vultures in cleaning the environment, essential for health, and on the ecological importance of this taxon.

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Data Availability

The data that support the findings of this study are available from the corresponding author upon request.

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