

Ecological Studies on Three Endangered Vulture Species in the Pokhara Valley, Nepal



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Abstract

In 2006, we started ecological studies on three ‘critically endangered’ or ‘candidate for endangered status’ vulture species in Pokhara, Nepal: White-rumped *Gyps bengalensis*, Slender-billed *G. tenuirostris* and Egyptian *Neophron percnopterus*. In five colonies, a total of 36 White-rumped, 15 Slender-billed and 86 Egyptian Vultures was recorded during the 2006-07 field season. The breeding activities of White-rumped started in September, Slender-billed in October and Egyptian in February. Based on occupied nests as primary units, the breeding success of White-rumped Vulture was 42.8% and that of Slender-billed Vulture was 57.1%. Seven chicks of Egyptian Vulture were on four nests. Diclofenac contamination is a long-term global threat while the destruction of nesting habitats is an immediate local threat to vultures at the Phedi Patan colony.

Introduction

Pokhara valley is a laboratory without four walls for vulture research in Nepal. Of eight vulture species in the country, we have recorded six species here (Gautam and Baral 2007). Four species are confirmed to breed in the valley: White-rumped Vulture *Gyps bengalensis*, Slender-billed Vulture *Gyps tenuirostris*, Egyptian Vulture *Neophron percnopterus* and Red-headed Vulture *Sarcogyps calvus*. Two species are winter visitors: Himalayan Griffon *Gyps himalayensis* and Cinereous Vulture *Aegypius monachus*. The status of Eurasian Griffon *Gyps fulvus* in the valley is debatable, but Lammergeier *Gypaetus barbatus* is often seen in the winter. Among these vulture species, four are either ‘critically endangered’ or ‘candidates for endangered status,’ following the catastrophic population declines in South Asia.

Diclofenac, an anti-inflammatory drug used in veterinary, has caused a mass mortality of three species of *Gyps* vultures (*G. bengalensis*, *G. tenuirostris* and *G. indicus*) in South Asia (Oaks et al. 2004, Pain et al. 2003, Shultz et al. 2004). The wild populations of these vultures have plummeted more than 95% during the 1990s (Prakash 1999). Recent research in India shows a sharp decline in populations of Egyptian Vulture *Neophron percnopterus* and Red-headed Vulture *Sarcogyps calvus* (Cuthbert et al. 2006). In other vulture colonies too, the population of these vultures is decreasing, and the reasons for this are diclofenac poisoning, habitat destruction, disturbance and hunting (Baral and Gautam 2006, Baral and Gautam 2007).

Although we have been collecting ecological data on these vultures opportunistically for two years, we started systematic research only in 2006. Many nesting trees of White-rumped Vulture (WRV) and Slender-billed Vulture (SBV) are in private lands and a few in community forest in two colonies, while nests of Egyptian Vulture (EGV) are on cliffs along the bank of Seti River or its tributaries in four locations. We have not yet discovered breeding colonies of Red-headed Vulture. We visited all the breeding colonies at least nine times between May 2006 and July 2007. We counted vultures seen on roosts and nests early in the morning and late in the afternoon, and collected data on population status, breeding activities and other ecological parameters.

In 2005, we surveyed 29 vet shops in Pokhara and found that all shopkeepers were selling diclofenac (Gautam and Baral 2005). Neither we have data on diclofenac availability in

Pokhara after its ban, nor do we know the magnitude of diclofenac contamination in livestock carcasses around the vulture colonies. We assume that many of these vet shops still have left over diclofenac on their shelves, so the threat of diclofenac contamination has not been removed completely in the wild. To our knowledge, a diclofenac swap program has not been initiated in Pokhara; hence, it should be a priority.

To be able to study the ecology of three endangered species in one valley is a rare opportunity for vulture scientists. In the light of mass mortalities throughout the vulture range states, we are delighted by the number of vultures that we have recorded in the Pokhara valley. The breeding success of these vulture species is appreciable. In Pokhara, the vulture colonies that are in public lands are comparatively safer but those in private lands are highly vulnerable. To understand population dynamics of the endangered vultures in depth, a long-term monitoring of the existing colonies and exploration of other potential sites are imperative.

Objectives

The broad objective of the study was to collect ecological data on three vulture species. The specific objectives were:

- To estimate population sizes of WRVs, SBVs and EGVs
- To assess the breeding success of three vulture species
- To study breeding ecology of three vulture species comparatively

Study area

The Pokhara valley is densely populated and has highly productive lands in Kaski District. The district ($83^{\circ} 40'$ to $84^{\circ} 12'$ E and $28^{\circ} 06'$ to $28^{\circ} 36'$ N) lies at the center of Nepal and the elevation ranges from 450m to 7969m. Of the total land area in the district (201,700 ha), forests cover 89,943 ha and a total of 406 forest parcels have been handed over to local forest user groups for conservation, management and utilization (DDC, 2005). The valley has the sub-tropical climate. The absolute maximum and minimum temperatures were recorded 33°C in April and 5.6°C in January, respectively and the highest rainfall in Nepal occurs here. A short description of the intensive study areas is given below:

Phedi Patan ($28^{\circ} 10' 6.8''\text{N}$ and $83^{\circ} 59' 13.7''\text{E}$, elevation: 756 m): Situated within Nirmal Pokhari Village Development Committee (VDC), a small administrative and political unit in rural Nepal. There were seven nesting trees in Phedi Patan (four from the previous year and three discovered in March 2007). Only one nesting tree was in community forest and the rest were in private lands. The colony is in the midst of human habitation.

Kattuwa ($28^{\circ} 10' 20.1''\text{N}$ and $83^{\circ} 58' 15.2''\text{E}$, elevation: 735 m): Situated within Nirmal Pokharai VDC. There were six nesting trees (Tiju *Picrasma javanica* 2, Chilaune *Schima wallichii* 1 and Kapok *Bombax ceiba* 3) in Kattuwa. Only two nesting trees were in community forest and four were in private lands (agricultural fields). This colony is on the outskirts of a village so less anthropogenic activities are recorded here.

Narayanthan ($28^{\circ} 13' 51.3''\text{N}$ and $83^{\circ} 59' 33.9''\text{E}$, elevation: 874 m): Situated within the Pokhara Sub-Metropolitan city. A vulture nest is on the steep cliff, about 40 m high above the ground. Above the cliff is a Hindu temple and below it is a cremation site on the bank

of Seti River. Local people collect sand from the bank of the river and visit the temple frequently. Although many people visit the site on a daily basis, the disturbance level is low because the nest is on the inaccessible steep cliff.

Hemja ($28^{\circ} 15' 56.8''$ N and $83^{\circ} 57' 23.3''$ E, elevation: 995m): It is in 4 km north-west from Pokhara city. There were three occupied nests of EGV in Hemja. Two nests were on the cliff of Seti River, near by the Tibetan Refugee Camp. The other nest was on the cliff of Wamdi River, a tributary of the Seti River.

Lahachowk ($28^{\circ} 18' 9.1''$ N and $83^{\circ} 55' 58.2''$ E, elevation: 1088m): It is about 12 km (a road distance) north-west from Pokhara city. A nest of EGV was located on the cliff of Seti River. Underneath the cliff is a paddy field.

Methods

The population sizes of three species of vultures were estimated in the roosting and nesting sites early in the morning (0630-0930 hr) and late in the evening (1730-1930 hr). Since all breeding colonies were within an hour drive from Pokhara, it was easier to monitor colonies frequently. We followed the absolute count method and spent about 7-8 hours per day in the field.

Many of our friends and relatives now know that we have been working on vulture conservation. They told us about the breeding sites or roosting sites of vultures they had seen in and around Pokhara. We visited the sites they had mentioned to us and then asked the local people regarding the vultures' status in the area. Once we confirmed breeding activities in a particular colony, we monitored that colony regularly. We also explored vicinities of the breeding colonies. Observations of nest, breeding status and general breeding behavior of all the birds were made from the ground without disturbing them. Following Postupalsky (1974), an active nest is defined as a nest in which eggs had been laid, whereas an occupied nest is one in which an egg need not have been laid, but a minimum of nest building must have taken place. In other words, all active nests are occupied but all occupied nests are not active. A nest from which a chick fledged is termed as 'successful.'

Both WRV and SBV lay one egg per nest so we calculated the breeding success as the percentage of chicks successfully fledged from the total number of occupied and active nests. EGV lays two eggs per nest so we have to modify the method to calculate the breeding success, which is the number of chicks successfully fledged divided by two times the total number of active nests.

Results

Field efforts

We started the fieldwork in September 2006 and still continuing the nest monitoring of Egyptian Vultures to the time of writing (Table 1). All colonies were visited at least on a monthly basis so a total of 23 days was spent in the field. In a few occasions, we visited the colonies fortnightly or weekly. We covered all phases of a breeding cycle of three vulture species. Each colony was visited at least nine times during the breeding season.

Table 1: Total number of days spent in the field during the 2006-07 season in Pokhara

Breeding colonies	Date	Number of days
A, B, C, D and E	2006/9/9	1
A, B, C, D and E	2006/10/9 and 28	2
A and B	2006/11/30	1
A, B, C, D and E	2006/12/1 and 23	2
A, B, C, D and E	2007/1/17, 21 and 22	3
A, B, C, D and E	2007/2/12 and 24	2
A, B, C, D and E	2007/3/3 – 4, 17, 19 and 31	5
A, B, C, D and E	2007/4/7 – 8	2
A, B, C, D and E	2007/5/11 – 12 and 19	3
A, B, C, D and E	2007/6/10	1
C and D	2007/7/21	1
Total	5	23

Note: A = Phedi Patan, B = Kattuwa, C = Narayanthan, D = Hemja, and E = Lahachowk

Population size estimate

Of five colonies, Phedi Patan and Kattuwa harbored both White-rumped and Slender-billed Vultures while the other three colonies had only Egyptian Vultures. The recorded population of Egyptian Vultures was higher than the other two species. We recorded 36 White-rumped, 15 Slender-billed and 86 Egyptian Vultures in the Pokhara valley during the 2006-07 field season (Table 2). The Phedi Patan colony held the highest number of vultures where we recorded 21 White-rumped Vultures (15 adults and 6 juveniles) on 2007/03/19, 14 Slender-billed Vultures on 2006/10/28 and 43 Egyptian Vultures (32 mature and 11 immature) on 2007/03/31. We discovered a new mixed breeding site of WRV and SBV in March 2007 about half an hour walking distance to the east of the existing colony in Phedi Patan. We included this site within the Phedi Patan colony for convenience. Please refer to Appendix 1 for the detail about the population status and age structure.

Table 2: The maximum number of three vulture species counted in Pokhara in 2006-07

Sites / Colonies	White-rumped	Slender-billed	Egyptian
Phedi Patan	21	14	43
Kattuwa	15	1	33
Narayanthan	-	-	1
Hemja	-	-	6
Lahachowk	-	-	3
Total	36	15	86

Nests and breeding success

Egyptian Vultures roost in nesting holes on cliffs or on trees while Slender-billed and White-rumped Vultures roost only on trees. Generally, Egyptian Vultures left the roosting sites earlier than the other two species.

We recorded seven occupied nests of each species in Pokhara during the 2006-07 breeding season (Table 3). The breeding season of WRV started in September commencing with nest building activities and they lasted until December. Of seven

occupied nests, three were active. We observed the first chick of WRV on January 17, 2007. By the last week of April, all three chicks successfully fledged. Thus, the breeding success was 100% based on active nests as primary units and 42.8% based on occupied nests as primary units.

Table 3: Occupied, active and productive nests, and the breeding success of White-rumped, Slender-billed and Egyptian Vultures for the 2006-07 season in Pokhara

Breeding activities	White-rumped	Slender-billed	Egyptian
Occupied nests	7	7	7
Active nests	3	7	7
Successful nests	3	4	Seven chicks in
Unproductive nests	4	3	four nests
Breeding success #	A = 100%; B = 42.85%	A / B = 57.14%	*

The breeding success was calculated based on active nests as primary units (A) and occupied nests as primary units (B). We did not calculate the breeding success of Egyptian Vultures (*) because all chicks have not fledged from nests at the time of writing.

The breeding season of SBV started in October as we saw a new nest being built on October 28, 2006. Another new nest was added in November, two new nests were added in December and three nests with chicks were discovered in March 2007, so the total number of nests was seven. All seven nests were active, which had either eggs or chicks. However, only four chicks were successfully fledged. The breeding success was 57.1%. To get rid off the nasty smell of vultures' droppings, a landowner cut the branch of a nesting tree that was holding a nest having an egg. Thus, the first nest failed during incubation (on January 22, 2007). When we asked the landowner, why he cut the branch, he told us that vultures' droppings damage paddy and livestock do not eat grasses grown near vultures' droppings. A nest collapsed and a chick fell down on the ground along with the nest. It was alive, but the land owner killed it later with a stick because he did not like vultures nesting above his field. Another chick fell off a nest while practicing to fly and died immediately after smashing on the ground.

Breeding activities of EGV started during the last week of February; we observed a vulture pair mating on February 24, 2007. A maximum number of three nesting holes was observed in Hemja; other four colonies had one nesting hole each. March was the peak time for incubation. We saw the first chick of EGV on May 19, 2007 in Phedi Patan. A chick from Hemja successfully fledged on July 21, 2007. At the time of writing other chicks were still in nests so we did not calculate the breeding success. There were six chicks about to fledge in four nests. Two chicks were raised from three holes one each in Phedi Patan, Narayanthan and Hemja. Only one chick was raised in Kattuwa. No chicks were raised in two holes from Hemja and one hole from Lahachowk. Please refer to Appendix 2 for the detail on breeding activities.

Of three vulture species, only WRV and SBV built nests on trees and they used a total of 13 trees in 2006-07. White-rumped Vultures used six trees to build seven nests (Table 4). They used three species of trees: Kapok *Bombax ceiba*, Tiju and Chilaune *Schima wallichii*. One Kapok tree held two nests and all the other trees had one nest on them. Slender-billed Vultures built seven nests on seven Kapok trees.

Table 4: Number of occupied nests and species of nesting trees used by vultures during the 2006-07 breeding season in Pokhara

Vulture colonies	White-rumped			Slender-billed	Egyptian
	Kapok	Tiju	Chilaune	Kapok	Cliffs
Phedi Patan	0	0	0	7 (7)	1 (1)
Kattuwa	3 (4)*	2 (2)	1 (1)	0	1 (1)
Narayanthan	0	0	0	0	1 (1)
Hemja	0	0	0	0	3 (3)
Lahachowk	0	0	0	0	1 (1)
Total	3 (4)	2 (2)	1 (1)	7 (7)	7 (7)

*Numeral in parenthesis is occupied nest.

Dead vulture

We recorded two matured dead Egyptian Vultures, one each from the Phedi Patan site on January 23, 2007 and from Kattuwa on March 19, 2007. We dissected the dead vulture from Phedi Patan and took its measurements. Its crop was full of fish muscles and bones, and chicken bones. It was 1.55 kg and had wing length of 48.5 cm and beak length of 10.8 cm. The dead Egyptian Vulture from Kattuwa was found hanging in a tree branch. We did not observe any sign of visceral gout in the dead vulture.

Habitat protection

One serious challenge for vulture conservation in Nepal is the protection of nesting and roosting sites. The destruction of nesting habitats poses an immediate threat to vultures in Pokhara. Of five colonies, the Phedi Patan site is most vulnerable. All seven nesting Kapok trees were in private lands. Local people did not like vulture building nests in their lands. They have cut down branches having nests, disturbed vultures and killed chicks. Local people consider vultures as pests and one easy way to get rid of them is to cut the nesting and roosting trees. Without an immediate intervention to save nesting trees, the prospect for WRV and SBV to breed in this site is bleak. Kattuwa is comparatively safer than Phedi Patan at present. In Kattuwa, four trees were in private lands and two were in community forest. We personally know villagers in whose lands vultures are nesting. We humbly requested them not to cut down the nesting trees or disturb vultures and they had agreed to our request. The nesting trees in community forest are on the steep slope, difficult to log and not of valuable timber species, therefore these trees are safe havens for vultures. All cliffs on which Egyptian Vultures nest are safe in Pokhara for a while.

Conclusion

The estimated population sizes of three endangered vultures in Pokhara indicate a good sign for their survival. Among three species, Egyptian Vultures are the most abundant in Pokhara followed by White-rumped Vultures and Slender-billed Vultures. We could have missed other potential colonies. Further exploration in and around Pokhara will give a better picture of vultures' population status. Based on the information we collected during this season, we've planned to explore a few potential breeding sites in the next field season.

White-rumped Vultures breed first, Slender-billed Vultures breed second and Egyptian Vultures breed at last in Pokhara. Although the number of nests is low, the breeding

success of these vultures is comparable to the breeding success recorded in other colonies in the post-decline era.

Diclofenac contamination and habitat destruction are two major threats to vultures. The Phedi Patan colony is not only the most important colony in term of vulture populations but also the most vulnerable colony from habitat destruction. To protect vultures, we need to intervene to save nesting trees in private lands. A program to swap diclofenac with meloxicam should be implemented immediately in Pokhara. Averting the twin threats of diclofenac contamination and habitat destruction helps vultures' struggle for survival.

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Appendix 1: Population structure of White-rumped Vulture (WRV), Slender-billed Vulture (SBV) and Egyptian Vulture (EGV) during the 2006-07 breeding season in Pokhara Valley

Date	Phedi Patan			Kattuwa			Narayanthan	Hemja	Lahachowk
	WRV	SBV	EGV	WRV	SBV	EGV	EGV	EGV	EGV
2006/9/9	0	7	23m	9a	0	0	0	0	0
2006/10/9	0	13	5 (4m + 1i)	10 (8a + 1s + 1j)	0	0	0	0	0
2006/10/28	0	14	2m	4a	0	18m	0	0	0
2006/11/30	0	2	5m	7a	0	33 (27m + 6i)	-	-	-
2006/12/1	-	-	-	-	-	-	0	2m	0
2006/12/23	0	4	10 (9m + 1i)	5a	0	18 (15m + 3i)	0	3m	0
2007/1/17	-	-	-	6a	0	20 (18m + 2i)	-	-	-
2007/1/21	-	-	-	-	-	-	0	0	3m
2007/1/22	0	3	0	-	-	-	-	-	-
2007/2/12	0	6	0	5 (4a + 1j)	0	4m	-	2m	-
2007/2/24	0	4	0	6a	0	10m	0	2m	2m
2007/3/3	0	3	8 (4m + 4i)	9 (6a + 2s + 1j)	1	2m	-	-	-
2007/3/4	-	-	-	-	-	-	0	0	2m
2007/3/17	7a	7	8 (5m+3i)	-	-	-	0	-	-
2007/3/19	21 (15a + 6j)	13	43 (32m + 11i)	15a	0	2m	0	3m	0
2007/3/31	-	-	-	-	-	-	-	4m	-
2007/4/7	8 (5a + 2s + 1j)	4	13 (7m + 6i)	-	-	-	-	-	-
2007/4/8	-	-	-	10 (8a + 1s + 1j)	-	4m	1	3m	1m
2007/5/11	-	-	-	-	-	-	1m	6m	1m
2007/5/12	5a	11	1m	7a	0	1m	-	-	-
2007/5/19	-	-	-	8a	0	2m	-	-	-
2007/6/10	6a	11	6 (5m + 1i)	-	-	-	1m	3m	1m

Note: a = adult, s = subadult, j = juvenile, m = mature, i = immature, '-' = sites not visited

Appendix 2: Breeding activities of three vulture species during the 2006-07 breeding season in Pokhara

Date	Phedi Patan		Kattuwa		Narayanthan	Hemja	Lahachowk
	SBV	EGV	WRV	EGV	EGV	EGV	EGV
2006/9/9	No nest		1 old nest				
2006/10/9	No nest		2 BLD (1 repaired)				
2006/10/28	1 BLD		3 (2 completed + 1 BLD)				
2006/11/30-12/1	2 BLD		3 (1 BLD)				
2006/12/23	4 (3 BLD)		4 (3 INC + 1 BLD)				
2007/1/17,21,22	3 INC*		3 (2 INC + 1 CHK)				
2007/2/12,24	3 INC (1CHK)		3 (1CHK + 2 nests)			mating	
2007/3/3,4	3 CHK		5 (3CHK + 2 nests)				
2007/3/17,19,31	6 (6 CHK)		6 (3 Fledglings)	1 INC		3 INC	
2007/4/7,8	6 (6 CHK)	1 INC	6 (3 Fledglings)	1 INC	1 INC	3 INC	
2007/5/11,12,19	5 (5 CHK)	1 INC	3 Chicks fledged	1 CHK	1 INC	3 INC	INC
2007/6/10	4 CHK	2 CHK (1Nest)		1 CHK	2 CHK	3 (2 CHK)	1 nest

Note: SBV = Slender-billed Vulture, EGV = Egyptian Vulture, WRV = White-rumped Vulture, BLD = Nest building, INC = Incubating, CHK = Chick in the nest

Photo 1: A dead adult Egyptian Vulture in Phedi Patan recorded in March 2007



Photo 2: White-rumped Vultures on the bank of Seti River in Pokhara



Photo 3: Slender-billed Vultures on a Kapok tree in Phedi Patan



Photo 4: Two Slender-billed Vultures and a Himalayan Griffon in Pokhara

