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Hooded Vultures *Necrosyrtes monachus* scavenge on a mass wreckage of large terns in a major HPAI outbreak in The Gambia: a photo report of scraper-feeder type damage to carcasses

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Abstract

We report Hooded Vultures *Necrosyrtes monachus*, a Critically Endangered species, scavenging on fresh carcasses at a mass wreckage of two large tern species which died of the highly pathogenic avian influenza virus (HPAIV) H5 on the south Gambian coast in April 2023. Hooded Vultures, classified as scraper feeders, scavenged on bare and unfeathered parts such as eyes and mandibular areas, and gained access to the skull cavity to feed on brain tissue. Although we found no resulting cases of infected vultures, our observations raise concern regarding alimentary HPAIV infection as is described for other raptor species in Asia, Europe and the Americas, where HPAI H5 viruses of the goose/Guangdong (gs/GD) lineage have established enzootic status in wild bird populations.

Keywords: The Gambia, Hooded Vulture, *Necrosyrtes monachus*, scavenging, tern wreckage, HPAI

Background

Results from laboratory tests carried out in Dakar, Senegal, on Gambian avian samples collected during collaborative field work led by The Ministry of Environment, Agriculture, Health and National Disaster Management Agency confirmed the presence of HPAI virus in wild birds in The Gambia. Although further virus characterisation is pending, the cases are highly likely embedded in the panzootic spread of HPAI viruses of subtype H5N1 of the so-called goose/Guangdong (gs/GD) lineage which emerged in the 1990s in southeast Asia and have subsequently evolved and spread globally (Lee et al. 2021). An epidemic was officially declared in The Gambia on 4 April 2023. The first HPAI casualty in The Gambia we are aware of is a solitary West African Crested Tern *Thalasseus albididorsalis* unable to fly, wing spreading and in a state of opisthotonos (a condition of spasm of the muscles of the back, causing the head and lower limbs to bend backwards and the trunk to arch forward) collected at Cape Point (13.489268°, -16.667124°) south of the River Gambia on 6 March 2023. The

condition fits into the pattern of neurological clinical signs associated with systemic HPAIV infection which also affects the brain (Caliendo et al. 2022). The tern was found on the tiled floor of an open-air restaurant situated a short distance from the beach; the management affirmed that the debilitated bird had “fallen from the sky” (Peter Larden, pers. comm.). Further cases followed, amounting to a mass mortality event among West African Crested Terns involving ca. 10 000 casualties. Lesser numbers of Caspian Terns *Hydroprogne caspia*, Sandwich Terns *T. sandvicensis* and Grey-headed Gulls *Chroicocephalus cirrocephalus*, and some cormorant and wader species were also reported. Throughout April, dead and dying birds were found along the entire 80 km of the country’s coastline, both north and south of the Gambia River. A comprehensive report covering the detection of the outbreak, transmission issues, a complete species inventory, information from ring findings, plus a breakdown of the numbers of birds affected will be published elsewhere (Gambia Environmental Alliance in litt.), based on extensive field work carried out by the Epidemiology and Disease Control Unit,

Ministry of Health, Department of Parks and Wildlife Management and partners with the Department of Livestock, Government of The Gambia. Recent publications show that wild birds affected by HPAI fed on by predatory birds and mammals may lead to alimentary infection, and potentially to disease and death, in the predators (Krone et al. 2018, Bordes 2023).

A review of the feeding ecology of the Critically Endangered Hooded Vulture *Necrosyrtes monachus* in coastal Gambia, where the species occurs at high densities, revealed an eclectic diet which includes oil-palm fruit, boiled rice, various invertebrates and larvae at dumps and abattoirs, liquid blood at slaughter sites and domestic animal roadkill (Barlow et al. 2020, 2022b). We also reported on extensive scavenging for carrion on Gambian and Senegalese beaches that included strandings of whale, dolphin and sea turtle species, and washed-up fish; live fiddler crabs are also taken. Prior to the observations presented below, we are unaware of any records of Hooded Vultures feeding on the carcasses of any tern species (or larid taxa) anywhere in this vulture's range.

Previous observations of Hooded Vultures scavenging on wild bird fatalities in The Gambia

Observations detailing foraging procedures of Hooded Vultures when encountering fully feathered bird carcasses in The Gambia are scant and the topic requires further study. CRB regularly monitored stretches of tar road on both sides of the river in Upper and Central River Regions (CRR) throughout the 1990's and the early 2000's and collected nightjar roadkills. On no occasions were vultures observed scavenging on nightjar casualties or other avian fatalities such as owls and thick-knees, the opportunities for which frequently occurred. Hooded Vultures responded promptly to feed on roadkilled frogs on a new tar road in CRR (Barlow and Brouhaugh 2022c).

In June 2011, groups of Hooded Vultures were found feeding on the shore and revealed a mass wreckage of Great Shearwaters *Ardenna gravis* at Tanji Bird Reserve (13.378188°, -16.788434°) in south Gambia (Barlow et al. 2018). On the first day of the event, two feathered specimens with

undamaged skulls were taken from actively feeding vultures; both had empty eye sockets and viscera removed from the body cavity. It is assumed that the Hooded Vultures were responsible for the removal of the soft parts, but initial feeding damage by fish and ghost crabs cannot be ruled out. Studies in June 2011 at the above wreckage focused more on the shearwaters than on vulture scavenging activities. During the capture of Hooded Vultures at Makasutu (13.300034°, -16.616656°) in 2013 as part of a Pan-African movement study (Thomson et al. 2020), a lacerated and partially plucked slaughtered domestic chicken *Gallus g. domesticus* was used as bait. Vultures were successfully snared, satellite-tagged and released. Other vultures cleaned the carcass leaving the legs, feet, a damaged head and sternum, and bony parts of the feathered wings (pers. obs.). There has been a considerable increase in small-scale poultry production in recent years in coastal Gambia, and a study of Hooded Vulture feeding behaviour around smallholding dump sites containing poultry waste would be constructive. On 30 April 2017 at Brusubi (13.392957°, -16.761371°), an adult Hooded Vulture fed on the carcass of a White-billed Buffalo Weaver *Bubalornis albirostris* both when on the ground and perched in a low African Oil Palm (Barlow et al. 2022b). At Tanji Bird Reserve beach in July 2018, five birds from a group of 33 Hooded Vultures feeding on a dolphin carcass walked a few metres to pick-feed on a dead Great Cormorant *Phalacrocorax carbo* (Barlow et al. 2021). On beaches close to fish-landing sites, e.g. Tanji (13.358348°, -16.798920°) and Ghana Town (13.385583°, -16.774490°), Hooded Vultures have been watched on occasions picking on washed-up, fully feathered domestic chickens that had been taken to sea for human consumption (pers. obs.). For the cormorant and chicken observations, no focused attention was given to which parts of the carcasses were being scavenged. Presumably expectant of a feeding opportunity, groups of Hooded Vultures frequently accumulate and linger around a variety of dead seabirds, including Great White Pelican *Pelecanus onocrotalus*, Northern Gannet *Morus bassanus*, West African Crested Tern, Grey-headed Gull and some smaller tern (*Sterna*) species, and this is comparable to behaviour exhibited at unopened turtle and cetacean strandings and also domestic livestock carcasses, e.g. roadkill (Barlow et al. 2021).

Observations of Hooded Vultures feeding on large tern carcasses April 2023

During regular walks around a wetland situated immediately behind the beach at Kianko, Sanyang (13.256674°, -16.787510°), south Gambia (a habitat in part generated by industrial extractive sand mine activity), BW found the first dead and dying West African Crested and Caspian terns on the morning of 2 April 2023 when six fatalities were seen. The occurrence at the Sanyang Lagoon was reported to the authorities. A total of 150 terns (predominantly West African Crested Terns) are estimated to have died at the Sanyang site during the period 2–11 April. Over this period most of the carcasses remained on dry land, whilst a few were seen floating in the adjacent waterbody (Figure 1). On the morning of 12 April, an assemblage of 42 scavenging Hooded Vultures was observed and photographed feeding on tern carcasses. A single Yellow-billed Kite *Milvus aegypticus* and Pied Crow *Corvus albus* were also present (Figure 1). Hooded Vultures were seen feeding on the mornings of 12–14 April. Figures 2 and 3, taken on 14 April 2023, illustrate bare eye sockets with penetration of the cranium by feeding vultures, enabling access to brain tissue. The zoomed images clearly show that the cervical vertebrae and tempero-mandibular areas have been stripped of tissues. No evidence of picking on pectoral muscle or extraction of viscera was found on any of the inspected specimens and we presume that dense body feathering prevents the Hooded Vultures from gaining access to the deeper soft parts of the terns. We collected numerous West African Crested Tern carcasses over 20 years in The Gambia for a skull biometrics study (Barlow et al. 2022a) and none of the specimens presented damage to the skull and neck as exhibited in Figures 2 and 3. Hooded Vultures are classified as scrapers that peck at tissue remains which larger vultures (gutters and rippers) leave when feeding on carcasses (Linde Medina et al. 2021). The pecking method appears to restrict them to eating only the soft tissues, e.g. eyes and small muscles of the head and neck of the dead terns, even when the absence of competitors would permit them to eat the whole carcass if it could be efficiently opened and the edible contents accessed (pers. obs.). One Yellow-billed Kite was present on the ground amidst the vultures on 12 April. No Palm-nut Vultures *Gypohierax angolensis*, which are regular beach feeders in the area, were seen on any

visits. Gyps vultures are very rarely encountered in coastal areas of The Gambia nowadays and there are no beach-feeding records of these birds (pers. obs.).

During the morning of 15 April, MS conducted an on-foot survey at low tide along the beach at Kartong (13.078152°, -16.771142°), the country's most southerly beach and which borders Casamance, Senegal. Along an approximately 1 km stretch of beach, 23 dead and dying terns were observed comprising 17 West African Crested Terns and six Caspian Terns. A total of 78 Hooded Vultures were counted on the beach with many actively feeding on tern carcasses, while others stood at various distances from congener activity. Record shots were taken using an iPhone 7 (see Figure 4). A recently stranded large Green Turtle *Chelondias mydas* was also recorded, atypically with no scavenging Hooded Vultures in attendance. Dead turtles usually attract large numbers of scavenging Hooded Vultures (Barlow et al. 2021).

Discussion

We report extensive scavenging by assemblages of Hooded Vultures at large numbers of fully feathered large tern carcasses. Although scavenging on seabirds by Hooded Vultures has been previously reported from south Gambian beaches, information is limited. Further work is needed to confirm if dense, impenetrable feathering prevents Hooded Vulture from feeding extensively on seabird carcasses. Simple experiments providing artificial access to muscle and internal organs could provide further insights in this regard. This could be carried out by partial plucking and making incisions to the neck and body of the carcasses and observing vulture foraging patterns. Also, observations would be required over several days to follow events during decomposition and attack by *Ocypode* crabs on carcasses to see if vultures exploit such natural assistance. The cloaca is a feasible entry point, but it is unproven if vultures use this route.

Observations in south Gambia at Sanyang and Kartong in April 2023 appear the first to show Hooded Vultures feeding on any tern species anywhere in the species range. Carcasses of West African Crested and Caspian terns are added to a notably diverse list



Figure 1. Part of an assemblage of 42 Hooded Vultures feeding on large tern carcasses at Sanyang Wetland, The Gambia, 12 April 2023, a single Yellow-billed Kite (off centre left) and a single Pied Crow are also present (far right) (© Bob Wilde).



Figure 2. Evidence of 'scraper-feeding' by Hooded Vultures: West African Crested Tern with cervical vertebrae stripped of muscle tissue and showing penetrated cranium cavity (© Bob Wilde).



Figure 3. Caspian Tern with tempero-mandibular areas stripped of muscle tissue; both specimens have empty ocular sockets (© Bob Wilde).

of food items in The Gambia for this highly versatile, non-specialised obligate scavenger.

The feeding habit of targeting the eyes and brains of tern carcasses is worrisome in regard to ongoing HPAI outbreaks in terns along the East Atlantic Flyway. Neurological signs of disease as described here are strongly linked to infection of brain tissues with high titres of infectious virus being present (Gulyaeva et al. 2016). Alimentary exposure is confirmed, also by experimental oral infections, to cause systemic, often fatal, infections in several predatory species, both avian and mammalian, in Europe, Asia and the Americas (Reperant et al. 2008, Vahlenkamp et al. 2010, Alkie et al. 2023). Follow-up observations failed to find any diseased or dead Hooded Vultures along the Gambian coastline during the study period, although infection of vulture species, including Hooded Vultures in Africa with HPAI virus

strains related to the currently circulating Asian H5 lineage have been previously reported (Ducatez et al. 2007). Further and closer surveillance of vultures would be interesting to determine their exposure rates to HPAIV. This would also cast some light on the susceptibility of vultures to HPAIV infection and subsequent disease. On an evolutionary scale, HPAI viruses are comparatively young pathogens that have been detected for not much longer than a century (Lee et al. 2021). Exposure of African vultures to these HPAIV viruses dates back no longer than 15 years and is certainly only episodic; other HPAI viruses have been detected on very rare ($n = 3$) occasions and for short periods only in the whole of Africa (Lee and Swayne 2021). Thus, chances of interactions between HPAIV and Hooded Vultures at a population scale are very likely too low to have driven selection towards more disease-resistant phenotypes. We propose that while it would be interesting to study



Figure 4. A total of 78 Hooded Vultures were feeding on and standing around the carcasses of two large tern spp. strewn along 1 km of beach at Kartong, 22 April 2023 (© Mariama Sanneh).

whether inherent (older) resistance mechanisms exist that help Hooded Vultures and other scavenging avian species to better cope with otherwise deadly infectious agents, it remains very difficult to dissect such holistic questions into details that can be studied experimentally.

The Gambia poultry flock so far appears to be escaping devastating HPAI outbreaks. Nevertheless, it needs to be stressed that the current HPAI panzootic is fuelled by both virus incursions from wild birds into poultry holdings but also by spillback transmission from poultry to wild birds. Poultry has been serving as an HPAIV reservoir in several African countries where the virus established an endemic status in poultry populations (El Shesheny et al. 2021). Biosafety measures as well as appropriately controlled vaccination to protect poultry flocks from incursions are vital, as are early notification of suspected outbreaks and safe disposal of carcasses in confirmed cases so as to prevent spillbacks (Nantima et al. 2019).

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