Relative abundance, agonistic behaviour, and resource partitioning among three scavenging bird species in Ghana

by Nathaniel N.D. Annorbah[1] & Lars H. Holbech[2]

[1]Ghana Wildlife Society, P.O. Box GP 13252, Accra, Ghana.
<nd.annorbah@gmail.com>
[2]Dept of Animal Biology and Conservation Science, University of Ghana, Legon, Ghana

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Summary

The Hooded Vulture *Necrosyrtes monachus*, Pied Crow *Corvus albus* and Cattle Egret *Bubulcus ibis* are all scavengers of organic waste at refuse dumps at the University of Ghana at Legon, where they have higher populations than four decades ago. We examined their abundance, interactions while feeding, and food types consumed. The vulture was the commonest of the three, followed by the crow and egret. Eleven types of agonistic interaction were observed, and seven food types identified. The Hooded Vulture and Pied Crow ate the same six food types; the Cattle Egret ate four food types, three of which were in common with the Hooded Vulture and Pied Crow, the other being flies.

Résumé

Abondance relative, comportement agonistique et répartition des ressources entre trois espèces d'oiseaux charognards au Ghana. Le Vautour charognard *Necrosyrtes monachus*, le Corbeau pie *Corvus albus* et l'Héron garde-bœufs *Bubulcus ibis* sont tous trois charognards de déchets organiques sur les ordures à l'Université du Ghana à Legon, où leurs populations sont plus nombreuses qu'il y a quatre décennies. Nous avons examiné leur abondance, leurs interactions lorsqu'ils se nourrissent et les sortes de nourriture consommées. Le vautour était le plus commun des trois, suivi par le corbeau et l'aigrette. Onze types d'interactions agressives ont été observées et sept sortes de nourriture identifiées. Le Vautour charognard et le Corbeau pie ont consommé les mêmes nourritures, six sortes; l'Héron garde-bœufs a consommé quatre sortes de nourriture, dont trois communes avec le Vautour charognard et le Corbeau pie, l'autre étant des mouches.

Introduction

Of over 111 bird species regularly recorded each year on the University of Ghana (UG) campus at Legon in the 1960s and 1970s, only 83 were recorded in 2004 (Grimes 2006). The more common species included the Hooded Vulture *Necrosyrtes monachus*, Pied Crow *Corvus albus* and Cattle Egret *Bubulcus ibis*. Grimes (2006) reported that these three species were more common on the Legon campus in 2004 than in the 1960s and 1970s, but no details of population sizes or relative abundance were given.

Many environmental and infrastructural changes have occurred on the UG campus and its environs since the 1970s, and the increase in numbers of these birds is thought to be due to the easy availability of food from the numerous food stalls and undisposed waste on campus (Grimes 2006), particularly from Refuse Transit Depots (RTDs) which provide a dependable food source. RTDs are dumps where refuse from the student hostels is temporarily stored before it is carted to a major dump outside the university.

Avian scavengers play an important role in clearing the environment of carcasses and organic urban refuse, and may thereby curb the spread of diseases and undesirable scavenging mammals (e.g. Sekercioglu 2006, Wenny *et al*. 2011). The scavengers on the UG campus may fulfil this function but are a nuisance in that their droppings may fall on pedestrians under trees (Gbogbo & Awotwe-Pratt 2008). This is of concern to students due to their perception of wild birds as potential disease vectors (e.g. Fenlon 1981, Hubálek & Halouzka 1999, Hubálek 2004). These scavengers, especially the Pied Crow, also litter the environment with plastic materials picked up from RTDs.

Since all three bird species feed on the same source of waste food material they may compete for space or food resources. This study sought to examine the populations of the three species, their interactions while feeding, and the food types consumed, on the UG campus. The study focused on the populations at selected RTDs on campus, to: determine the relative abundance of the three bird species feeding at RTDs and on the campus in general; identify and document intra- and inter-specific agonistic interactions between the three species at the feeding sites; identify food types consumed by each of the three species.

Study area and methods

The UG campus is described by Grimes (2006). Each hall of residence has an RTD located not more than 25 m from it. The refuse dumped in the mornings mainly comprises polythene materials, many of which contain some organic matter that serves as food for the scavengers. This early morning rubbish is carted away between mid-morning and mid-afternoon. However, more rubbish, much of which is leftover food from dining halls and kitchens, is brought in between afternoon and dusk. Some of the scavengers are found at some of the RTDs in the late mornings, but their numbers peak between late afternoon and dusk.

The RTDs at Mensah-Sarbah Hall (MSH) and Commonwealth Hall (CH) are close to their respective halls, with tall trees overhanging them. The MSH RTD receives large amounts of waste, from seven student residential quarters, and feeds a large number of scavengers. The CH RTD receives appreciable amounts of waste from the CH dining hall and a restaurant located within the premises.

The field study was carried out over about six weeks in June–July 2007.

Transect surveys

The area of the UG campus and its environs was divided into a grid of ten cells, each 1 km^2. Counts were normally conducted between 7h00 and 9h00, between the second week of June and the third week of July 2007. On each survey day, up to four cells were surveyed. Each cell was surveyed on ten days, with main roads and footpaths in the cell used as transects and repeated on each of the ten days on which the cell was surveyed. Transects were walked over a distance of 500 m at a steady pace, and all individuals of the three scavenger bird species seen or heard within *c.* 100 m on either side of the transect were counted. The effective survey area in each cell was therefore 0.1 km^2, or 10 % of the total area of the cell. Efforts were made to avoid double-counting birds, by not recording any vocalizations heard behind the observer that had previously been recorded in the last 30 m and by not recording any previously detected birds that flew from behind to ahead of the observer.

Counts and observations at RTDs

Bird counts and behavioural observations were made at the MSH and CH RTDs, normally between 15h30 and 18h00, from the second week of June through the third week of July 2007, using binoculars from a distance to avoid disturbance to the birds. Each RTD was studied for ten days in total. The number of birds of each of the three species at the RTD was determined at the start of every 30-min. interval over a period of 120 minutes (= total 4 counts in 120 minutes). Only birds present within 20 m of the RTD and feeding or standing on or near garbage were counted. Agonistic behaviour patterns displayed in response to intra- or inter-specific competition for space or food, while feeding at the RTDs were also detailed during these 30-min. periods. Food types consumed by the three species were documented.

Data analysis

Data were analysed using the Statistical Package for Social Scientists software (SPSS 12.0 for Windows). The data were checked for normality and an appropriate test (ANOVA) was performed accordingly.

The relative abundance (RA) of each of the three bird species during transect surveys and at the MSH and CH RTDs was calculated as the average daily number (adn) of that species relative to the sum of the adns for the three species, as follows:

$$RA_i = 100\ (n_i / N)$$

where n_i = the adn of the i^{th} species and $N = n_v + n_c + n_e$ (where n_v = the adn of vultures; n_c = the adn of crows; n_e = the adn of egrets). For transects, the average of the ten counts in each cell was first calculated to give the cell average, then the cell averages for the ten cells were themselves averaged to give the adn for each species. For RTDs, adn = overall average of the ten daily averages of the four counts made each day.

Results

Relative abundance

The Hooded Vulture had the highest adns and RAs, followed by the Pied Crow and the Cattle Egret (Table 1). The difference in adn values for the Hooded Vulture and the Pied Crow was however, not statistically significant on transects, although it was significant at the RTDs. The adn values for the Hooded Vulture and the Pied Crow at the two RTDs were significantly different, whereas for the Cattle Egret they were not.

Table 1. Average daily numbers (adn) and relative abundance (RA) of the Hooded Vulture, Pied Crow, and Cattle Egret on transects and RTDs over ten days.

	Transects		MSH RTD		CH RTD	
	adn[1]	RA (%)	adn[1]	RA (%)	adn[1]	RA (%)
Hooded Vulture	18.68[a]	55.1	45.20[c]	51.7	30.13[d]	47.4
Pied Crow	12.39[a]	36.5	29.73[d]	34.0	22.43[f]	35.3
Cattle Egret	2.84[b]	8.4	12.45[e]	14.3	10.95[e]	17.3

[1]Values of adn with the same letter are not significantly different (ANOVA $P > 0.05$).

Agonistic interactions

Eleven types of aggressive interaction were displayed by the three species while feeding at the RTDs (Table 2).

Stealing food. Some birds of all three species attempted to seize food items already picked up by other birds (in the case of Cattle Egret, usually chicken intestines). This kleptoparasitism seemed to occur more frequently between conspecifics. Robberies were not always successful. Successful vultures and egrets usually consumed the seized food items without moving far away, whereas successful crows usually flew away to consume the seized food items some distance away. Robbed vultures and crows usually tried to attack the robbers, while robbed egrets usually resisted the robbery by trying to pull away the food material.

Pointing beak. Some Hooded Vultures and Pied Crows moved the beak towards another individual, usually by a slight movement of the lowered head to one side, while

feeding. The recipient of this movement by a vulture usually retreated to some distance away. Crows pointed at the head of other crows, resulting in alertness in the recipient.

Table 2. Agonistic interactions displayed by the Hooded Vulture, Pied Crow, and Cattle Egret at the MSH and CH RTDs.

	Hooded Vulture	Pied Crow	Cattle Egret
Stealing food	+	+	+
Pointing beak	+	+	
Open wings display	+		
Claws display	+		
Approaching directly	+	+	+
Pushing with feet	+		
Fight	+	+	
Interposition		+	
Raising beak		+	
Attacking with claws		+	
Raising crest			+

***Open wings display*.** Some Hooded Vultures faced another bird and spread the wings slightly or fully. Conspecific recipients of this movement usually responded in a like manner and both birds turned away, though fights sometimes ensued. Pied Crows and Cattle Egrets normally retreated in response to such threats.

***Claws display*.** Some Hooded Vultures lifted one of the legs horizontally and directed the spread claws at another bird. This usually occurred simultaneously with the open wings display. Conspecific recipients usually retreated, but rarely fought back. Pied Crows and Cattle Egrets normally retreated in response to such threats.

***Approaching directly*.** Some birds of all three species walked or leapt directly towards another bird. When approached by a vulture, vultures sometimes moved away but crows and egrets always retreated. When approached by a crow or egret, the approached bird jumped or flew away, but sometimes confronted the approaching bird. Crows usually approached other crows but sometimes egrets. Cattle Egrets only approached conspecifics.

Pushing with feet. Some Hooded Vultures gave a strong push to another individual, using the spread toes of one foot. This push usually dislodged the latter from its feeding point.

Fight. Hooded Vulture opponents confronted each other jumping forward while showing their claws and trying to peck at each other, and simultaneously spread or flapped the wings and raised themselves from the ground. The fighting pair repeatedly bumped into each other until the loser fell on the ground trying to defend itself with both feet. The loser usually moved away with folded wings, retracted neck, and ruffled feathers. Some Pied Crows flew towards an opponent, with beak and claws

directed towards the other, trying to reach it while simultaneously trying to avoid blows, such that both animals rose vertically while facing each other. Losers usually fell on their backs with body stretched out, while the winner rested on top of them.

Interposition. Some Pied Crows attempted to prevent other birds from reaching a food item by quickly stepping between a prospective forager and the food item. This interaction seemed to occur more frequently with other crows than with other species.

Raising beak. Some Pied Crows raised themselves up on the legs and stretched the neck vertically, while directing the beak at a conspecific.

Attacking with claws. Some Pied Crows jumped on top of another, with both feet with the toes spread. Recipients of such attacks were normally conspecifics and were usually startled and fled.

Raising crest. Cattle Egrets sometimes raised the crest when approached by another bird. This behaviour usually occurred during aggressive approach by a conspecific.

Only food robbing and approaching directly were common to all three species. Approaching directly usually caused the recipient to flee and therefore made way for the approaching bird to feed. Pointing beak and fighting were observed only in the Hooded Vulture and Pied Crow.

Food types consumed

The food types consumed by the three species are listed in Table 3. Each species fed on the same food types at both the MSH and CH RTDs. Hooded Vultures and the Pied Crows shared six food materials. Cattle Egrets fed on the prolific numbers of flies present in addition to fish fragments, pieces of meat and offal, but did not eat the other food items.

Table 3. Food items consumed by Hooded Vulture, Pied Crow and Cattle Egret at the MSH and CH RTDs.

	Hooded Vulture	Pied Crow	Cattle Egret
Fish fragments	+	+	+
Pieces of meat	+	+	+
Cooked rice	+	+	
Cooked cassava	+	+	
Remnant contents of egg shells	+	+	
Offal	+	+	+
Flies			+

Discussion

The RA values obtained during transect and RTD studies on the UG campus may be explained by a number of factors. First, transect counts were made in the mornings

and RTD counts in the afternoons (due to refuse being dumped at RTDs in the afternoons). Second, detectability could vary among the three species on the transects, but not at the RTDs, where all birds were visible at close range.

In the Hooded Vulture and Pied Crow, the similar RAs in transect and RTD studies reflect their proportionate abundance on the campus. The greater RA values for Cattle Egrets at RTDs than on the transects may be because the Cattle Egrets on campus have become accustomed to scavenging on RTDs owing to the ready availability of food there compared with hunting for insects elsewhere. The large number of flies present at the RTDs may be enough motivation for a high level of use.

The Hooded Vulture and Pied Crow were more omnivorous than the Cattle Egret, which is a more specialised insectivore. There was no obvious trophic resource partitioning between vulture and crow, but resource partitioning between the Cattle Egret and the other two species was 50 %.

Pomeroy (1975) reported that Cattle Egrets fed at dumps in Uganda but stated that they feed on insects associated with the dumps and are not true scavengers. Feare (1975) also reported Cattle Egrets feeding at a dump in the Seychelles, but their diet was unknown. Cattle Egrets have however been seen at dumps feeding on items other than insects alongside vultures and crows (Burger & Gochfeld 1983). The consumption by the Cattle Egret of fish fragments, pieces of meat and offal at RTDs, in addition to flies, contradicts Pomeroy's (1975) assertion that they eat only flies at refuse dumps and therefore are not true scavengers. However, flies may still be the major component of the diet at Legon: gut content analysis of Cattle Egrets from landfills at Accra, Ghana have shown that fly larvae of the families Muscidae and Calliphoridae constituted up to 84 % of the diet, with most of the rest being adult flies (A. Kuranchie & L.H. Holbech, unpublished data). This, combined with the observations at the RTDs, suggests they may play a significant role in the control of pest flies in Ghana.

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