

The importance of vultures for ecological stability and human society

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Abstract. As human society continues to evolve and advance, urbanization has become increasingly prevalent in various countries. Consequently, the natural environment is confronted with a growing array of challenges. It is imperative for individuals to enhance awareness of the significance of vultures to both humanity and the natural environment. This essay will primarily elucidate the significance of vultures, encompassing their role within human culture and the natural environment. Research has indicated that vultures possess a scarcity as significant, sizable scavengers within the natural environment. They play a crucial role in impeding the spread of infectious diseases arising from deceased organisms, while also expediting the progression of vital ecological cycles, such as the carbon and nitrogen cycles. Vultures play a significant role in agricultural growth by aiding in the disposal of animal carcasses. Furthermore, due to their longstanding coexistence with humans, vultures have acquired symbolic significance in various religious traditions worldwide, representing spiritual potency. The significance of human beings is widely acknowledged in numerous geographical areas. Enhanced focus on vultures is vital for safeguarding the growth of their population, facilitating the expeditious advancement of science and technology, mitigating ecological harm, and upholding the symbiotic coexistence of humanity and the natural world.

Keywords: Aegyptius Monachu; Gyps indicus; Percnopterus; Gyps coprotheres.

1. Introduction

In contemporary times, extensive research has yielded significant findings in the field of studies. These findings have contributed to a more thorough understanding of vultures and facilitated their conservation efforts. Consequently, numerous aspects pertaining to vultures have emerged as subjects of scholarly investigation and warrant serious consideration and discourse. In 2022, a study was undertaken by Awoyemi et al. to examine the influence of culture on vultures in the southwestern region of Nigeria. This document provides a unique viewpoint on the cultural understanding of the relationship between vultures and humans. The article highlights that vulture, being emblematic of various beliefs, has influenced several believers to purchase vulture-related things, hence exacerbating the illicit wildlife trade within the local region. Ultimately, scholars aspire to mitigate this unlawful trade by leveraging religious influence. The scholarly essay pertaining to vultures from a cultural standpoint incorporates the investigation undertaken by JHA, RADHIKA, and other esteemed researchers in 2023, focusing on vultures in northern India. The research findings indicate that a majority of the populations in India express overwhelmingly favorable sentiments about vultures, with a significant proportion of these communities being indigenous tribes. The article demonstrates that the extensive cultural legacy of indigenous tribes is highly likely to have a positive impact on the conservation of vultures. Numerous scholarly investigations have been conducted to examine the various perils encountered by vultures in their natural habitat. In the year 2021, Stamenov et al. conducted a study that established a causal link between the lead poisoning of several European vultures and the illicit practices of hunting and shooting. This conclusion was reached via the use of testing and detection methodologies specifically applied to European Griffin vultures. There is an additional inquiry that offers a more detailed analysis. In the year 2022, Ives and a group of scientists conducted a comprehensive examination of the factors contributing to the mortality of vultures in their natural habitats worldwide. The findings indicated that poisoning, particularly lead poisoning and pesticide poisoning, emerged as the predominant cause of mortality, followed by traumatic fatalities resulting from human infrastructure or machinery. Additionally, research has been

conducted on vultures throughout the Asian region. In 2008, Wang Xia, a Chinese scholar, along with other researchers, conducted a comprehensive examination of the skeletal structure of *Aegyptius monachus*. The examination of the findings revealed insights into the dietary preferences of vultures as well as the traits and motivations underlying their flight postures. This essay can serve as a valuable academic reference for future generations studying the characteristics of vulture habits and architecture.

In broad terms, the current body of study about vultures may be categorized into three primary areas. Firstly, there is a focus on the examination of vultures' anatomical structure and their behavioral patterns. Secondly, there is an exploration of the detrimental effects inflicted upon vultures by human activities, with particular emphasis on the implications of toxins and urban development [1]. In conclusion, an examination of the association between vultures and religious culture is presented [2, 3]. Nevertheless, there is a need to enhance the existing studies on viral diseases and physical ailments among vulture populations. Additionally, there exists a notable vacuum in the discourse surrounding the significance of vultures to both the ecological environment and human society in contemporary times. This research aims to examine and provide a comprehensive overview of the significance of vultures, intending to raise awareness among individuals. Vultures currently encounter numerous challenges and risks, although they have not received adequate attention from the human population, and the existing conservation measures are not fully satisfactory. The primary focus of this paper will be an examination of vultures in India, Nigeria, and various regions of Africa. The vulture species under investigation primarily consist of three subfamilies, namely *Neophron percnopterus*, *Gyps coprotheres*, and *Gyps indicus*.

2. The importance of vultures

2.1. Structure and habits of vultures

Vultures exhibit a global distribution across various geographical regions, with a spatial range of approximately 6,599,508 square kilometers. The extent to which vultures are distributed varies from region to region, with high densities in Southern Europe, India and North Africa, and rarities in Northern Europe and East Africa. However, vultures are comparatively less likely to be distributed in Central Africa, the Middle East, and Afghanistan, despite these areas falling within their overall range [4, 5]. Despite their varied habitats and appearances, vultures are essentially carnivores that have evolved a number of adaptive strategies and physiological structures in terms of behavior and physiology, adaptations that enable them to efficiently locate and efficiently dispose of carcasses. According to previous research findings, the digestive system of vultures exhibits certain anatomical features that contribute to their efficient consumption and digestion of carrion. Notably, their digestive system includes a well-developed crop with a thick esophagus, while the cecum experiences significant degradation. Additionally, the muscular stomach lacks an evident cutin membrane, which is believed to be associated with their feeding behavior. These adaptations enable vultures to effectively process and extract nutrients from carrion, even reducing it to bones in large quantities [6]. The individuals exhibited the capacity to consume sustenance on multiple occasions, and their skeletal composition underwent adaptive modifications. These adaptations included a broad cranium, a notably robust and elongated upper beak, and a vertical curvature at the anterior region, facilitating efficient flesh removal from carcasses. Additionally, the frontal bone and orbit anteriorly protruded, while the length of the anterior limb bones surpassed that of the posterior limb bones. According to Wang, the initial metacarpal extensor muscle exhibits a sudden and forceful release, while the proximal phalanx of the foot is marginally longer than the distal phalanx [7]. The aforementioned traits exhibit a strong correlation with the feeding behavior, flight posture, and roosting preferences of vultures. This particular anatomical configuration enables vultures to expend minimal energy while sustaining prolonged aerial suspension, thereby enhancing their ability to locate sustenance. This observation implies that vultures may have exhibited scavenging preferences since ancient times, and subsequently underwent evolutionary adaptations following their ecological surroundings, leading to

their present-day state. This observation further demonstrates that the presence of sizable scavengers is a complex phenomenon, necessitating rigorous natural selection and the development of exceptional evolutionary pathways within the species. Consequently, vultures hold significant value and are considered highly valuable.

2.2. The role of vultures on ecology and human beings

The decomposition of deceased organisms plays a vital role in the preservation of ecological equilibrium. Decomposers have the ability to liberate nutrients, such as carbon and nitrogen, that are sequestered within deceased organisms, thereby facilitating their release into the atmosphere or soil. Alternatively, the accumulation of deceased organisms may lead to a decrease in the carbon cycle, the emergence of widespread diseases and climate change, and potentially trigger a cascade of events resulting in the extinction of various species. In contrast, vultures exhibit remarkable efficiency and possess formidable scavenging capabilities within the ecosystem. Typically, these organisms derive sustenance from the remains of both domesticated and untamed fauna, while their stomach's elevated levels of gastric acid possess the capacity to eradicate a wide array of bacterial species. Vultures play a significant role in the ecological process of decomposing deceased organisms, thereby contributing substantially to the maintenance of ecological stability. The impact of vultures on the natural environment extends significantly beyond that. The management of carcasses by vultures significantly diminishes the likelihood of animal plague epidemics, as it accelerates carcass decomposition and reduces the survival probability of pathogenic bacteria. Additionally, vultures have undergone evolutionary adaptations that have resulted in robust immune systems, rendering them largely resistant to the majority of viruses, even when consuming decomposing flesh. The implementation of this measure would yield significant advantages across various regions, particularly in areas characterized by high temperatures and limited economic resources. In such contexts, the prevalence of widespread epidemics could result in substantial ecological and agricultural repercussions. Furthermore, as a result of the prevailing low economic conditions and the limited capacity of individuals to implement efficient intervention strategies, there exists a significant likelihood of zoonotic diseases being transmitted to domesticated animals. This transmission can lead to extensive mortality among local animal populations, thereby exacerbating the issue by generating additional carcasses and perpetuating a detrimental cycle. In the event of a worst-case scenario, it is plausible that zoonotic diseases may proliferate among human populations as a result of various contributing factors. In recent years, there has been a persistent decline in the population of vultures in Africa [8]. This decline may have implications for local financial expenditure, as the local government will likely be compelled to address the aforementioned issues arising from the diminishing vulture population. Furthermore, the presence of unprocessed carrion can also serve as a magnet for rats and other scavenging organisms, thereby facilitating the potential transmission of diseases within human populations. The decomposition of meat has the potential to introduce contaminants into water sources. The dissemination of the human plague will result in even more significant casualties.

Vultures possess significant value to human society. Initially, vultures play a crucial role in assisting human beings in effectively managing a substantial quantity of organic waste. Consequently, the financial resources saved in this regard have the potential to facilitate advancements in various other domains of human development. Furthermore, the vulture holds significant spiritual significance in ancient human civilizations, and this symbolism has endured over time through various forms such as totems and symbols. In the field of sociology in India, the vulture's presence is observed in diverse cultural systems, encompassing domains such as food and health, superstitious practices, intergenerational transmission of vulture-related knowledge, religious values, and even objects of entertainment [2]. The vulture holds a significant role in the cultural practice of sky burial in Tibetan and Mongolian societies. This practice is deeply intertwined with the profound implications of Mongolian social culture, encompassing the wisdom of ecological equilibrium and the harmonious cohabitation between humanity and the natural environment. The vulture's behavior

also contributed positively to the preservation of the delicate ecological environment in Inner Mongolia during that period [9]. The coexistence of vultures and human beings has been observed since ancient times, demonstrating their ability to live together harmoniously. Additionally, vultures offer significant cultural value to human societies, which cannot be quantified. They play a pivotal role in shaping the cultural fabric of numerous regions at the national level. The potential collapse of vulture populations may lead to the loss of numerous beliefs, particularly those that rely on vulture body parts and bones as cultural symbols. Consequently, this aspect of ancient culture is also at risk of vanishing alongside the extinction of vultures. The loss of cultural diversity is an irreplaceable detriment that cannot be mitigated solely through financial means.

2.3. Human influence and harm to vultures

In the present era of scientific and technological advancements, vultures are confronted with numerous detrimental threats, primarily stemming from human activities. Among these, the most prevalent cause of mortality is poisoning, with lead and pesticides being the most significant contributors. Additionally, vultures face fatal injuries resulting from traumatic incidents, such as collisions with urban infrastructure and intentional shooting. Infection and malnutrition also pose significant risks to their survival [1]. To begin with, vultures have experienced significant repercussions due to the global issue of drug abuse. This has resulted in the proliferation of litter and waste to human habitations, thereby prolonging the duration spent by vultures in the process of carcass disposal. Consequently, there has been a surge in the incidence of diseases among scavengers. Numerous pharmaceutical substances administered to livestock are ostensibly advantageous; however, upon the animals' demise, these substances transform into toxins that accumulate within their bodies. Consequently, vultures, being scavengers that consume such carcasses over an extended period, are subject to poisoning. The current literature highlights the concerning decline of vultures in Pakistan and its adjacent regions, attributing this phenomenon to the administration of diclofenac sodium, a pain-relieving agent commonly employed by livestock breeders to address injuries sustained by their animals. Munawar, vultures experience renal failure upon consuming the flesh of livestock that has been administered diclofenac sodium, as this pharmaceutical agent exhibits nephrotoxic properties [10]. However, the prevalence of this practice is extensive on a global scale and exhibits no indications of diminishing. This situation has prompted apprehension that the proliferation of vultures as a result of this practice may become a prevalent occurrence if preventative measures are not implemented promptly. This concern is particularly heightened by the challenges associated with managing the usage of chronically toxic substances, which may inadvertently infiltrate human food sources. Furthermore, the prevalence of lead poisoning is widespread and can often be attributed to the illicit act of shooting in various geographical areas [11]. Due to the introduction of illicit projectiles into the animal's anatomy, it is commonly observed that the animal is struck and subsequently attempts to escape, only to endure a protracted period of lead toxicity, ultimately resulting in its demise. The vultures could have potentially been subjected to shooting and poisoning, or alternatively, they might have been exposed to poison subsequent to consuming carcasses contaminated with lead. The second peril pertains to religious convictions. The illicit trade of wildlife is a pervasive issue of international concern that significantly impacts the preservation of biodiversity. According to Stephen research interviews conducted in Nigeria, it has been observed that the belief in vultures is transmitted across generations within families [3]. Furthermore, the findings indicate that a significant number of individuals actively seek out opportunities to acquire vulture-related products. It is widely held that the consumption or possession of these items is associated with therapeutic or auspicious qualities, a connection that is inherently tied to illicit poaching practices. Consequently, this illicit activity has resulted in a notable decrease in vulture populations. There exists a potential avenue for diminishing the number of vultures procured by devout individuals through the provision of guidance by religious authorities. Furthermore, vultures are confronted with the issue of food scarcity in certain regions. The proliferation and deforestation activities undertaken by human populations have resulted in a decline in local species diversity and

population sizes, consequently leading to a decrease in animal carcasses. Insufficient resource availability poses a challenge in sustaining a substantial population of vultures, while concurrently leading to a significant contraction in their habitat range. The utilization of fish carrion resources on Gambian beaches has emerged as a significant dietary component for hooded vultures [12]. Currently, certain vulture species have been classified as endangered, and it is imperative to draw greater attention to the significant value of vultures to enhance their conservation efforts.

2.4. Prospects for future research directions of vultures

Despite an extensive review of the existing literature, significant gaps persist in the academic research about vultures. Future research on vultures can be initiated by considering the following three aspects. One area of study pertains to the examination of vulture nature reserves. Currently, there remains considerable scope for scholarly discourse regarding the cultivation or captive rearing of vultures, as our understanding of their distinct behaviors and population dynamics remains limited. The establishment of nature reserves dedicated to vultures, coupled with efforts to enhance their reproductive success and overall survival, holds promise for mitigating the alarming rate of decline observed in vulture populations. This allows for a greater allocation of time to conduct research and execute the implementation of protective measures. Furthermore, there exist inquiries pertaining to the issue of malnutrition among vultures and their susceptibility to diseases, as well as strategies to address the scarcity of vulture food sources and minimize the reliance on pharmaceuticals in poultry farming. Additionally, the challenge lies in ensuring that the nutritional intake of vultures is sufficiently balanced. The following instructions should be prioritized for a comprehensive examination to address the prevailing issue of vulture poisoning. Vultures, in and of themselves, exhibit susceptibility to various illnesses, occasionally including infectious diseases that have the potential to disseminate within their population. Regrettably, our current understanding of these diseases remains limited, impeding the development of effective treatment protocols. In conclusion, this study explores strategies for safeguarding and promoting vultures through cultural avenues. Given the profound religious connotations associated with vultures, it is suggested that cultural propaganda may serve as a viable approach to vulture conservation. By challenging the prevailing perception of vultures as unsightly and inconsequential, efforts can be made to reshape public attitudes toward these birds. Furthermore, raising global awareness about the crucial ecological role played by vultures is deemed essential in garnering international attention and support for their preservation.

3. Conclusion

Extensive deliberation and empirical inquiry have revealed that vultures hold significant importance within both the ecological framework and human societal systems. Vultures play a crucial role in mitigating the prevalence of severe infectious diseases resulting from the accumulation of numerous carcasses in natural environments. Their consumption of carcasses facilitates the survival of various wildlife species. Furthermore, the anatomical composition of vultures enables them to efficiently consume carrion without risking the transmission of diseases to themselves. Furthermore, this phenomenon expedites the carbon and nitrogen cycles of the planet and has been a crucial agent of natural decomposition for an extensive duration. The development of vultures has been significantly impacted by various human disturbances in contemporary society. Examples include drug abuse and illegal shooting in animal husbandry, which have resulted in the poisoning and death of numerous vultures. Additionally, the process of large-scale urbanization and certain negative stereotypes held by humans towards vultures have further diminished the already limited habitats available to these birds. Nevertheless, vultures possess not just ecological significance but also hold substantial cultural worth for human societies. Vultures hold significant religious and national importance in countries such as Tibet and Nigeria, playing an integral role in local belief systems. The primary objective of this essay is to garner increased public awareness of the significance of

vultures, while simultaneously challenging prevailing unfavorable perceptions associated with these avian species. It is imperative to encourage additional scholarly engagement in vulture research in order to enhance vulture conservation efforts and sustain the delicate equilibrium among humans, vultures, and the natural environment. Nevertheless, this paper also has certain shortcomings. The study's geographical scope and the range of vulture species examined may be limited, thus compromising the credibility of the findings. Furthermore, the absence of precise experimental data will diminish the trustworthiness of the article. One final aspect to consider is the limitation of employing a singular research method, which hinders the full examination of vulture data from several perspectives and compromises the precision of the findings. Despite an extensive review of several scholarly texts, significant gaps persist in the academic study pertaining to vultures. In subsequent investigations, additional studies may be conducted on spontaneous diseases among vultures and the establishment of vulture reserves, with the aim of enhancing human understanding of the species in a more comprehensive manner.

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