Final Report

Breeding Ecology of Critically Endangered Hooded Vulture in Cape Coast Metropolitan Area, Ghana

By

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1 Introduction

The population of vultures, including the critically endangered Hooded Vulture (*Necrosyrtes monachus*), is declining at an alarming rate, according to Birdlife International (BirdLife International, 2015). This has proven to be a major conservation problem, local extinctions have been documented across the world, and some extant populations are only found in protected areas like national parks and game reserves. According to evidence from several studies, vulture populations are at risk from a variety of factors, such as persecution, poisoning, habitat degradation, and hunting for body parts for believ-base use in various parts of Ghana and throughout Africa. Several studies conducted in Ghana have documented declines in the population of vultures and have attributed such declines to the issues outlined above. Although there have been studies that investigated the breeding ecology of the species within its range, little is known about nest site availability, nest site selection, and nesting success as well as nest predation by other species on the Hooded Vulture in Ghana. Knowledge of this nature can improve our understanding of possible unknown causes of population declines aside from the other well-studied factors which conservationists and researchers are working around the clock to provide solutions to in the country. Field evidence has shown that some of the vulture population is breeding within the Central Region of Ghana (Afrifa et al., 2022), despite studies showing that a large portion of the breeding populations are restricted to protected areas within the country (Goded and Yiadom 2022 cited by BirdLife International, 2022).

2 Project objective

The project aimed to contribute valuable insights into the breeding ecology of the critically endangered Hooded Vulture *Necrosyrtes monachus* in the Cape Coast Metropolitan Area, Ghana. Additionally, we envisioned fostering citizen science initiatives and community engagement towards monitoring the species' population and nesting sites while concurrently raising awareness through a conservation science education campaign.

3 Methodology

We employed two main approaches to achieve the objectives of the project. The first was a research on the breeding ecology of Hooded Vultures which involved nest search and ecological data collection, camera trapping and nest monitoring. The second approach was Citizen Science Training and Conservation Education which involved workshops to train volunteers and the volunteers carrying out group and one-on-one education and awareness campaigns in communities.

3.1 Project area

The study was carried out in the Cape Coast Metropolitan Area (CCMA) in the Central Region of Ghana. The region is part of the Guinean forest zone, a critical biodiversity hotspot in West Africa. The area receives an annual rainfall ranging from 800 to 1500 mm, with temperatures varying between 24°C and 34°C, and relative humidity between 50% and 85%. The wet season typically spans from March to October, while the dry season lasts from November to February. The study area is characterized by a mix of coastal savannahs, pockets of native forests, and tree species such as African mahogany (*Khaya ivorensis*), silk cotton tree (*Ceiba pentandra*), oil palm trees (*Elaeis guineensis*), and other species of the Family Arecaceae. The area is predominantly urban with three-quarters of the population residing in urban areas. Green spaces, usually remnant forests are restricted within the campuses of two universities and a number of second-cycle schools. These remnant forests also retain some of the original vegetation of the metropolis.

3.2 Research on the breeding ecology of Hooded Vulture

Our approach to engaging secondary school students, aged 16 to 19, in the search for nests yielded unexpected results. Despite the enthusiasm of over 97 students from second-cycle institutions, the nests discovered by the students belonged to either the Pied Crow *Corvus albus* or the Yellow-billed Kite *Milvus aegyptius*.

While this outcome did not meet our initial goal, it served as an educational opportunity, enlightening students about the crucial ecological role played by these species in communities and the significance of their conservation.

3.2.1 Nest Search and Ecological Data Collection

Undeterred by the outcome of the results of the mass nest search, we turned our attention to reported nesting sites and observed breeding behaviours, such as aerial displays, copulation, courtship, conflicts, and nesting material transport. Once a breeding behaviour is observed, the species is carefully followed and observed at a distance to locate the nest. This alternative strategy proved successful, leading to the identification of a total of 13 active and four inactive but suspected hooded vulture nests. Once a nest was located, the coordinates were marked with a handheld GPS device (Garmin® Etrex HC) to aid further visitations. Data collection on nest locations was carried out from June 2023 to March 2024, which encompasses the majority of the breeding season of the birds as reported by the species within their range. A DJI Mavic mini drone was used to inspect the contents of the nest. This was done at the time when the bird was nowhere near the nest or on the nest. When the nest was inaccessible to drones, we used a spotting scope to monitor the nest's activity.

Although we found 13 active nests, we could work with eight due to the safety of the nests and the cameras. At each confirmed nest of the Hooded Vultures, the tree species was identified and we measured tree height, and nest height using a laser rangefinder (Bushnell Bone Collector 850 yards, 6x25mm). Tree circumference at breast height was also measured using a tape measure. We also counted the number of branching that makes the fork where the nest is located on the tree. Additionally, within a 50 x 50-metre area the average tree height was determined by measuring and determining the average height of three randomly selected trees. We also conducted point counts in a 50-metre radius to record the number of other bird species in the vicinity. These variables were used to describe nest site characteristics.

3.2.2 Camera Trapping and Nest Monitoring

To avoid the destruction of a Hooded Vulture nest during the study, we planted camera traps to monitor nests that were found on the premises of the University of Cape Coast. We used the double-rope technique, as described in (Thompson et al. 2017) to access the canopy and fixed a Solaris weapon 4k Trail Camera to a branch approximately 1.1-1.5 metres from the nest as shown in **Fig 1**. The camera was set to take two pictures in quick succession and record 20 seconds of video whenever movement was detected, with an interval of 10 minutes between these two pictures and the video recording. The camera was also set to be active between 0430- and 2200 hours GMT. All nest sites were, however, still monitored by trained volunteers occasionally. A total of eight nests were monitored with camera traps from the nest-building stage till the young once left the nest.

Fig 1. Hooded vulture nests with an egg being monitored by a Camera trap in Coast Coast.

3.2.3 Data Analysis

Data collected on nest sites and breeding success were analyzed using descriptive statistics. Variables such as tree height, nest height, and surrounding vegetation were analyzed to determine patterns in nest-site selection. Success rates were calculated based on the number of fledged juveniles. R Statistical software was used to run logistic regression analyses to assess the relationship between environmental variables and nest success, though these factors were not found to be statistically significant.

3.2.4 Results

A total of eight Hooded Vulture nests were found, predominantly located in the southern part of the metropolis where tall trees were scarce compared to the northern part. Vultures were found to nest on trees with an average height of 24.95 (± 3.68) metres, and nests were placed on average 18.82 (± 4.73) meters above ground level. Nests were found on six different tree species. Five of the tree species were native species currently assessed as Least Concern according to IUCN RedList. Two species, Rosy trumpet *Tabebuia rosea,* Least Concern and Manila Palm tree *Adonidia merillii*, Vulnerable, were introduced tree species. Two nests were found on Indian Almond trees *Terminalia catappa*, and another two nests were on two Rosy trumpet trees, one of the trees had been parasitized by Ficus spp. The other four nests were placed on Kapok *Ceiba pentandra*, Ackee tree *Blighia sapida*, Royal Palm tree *Adonidia merillii* and Giant Cola tree *Cola gigantea*. Average tree diameter at breast height (DBH) and circumference were 0.79 (± 0.13) and 2.48 (± 0.41) meters respectively. Nests were placed between forks of branches but were exposed to above-ground sunlight.

Despite challenges such as nest abandonment and predation, the study recorded a 75% success rate in fledging juveniles among the identified nests. Factors like tree height and the presence of surrounding trees were identified as potentially influencing nest site selection, though not statistically significant in the logistic regression analysis. Incidents of unintentional egg crushing by

adult vultures were documented, highlighting vulnerabilities during nest maintenance and incubation periods.

3.2.5 Account of Breeding Failure in Hooded Vulture

In all eight nests monitored with camera taps, vulture pairs successfully laid an egg, with seven out of the eight hatching a chick. However, only six nests successfully fledged a juvenile, resulting in a 75% success rate. The first eggs of two nests failed due to the unintentional cracking of the egg by the adults as it moved nesting material around. One pair out of these two pairs re-laid, with the chick successfully fledging. Shockingly an incident of cannibalism was recorded from one other nest where the nest failed due to the chick being eaten, either alive or nearly dead by its parents.

3.3 Citizen Science Training and Conservation Education

A two-day workshop was carried out to train 32 citizen scientists, comprising 22 students from the University of Cape Coast and 10 from local communities in Cape Coast. The training focused on general bird identification, birdwatching, vulture populations, and nest site monitoring. Equipped with a pair of binoculars and a field guide to the birds of Ghana each, these citizen scientists are actively monitoring nests and occasionally organize bird walks to engage other locals. Additionally, these volunteers received training on bird atlassing, data entry, and submission using the BirdLasser app, aligning with the African Bird Atlas Project (ABAP).

On December 17, a vulture awareness conservation education event was organised, where trained citizen scientists engaged with their communities to disseminate knowledge about vultures and emphasize the importance of their nesting sites for population recovery (**Fig 2**).

Fig 2. Trained citizen scientists and volunteers engaging with community members to disseminate knowledge about vultures and emphasize the importance of their nesting sites for population recovery

This involved one-on-one discussions between volunteers and community members. To further amplify vulture conservation awareness, the project team participated in two live sessions on the local radio station "Radio Central" (**Fig 3**). These sessions facilitated discussions on vulture ecology, and threats faced by vultures in the region, and included phone-in sessions to address questions from the public. The public was also entreated to allow tall trees to grow as these were the main structures on which vultures breed.

Fig 3. The project team creating awareness to the public through live sessions on the local radio station "Radio Central" about Vultures.

4 Challenges Encountered during the project

One of the unforeseen challenges was the limited number of volunteers who remained active after the project ended. Although 22 students and 10 community members were trained, only 9 volunteers continued to contribute data and monitor nests.

The last and major challenge was the difficulty in accessing some areas with identified nests. In some instances, some property owners prevented us access to trees on their properties and some even demanded payment to access the trees. This resulted in situations where we had to abandoned some nest that we wanted to monitor with camera traps.

5 Communication Plans

To ensure the dissemination of our research findings and to engage a broader audience in vulture conservation efforts, we have developed steps to ensure the results of this project are made available publicly through:

5.1 Manuscript Preparation and Publication

A manuscript has been drafted based on the research outcomes of this study and is currently under peer review for publication in a reputable ornithological journal (Journal of Avian Ecology and Conservation). This will contribute valuable knowledge to the field of avian ecology, particularly regarding the breeding ecology of the Hooded Vulture, a critically endangered species.

5.2 Conference Presentations and Workshops

We plan to put in efforts to present the results of this study at various national and international conservation workshops and conferences. By presenting our findings at events, we aim to foster discussions on vulture conservation strategies and collaborate with other researchers working on similar projects.

5.3 Citizen Science and Community Feedback

As part of our continued citizen science initiatives, we will share the results with the 32 trained citizen scientists who participated in the project. We will host follow-up workshops to discuss findings and explore how the insights gained can be used to improve local vulture monitoring efforts. Additionally, feedback sessions with community members involved in the awareness campaign will help refine future conservation activities, ensuring that the work remains aligned with local interests and needs.

5.4 Collaboration with Conservation Organizations

We have engaged with key stakeholders, including representatives from the Municipal Assembly's urban planning and maintenance department, as well as the electricity company's division responsible for managing overgrown trees near power lines. During these meetings, we emphasized the critical role that these trees play in the survival of the Hooded Vulture population and other bird species in the area. The discussions focused on the need for conservation-friendly practices that balance urban infrastructure needs with the preservation of important habitats for these species.

We will also share our findings with key stakeholders such as the Ghana Wildlife Society, and other conservation NGOs working on avian conservation in West

Africa. This will facilitate the integration of our research into broader conservation strategies and action plans. We are also exploring potential collaborations to include our data in global vulture monitoring databases.

6 Conclusion

While facing challenges in our initial approach, the project has made substantial progress in understanding the breeding ecology of Hooded Vultures and engaging local communities in conservation efforts. The combination of scientific research, citizen science initiatives, and targeted education campaigns forms a comprehensive strategy towards the long-term conservation of this critically endangered species. We remain dedicated to our mission and look forward to further advancements in our project.

7 Recommendations

To ensure the long-term conservation of the Hooded Vulture, we recommend increasing public awareness of the species' breeding habits and the importance of preserving tall trees in urban areas. Further studies should investigate other potential threats, including environmental toxins, and competition for nesting sites in urban areas where nesting sites are limited. Collaboration with local governments to incorporate vulture-friendly policies in urban planning would be beneficial.

8 Acknowledgments

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9 Bibliography

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10 Photo Gallery

An adult Hooded Vulture in a nest in Cape Coast, Ghana

A juvenile vulture in a nest on Indian Almond trees *Terminalia catappa*, in Cape Coast, Ghana

Two parent Hooded Vulture with a hatchling in a nest on Indian Almond trees *Terminalia catappa*, in Cape Coast, Ghana