

ECO-TRANSFORMATION AND ELECTROCUTION. A MAJOR CONCERN FOR THE DECLINE IN VULTURE POPULATION IN AND AROUND JODHPUR

Ram Prakash SARAN*, Ashok PUROHIT

Department of Zoology, Faculty of Science, J. N. V. University, Jodhpur, India

Abstract

Vultures are large sized birds with late maturity and a low reproductive output, making populations especially vulnerable to adult mortality caused by environmental and anthropogenic perturbations. During the last few decades the Thar witnessed tremendous human activities, because of an increase in population. It underwent phenomenal eco-transformations, with dry land turning in to wet in several parts of the Thar Desert. The increase in population within this region generated several new challenges for the habits of vultures. The findings of the current investigation suggest that changes in the traditional cattle treatment pattern, the increase in the feral dogs population, the presence of high tension electricity poles near to dumping sites, the unavailability of food and water and the opening of a carcass waste management treatment plant were causes that adversely affected the biodiversity of vultures in the area under investigation.

Keywords: Endangered; Diclophenac; Electrocution; Mortality; Vulture decline; Thar.

Introduction

Nature is a blend of biotic and abiotic components and the equilibrium between them is vital for the existence of life on earth. It is necessary to recognize the importance of plants and animals, since they contribute largely to our lives. Large-size birds, such as the vulture are an essential component of the biotic system in the ecosystem. Vultures are successful scavengers and play an important role in clearing the animal carcasses and municipal dumps. They provide a range of ecological, economic and cultural services. Vultures are the only documented obligate scavengers and they are uniquely adapted to a scavenging lifestyle.

Due to lot of variations in geographical and environmental factors, India has nine species of vultures in the wild [1]. They are the Oriental White Backed Vulture (*Gyps bengalensis*), the Slender Billed Vulture (*Gyps tenuirostris*), the Long Billed Vulture (*Gyps indicus*), the Egyptian Vulture (*Neophron pernopterus*), the Red Headed Vulture (*Sacrogyps calvus*), the Indian Griffon Vulture (*Gyps fulvus*), the Himalayan Griffon (*Gyps himalayensis*), the Cinereous Vulture (*Aegypius monachus*) and the Bearded Vulture (*Gypateus barbatus*). Out of them, seven species of old world vultures were observed in and around Jodhpur, which is the Golden gate of entrance to the Thar Desert [2]. They were King Vultures (*Sacrogyps calvus*), Egyptian Vultures (*Neophron pernopterus*), Eurasian Griffons (*Gyps fulvus*), Long Billed Vultures (*Gyps indicus*), Himalayan Griffons (*Gyps himalayensis*) and White Backed Vultures (*Gyps bengalensis*).

Four species, namely *Gyps indicus*, *Gyps bengalensis*, *Sacrogyps calvus* and *Neophron pernopterus* are permanent residents and remain throughout the Jodhpur area. The remaining

* Corresponding author: saranrp@live.com

three species, *Gyps fulvus*, *Gyps himalayensis* and *Aegypius monachus* are migratory species and come to the area from October to February in the winter season. Resident species reproduce there, due to the favorable habitat and the availability of food throughout the year. Since cattle farming is the major source of income for the people of Western Rajasthan and because of the unavailability of adequate treatments, the death rate of cattle is high. Thus, dumping sites provide food and nesting sites for these vultures.

Vulture populations underwent a catastrophic collapse since the early 1990s [3]. Oriental white-backed vultures (*Gyps bengalensis*), long-billed vultures (*G. indicus*) and slender-billed vultures (*G. tenuirostris*) are now listed by the International Union for the Conservation of Nature (IUCN) as critically endangered species [4]. The causes for the population decline are plentiful, but habitat degradation and human maltreatment, or both, are featured in the list of risks for nearly every endangered species.

The ecological cost of vulture decline comprises changes in community composition of carcass scavengers, such as a rapid increase in the Canine population and canine related diseases like Anthrax, Tuberculosis etc. A dramatic fall in vulture population caused serious problems, such as that of carcasses disposal and the consequent rotting carcasses as potential disease transmitters through the mammalian carcass scavengers.

Since 1996, the breeding ecology and population of the vultures studied in and around Jodhpur and in the Thar desert were examined, by monitoring their nesting sites, making censuses, recording predation, observing inter-species interaction and locating their seasonal migration to Chhangani and Mohnot [2]. Over the last decade, there has been a drastic decline in the vulture population in the Indian sub-continent, as reported by Rahmani [5], Prakash [6], Prakash and Rahmani [7], Prakash et al [8] and Prakash et al [3].

The causes of vulture death in and around Jodhpur were not investigated to date. Scientists and Researchers differ in their opinions and findings. They believe that it could be a viral disease or a toxic chemical, or the lack of food availability, or extensive hunting and so on. The aim of this research paper is to investigate the changes in vulture population and the cause of mortality for different species of vultures in and around Jodhpur

Material and Methods

Study Area

The study site, Jodhpur ($26^{\circ}17'59''$ N and $73^{\circ}02'02''$ E), is situated in the western part of Rajasthan and is a prominent part of the great Indian Thar Desert. Climatically, Jodhpur is a typical hot desert. Topographically, it is by and large, plain and open, interrupted by hillocks. During summer, the temperature ranges between 6°C and 45°C , while in May and June it rises up to 49°C . The annual average rainfall is 300 mm, distributed over 20 rainy days. This wide range of climatic conditions has led to the formation of different habitat types and food eating places for vultures in and around the Jodhpur.

Intensive surveys of the study area were undertaken from October 2006 to December 2007, in order to locate vulture nests and feeding sites in and around Jodhpur, within a radius of 50 Km (Fig. 1). The information about various nesting and feeding sites was collected from various publications, from local people, from the presence of water bodies, safe and large trees, large rocks and cliffs, wild life, livestock populations, high tension electricity lines and carcass dumping grounds.

After the initial surveys of the study sites, an intensive study was carried out at some selected nesting sites of Jodhpur, until the end of December 2008, to find out the ecological specificities of the various vulture species that inhabit the area. Extensive investigations for active nests and nest sites and their monitoring were undertaken in the study area by performing daily visits.

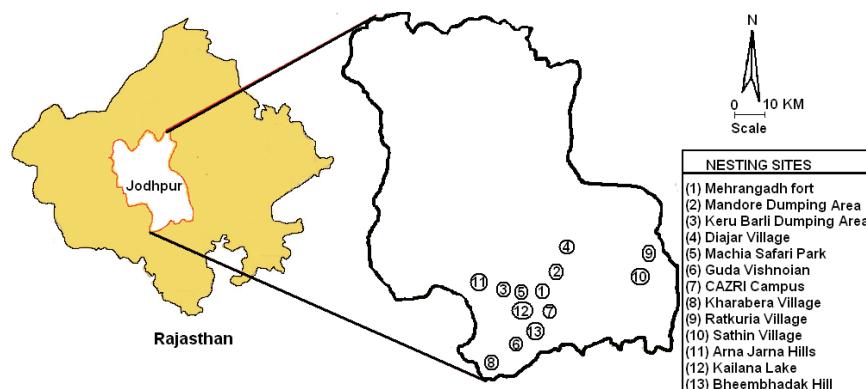


Fig 1. Nesting sites of different species of Vultures in and around Jodhpur

Identification

The identification of the different species of vulture was carried out on the basis of color patterns of the body, upper and under wing color pattern, length of bill, plumage orientation and shape, rump, the color of the head and neck regions. The identification of juvenile and adult birds was carried out on the basis of feathers patterns. Juvenile birds have smaller and more pointed wing and tail feathers than adults. The feathers of the scarf are longer, more lanceolate or spiky and less fluffy than those of adults. Adult birds have larger, more rounded flight and tail feathers than juveniles and the feathers of the scarf are mostly whitish and fluffy in appearance.

Microclimatic data

A digital minimum-maximum Hygro-Thermometer and a Digital Lux-meter (LX-101A, LT Lutron) were used to record microclimatic parameters, such as temperature, relative humidity and light intensity at dumping grounds. The relative humidity was assessed as, Dry (0-44%), Normal (45-74%) and Wet (75% and onwards). All those microclimatic parameters were recorded every week for the month of our study period.

Population status and Mortality

A population census of different vulture species was carried out every week of each month for a year. The final data were interpreted for each month. In a day population counting was carried for three times at nesting sites, feeding sites and drinking sites. The emphasis was on counting at feeding sites, because all species stayed a longer time at their feeding place. The population status of different species of vulture was studied by means of the head counting method, supported by photography and video recordings. The vulture colonies were searched daily for dead vultures, between October 2006 and December 2008. All carcasses were removed or marked to avoid double counting and, where feasible, the reason of death was determined.

Results and Discussion

A vulture decline in the Indian subcontinent for the *Gyps* species was reported for the first time by Prakash [6], in the Keoladeo Ghana National Park, Bharatpur, Rajasthan during mid 1980 to mid 1990s, followed by Northern India road count. The demographic status of the vulture population in and around Jodhpur was reported by Chhangani [9].

Declines have been reported of over 97% over in the *Gyps bengalensis* population, over a twelve year periods in India. The BNHS conducted a nationwide raptor survey in many parts of India, between 1991 to 1993, by using the road transect method [10]. A similar type of survey

was repeated in 2000 and it concluded that both *Gyps bengalensis* and *Gyps indicus* had almost disappeared from the area under survey.

As far as the population of Oriental White Backed Vultures and that of the Long Billed Vulture were concerned, they declined by more than 92%, between 1991-93 and 2000 [3, 8]. Repeated surveys in 2002 - 2003 indicated that between 2002 and 2003 the average annual decline rates were 48% for *Gyps bengalensis* and 22% for *Gyps indicus* [11]. The Slender Billed Vulture and Long Billed Vulture were considered and counted among other species until 2002, when the Slender Billed Vulture was found to comprise less than 2% of the combined total of Long Billed Vultures and Slender Billed Vultures [11]. The results from the 2002-03 counting suggested that the population of SBV was declining in India at approximately the same rate as the other two species. Similar types of decline were also observed in the present investigation. The number of the resident species *Gyps indicus* maximum population counted 33 individuals in January 2007 and the minimum counted 3 individuals in November 2008.

In India, the initial hypothesis for the drastic fall in Vulture population was pointing to the unavailability of food (dead livestock carcasses were presumed to be removed for commercial purposes) and habitat loss (increasing disturbances caused by increased human population) and an unknown viral epidemic disease, the neck down syndrome. The neck down syndrome symptoms were first observed in the Keoladeo National Park, Rajasthan, where birds would exhibits this behavior for periods of over several weeks, before collapsing and falling off trees, at the point of, or just prior to their death [6], due to pesticide intoxication and calcium deficiency [12].

The Thar Desert region has extreme environmental conditions, not more favorable for civilization. But during the last 20 years there was an increase in human population, which implied extra demands for land, food and other resources, ultimately resulting in the degradation or destruction of the habitats of vultures and in serious concerns. Jodhpur is a hilly area and mining is an alternate income source for the people there. Due to the increase in human population, mining works penetrated the nesting sites on hill cliffs and caused adverse disturbances.

In Mehrangadh fort, the population of Long Billed Vultures, *Gyps indicus*, decreased continuously from 2007 to 2009. In 2006 there were 24 birds of the *Gyps indicus* species observed throughout the year, but from the end of 2007 to January 2009 only 4 birds were observed. That reduction in population was due to the increased presence of human activities in that area of the fort, such as the shooting of movies for long periods of time in the area. Because of all the changes above, vultures migrated from that site.

In Jodhpur, the main occupation of the people is agriculture and cattle breeding. Food material of live stock mainly depend on the leaves of trees and the cutting of trees occurring every year is also a serious problem because it destroys the nests of vultures. In general, people of this area have myths and false beliefs regarding the nature of vultures, which makes them hate this significant wild creature. People were reported to destroy their nest from the trees in their fields.

Our comparative study suggests that there has been a drastic change in the total vulture population in the nesting, drinking and dumping sites in and around Jodhpur. The population of migratory species in the winter season in and around Jodhpur is of more than a thousand birds every year, according to Chhangani et al [9], but during our investigation a dramatic fall was observed in the migratory species of vultures, since February 2007. That reduction in the population of migratory species was due to a number of factors. In this area the carcass availability in plentiful. Quantity is an important factor responsible for the survival of vultures in and around Jodhpur. In 2008, the municipal waste management started a carcass processing plant in the Keru dumping area, Jodhpur. Now carcasses are disposed of directly by that plant

and converted into powder form, a material used in agriculture and as food for fishes (Fig. 2). In the absence of carcasses there may be a chance that migratory species of vultures move to adjacent sites, where the food is in available in plentiful amounts.

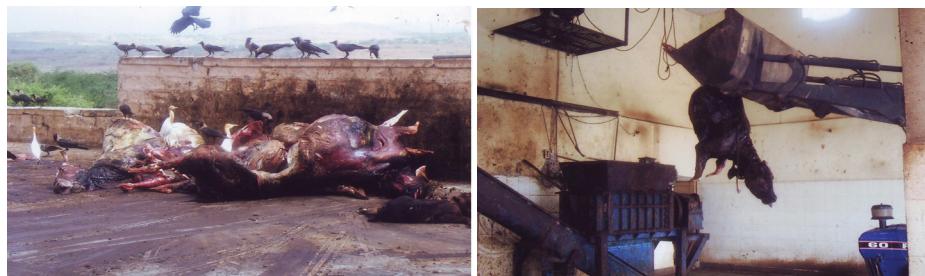


Fig 2. Municipal waste management started a carcass processing plant in the Keru dumping area, Jodhpur

The other reason behind the decline in vulture population in this area is the increase in the population feral dogs, as earlier reported by Prakash et al. [8]. In Jodhpur, in 1992, the population of feral dogs was 60 individuals, which increased to more than 1200 in 2000. The unavailability of carcasses and the increase in the population of feral dogs forced vultures to migrate. As the population of feral rats and dogs is increasing in this area, it also poses a danger of infectious disease transmission within the population by that species to other. Important zoonotic diseases, such as rabies and the bubonic plague, which are endemic within India and for which dogs and rats are the primary carriers, are likely to outburst, as a consequence of decreased vulture population.

In the present study, from 2006 to 2008, a total of 41 dead vultures were observed at various locations in and around Jodhpur, when the average total population of vultures was reported as more than 1800 and a 2.14% death rate was observed. Out of that, 1.1% was due to electrocution and the remaining 0.9% was due to natural death or due to other reasons. The maximum death rate due to electrocution was observed in *Gyps fulvus* and than in *Gyps himalayensis* (Table 1). That result coincides with the reporting of electrocution in bats in Jodhpur from Purohit and Sanecha [13].

Table 1. Total deaths observed at the Keru dumping site, Jodhpur in different species of vultures

Species	<i>Gyps fulvus</i>	<i>Gyps himalayensis</i>	<i>Gyps Indicus</i>	<i>Gyps bengalensis</i>	<i>Aegypius monachus</i>	<i>Neophron percnopterus</i>
Total population	493	361	156	13	74	815
Total death	16	11	4	—	3	7
Natural death	6	8	2	—	—	2
Electrocution death	10	3	2	—	3	5

Most deaths by electrocution were observed at the Keru dumping site. On two sides of this area there are road tracks and parallel to them runs a high voltage electricity line. It was observed that at the dumping ground, during feeding on Carcasses and after it, vultures sit on the wall of the field. When a vehicle passes on the road vultures fly in large numbers together to avoid the disturbance and, as the electricity line passes adjacent to the wall, during flight the vultures touch the electricity wire and death occurs (Fig. 3).

Vultures are known to have sharp eye sight, so the explanation of how fail to see the electric line was that vultures fly in large numbers together during that time and their wide wing span impedes their detection of the electricity line. Additionally, the distance between the field, wall and the electricity line was lesser than 50 meters. Therefore, vultures could not take enough altitude to avoid the wire (Fig. 4.).



Fig. 3. Dead specimen of THE migratory species Cinerous Vulture, *Aegypius monachus* at the Keru dumping area, Jodhpur.



Fig. 4. Electrocuted individual of the Griffon Vulture, *Gyps fulvus*, hanging on an electricity pole at the Keru dumping site, Jodhpur.

Deaths by electrocution were observed in all species of vulture and in common crows and hawks in and around Jodhpur, but it was observed that the death rate in different species was different, according to the size of birds and the number of individuals. It was observed that the maximum death rate caused by electricity was in *Gyps fulvus* and then in *Gyps himalayensis*, both being large birds.

Green et al [11] estimated that no more than 0.8% of ungulate carcasses available to foraging vultures would need to contain a lethal dose of diclophenac to cause the observed population decline. Schultz et al [14] found that a high proportion of *Gyps bengalensis* and *Gyps indicus* vultures found dead in the wild had severe visceral gout, consistent with diclophenac poisoning, that being the main or sole cause of the population decline [15, 16]. The license to manufacture the drug diclophenac was withdrawn by the drug controller General of

India, via a letter dated May 11, 2006, addressed to all the state drug controllers. The toxicity of diclophenac to vulture and the strong evidence of its effect on their population were the main reasons for that withdrawal.

The use of diclophenac in and around Jodhpur, according to our survey, suggested that only 3.8% of the animals were treated with diclophenac and only 8.08% were cows, buffalos 4%, camels 0%, goats 2% and sheep 0%. Various reports suggested that diclophenac residues were the main cause of vulture population decline, but we observed that diclophenac is not the main cause of vulture death in this region, because the percentage of cattle treated with diclophenacs was very low. Nevertheless, further research needs to be done, to assess the effect of diclophenac on the vulture population in this area.

Conclusions

The present investigation aims to identify the main factors accountable for vulture population decline. High tension electricity poles, unavailability of food in nesting areas and the opening of carcass waste processing plant had adverse effects on the vulture population in the area. Out of the seven species of vultures reported in Jodhpur during earlier studies, only six species were observed during the present investigation. A drastic decline was observed in the total vulture population and the maximum mortality rate was by electrocution. We also found that the use of diclophenac for cattle treatment in this region is very low and that the main cause of death for the vultures in this region is electrocution.

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