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Threatened Taxa
Monitoring observations of the southernmost breeding population of Long-billed Vultures *Gyps indicus* (Scopoli, 1786) (Aves: Accipitriformes: Accipitridae) in the Nilgiri Biosphere Reserve, India

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Abstract: The Long-billed Vulture (LBV) population was systematically monitored across four nesting colonies in the Nilgiri Biosphere Reserve (NBR) throughout three extended breeding seasons. Breeding success rates between years ranged from 83.33% in 2018–2019 and 62.5% in 2020–2021. Nesting was monitored at the cliff sites, consistent with prior research. Overall population fluctuations were minimal, varying between 21 individuals in 2020–2021, 17 individuals in 2018–2019, and 16 individuals in 2019–2020. There was an apparent impact of forest fires and other human disturbance activities, and certain proactive conservation measures are proposed to help address these. There was indirect evidence of other threats including poison baits targeting wild carnivores and non-steroidal anti-inflammatory drugs (NSAIDs) being widely available for use in domestic livestock. The study endorses the approach of establishing vulture-safe zones, which focus on addressing the local threats. This includes raising awareness about wildfire management, controlling toxic NSAIDs availability that are harmful to vultures, discouraging the illegal use of poison-baits, and highlighting the necessity of monitoring threats posed by power infrastructure. Due to the high mobility of LBVs, all these threats need addressing through large-scale vulture safe zone work (up to 100 km radius) surrounding the breeding colonies to secure the LBV’s long-term survival. These conservation actions are urgently needed.

Keywords: Conservation, Critically Endangered, forest fire, livestock, NSAID, poison, vulture safe zone.

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INTRODUCTION

The decline in the population of Gyps vultures across the Indian subcontinent is largely attributed to accidental poisoning resulting from their consumption of carcasses contaminated with the non-steroidal anti-inflammatory drug (NSAID) diclofenac (Oaks et al. 2004; Swan et al. 2006). The Long-billed Vulture (LBV) Gyps indicus, is one of the three native resident Gyps species in India. The LBV breeds in southeastern Pakistan (Collar & Butchart 2013) and peninsular India south of the Gangetic plain up to Delhi (Risebrough 2004), eastward through Madhya Pradesh (Rasmussen & Anderton 2005), Telangana (Manchiryala & Medichet 2014), Andhra Pradesh (Umapathy et al. 2009) and southwards to the Nilgiris (Subramanya & Naveen 2006; Venkitachalam & Senthilnathan 2015; Manigandan et al. 2023), nesting primarily on cliffs and occasionally ruins and has been observed only occasionally nesting in trees in Bikaner, Rajasthan (Rasmussen & Anderton 2005). The Nilgiris is the southern limit of the species. The spectrum of NSAIDs available in the veterinary market within the confines of the Nilgiri Biosphere Reserve (NBR), includes aceclofenac, ketoprofen, nimesulide, and flunixin, all known to be toxic to vultures (Mathesh et al. 2023) and this is a serious concern within the proposed vulture safe zone (VSZ) of southern India (Manigandan 2018). These observations prompted us to further monitor and understand the LBV population within the NBR.

While efforts toward vulture conservation have predominantly centered in the northern and eastern regions of India, with research and captive breeding programs targeted at saving the three Critically Endangered Gyps species—the White-rumped Vulture Gyps bengalensis, LBV, and Slender-billed Vulture Gyps tenuirostris (Prakash et al. 2003; Bowden et al. 2012; Ranade et al. 2023), such initiatives remain scarce in southern India. The prospect of establishing a similar captive breeding centre in the south is currently being deliberated both in Karnataka and in Hyderabad Zoo and is at various stages (MoEFCC 2020). Despite this, a conspicuous dearth of information persists for both the ‘Endangered’ Egyptian Vulture Neophron percnopterus (Byju & Raveendran 2022) and this ‘Critically Endangered’ species (LBV) within the precincts of the NBR. The present study aims to set some baseline information and evaluate recent LBV population trends, providing some breeding success data, and evaluating conservation challenges for this species in the Tamil Nadu landscape.

Study Area

The NBR (11.5731°N & 76.7558°E), was established in 1986 in the southern Western Ghats and connects the Western Ghats to the Eastern Ghats (Rasmussen & Anderton 2013). Our study was restricted to MTR and Sathyamangalam Tiger Reserve (STR) of the NBR in Tamil Nadu (Figure 1). This biosphere reserve includes areas of Tamil Nadu, Kerala, and Karnataka states. Among the seven vulture species recorded within the NBR, four are resident—Egyptian Vulture Neophron percnopterus, Red-headed Vulture Sarcogyps calvus, White-rumped Vulture Gyps bengalensis, and Long-billed Vulture Gyps indicus; and three are scarce winter migrants—Cinereous Vulture Aegypius monachus, Himalayan Griffon Vulture Gyps himalayensis, and Eurasian Griffon Vulture Fulvus (Manigandan et al. 2023).

METHODS

LBV nesting behavior was assessed by a combination of drawing upon prior research (Manigandan et al. 2023), local villager insights from indigenous inhabitants for potential nesting and roosting sites collected, local government officials, forest guards, and researchers of Government Arts College, Ooty along with the authors. Systematic visits were made between October and July, capturing the known vulture breeding period in the landscape (Stotrabhashyam et al. 2015). During this period, each LBV nest site location was visited twice (15-day intervals) per month during breeding seasons and assessments were based on the frequency of bird visits to cliffs and on the presence of white droppings visible around the nesting site. These observations were repeated for three successive breeding seasons: 2018–2019, 2019–2020, and 2020–2021. The selection of observation timings, either in the morning (0600–1000 h) or the late afternoon (1700–2000 h) depended on the visibility thereby avoiding some misty mornings and evenings. These designated periods were determined both to optimize visibility due to haze and addressing safety concerns from elephant movement and sloth bears in the region. As LBVs are primarily cliff nesters, the survey focused on cliff searches and so could potentially have missed tree nesting pairs—although this seems unlikely as we have been collecting secondary information from forest dwellers from indigenous communities which has not revealed any tree-nesting of LBVs. Each nest site was given a reference number for inter-year tracking. Observations were made from carefully selected points that allowed clear observation of the nest contents.
and birds’ behaviour. All observations were made using a spotting scope (Nikon Pro Staff 3 16–48 x 60) and binoculars (Nikon Monarch M5 12 x 42 binoculars) from about 100–250 m to minimize disturbance. Also, we noted any potential threats detected near nesting sites. We consulted published literature to assess the availability of NSAIDs in the area (Manigandan 2018). After analyzing the information, we went to nearby villages for further investigation of each of the threats to vultures. We investigated whether vultures had died of poisoning with the community stakeholders along with the details of the mortality of cattle. Between 2018 and 2020, we conducted surveys involving 208 pharmacy shops within the vulture safe zone area. These surveys were carried out covertly, with the help of local community posing as livestock owners. The objective was to assess the presence of NSAIDs that are harmful to vultures in these establishments.

RESULTS AND DISCUSSION

The study identified four distinct nesting colonies of the LBV (Table 1). All breeding sites were on rock cliffs adjacent to the river Moyar or its streams (Images 1, 2). No LBVs were found breeding on trees. The locations of all breeding sites detected together with habitat features, are presented in (Tables 1, 2). Breeding success across the colonies and between years averaged 70.83% (Table 3). The reasons for nest failures were not determined directly, but in the breeding season of 2018–2019, high breeding productivity of 83.33% was observed across all four nesting colonies combined. Subsequently, during the breeding season of 2019–2020, an overall breeding success rate of 66.66% was recorded in the three LBV nesting colonies collectively. However, the breeding success rate dropped to 62.5% in the season of 2020–2021. A new nesting site was found in the 2020–2021 breeding season, but this site did not yield successful breeding (Table 3). The LBV population monitoring revealed only minor fluctuations. The highest count of LBV individuals (21) was documented in the breeding

Figure 1. Study area and nesting locations of Long-billed Vultures (LBV) Gyps indicus in Nilgiri Biosphere Reserve.
season of 2020–2021. The previous breeding seasons, 2018–2019 and 2019–2020 had maximum sightings of 17 and 16 individuals, respectively (Table 1).

From our field observations and interactions with local pharmacies, we confirmed that drugs that are harmful to vultures (Nimesulide, ketoprofen, aceclofenac, and flunixin) are still available in villages near the LBV nesting area. We conducted an inspection of nesting trees along major rivers like Moyar, Sigur, and Siriyur, in these areas, and potential nesting places to search for LBV nests. We also interacted with the forest department field staff to find out if there were any LBV nests in trees during our regular monitoring and found no tree-nesting of LBV in the study area. Notably, all identified nests of Kallampalayam and Ebbanad nesting sites were situated on east-facing cliffs.

The LBV population remained relatively stable over the three years. But notably, the Ebbanad nesting colony, in the years 2018–2019 harbored two nests, but only one nest in the subsequent breeding season. This decline was attributed to observed frequent disturbance by visitors from a nearby cottage frequented by tourists that resulted in the birds being repeatedly flushed and may have caused the birds to leave their nesting location. An illegally constructed cottage (Hitten Valley) was located 100–150 m away from the colony with a viewpoint arranged for the tourists. We observed people screaming and shouting during the daytime, followed by campfires in the night. Notably, in the breeding season

<table>
<thead>
<tr>
<th>Name of the nesting colonies</th>
<th>Long-billed Vulture population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ebbanad</td>
<td>6</td>
</tr>
<tr>
<td>Kodanad</td>
<td>8</td>
</tr>
<tr>
<td>Kallampalayam</td>
<td>3</td>
</tr>
<tr>
<td>Karuvendrayan Malai</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
</tr>
</tbody>
</table>

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of 2020–2021, after the closure of this cottage, the number of LBV nests increased (from one to two) in the Ebbanad nesting colony (Table 3). The Kodanad nesting colony encountered the impact of the 2019 forest fires as this nesting site has an approximate 50% grass cover in the area. This incident almost certainly caused the LBV pairs to abandon their nests as the nesting sites were surrounded by grassland, and the impact of flames reached the nests in December 2019. We recommend taking proactive steps to prevent fires. To reduce the impact of forest fires on vulture colonies, it is imperative to strategically plan pre-fire activities during non-breeding periods. The Kallampalayam nesting colony exhibited a positive trend, with 100% breeding success rate in 2020–2021. This success is likely due to the colony’s limited exposure to forest fires and lower human disturbances, as no signs of human presence were detected near the nesting area during the study period.

### Poison baits incident

The regular monitoring led to the discovery of a poison-bait mortality incident within the Karuvendrakayam Malai nesting colony. LBVs were observed incubating during November 2020; however, they were conspicuously absent from this nesting site in December 2020 and January 2021. This deviation from expected nesting behavior prompted further investigation. It was discovered that on 3 December 2020, four Asiatic Wild Dogs had succumbed to a poison-bait incident in the vicinity. Significantly, it was reported by locals that three vultures had also indirectly fallen victim to the poisoning, apparently a case of retaliatory killing of wild carnivores which had recently caused mortality in domestic livestock. Several locals were arrested for this incident by the forest department and this is subject to further investigation. Instances of vulture fatalities due to poison baits necessitate thorough investigations to ascertain the motivation and full circumstances relating to the incidents, and it is often difficult to establish the full story. Identifying the sources and mechanisms of poisoning is essential to allow the implementation of targeted interventions to prevent further losses (Ogada et al. 2012).

### Evidence of other threats

Interestingly, the fatality of a Himalayan Griffon Vulture was observed under powerlines, apparently a result of electrocution in NBR (Manigandan et al. 2021) with a burning smell of tissues reported although no tissue testing was done due to a lack of facilities. The potential accessibility of harmful substances to vultures, specifically from toxic NSAIDs (Nimesulide, ketoprofen, aceclofenac, and flunixin) which were found to be available for use in cattle from local pharmacy outlets adds to the threat to vultures as the covert survey done during the period from the proposed VSZ (Manigandan 2018). Apart from the wider availability of safer drug meloxicam, other harmful drugs sold in the market such as ketoprofen and nimesulide is a major concern in vulture conservation of NBR, as this study concentrated on pharmacies in the districts of Nilgiris, Erode, Tirupur and Coimbatore, adjacent to the VSZ. The collaborative efforts of the forest department and local NGOs in monitoring the availability of NSAIDs in pharmacy shops are commendable as they create awareness among the local community, pharmacy shop owners, and staff about the importance of vultures in society and the harmful effects of NSAIDs. However, pharmacy shop owners are only aware of diclofenac and not aware of other harmful drugs (Manigandan et al. 2023). To prevent the accidental poisoning of vultures, it is important to make sure that these substances are not accessed by vultures and above all that they are not used in livestock practices when affordable alternatives like meloxicam and tolfenamic acid are available. Villagers typically bury naturally deceased cattle, while livestock killed by wild animals, particularly those within...
the forest, are left in the open and available to vultures. If such incidents occur near the village, the animals are always buried.

CONCLUSION

To tackle the challenges faced by vulture conservation, the approach of the establishment of vulture-safe zones has been developed (Thapa et al. 2009; Mukherjee et al. 2014; Insua-Cao et al. 2022). Such conservation endeavors are playing a key role in safeguarding the remaining LBV population in NBR, along with the other nesting vulture species in the area, White-rumped Vulture (WRV). The conclusions from this three-year study suggest that vulture safe zone activities may best focus in this area on the following: a) optimizing fire management practices; b) controlling NSAID availability for veterinary use; c) investigating poison baits incidents; and d) monitoring the threat and safety of power infrastructure. Hence, a comprehensive vulture safe zone approach will be needed addressing all of these issues along with raising local awareness of the positive attributes of vultures. Local human disturbance may also be a further threat. The imperative lies in the coordinated commitment of researchers, government agencies, NGOs, and local communities to ensure the long-term survival of LBV populations. In conclusion, this monitoring study demonstrates how local threats can be determined through regular monitoring and follow-up, and how widespread vulture safe zone work is needed to secure the future of vulture populations.

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**Note**

**Hunteria zeylanica** (Retz.) Gardner ex Thwaites (Magnoliopsida: Gentianales: Apocynaceae)—new addition and first genus record to the flora of Karnataka