

Rapid population declines of Himalayan Griffon *Gyps himalayensis* in Upper Mustang, Nepal

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Summary

The population collapse of resident *Gyps* vulture species in South Asia, caused by the use of a veterinary drug diclofenac, has highlighted an urgent need to monitor numbers of other vulture species in the region. This study assessed population trends of Himalayan Griffon *Gyps himalayensis* in the mountainous region of Upper Mustang, Nepal, which is an important breeding area for the species. Vultures were surveyed in 2002, 2004 and 2005 by recording the number of birds sighted along 188 km of transects, and observing numbers of birds at breeding colonies. The number of birds recorded per day and per kilometre of transect declined by 67% and 70% respectively over the period of study. The number of active nests declined by 84% from 2002 to 2005. The veterinary drug diclofenac was available in pharmacies in the Mustang region. Young Himalayan Griffons, which migrate to the lowland areas of Nepal and, in increasing numbers to India, are highly likely to be subject to diclofenac poisoning. If this rate of population decline occurs throughout the Himalayan region, the conservation status of the species will need to be urgently reassessed.

Introduction

Populations of three resident species of *Gyps* vulture, Oriental White-backed Vulture *G. bengalensis*, Long-billed Vulture *G. indicus* and Slender-billed Vulture *G. tenuirostris* have collapsed in South Asia in the last decade, and they are now classed as 'Critically Endangered' (IUCN 2007, Vulture Rescue 2007). The main cause of the declines is the non-steroidal anti-inflammatory drug (NSAID) diclofenac, which is commonly used to treat pain and inflammation in livestock in India, Pakistan and Nepal (Green *et al.* 2004, Oaks *et al.* 2004, Shultz *et al.* 2004). Vultures are exposed to diclofenac when they feed on carcasses of livestock that were dosed with the drug shortly before death, and birds die from kidney failure within a few days of exposure (Oaks *et al.* 2004, Swan *et al.* 2006). It is unknown if diclofenac is affecting populations of other vulture species and scavenging birds in the region, but numbers of Red-headed Vulture *Sarcogyps calvus* and Egyptian Vulture *Neophron percnopterus* have recently undergone rapid declines in India (Cuthbert *et al.* 2006) and studies have pointed out that not only diclofenac, but also some other NSAIDs are harmful to vultures and other scavenging birds (Cuthbert *et al.* 2007).

Within Nepal, research and monitoring of vulture species has been undertaken in lowland areas and has revealed similar declines (in excess of 90%) in populations of Oriental White-backed and Slender-billed Vultures (Baral *et al.* 2002a, 2004), as well as the widespread use of diclofenac (H.S. Baral pers. obs.) and the presence of the drug in vulture carcasses (Shultz *et al.* 2004). Populations of both lowland species have continued to decline and they are now almost absent or extinct from eastern areas of the country as breeding birds (H.S. Baral pers. obs.). While a grave conservation situation is clear for lowland species, research in high altitude areas of Nepal has been lacking. Nepal holds important breeding populations of the Himalayan

Griffon *G. himalayensis* which is found elsewhere in Pakistan, India, the Peoples Republic of China, Myanmar and possibly the northern part of Russia (Del Hoyo *et al.* 1994). Currently the Himalayan Griffon is not believed to approach the thresholds for the population decline criterion of the IUCN Red List and is evaluated as 'Least Concern' (IUCN 2007) and its status has been described as "common" to "fairly common" in Nepal (Grimmett *et al.* 2000, Baral *et al.* 2002b).

The effect of diclofenac on Himalayan Griffon is predicted to be as lethal as on the lowland species of *Gyps* vultures (Swan *et al.* 2006). Since livestock husbandry is an integral part of Nepal's mountain ecosystems there may also be diclofenac use and contamination of carcasses in high altitude areas of the country. As a consequence, there is an obvious need to monitor the population of Himalayan Griffons and ascertain the use of diclofenac in the Himalayan regions of Nepal. This study aims to fill this gap, and to set out baseline data on population trends of Himalayan Griffon within Upper Mustang, Nepal.

Methods

Study Area

The study was conducted in Upper Mustang, an area of 2,567 km², which covers the northern half of Mustang District (Ale 2002; Figure 1). The study area belongs to the arid, trans-Himalayan zone of the Annapurna Conservation Area (ACA) (BCDP 1994) which supports a unique ecosystem (Suwal 2003). The zone receives an average rainfall of 132 mm per annum and is drained by the Kaligandaki River and its numerous tributaries. Upper Mustang is overseen by seven Village Development Committees - (Chuksang, Ghemi, Tsarang, Lomanthang, Chhosyar, Chhunup and Surkhang) and has up to 33 human settlements containing around 6,100 people (Shah 2001). These people practise a combination of livestock farming, agriculture and seasonal trade in winter. The Upper Mustang Biodiversity Conservation Project has been implemented to restore the ecology and economy through the sustainable use of its biodiversity (Suwal 2003).

Survey methods

Himalayan Griffons were surveyed along transects for 24, 22 and 22 days in 2002, 2004 and 2005 respectively. The surveys were carried out between July and September (Table 1), the summer months when Himalayan Griffon are breeding and when resident birds are most likely to be observed. Two main data collection methods were used: 1) transects were walked through the region and all vultures recorded; and 2) all nesting sites in areas of suitable habitat were scanned, with additional incidental observation of vultures at carcasses and human sky-burial sites.

Transects were walked along the main trails used by local people in the region. These trails were selected for their relative ease of access and because they covered a representative area of Upper Mustang where Himalayan Griffons were known to occur. Four main transects totalling 188 km in length were covered in each survey year. Those transects were located north-south from Jomsom to Nichung, Lomanthang to Samjung and back, and Lomanthang to Jomsom (approximately 89, 18 and 64 km respectively, and taking 16, one and four successive days of walking in 2002 and 15, one and four successive days of walking in 2004 and 2005) and east-west from Lomanthang to Yara and back (17 km over three days in 2002 and two days in the rest of the year). The length of transects covered per day varied depending upon the settlement, altitude and climate. Transects were walked from 08h00 to 17h00 of each survey day, when Himalayan Griffon vultures were active and soaring in search of food. All vultures observed up to 500 m on each side of the transect were identified and recorded. Vultures observed beyond 500 m were ignored in each survey year. Distance was based on ocular estimation and repeated in each survey year. To make a more precise estimate of distance, a distance of 500 m was marked out on the ground prior to each survey, to familiarize the observer with the width of observation. There was

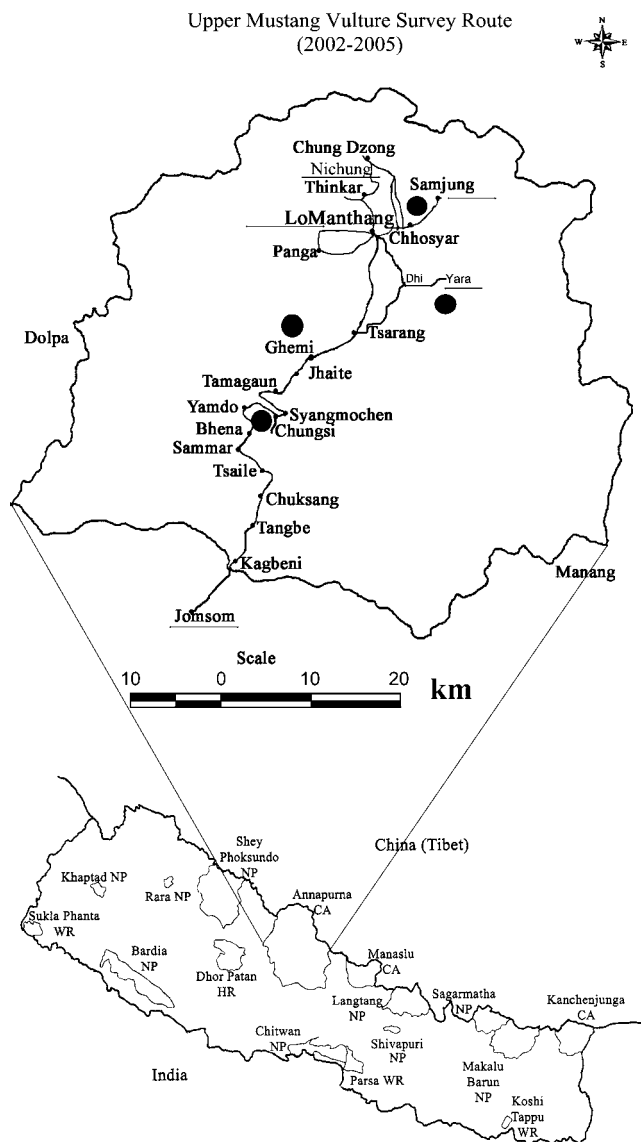


Figure 1. Locations of the transect survey routes and breeding colonies in Upper Mustang district, Nepal. —Indicates the major survey route and ● indicates the breeding colonies of Himalayan Griffions Source: Baral and Heinen 2007, NTNC/ACAP.

some possibility of double counting individual birds, either on the same day or succeeding days. However, the same bias is present in each year of the study and should still allow reliable estimation of population trends.

An area of approximately 400 km² of suitable habitat (e.g. steep rocky cliffs and gorges where Himalayan Griffion are likely to nest) was scanned from transect routes and vantage points to locate and identify nesting sites of the species. Possible sites were also located on the basis of information from local people and published sources. Survey efforts for nests observation were

Table 1. Dates, duration, numbers of Himalayan Griffon and detection frequency over 188 km of transect in Upper Mustang.

	2002	2004	2005
Dates	12 August to 9 September	13 July to 7 August	26 August to 18 September
Duration	24 days	22 days	22 days
Total recorded (transect, baiting and carcasses)	333	235	185
Number at baiting sites	–	62	82
Number at carcasses	110	28	35
Birds recorded along the transects	223	145	68
Birds day ⁻¹ (transect)	9.29	6.59	3.09
Birds km ⁻² (transect)	1.19	0.77	0.36

increased over the course of the study, with an additional nesting area being visited in 2005. The nests were classified as 'occupied' on the basis of the presence of nesting birds or fresh white droppings on the nest rim and nesting ledge, or fresh droppings on the rock cliffs underneath the nesting sites (Postupalsky 1974). Nests with old droppings of an off-white or brown appearance were categorized as 'unoccupied'. The occupied nests were assumed to hold one pair of vultures. 'Active' nest refers to any nest where young ones were present at the time of the study.

Data on the availability and use of veterinary medicines, pesticides, fungicides and insecticides were collected from the District Livestock Service Centre, the District Agriculture Development Centre and from three veterinary/agricultural service shops at Jomsom, the main town and headquarters of Mustang district.

Results

Transect surveys

Totals of 223, 145 and 68 Himalayan Griffons were recorded along the transects in the three respective years of the surveys (Table 1), with annual totals including birds recorded at carcasses or at burial sites of 333, 235 and 195, respectively. Between 2002 and 2005, the number of birds recorded per day and number of birds recorded per kilometre of transect declined by 67% and 70% respectively, which is equivalent to a decline rate of 31–33% per year, if declines have been constant over the four-year period. The numbers of vultures recorded on transect 1 (Jomsom to Nichung, 89 km in length) and transect 4 (Lomanthang- Yara-Lomanthang, 17 km in length), showed 73% and 94% declines respectively, over the period from 2002 to 2005 (Table 2). An observed decline of 54% was recorded along transect 2 (Lomanthang-Samjung-Lomanthang, 18 km)

Table 2. Number of Himalayan Griffons recorded on the four transects.

	Transect 1 (Jomsom to Nichung) (89 km)	Transect 2 (Lomanthang- Samjung- Lomanthang) (18 km)	Transect 3 (Lomanthang to Jomsom) (64 km)	Transect 4 (Lomanthang-Yara- Lomanthang) (17 km)
Year				
2002	165	33	9	16
2004	130	4	4	7
2005	44	14	9	1

over the same period, however almost no change was observed on transect 3 (Lomanthang to Jomsom, 17 km) where low numbers of vultures were observed in all three years of the survey (Table 2). Transects 2 and 3 are of the shortest distance and duration and consequently may be subject to more random variation than the longer sections and the whole route.

Nesting sites

In total, 58 and 61 Himalayan Griffon nests were observed in caves on vertical cliffs in 2004 and 2005 respectively, although survey effort was higher in 2005, with an additional four nests (one active and three unoccupied) encountered in a new area in 2005. At nest sites that were fully visible, birds were not observed to use nesting materials of any kind. In 2005, nine nests (15%) were active, 16 nests (26%) were occupied and 36 nests (59%) were unoccupied. Similarly, in 2004, eight nests (14%) were active, 17 nests (29%) were occupied and 33 nests (57%) were unoccupied. Assuming that all active nests and all occupied nests with fresh faeces contained two members of a pair, then the number of nests recorded in 2004 and 2005 represents a population of around 50 adult birds. New and active nesting sites of Himalayan Griffon were observed in Chungshi and Samjung areas in 2005 due to the wider coverage of the survey in 2005 than in 2004. Two nesting colonies (Ghemi and Chosyar) were monitored in all years of this study, with a third nesting colony (Chungshi) monitored in 2004 and 2005 (Table 3). The number of active nests at Ghemi and Chosyar declined by 100% and 75% respectively from 2002 until 2004, with evidence of a smaller decline (27%) at Chungshi from 2004 to 2005. Numbers at Chosyar appear to be stable (but very low, four and six respectively) in the last two years of survey. Combining both Ghemi and Chosyar colonies, nest numbers have declined by 84% from 2002 to 2005 (Table 3).

Veterinary and agricultural compounds

In Mustang district, the District Livestock Development Service and three other shops in the Jomsom area were found to be distributing and selling veterinary medicines. In total, 47 products were recorded, the most common being anti-helmenthic medicines for the treatment of internal (six compounds) and external (three compounds) parasites; antibiotics (six), and antiseptics (three). Only one general pain killer and anti-inflammatory drug for the treatment of livestock was found, the NSAID voviram bolus, which contains diclofenac sodium as the active ingredient.

In Mustang district, the use of agricultural chemicals including pesticides, insecticides and fungicides started in 1998 and the practice still continues. Altogether 5,623 litres of diesel and 2.57 metric tons of other pesticides, insecticides, and fungicides have been distributed between 1998 and 2004. Of these, diesel oil (used as a herbicide), dimethoate, ravistin, zinc phosphitezon and diethane-45 are most commonly used in the Mustang region.

Discussion

The results of this study indicate that there have been substantial declines in the resident population of Himalayan Griffons in upper Mustang of Nepal. While the study period was

Table 3. Number of Himalayan Griffons recorded at colonial nest sites in Upper Mustang.

Year	Site		
	Ghemi	Chosyar	Chungshi
2002	22	16	*
2004	0	4	15
2005	0	6	11

*Not surveyed in 2002

limited in duration (from 2002 to 2005), evidence for declines comes from the decrease in vultures seen along transects walked across the region and from repeated counts of nest numbers at monitored breeding sites (Figure 2). Declines in breeding numbers were found at all three areas monitored, with no nests recorded at one site (Ghemi) in 2004 and 2005, despite the presence of 22 nesting birds in 2002. Similarly, no nesting birds were recorded in any year of the survey at a fourth breeding colony (Yara cave) despite the presence of breeding birds observed here during 1993 to 1997 (R. Acharya pers. obs.). Over the same time period the number of birds recorded along 188 km of transect through the region declined by 70%. These observations from four breeding colonies and transects indicate a substantial decline of the species, confirming the suggestions made by Baral *et al.* (2002b).

While evidence from transects and nesting colonies has indicated a significant decline, incidental counts of vultures attending sky burial sites and carcasses have shown more stable numbers. Between 54 and 70 vultures (average 61) were in attendance at human sky burial sites (Box 1) between October 2003 and February 2005. Similar numbers (62 and 82) were recorded in 2004 and 2005 for goat carcasses used as bait at the same sky burial site. A total of 110 (with one carcass site), 28 (with three carcass sites) and 35 (with one carcass site) Himalayan Griffons was recorded in 2002, 2004 and 2005 in attendance at livestock carcasses along the transect route. However sample size (only a limited number of feeding events in each year of survey), exact date of baiting, amount of food available, time spent at the site, and other climatic conditions may confound the comparisons. In addition, as feeding events are likely to attract vultures from a very wide area (satellite tagged White-backed Vultures in Pakistan ranged over areas of up to 69,000 km²; Gilbert *et al.* 2007) they may be less likely to reflect population trends than counts of birds along transect routes and at breeding colonies.

Box 1. Sky burial practices in the study area

When a local person dies, the *lama*, the religious leader and respected holy person of the area, decides how to carry out funeral rites. A few specific castes including *Bista* usually burn a small portion of dead body parts, but the major caste of the area, the *Gurung* (> 90% of the local population) cuts up the corpse into small pieces as offerings to the vultures. The *Lama* invites the vultures by praying and playing a trumpet or bell. If vultures do not visit the corpse it is believed that the person has committed some great sins during his lifetime. Local Buddhist people believe that the vultures take the soul of dead person to heaven.

The use of pesticides, herbicides, and insecticides was found to be common in Upper Mustang. Pesticides may be lethal to the predators of livestock, which may eventually affect other carrion feeders over the whole of Mustang (Suwal 2003). Although the Annapurna Conservation Area Project (ACAP) gives emphasis to organic farming, the rate of pesticide consumption in the area is actually increasing. A wide range of veterinary medicines was found to be promoted and on sale in Mustang district, including one NSAID for treating livestock that contained diclofenac. The scale of use of this drug in the region is currently unknown. However, given our knowledge of the impact of diclofenac on lowland species of *Gyps* vultures, we advocate an immediate end to the use of this drug in Mustang and other Himalayan regions, in order to protect Himalayan Griffons. As a result of the recent ban (2006) on the manufacture and import of diclofenac in Nepal (Vulture Rescue 2007), the amount of veterinary diclofenac should become reduced in the region. Promotion of meloxicam, a vulture-safe alternative drug which is as effective as diclofenac for treating livestock (Swan *et al.* 2006, Swarup *et al.* 2007) and already manufactured and on sale within Nepal, should be undertaken throughout the country. Mustang's proximity to China and Tibet, where veterinary diclofenac is manufactured, means that controls must also be put in place to ensure that it is not illegally imported into Nepal. Similarly, diclofenac may also reach Nepal from India (BCN unpubl. data). As well as the threat diclofenac presents

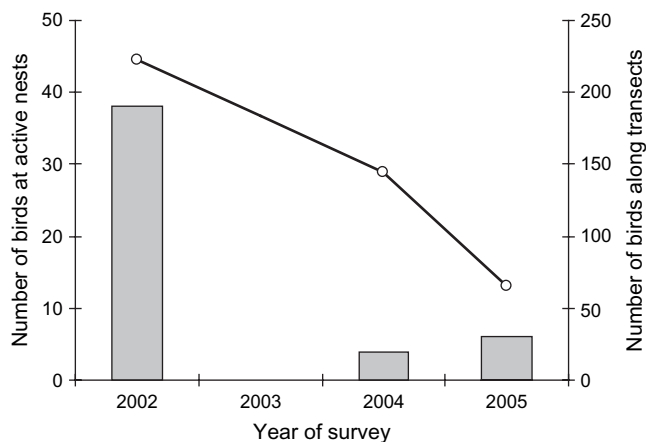


Figure 2. Combined number of Himalayan Griffions recorded at the Ghemi and Chosyar breeding colonies (bars) and total number of Himalayan Griffions (line) recorded flying (excluding sightings at carcasses and burial sites) along 188 km of transects walked over 22–24 days in 2002, 2004 and 2005.

to breeding vultures resident within Mustang, many young Himalayan Griffions descend to lowland Nepal and further south to northern India during winter (Chaudhary and Pariyar 2004, de Roder 1989, Gurung *et al.* 2004, Cuthbert *et al.* in prep). Numbers of both Himalayan Griffions and Eurasian Griffions *Gyps fulvus* have increased nearly threefold in Rajasthan State, northern India, over the period 1995/96–2003 (Chhangani and Mohnot 2004), and increasing numbers are seen further south in India each year (V. Prakash pers. comm.). In these localities, Himalayan Griffions will be exposed to the same risk of diclofenac poisoning as the other three Critically Endangered *Gyps* species of the Indian subcontinent, and it is likely that the lowlands of Nepal and northern India are acting as a major population sink for the species since the collapse in numbers of resident *Gyps* species.

In conclusion, this study demonstrates that the number of Himalayan Griffions has substantially decreased in the Mustang region of Nepal. Populations along transects declined by up to 70% from 2002 to 2005, at an average decline rate of 30% a year: a rate of decline comparable with the annual declines of 22% and 48% recorded for the now 'Critically Endangered' Long-billed and Oriental White-backed vultures in India (Green *et al.* 2004). We strongly recommend repeat surveys and population assessments of Himalayan Griffions from Mustang and other areas of Nepal, India and Pakistan along the species' breeding range to determine if this species is declining across its range. If these declines are replicated in other areas of Nepal and throughout the Himalayan region, then the conservation status of the Himalayan Griffion needs to be urgently assessed and immediate steps should be taken to conserve Himalayan Griffions before their population follows the same course as other *Gyps* vultures in South Asia.

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