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OBSERVATION OF MIXED-SPECIES VULTURE ASSEMBLAGES IN THE KHOH RIVER FLOODPLAIN OF WESTERN UTTAR PRADESH, INDIA

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Abstract. Ad hoc field surveys were conducted on 11 and 12 March 2025 along the Khoh River floodplain in the Najibabad Forest Division, India. On two occasions, the near-threatened Cinereous Vulture (*Aegypius monachus*) and Himalayan Vulture (*Gyps himalayensis*) were observed co-occurring with the endangered Egyptian Vulture (*Neophron percnopterus ginginianus*) at carcass-feeding sites. Up to 14 individuals were recorded in mixed-species assemblages. These observations document the co-occurrence of the three species and describe basic feeding behaviour, including differences in spatial positioning and interactions at carcass sites. Given the limited temporal scope of the study and the absence of quantitative behavioural analysis, the findings are presented as observational records. Further systematic studies are required to better understand behavioural patterns and ecological interactions in this region.

Vultures perform vital ecological functions by rapidly consuming vertebrate carcasses, thereby mitigating the risk of pathogen transmission and facilitating nutrient cycling in terrestrial ecosystems (Mundy et al. 1992). Since the early 1990s, *Gyps* vulture populations in South Asia have experienced catastrophic declines, primarily due to renal failure induced by exposure to diclofenac. This compound classified as a non-steroidal anti-inflammatory drug (NSAID) is routinely administered to livestock during clinical treatment and has been scientifically linked to vulture mortality following the ingestion of contaminated carcasses (Pain et al. 2003; Oaks et al. 2004). Initial field surveys documented precipitous reductions in *Gyps* populations across core habitats; these declines were attributed to pharmaceutical exposure and deficiencies in carcass management (Prakash et al. 2003; Cuthbert et al. 2006; Margalida et al. 2014).

Across different regions of Uttar Pradesh, counts and qualitative assessments have documented the distribution and abundance of *Gyps* species across different habitat types, with food availability and habitat conditions influencing their occurrence (Jha 2015). In addition, occupancy modelling, which estimates the probability of species occurrence while accounting for imperfect detection, has been used to assess changes in vulture occurrence and habitat suitability in Uttar Pradesh (Jha et al. 2023). Recent national-scale surveys and citizen-science initiatives have expanded monitoring coverage. The eighth national road transects survey reported stabilised, albeit low, *Gyps* vulture populations across 13 Indian states (Prakash et al. 2024). In the adjoining state of Uttarakhand, a satellite telemetry study has been conducted across the Corbett and Rajaji Tiger Reserves, as documented in WWF-India's 2025 report (WWF-India 2025), which was developed in collaboration with the Uttarakhand Forest Department. This study tracked the movements of endangered vulture species, identified critical feeding and roosting sites beyond protected boundaries, and informed spatially explicit conservation planning. Here, I present field observations of the *Gyps himalayensis*, *Neophron percnopterus ginginianus*, and *Aegypius monachus* co-occurring during feeding at a carcass site along the Khoh River floodplain and discuss their implications for habitat management and vulture conservation in the Himalayan foothills.

The survey was conducted between 08:00 a.m. and 13:00 p.m. on 11 and 12 March 2025 along the Khoh River floodplain in the Shivalik foothills. Observations were made during continuous field sessions using binoculars (10 × 50) and a digital camera for species identification and documentation. The study was based on ad hoc field observations and is therefore presented as an observational record rather than a structured ecological assessment.

Surveys were carried out along a 6.3 km stretch of the floodplain (29°37′53″N, 78°29′52″E – 29°40′51″N, 78°31′08″E), covering sandbars, riverine areas, adjacent forest patches, agricultural fields, and rural habitation. Observations were conducted at close range (approximately 10 m when possible), with minor variation de-

pending on vulture movement and field conditions. Data recorded included species identity, flock composition, group size, and qualitative observations of feeding behaviour and interspecific interactions at carcass sites.

The origin of carcasses at feeding sites could not be determined with certainty; however, their presence is likely associated with local livestock practices in the forest – agriculture interface. The study area lies within a heterogeneous landscape characterised by riverine vegetation, scrub and forest patches and agricultural land use and ranges in elevation from 297 to 319 m above sea level.

The recorded vulture species were categorised according to their global conservation status based on the most recent assessments of the International Union for Conservation of Nature (IUCN 2025).

During the two-day survey, 14 individual vultures representing three species across three genera were recorded (Table 1). All three species were observed in mixed-species assemblages near active carcass dump sites located on a side-channel sandbars (Figure 1A, B). Both *G. himalayensis* and *A. monachus*, which are winter visitors to the region (Grimmett et al. 2011; SoIB 2023), were represented by sub-adult individuals, whereas *N. p. ginginianus* included both adult and juvenile individuals. The carcasses were identified as adult female Gojri buffalo (*Bubalus bubalis*), a domesticated livestock breed maintained by nearby Gujjar communities (a traditionally pastoral ethnic group of northern India), and were estimated to be approximately 1–2 days old at the time of observation.

Differences in feeding positions were observed during carcass use. Sub-adult *A. monachus* predominantly occupied the central feeding zone, often displacing other individuals or advancing directly toward the carcass (Figure 1C, D). However, when sub-adult *G. himalayensis* engaged in conflict with sub-adult *A. monachus*, the former typically prevailed, successfully displacing the latter from the central feeding area during three observed displacement events (Figure 1E, F). In contrast, *N. p. ginginianus* consistently foraged along the periphery of the carcass site (Figure 2G, H). Some sub-adult *Gyps* individuals, characterised by darker brown plumage and reduced contrast compared with adult, along with juvenile *Neophron* individuals showing predominantly dark brown plumage, were observed perching on adjacent trees and approaching the carcass opportunistically when adult conspecifics temporarily vacated the feeding zone (Figure 2I, J). Both *Aegypius* and *Neophron* species were observed engaging in persistent ground-level conflicts with *Gyps* individuals, although three temporary displacement events were observed during feeding interactions, neither species permanently abandoned the carcass site during the observation period.

The co-occurrence of three vulture species in the floodplain habitats of western Uttar Pradesh emphasises the importance of these dynamic landscapes in maintaining the diversity of scavengers. Seasonal variations in the local carcass supply may reduce competition among species by promoting spatial overlap; this is in line with the facilitation mechanisms found in scavenger guilds (Cortés-Avizanda et al. 2012). In addition, the heterogeneous habitat structure of the study area, including sandbars used for foraging, nearby trees such as *Bombax ceiba* for roosting, and nearby agricultural areas associated with livestock presence, encourages niche partitioning and multi-species persistence, as observed in other vulture species in south-western Europe (Margalida et al. 2011; Moreno-Opo et al. 2016). Other studies have shown that anthropogenic food sources, including carcass dumps and informal feeding stations, significantly influence spatial dynamics and conservation outcomes (Piper 2006; Duriez et al. 2022). These patterns align with broader ecological models of scavenger coexistence, wherein behavioural adaptations and trophic segregation reduce the likelihood of competitive exclusion (Plaza and Lambertucci 2020).

Observations from the Khoh River floodplain documented the presence of the Indian subspecies *N. p. ginginianus*, with individuals exhibiting diagnostic plumage patterns, bill dimensions, and extent of yellow facial skin characteristics of this taxon (Baumgart 2018). Records of vagrant individuals in Djibouti underscore their dispersal capacity and imply potential gene flow between South Asian and East African populations (Rayaleh

Table 1. Behavioural and spatial dynamics of three vulture species observed during carcass utilisation in the Khoh river floodplain.

Species	Flock composition	Flock size	Feeding behaviour
Gyps himalayensis	Predominantly sub-adult individuals in the mixed flock; some individuals perched on adjacent trees.	7–8 individuals	Frequently occupied exposed feeding areas and engaged in feeding interactions with *A. monachus*.
Aegypius monachus	Sub-adult individuals occupying central feeding positions in the mixed flock.	2–3 individuals	Occupied central feeding areas, penetrated carcass hides, and engaged in feeding interactions with *Gyps* individuals.
Neophron percnopterus ginginianus	Adult and juvenile individuals feeding along the periphery of the mixed flock.	2–3 individuals	Primarily foraged along peripheral feeding areas and fed on residual fragments after larger species had accessed feeding areas.

Figure 1. A) Mixed-species assemblage of *G. himalayensis*, *A. monachus*, and *N. p. ginginianus* basking on the flood plain; B) sub-adult of *A. monachus* and *G. himalayensis* in a conflict position near the buffalo (*Bubalus bubalis*) carcass; C) sub-adult *A. monachus* feeding on the carcass while another sub-adult of the same species is in between *G. himalayensis* individuals; D) another sub-adult *A. monachus* visible on the extreme left; E & F) conflict between sub-adult *G. himalayensis* and *A. monachus* on the floodplain.

and McGrady 2019). Ecologically, *N. p. ginginianus* demonstrates considerable adaptability, foraging on riverine carrion and anthropogenic refuse in riparian habitats in behaviour that is comparable to its coastal scavenging (Mundy 2014).

The congregation of near-threatened Cinereous Vultures (*A. monachus*), Himalayan Vultures (*G. himalayensis*), and endangered Egyptian Vultures (*N. p. ginginianus*), including multiple immature individuals, within the Khoh River floodplain indicates the ecological importance of

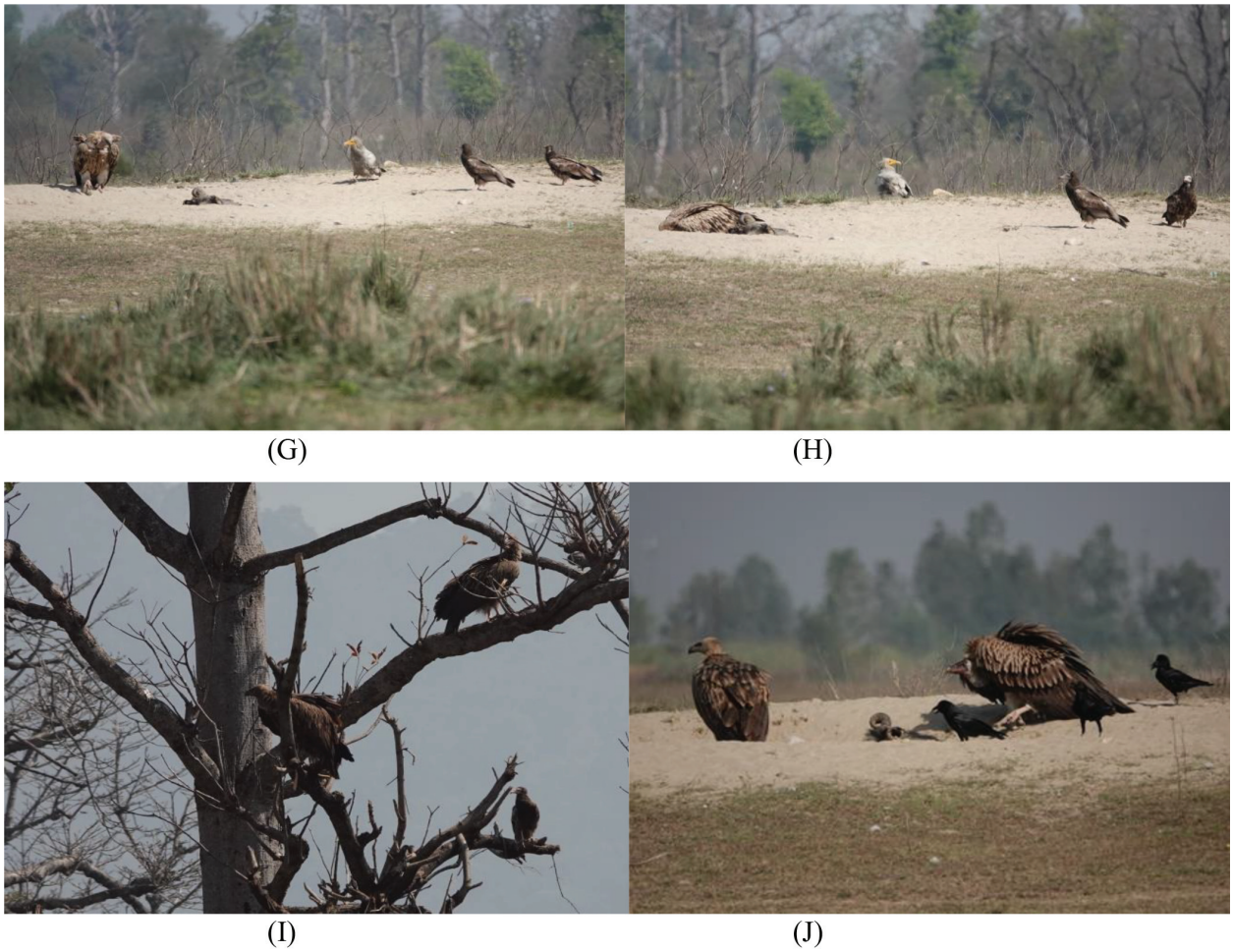

Figure 2. G & H) Mixed assemblage of *G. himalayensis* (sub-adult) and *N. p. ginginianus* (adult on the right side of the carcass and juveniles on the extreme right); I) sub-adults of *G. himalayensis* and a juvenile *N. p. ginginianus* perched on an adjacent tree (*Bombax ceiba*) prior to feeding; J) *G. himalayensis* (sub-adult) feeding with companion scavengers, including Large-billed crows (*Corvus macrorhynchos*).

the area for scavenging vultures and suggests that it may warrant further monitoring and conservation attention under regional vulture conservation initiatives (Jha et al. 2023; Kumar et al. 2025). The floodplain's contiguity with Uttarakhand's forested corridors may facilitate juvenile dispersal and nesting success, highlighting the need for states to collaborate in monitoring and management (Jha et al. 2023). Internationally, the ban on veterinary diclofenac in South Asia has led to early signs of stabilisation of the *Gyps* population (Oaks et al. 2004), while the establishment of protected feeding and roosting sites has demonstrably improved survival and reproductive success in European and Asian vultures (Safford et al. 2019).

During the survey, fewer individuals of *A. monachus* than *G. himalayensis* were observed at carcass sites. *A. monachus* was observed penetrating carcass hides and occupying central feeding positions, whereas *G. himalayensis* frequently approached exposed feeding areas following carcass access. In contrast, *N. p. ginginianus* remained on the periphery of mixed-species assemblages, feeding on residual fragments and exhibiting the lowest abundance. These species-specific foraging strategies and interspecific interactions align with the behavioural summaries of these three species in the Birds of the World database (Billerman et al. 2025).

The Khoh River floodplain forms part of the broader Shivalik foothill landscape connecting the Rajaji–Corbett landscape complex with the Upper Ganga floodplains of western Uttar Pradesh. This heterogeneous landscape, comprising riverine habitats, forest patches, agricultural fields, and livestock-associated human settlements, may facilitate seasonal movement and feeding opportunities for scavenging raptors. Himalayan Vultures (*G. himalayensis*), which exhibit seasonal altitudinal movements from higher Himalayan regions to lower elevations during winter, are regularly reported from the northern Indian plains during the non-breeding period (Grimmett et al. 2011; SoIB 2023). Observations from the present survey indicate that livestock carcass disposal areas within the Himalayan foothill–Gangetic interface may serve as seasonal feeding locations for both migratory and resident

scavenging species. These observations also suggest ecological linkage between the foothill landscapes of Uttarakhand and adjoining floodplain habitats of western Uttar Pradesh for wide-ranging vultures.

In the Indian subcontinent, habitat prediction modelling has highlighted the importance of heterogeneous landscapes for vulture conservation in the Gangetic-Thar-Deccan region of India (Jha and Jha 2021). More recently, climatic niche modelling has suggested that future climate change scenarios may substantially alter the distribution and climatic suitability of several vulture species across India, with projected niche contractions for species such as *G. bengalensis*, *G. indicus*, and *N. percnopterus* (Bhattacharya et al. 2025). Longitudinal surveys have documented species richness and nesting preferences across Uttar Pradesh, with the Tarai region supporting the highest diversity (Jha 2015). However, threats such as diclofenac toxicity, food scarcity, electrocution, and habitat degradation continue to undermine vulture populations in the state (Mani et al. 2024). According to the State of India's Birds report (SoIB 2023), both *A. monachus* and *N. percnopterus* are experiencing "rapidly declining" population trends, whereas *G. himalayensis* is classified as "declining" in abundance. The sharp decline in *A. monachus* and *N. percnopterus* emphasises the urgent need for strengthened regulatory enforcement, expanded carcass-safe zone networks, and targeted population reinforcement. Continued monitoring of *G. himalayensis* is essential to prevent further losses.

A recent study conducted in southern India demonstrated that community-driven partnerships and stringent enforcement of veterinary NSAID regulations sustain carcass-provisioning networks and foster the establishment of vulture-safe zones (Manigandan et al. 2024). Similar associations between vultures, livestock carcass availability, and rural agricultural landscapes have also been reported from northern India, particularly in Uttar Pradesh, where carcass disposal sites support scavenging vulture assemblages (Jha 2015; Kushwaha et al. 2020).

These findings corroborate the core objectives of India's National Vulture Conservation Action Plan: strategic habitat protection, systematic carcass management, and captive breeding initiatives to reverse the population decline (Ministry of Environment and Forests 2006). Integrating these fine-scale ecological insights into existing policy frameworks can enhance the design, implementation, and effectiveness of conservation interventions aimed at promoting the recovery of vulture populations across northern India.

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Data Availability

All data generated or analysed during this study are included in this published article.

Conflicts of Interest

The author declares no conflict of interest.

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Author contributions

Mohan Kukreti: Conceptualization; Methodology; Investigation; Formal analysis; Writing – original draft; Writing – review & editing.

REFERENCES

Baumgart, W. 2018. Indiens Schmutzgeier: *Neophron percnopterus ginginianus* oder *N. ginginianus*? [India's Egyptian Vulture: *Neophron percnopterus ginginianus* or *N. ginginianus*?] *Ornithologische Mitteilungen* 70(3–4), 59–74. [In German]

Bhattacharya, M., Sarkar, D., Zode, A., & Talukdar, G. 2025. Climatic niche modeling to assess the impact of climate change on nine vulture species in India. *Journal of Raptor Research* 59(3), 1–13. doi: 10.3356/jrr2451

Billerman, S.M., Keeney, B.K., Kirwan, G.M., Medrano, F., Sly, N.D., & Smith, M.G. (eds) 2025. *Birds of the World*. Ithaca: Cornell Laboratory of Ornithology. https://birdsoftheworld.org/ (Accessed on June 2025).

Cuthbert, R., Green, R.E., Ranade, S., Saravanan, S., Pain, D.J., Prakash, V., & Cunningham, A.A. 2006. Rapid population declines of Egyptian vulture (*Neophron percnopterus*) and red headed vulture (*Sarcogyps calvus*) in India. *Animal Conservation* 9(4), 349–354. doi: 10.1111/j.1469-1795.2006.00041.x

Cortés-Avizanda, A., Jovani, R., Carrete, M., & Donázar, J.A. 2012. Resource unpredictability promotes species diversity and coexistence in scavenger guilds: a field experiment. *Ecology* 93(12), 2570–2579. doi: 10.1890/12-0221.1

Duriez, O., Andevski, J., Bowden, C.G.R., Camiña Cardenal, A., Frey, H., Genero, F., & Tavares, J. 2022. "Commentary: Not all vulture feeding stations are supplementary: proposed terminology for carcass provisioning with reference to management goals and food sources."*Journal of Raptor Research* 56(1), 131–137. doi: 10.3356/jrr-20-19

Grimmett, R., Inskipp, C., & Inskipp, T. 2011. *Birds of the Indian Subcontinent*. 2nd edn. London, United Kingdom: Christopher Helm, 528 pp.

IUCN 2025. *The IUCN Red List of Threatened Species*.

Version 2025-1. https://www.iucnredlist.org (Accessed on August 2025).

Jha, K.K. 2015. Distribution of vultures in Uttar Pradesh, India. *Journal of Threatened Taxa* 7(1), 6750–6763. doi: 10.11609/jott.o3319.6750-63

Jha, R., & Jha, K.K. 2021. Habitat prediction modelling for vulture conservation in Gangetic-Thar-Deccan region of India. *Environmental Monitoring and Assessment* 193(8), 532. doi: 10.1007/s10661-021-09323-4

Jha, R., Jha, K.K., & Kanaujia, A. 2023. Notable changes in conservation status of vultures in Uttar Pradesh, India: a study based on occupancy and habitat modelling. *Proceedings of the Zoological Society* 76, 288–304. doi: 10.1007/s12595-023-00496-z

Kushwaha, S., Kumar, A., & Singh, N. 2019. Vultures in human-distorted landscapes of Balrampur, Uttar Pradesh, India pertaining to roosting and feeding sites. *G-Journal of Environmental Science and Technology* 7(2), 6–14.

Kumar, P., Kumari, P., Vasudev, V., Lavania, P., Gupta, G., Tiwari, P., Dobriyal, M., & Srivastav, M. 2025. Threatened vultures of India: population, ecology, and conservation. *EcoHealth* 23, 18–37. doi: 10.1007/s10393-025-01742-w

Mundy, P., Butchart, D., Ledger, J., & Piper, S. 1992. *The Vultures of Africa*. Randburg and Halfway House, South Africa: Acorn Books and R. Friedman Books, 464 pp.

Ministry of Environment and Forests. 2006. A*ction Plan for Vulture Conservation in India*. Government of India, New Delhi. https://moef.gov.in/uploads/2018/03/vulture_plan.pdf (Accessed on August 2025).

Margalida, A., Colomer, M.À., & Sanuy, D. 2011. Can wild ungulate carcasses provide enough biomass to maintain avian scavenger populations? An empirical assessment using a bio-inspired model. *PLoS ONE* 6(5), e20248. doi: 10.1371/journal.pone.0020248

Mundy, P.J. 2014. Egyptian vultures and the principle of subspecies in vultures. *Vulture News* 66(1), 60–65.

Margalida, A., Sánchez-Zapata, J.A., Blanco, G., Hiraldo, F., & Donázar, J.A. 2014. Diclofenac approval as a threat to Spanish vultures. *Conservation Biology* 28(3), 631–632. doi:10.1111/cobi.12271

Moreno-Opo, R., Trujillano, A., & Margalida, A. 2016. Behavioral coexistence and feeding efficiency drive niche partitioning in European avian scavengers. *Behavioral Ecology* 27(4), 1041–1052. doi: 10.1093/beheco/arw010

Manigandan, S., Byju, H., & Kannan, P. 2024. Harmonizing ecology and society: an integrated analysis of vulture conservation in the Nilgiri Biosphere Reserve, India. *Journal of Threatened Taxa* 16(6), 25330–25344. doi: 10.11609/jott.8915.16.6.25330-25344

Mani, N., Antil, J., & Kanaujia, A. 2024. Threats to vultures of Uttar Pradesh: a review. *International Journal of Science and Research Archive* 13(2), 2797–2803. doi: 10.30574/ijsra.2024.13.2.2285

Oaks, J.L., Gilbert, M., Virani, M.Z., Watson, R.T., Meteyer, C.U., Rideout, B.A., Shivaji, S., & Ahmed, S. 2004. Diclofenac residues as the cause of vulture population declines in Pakistan. *Nature* 427(6975), 630–633. doi: 10.1038/nature02317

Pain, D.J., Cunningham, A.A., Donald, P.F., Duckworth, J.W., Houston, D.C., Katzner, T.E., Parry Jones, J., Poole, C.M., Prakash, V., Round, P.D., & Timmins, R.J. 2003. Causes and effects of temporospatial declines of *Gyps* vultures in Asia. *Conservation Biology* 17(3), 661–671. doi: 10.1046/j.1523-1739.2003.01740.x

Prakash, V., Pain, D.J., Cunningham, A.A., Donald, P.F., Prakash, N., Verma, A., Gargi, R., Sivakumar, S., & Rahmani, A.R. 2003. Catastrophic collapse of Indian white-backed *Gyps bengalensis* and long-billed *Gyps indicus* vulture populations. *Biological Conservation* 109(3), 381–390. doi: 10.1016/S0006-3207(02)00164-7

Piper, S.E. 2006. Supplementary feeding programmes: how necessary are they for the maintenance of numerous and healthy vulture populations. In *Proceedings of the International Conference on Conservation and Management of Vulture Populations,* edited by Houston, D.C., & Piper, S.E., 41–50. Thessaloniki, Greece: Natural History Museum of Crete and WWF Greece.

Plaza, P.I., & Lambertucci, S.A. 2020. Ecology and conservation of a rare species: what do we know and what may we do to preserve the Andean condors? *Biological Conservation* 251, 108782. doi: 10.1016/j.biocon.2020.108782

Prakash, V., Bajpai, H., Chakraborty, S.S., Mahadev, M.S., Mallord, J.W., Prakash, N., Ranade, S.P., Shringarpure, R.N., Bowden, C.G.R., & Green, R.E. 2024. Recent trends in populations of Critically Endangered *Gyps* vultures in India. *Bird Conservation International* 34, e1. doi:10.1017/S0959270923000394

Rayaleh, H., & McGrady, M. 2019. An observation of the Indian subspecies of Egyptian vulture *Neophron percnopterus ginginianus* in Djibouti. *Vulture News* 77(1), 62–68. doi: 10.4314/vulnew.v77i1.3

Safford, R., Andevski, J., Botha, A., Bowden, C.G.R., Crockford, N., Garbett, R., Margalida, A., Ramírez, I., Shobrak, M., & Tavares, J. 2019. Vulture conservation: the case for urgent action. *Bird Conservation International* 29(1), 1–9. doi: 10.1017/S0959270919000042

SoIB. 2023. *State of India's birds, 2023: Range, trends, and conservation status*. The SoIB Partnership. doi: 10.5281/zenodo.11124590

WWF India. 2025. *Satellite telemetry: a tool for raptor conservation*. WWF India, New Delhi. https://wwfin.awsassets.panda.org/downloads/setellite-telemetry-2025.pdf (Accessed on July 2025).