

Research Article

Some Important Observations on the Populations of Hooded Vultures *Necrosyrtes monachus* in Urban Ghana

Francis Gbogbo,¹ Japheth S. T. Roberts,² and Vincent Awotwe-Pratt³

¹Department of Animal Biology and Conservation Science, University of Ghana, P.O. Box LG 67, Legon, Accra, Ghana

²Ghana Wildlife Society, P.O. Box 13252, Accra, Ghana

³Conservation Alliance, P.O. Box KA 30426, Accra, Ghana

Correspondence should be addressed to Francis Gbogbo; fgbogbo@ug.edu.gh

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Despite major declines in the population of vultures around the world, noticeable increases were reported in the populations of Hooded Vultures *Necrosyrtes monachus* over the past decade in Accra—an important vulture habitat in Ghana. In recent times, however, there is a growing concern that the vulture numbers are decreasing even though scientific data to support this is nonexistent. As a vital zoogeographical and conservation tool, it is important to keep an up-to-date knowledge about urban bird populations amidst rapid urbanization and associated changes. Using a combination of field data, literature review, and stakeholder consultations, it was indicative that severe decline might have indeed occurred in the populations of Hooded Vultures in Accra. Evidence suggests the killing of vultures for consumption, traditional medicine, and black magic in an undercover trade with possible transboundary connections as important underlying factor. Additional factors suspected to underlie the declines include changes in management of urban facilities and destruction of roosting and nesting trees. The implications of interspecific competition with Pied Crows *Corvus albus* on Hooded Vultures however remain unclear. There is an urgent need for conservation campaign and education to save the Hooded Vulture in Ghana.

1. Introduction

Since the 1980s, the populations of vultures in many areas around the world have decreased drastically and, in several places, vultures are now absent or confined only to protected areas [1, 2]. Published literature recognised the decline in Hooded Vulture *Necrosyrtes monachus* populations across Africa resulting in the species being reclassified from the status of Least Concern to Endangered [3] and, quite recently, Critically Endangered.

Despite the drastic decreases in vulture numbers in many parts of the world, the population of Hooded Vultures in Ghana is generally considered to be stable [3]. Indeed, the Hooded Vulture had been so common in Ghana that it occurred in 59 out of 93 atlas squares [3] and commonly makes use of open food markets, landfill sites, open dumpsters, and slaughterhouses [4–6].

Accra is one of the most important habitats for vultures in Ghana and according to [7] flocks of about 500 Hooded

Vultures were regularly seen around slaughterhouses and meat markets in Accra (the capital city of Ghana) and Kumasi (the second largest city in Ghana). Over the past decade, noticeable increases in Hooded Vulture populations have been reported in Accra [5, 6, 8, 9]. In recent times, however, there is a growing concern that vulture numbers are rapidly decreasing in Ghana even though scientific data to support this is practically nonexistent. As a vital zoogeographical and conservation tool, it is important to keep an up-to-date knowledge about urban bird populations amidst rapid urbanization and associated changes. In this paper, we support field data on Hooded Vultures in Accra with reviewed literature and consultation to demonstrate that declines might have indeed occurred in the populations of Hooded Vultures in the city. Literature search and stakeholder consultations further revealed changes in management of urban facilities and destruction of roosting and nesting trees as well as killing of vultures for consumption, traditional medicine, and black magic as possible underlying causes of the declines. The role

of interspecific competition with Pied Crows *Corvus albus* in the decline of vultures remains unclear.

2. Materials and Methods

2.1. Study Area. The study was carried out in Accra, the capital city of Ghana. Accra had a human population of 377,558 in 1960 which increased to 1,657,856 in 2000 [10, 11]. In 2010, Accra had an urban population of about 2.9 million and a metropolitan population of about 4 million [12]. With an area of 241 km², the capacity of Accra to contain the population growth was exceeded, leading to major challenges including difficulties with waste management, development of shanty towns, and increased rates of housing development [10, 11, 13, 14]. As Hooded Vultures are primarily associated with human settlements, a large number of the vultures inhabit Accra making use of landfill sites, slaughterhouses, open markets, open lawn areas, and the tall trees lining the streets in the city [4, 6, 8].

2.2. Field Work. The work in [15] reported the Legon Campus of the University of Ghana as the second most important area for Hooded Vultures in Accra. Between June 2005 and February 2006, weekly counts of Hooded Vultures and Pied Crows were conducted on foot in some major foraging areas on the Legon Campus of University of Ghana as outlined in [5]. Counts which were conducted simultaneously in the academic and residential areas of the Campus involved walking the foraging areas and counting the total number of Hooded Vultures and Pied Crows without width limits.

Analysis of the data collected between June 2005 and February 2006 as indicated by [5] revealed that peak count of Hooded Vultures occurred on the Legon Campus between November 2005 and January 2007. Therefore, the counts were repeated weekly between the months November 2010 and January 2011, November 2014 and January 2015, and November 2015 and January 2016 to monitor trends.

2.3. Review of Field-Based Scientific Reports and Published Literature. We reviewed published peer-reviewed papers including [3, 5, 6, 8, 9, 16]. In addition, reports from field-based studies of Hooded Vultures and Pied Crows in Ghana were reviewed including [15, 17–22].

2.4. Consultation of Key Stakeholders. We also had informal interactions with vulture researchers in Ghana and waste managers including scrap dealers and individuals frequently found in waste dumps sorting out potentially useful objects for reuse or reprocessing (referred to in this work as “refuse scavengers”).

3. Results and Discussion

3.1. Field-Based Studies

3.1.1. Trends in Vulture Populations. The daily abundance of Hooded Vulture on the Campus (mean \pm SE) for the period from June 2005 to February 2006 as reported by [5] was 84 ± 9 with a peak of 115 ± 4 between November 2005 and January

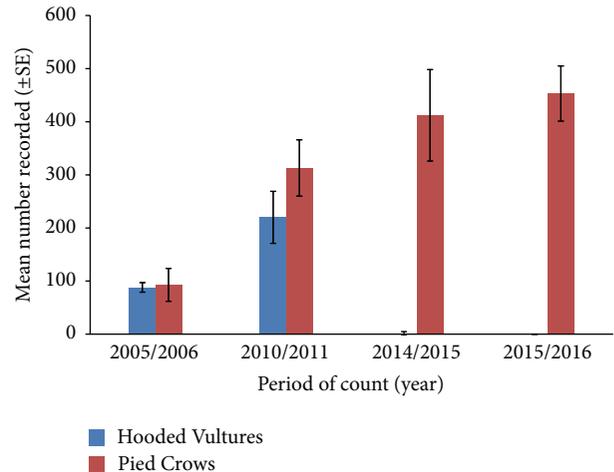


FIGURE 1: Number of Hooded Vultures and Pied Crows counted in important foraging areas of vultures on the Legon Campus.

2006. This daily abundance however increased to 220 ± 49 between November 2010 and January 2011. On the contrary, the daily abundance decreased to 5 ± 2 between November 2014 and January 2015 (Figure 1). Thus, the number recorded in 2014/15 constituted 2.3% of the number of vultures present on the Campus in 2010/11 whilst no vultures were seen on the foraging areas of the Campus between November 2015 and January 2016. Indeed, over four simultaneous visits to all known roosting sites on the Legon Campus in June 2015, no Hooded Vulture was seen. Clearly, a severe decline might have occurred in the vulture population on the Campus after the population increased to about 220 ± 49 in the year 2010/11.

Hooded Vultures in West Africa are primarily known to be associated with human settlements foraging on meat, vegetables, and rubbish [3, 5, 6, 9] and therefore there was the possibility that the vultures might have redistributed from the Campus to other urban areas as a result of developmental changes. However, in a count of Hooded Vultures in the entire city of Accra in the year 2012 [15], only 257 Hooded Vultures were recorded including 55 individuals on the Legon Campus (Table 1). Thus, the number of Hooded Vultures counted daily at forage sites on the Legon Campus in 2010/11 (220 ± 49) constituted 86% of the total number of vultures recorded in the entire city of Accra in 2012 [15]. Also, the number of vultures recorded on the Campus in 2012 [15] (55) constitutes only 25% of the number recorded in 2010/11 (220 ± 49) whilst the number recorded in 2014/15 (5 ± 2) constituted 9% of the 2012 records, not forgetting that no vultures were seen on the Campus between November 2015 and January 2016.

Although [15] counted vultures at roost sites in Accra compared to forage sites by earlier works, the methodology of [15] was chosen as a result of the unavailability of vultures at known forage sites. These are therefore indications that Hooded Vulture populations in Accra might have indeed decreased. Indeed, major decreases in the populations of Hooded Vultures have already been reported in Ghana's neighbouring countries such as Burkina Faso and Ivory Coast [3, 23]. With major decreases in an important area like Accra,

TABLE 1: Roost counts of verified active roost sites of Hooded Vulture [15]. Counts were undertaken simultaneously from the hours of 16:00 hrs to 19:30 GMT.

Site name	Mean number of roosting vultures
University of Ghana Campus	55
Ridge area	115
Achimota area	25
Presec high school area	10
Gimpa Campus	15
Burma camp	5
Cantonments	7
Atomic energy area	10
Labone area	5
Total	257

it appeared that trends in the population of Hooded Vultures in Ghana as a whole may equally be in jeopardy and would thus need research and management attention.

3.1.2. Competition between Pied Crows and Hooded Vultures. Closely associated with Hooded Vultures in the urban West African environment are Pied Crows although the latter did not attract as many published works as vultures [6, 9]. Contrary to the number of Hooded Vultures that increased to a peak in 2010/11 on the Legon Campus and decreased thereafter (Figure 1), Pied Crow population on the Campus has gradually been increasing from about 93 ± 31 to an estimated present population of 453 ± 52 in 2014/15 (Figure 1). By dividing the number of vultures by Pied Crows counted simultaneously on the Legon Campus, a vulture-to-crow ratio was obtained. This ratio generally decreased from 0.9 in 2005/6 to 0.01 in 2014/15 (as indicated in Figure 2) in a manner that is consistent with general competitive extinction models. The results of additional simultaneous counts obtained from literature search including [6, 9, 17, 18] are shown in Table 2 with values that are clearly consistent with our findings that Hooded Vulture populations far outnumbered crows in the past.

In the study of antagonistic behaviour and resource partitioning among scavenging birds in Ghana, [9] reported Hooded Vultures and Pied Crows to feed on the same types of food resources with frequent robberies occurring between the two. A strong competition could therefore have ensued between the growing numbers of vultures and crows for a number of resources. Nevertheless, compared to Hooded Vultures, Pied Crows are known to forage on a wider range of food items including seed and fruits and are known to outcompete many species of birds [24]. Annorbah and Holbech (2012) indicated that crows transported stolen foods to faraway distances contrary to the vultures' frequent attempts to consume food items in the immediate vicinity. With both species fighting back to recapture stolen food [9], vultures might be disadvantaged as "kleptoparasitic crows" fly far away to avoid repeated fight backs. At the same time, the tall trees used by vultures for nesting are equally used by crows but whilst the vulture would not nest in trees that

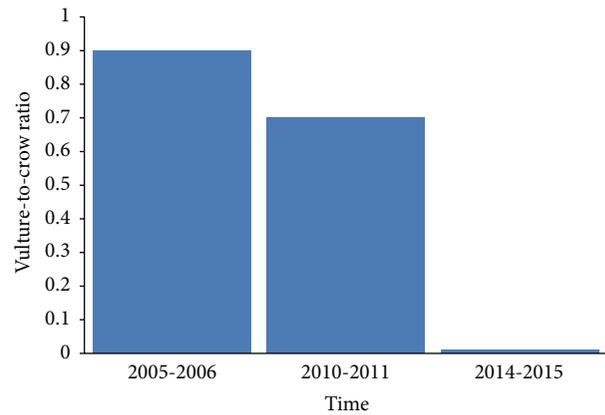


FIGURE 2: Trends in vulture populations expressed as a ratio to crow populations in simultaneous count of the two species on Legon Campus.

had Pied Crows nests, the latter additionally specialised on nesting on pylons and therefore have a wider nesting niche than vultures. Thus, the possibility of vultures succumbing to competition from crows in the presence of limited resources exists and this has indeed been reported by [25]. Further research is however needed to clarify the outcome of vulture-Pied Crow interactions.

3.2. Stakeholder Consultations and Literature Review

3.2.1. Management of Urban Facilities. The work in [5] reported littering of streets and defecation by roosting vultures on human and cars as major challenges associated with increasing Hooded Vulture populations on the Legon Campus. Hooded Vultures were also implicated as major risk to the aviation industry in Ghana [16]. In this regard, some direct measures were instituted to curb Hooded Vulture populations.

On the Legon Campus, contrary to the inefficient waste management practices identified by [5], major advances have been made including the provisioning of covered bins at vantage points all over the Campus. These bins are emptied into waste trucks for direct transport into designated off-Campus waste disposal sites therefore limiting the availability of rubbish to scavenging birds on the Campus. Also, in the bid to avoid bird strikes in the aviation industry, the Kotoka International Airport in Ghana considered a range of options to cut down on bird numbers [16]. Such measures include limiting the availability of major bird attractants such as food sources, open water, roosting sites, nesting sites, and perching sites, as well as bird scaring patrol and lethal control methods [16]. The airport authority working with other government agencies has implemented all but lethal control options within the 13 km radius of the airport. Thus, either all open refuse dumps have been closed or covered skips have been installed and are evacuated in the evenings. The outcome has generally been described by the airport authorities as successful.

Also, in addition to specific measures targeting the reduction in vulture populations as a result of their perceived

TABLE 2: Results of literature search on simultaneous count of crows and vultures in Ghana.

Year in which data was collected	Location	Mean number of vultures	Mean number of crows	Ratio of number of vultures to crows	Source
1989–2000	Accra and Kumasi	45 ± 32	20 ± 8	2.25	[6]
2005/2006	Achimota, Accra	64 ± 26	68 ± 20	0.94	[17, 18]
2007	Legon Campus	94	66	1.46	[9]

nuisance, rapid urbanization in Sub-Saharan Africa is associated with changes in the management of urban facilities [10]. The open refuse dump sites utilized by vultures are constantly threatened in the bid to improve sanitation across cities. For instance, a check from Districts Assemblies in the Accra Metropolis indicated that there were five landfill sites in Accra in the year 2010 but four of these were closed down by 2012. Also, there is a campaign for the closure of unhygienic slaughterhouses across the country although the exact numbers that have been closed down or rehabilitated are not known. Clearly more efficient and hygienic means of waste management are being introduced across the country and these would not be without consequence to Hooded Vulture populations.

3.2.2. Use of Hooded Vultures in Traditional Medicine and Black Magic. Our consultations with “refuse scavengers” indicated that they were abreast with noticeable reduction in the number of Hooded Vultures in Accra and many other parts of Ghana. Several of them indicated that Hooded Vultures in their numbers can now be found only in Tamale, the regional capital of the Northern Region of Ghana. They attributed the low vulture populations to the closure of landfill sites and trade in vulture and vulture parts in Ghana. According to the “refuse scavengers” the trade in vulture and vulture parts is a close market that is patronised by individuals interested in traditional medicine and black magic. This trade was reported to be connected to markets in Nigeria such that some killed vultures and vulture parts are smuggled from Ghana to markets in Nigeria. Indeed, [15] reported an encounter with a man at a landfill site in Accra capturing Hooded Vultures meant for export and use in Nigeria. In a confidential agreement to test the veracity of the existence of these markets, a confidant led a member of this team to an undercover sales point in a market at Tamale where many animal parts including Hooded Vultures were found (Figure 3). The head of a vulture in this market costs 200 Ghana cedis (~60 USD) whilst a whole vulture was 500 cedis (~140 USD).

There may be several reasons why vultures would still thrive in Tamale. In Ghana, cattle production is concentrated in the Northern Savannah Zone in which Tamale is located [26]. Unlike Accra that has witnessed the renovation of several slaughterhouses, the main Tamale slaughterhouse has not been renovated until very recently [27]. Also, although Accra has seen the closure of many landfill sites, these landfill sites still exist in Tamale and are reported to be poorly managed [28, 29]. Thus availability of food to the Hooded Vulture in Tamale might not be as difficult as it would be in Accra. Besides, the driving distance from Accra to Tamale



FIGURE 3: Exhibits of five Hooded Vulture specimens (concealed in brown paper) among other items being sold in a market at Tamale.

is about 618 km and it is possible that, until recently, many stakeholders in the vulture trade might be reluctant to go all the way to Tamale.

3.2.3. Killing of Vultures for Human Consumption. A search through archive electronic news of Ghana revealed that the killing and sale of vulture meat were alien to the Ghanaian culture until the first reported case in 2001. Although many of these incidents might have gone unnoticed or treated as a rumour, at least six archive pieces of news have been uncovered in which the culprits were seen with killed Hooded Vultures [30–35]. In 83% of the cases, the killed vultures were intended for sale to local restaurant operators or kebab sellers for onwards sale of the cooked meat to the unsuspecting public compared to 17% intended for black magic. The highest number of killed Hooded Vultures reported per each of such incidents was 32 and the last reported case was in 2012 [24]. Indeed, many of the vulture killing incidents may have gone unnoticed. Thus, with the killing of 32 Hooded Vultures per a single encounter, it is clear that such individuals could easily hunt down Hooded Vulture populations given the low clutch size of vultures.

3.2.4. Destruction of Roosting and Nesting Trees. Table 3 indicates some physical characteristics of tree species used by roosting Hooded Vultures in Accra together with their mean height and mean thickness at breast height [15, 21]. Only very tall trees including *Bombax* sp., *Khaya senegalensis*, *Antiaris toxicaria*, *Roystonea regia*, and *Anogeissus olitorius* were used by the roosting vultures. Nests were also recorded on *Bombax* sp. and *Khaya senegalensis*, *Ceiba pentandra*, and *Roystonea regia* [8, 21]. In many urban areas of Ghana including Accra, these trees are matured avenue trees several of which have recently fallen down after heavy downpours in response to

TABLE 3: Tree species used by roosting Hooded Vultures in Accra [15, 21].

Name of tree	Mean thickness at breast height (cm) \pm SD	Mean height (cm) \pm SD
<i>Bombax</i> sp.	136.5 \pm 26	2350 \pm 45
<i>Khaya senegalensis</i>	140 \pm 15 cm	2690 \pm 90
<i>Antiaris toxicaria</i>	150 \pm 0.1	2350 \pm 50
<i>Roystonea regia</i>	64 \pm 1	3000 \pm 10
<i>Anogeissus olitorius</i>	69 \pm 4	1850 \pm 0.1

which many are also cut down to prevent loss of life and destruction of property [15]. The cutting down of trees by property owners to reduce littering of cars and people by roosting vultures and crows has earlier been reported by [15]. According to [15], loss of roosting trees did not have a devastating impact on vultures because of the availability of alternatives. The impact of such destructions on nesting vultures would however not be overemphasised.

4. Conservation Implications

Hooded Vulture populations thrived well in Accra as a result of problems with the management of waste generated from the ever-increasing number of urban dwellers and the presence of tall trees used for nesting and roosting [15, 17]. It is clear that improvements in urban sanitation would affect the species population. However, factors such as the killing of vultures for consumption, traditional medicine, and black magic also appeared to be important underlying causes. There is therefore the need for an intensive education of the Ghanaian populace on the significant status and the need for the protection of the species.

Competing Interests

The authors declare that they have no competing interests.

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