Rapid decline of the Bearded Vulture
Gypaetus barbatus in Upper Mustang, Nepal

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We assessed the status of the Bearded Vulture Gypaetus barbatus between 2002 and 2008 in Upper Mustang, Nepal. Regular monitoring of four transect lines indicate a rapid decline of the species over the study period, with the number of individuals recorded per day and per kilometre falling by 73% and 80%, respectively. The use of the veterinary drug diclofenac could lie behind this decline, as the species’s range overlaps with those of other vulture species known to be affected by diclofenac. A regular monitoring programme to assess the status of Bearded Vulture population is urgently needed, along with assessment of its population trends over a wider area. If ongoing declines on a wider geographic scale are observed, then the conservation status of this species should be reassessed.

INTRODUCTION

The Bearded Vulture or Lammergeier Gypaetus barbatus is a territorial cliff-nesting accipitrid vulture whose diet mainly consists of bone remains from wild and domestic ungulates (Hiraldo et al. 1979, Margalida et al. 2007). Its range in Asia includes the mountains of Afghanistan, Baluchistan, Tibetan Plateau, Mongolia and throughout the Himalayas from the extreme north-west across to Arunachal of India in east (Kaul & Ahmed 1992, Ferguson-Lees & Christie 2001). In addition, it occurs in the mountainous regions of Europe, North Africa, East Africa and southern Africa (Brown 1997, Margalida et al. 2003, Hirzel et al. 2004, Gil et al. 2009).

Although the Bearded Vulture is threatened within its range in Europe, the species is listed as Least Concern by BirdLife International owing to its common occurrence in other areas of the world (BirdLife International 2009). The Bearded Vulture is a resident species in Nepal (Grimmett et al. 2000), which holds one of the largest populations in the world (Gil et al. 2009). It is recorded in almost all protected areas in the country’s mountains (IUCN Nepal 2008) and its status has been described as ‘fairly common to common’ (Grimmett et al. 2000) including at our study area, Upper Mustang (Suwal 2003).

Owing to catastrophic population declines of three resident Gyps vulture (White-rumped G. bengalensis, Indian G. indicus and Slender-billed Vultures G. tenuirostris) in South Asia in the last decade, these species, once very common in the region, are all now classified as Critically Endangered (BirdLife International 2001, Green et al. 2006). The use of veterinary diclofenac is the major reason for the decline (Oaks et al. 2004). Diclofenac is a non-steroidal anti-inflammatory (NSAID) drug commonly used to treat pain and inflammation in livestock in India, Pakistan and Nepal (Green et al. 2004, Shultz et al. 2004). It is not known whether diclofenac is affecting other vulture species and scavenging birds in the region. However, numbers of Red-headed Vultures Sarcogyps calvus and Egyptian Vultures Neophron percnopterus have also recently undergone rapid declines in India (Cuthbert et al. 2006a). Evidence from studies suggests that, in addition to diclofenac, vultures and other scavenging birds are susceptible to a range of other NSAIDs (Cuthbert et al. 2006b). Acharya et al. (2009) described the rapid decline of Himalayan Griffon Gyps himalayensis over the period 2002–2005 in the high Himalaya region of Nepal.

Bearded Vultures share the same habitat with other vultures, although their status has not been studied in Nepal until now. This study aims to fill these gaps and explore the situation and trends of Bearded Vulture populations in Upper Mustang, Nepal.

STUDY AREA

Upper Mustang (28°50′23″N 83°47′38″E to 29°11′56″N 83°59′21″E), with an area of 2,667 km², covers the northern half of Mustang District (Ale 2002) (Fig. 1). The northern border of the study area extends up to the Tibetan border, an autonomous region of the People’s Republic of China. The area contains seven Village Development Committees (VDCs)—Chuksang, Ghemi, Charang, Lomanthang, Chosyar, Chunup and Surkahang—and includes 33 Buddhist settlements with a total population of about 6,100 people (Shah 2001). Local people depend on seasonal livestock farming, agriculture and winter trade for their livelihoods.

The Upper Mustang area (including the Upper Kali Gandaki Valley) is located in the arid, trans-Himalayan zone, which receives 132 mm of rain per year. This unique marginal land lies between the east and west Himalayan Tibetan Plateau, within the Hindu Kush. The area is known to be rich in globally significant flora and fauna owing to the steep geophysical topography of the area, and is recognised as a biodiversity hotspot by Conservation International (under the Eastern Himalayan Landscape) (Biodiversity Hotspots 2009).

METHODS

Bearded Vultures were surveyed along predetermined walked transects for 24, 22, 22 and 17 days in 2002, 2004, 2005 and 2008, respectively, during July and August. The transects were along the main trails used by local people in the area, to ensure easy demarcation for future monitoring. All vultures identified within 500 m on both sides of the transect line were recorded. Vultures observed beyond 500 m in each survey year were ignored. Distances were determined by visual estimation, a distance of 500 m being marked out on the ground prior to each survey to familiarise the observer with the observation distance. The linear distance of transects covered per day...
varied depending on settlement, altitude and climate. The transects were walked between 08h00 and 17h00 (roughly 7 hours/day) of each survey day.

The possibility of repeated counting of the same individuals on the same day and subsequent days cannot be ruled out. However, error due to this bias should not affect the estimated trends, because similar biases were present in all study years, although fewer birds in subsequent years may result in fewer repeat counts. More survey days were covered in the first year (2002) than in the following years (2004, 2005 and 2008). Results are presented on a per day and per kilometre basis.

Four transects, totalling 188 km in length, were covered in all four survey years. These were located as follows: Transect 1, north–south from Jomsom to Lomanthang via Nichung (89 km); Transect 2, Lomanthang to Samjung and back (18 km); Transect 3, Lomanthang to Jomsom (64 km); and Transect 4, east–west from Lomanthang to Yara and back (17 km). Ordinary least squares regressions were fitted against the natural logarithm of numbers for each transect and for the total combined counts (Table 1). The estimated annual multiplicative rate of increase ($D$) was estimated from the fitted regression line.

All the pharmaceutical veterinary product information was obtained from three shops located in villages (Jomsom, Kobhang and Marpha) and the Livestock Development Centre in the district headquarters.

**RESULTS**

During the surveys a total of 67, 49, 21 and 13 Bearded Vulture were recorded in the years 2002, 2004, 2005 and 2008, respectively (Table 1). In 2002, 2.79 birds were recorded per day and 0.35 birds in a km² area. Similarly, in 2004, 2.23 birds were recorded per day and 0.26 birds in a km² area. This fell to 0.95 birds per day and 0.11 birds per km² in 2005. The decline of birds continued in 2008, with records of just 0.76 birds per day and 0.07 birds per km² (Table 1). Between 2002 and 2008, the number of Bearded Vultures recorded per day and per kilometre declined by 73% and 80%, respectively. Of the four main transects statistically significant declines over the period 2002–2008 were observed in Transect 1 and in Transect 4, with declines of 96% and 64%, respectively. A statistically significant decline was observed for the total numbers of birds along on all four transects combined, with an estimated multiplicative decline rate of 25.0% a year (Table 1).

During the study, 47 agro-veterinary pharmaceutical products were recorded in local shops and the District Livestock Development Centre. Among the most commonly displayed products were anti-helminthic medicines (six compounds for treating internal and three...
DISCUSSION

The investigation was limited by its study period (2002–2008) and was based only in Upper Mustang, so extrapolation of the population trend for the whole country is difficult. However, it is alarming that a substantial decline (73%) of the species was found in the survey in this remote region of the Himalayas. Surveys of Bearded Vultures from an adjacent area of Nepal (two villages are overlapped) in 1995 recorded 76 Bearded Vultures at a rate of 0.38 birds/km² and 5.1 birds/day (Gil et al. 2009). These records are similar to those observed in the first year of this study in 2002 (Table 1), suggesting that this frequency of occurrence is more typical than the low rates observed by the end of our study.

Veterinary pharmaceutical medicines are commonly available in the Mustang district. One of them is diclofenac, but as noted above some other NSAIDs are also harmful to vultures. The Himalayan Grifon and Bearded Vulture were found to be sharing habitat and roosting sites in China (Katzner et al. 2004). Our team also observed sharing of roosting sites by these two species outside the study area (28°39′24.9″N 83°39′53.6″E in Kunjeri VDC, 2,500 m a.s.l. in 2005). Bearded Vultures are primarily bone-eaters, so it is unlikely they feed on the carcass as well (Xirouchakis & Nikolakakis 2002, Margalida et al. 2007). However, with the collapse of resident Gyps vultures and decline in Himalayan Griffins from the same area (Acharya et al. 2009) it is possible that Bearded Vultures are now able to access and feed on soft tissues from which previously they would have been excluded. It is not known if diclofenac residues remain within bones of treated animals, although residues of diclofenac are known to be passed into feathers and hair (N. Richards pers. comm.). Although the Bearded Vulture is mainly a resident and non-migratory species (Grimmett et al. 2000, Besten 2004), it has been observed flying with other vulture species near the carcass of an Ox Bos indicus in a lowland area of Nepal (Chansu, Sildujure VDC, Kaski, 1,100 m a.s.l., in 2001; RA pers. obs.). In addition to this, it was also recorded 305 m. a.s.l. at Mugling, Nepal (Fleming et al. 1984) and near sea level in Gujarat (Thakker 2005). The movements of Bearded Vultures depend on food availability (Xirouchakis & Nikolakakis 2002) and they feed in close proximity with lowland vultures when sharing food with them; hence, diclofenac could be one of the reasons for its decline.

Along with diclofenac, other toxic substances (fungicides, herbicides and pesticides) could have similar or compounding effects on the decline of the Bearded Vulture population in the area. It has already been observed that poisoning was the principal reason for non-natural mortality during the steep decline of the population of Bearded Vulture in Europe (Hiraldo et al. 1979, Margalida et al. 2008). In addition, virtually all local people within the study area believe that Bearded Vulture intestines make an effective treatment for diarrhoea. The practice is also common in Tibet (Ghyacho Bista, local homeopathy doctor in Upper Mustang, pers. comm.). Similarly, in Mustang it is believed that anyone who takes chicks from the nest of a vulture becomes more prosperous. Such beliefs suggest that exploitation of this bird may still occur in this area and in Tibet. Understanding the extent of this additional threat is a priority.

In Europe and Africa, Bearded Vultures have declined massively in the last two decades (Ferguson-Lees & Christie 2001), with the European Alps most prominently affected by these declines. Shooting and climatic variability were considered the most significant causes (Mingozzi & Esteve 1997, Hirzel et al. 2004, Margalida et al. 2008). Different intentional and unintentional poisoning practices were the most problematic factors in the conservation of Bearded Vultures in Europe during 1955–2002 (Margalida et al. 2008). The species is recovering with the help of an international reintroduction project (after introduction in 1986) (Mingozzi & Esteve 1997, Margalida et al. 2003, Hirzel et al. 2004). The rate of recovery was 5% per annum in the Spanish Pyrenees (Margalida et al. 2003). The restoration practices for Bearded Vulture in the European Alps were very expensive, costing about €1 million for every young bred and reared in captivity until the moment of the release (Frey 1998). Such a programme would be a huge undertaking within Nepal, although vulture conservation breeding centres have been established in the country in order to safeguard the Nepal’s critically endangered Gyps vultures.

Further monitoring and understanding the cause of the decline are the next crucial steps for determining conservation actions for the Bearded Vulture in Nepal. If these declines are in fact found in any other areas of Nepal and throughout the Himalayan region, then the conservation status of the Bearded Vulture would need to be urgently reassessed. Furthermore, immediate steps should be taken to conserve it, in case it follows the same course as Gyps vultures in South Asia. Regular investigation of the population is essential in the long term to determine the real status of the species throughout its range.

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