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Himalayan Vultures in Khodpe, far-west Nepal: is there any threat?

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Manoj Kumar Joshi [1], Mukesh Kumar Chalise [2], Anand Chaudhary [3] & Hem Bahadur Katuwal [4]

[1,2,4] Central Department of Zoology, Tribhuvan University, Kirtipur, Kathmandu, Nepal
[3,4] Bird Conservation Nepal, Kathmandu, Nepal
[3] The Institute of Ecological, Earth, and Environmental Sciences, Baylor University, Waco, TX, U.S.A
[4] Small Mammals Conservation and Research Foundation, Kathmandu, Nepal
[1] manoj_joshi330@yahoo.com, [2] mukesh57@hotmail.com, [3] anand.chaudhary@yahoo.com,
[4] hello2hemu@gmail.com (corresponding author)

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Abstract: There is evidence that Himalayan Vulture *Gyps himalayensis* is susceptible to the veterinary drug diclofenac, which is responsible for the decline of other *Gyps* species across South Asia. Unlike other *Gyps* species, there is little quantitative data to assess Himalayan Vultures population. Based on observation, we analyzed the flock size and breeding success of the Himalayan Vultures on two cliffs of Khodpe in Baitadi District, far-west Nepal. The mean flock size of Himalayan Vulture was 25.83±6.33. Overall breeding success was 90.9% based on active nests. We also conducted a questionnaire survey to assess the perceived threats in the view of local people to vultures and these threats include loss of food, veterinary drug, lack of proper nest sites, and lack of public awareness. Additionally, 76% of the respondents felt that vultures were decreasing in the area, 94.7% were not aware of the toxicity of diclofenac to vultures, and very few (2%) knew about the availability of meloxicam as a safe alternative drug. The colony we studied is one of the few remaining known breeding populations, which provide baseline information from far-west Nepal, thus we recommend for conservation and continuous monitoring of this species to understand their population change and breeding biology.

Keywords: Active nest, breeding success, diclofenac, *Gyps himalayensis*, meloxicam, threat.

A dramatic decline in the populations of *Gyps* vultures; White-rumped Vulture *G. bengalensis* by 99.9%, Slender-billed Vulture *G. tenuirostris*, and Indian Vulture *G. indicus* by 96.8% in India within 1992–2007 led to the global conservation concerns for these species (Prakash et al. 2007). A similar decline is also evident in Nepal; White-rumped and Slender-billed Vulture declined by 91% and 96% respectively within the period of 1995–2011 (Chaudhary et al. 2011). Veterinary use of diclofenac, a non-steroidal anti-inflammatory drug (NSAID) was identified as the major cause for these declines (Green et al. 2004; Cuthbert et al. 2009; Das et al. 2010, Chaudhary et al. 2011; Khan & Murn 2011; Harris 2013). Recently diclofenac was also found to be lethal to the Himalayan Vulture (Das et al. 2010), and partly as a result, Himalayan Vulture has been reassessed and

Gyps himalayensis
Himalayan Vulture

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elevated by the IUCN from the category Least Concern to Near Threatened on the IUCN Red List of Threatened Species (BirdLife International 2014). It is also assessed as Vulnerable at national level with population less than 10,000 individuals (BCN & DNPWC 2011).

In Nepal, Himalayan Vultures are distributed from 75m to 6,100 m (Grimmett et al. 2000). The available literatures after 2,000 only reveals total counts of Himalayan Vultures from different districts of Nepal (Baral et al. 2002; Gurung et al. 2004; Tyabji 2006; Virani et al. 2008; Acharya et al. 2009; Bhusal 2011, 2014; Karmacharya 2011; Phuyal 2012; Subedi et al. 2013; Paudel et al. 2015; Fig. 1). Baral et al. (2002) observed decreasing population of Himalayan Vultures in Annapurna Conservation Area, Langtang National Park and Sagarmatha National Park. Though Virani et al. (2008) reported stable population of Himalayan Vultures, Acharya et al. (2009) recorded dramatic decline in sightings by 67% and 70% per day and per kilometer respectively from the same district. Still there is a slower decline rate on its population in the area (Paudel et al. 2015). Being a scavenger of wild and domestic animals (Pain et al. 2008; Lu et al. 2009), Himalayan Vulture migrate to the lowlands of Nepal and India in winter and co-habit with other *Gyps* vultures. This ultimately increases the probability of them coming in contact with diclofenac. Although the Nepalese and Indian government have banned the veterinary use of diclofenac since 2006 (Chaudhary et al. 2011; Cuthbert et al. 2011), and have promoted the use of meloxicam, which is safe alternative drug for the vultures (Harris 2013), it is still used illegally in some parts of the country.

In South Asia, though some *Gyps* species are bred in captivity, Himalayan Vulture is not a conservation priority to date (Bowden 2009). Their breeding season is between November/December to April/May. They start by constructing nests of sticks, twigs and other material on a cliff, where usually a single white egg is laid. Sometimes the egg color is blotched pale reddish to deep reddish-brown (Karmacharya 2011). In most of the studies, the active nests are low in comparison to occupied nests and finally lower breeding success (Baral et al. 2002; Acharya et al. 2009; Bhusal 2011; Thakur 2014).

The susceptibility of Himalayan Vultures to diclofenac (Das et al. 2010) and reported declines in its population (Acharya et al. 2009) stress the need to study the species. We decided that the study of the species in an area other than that reported by Acharya et al. (2009) and Virani et al. (2008) from Mustang District, would help better understand the population status in another part of their range at Baitadi District (see Fig. 1). The aim of this study was to estimate the mean flock size and breeding success of Himalayan Vultures in Khodpe, and in some aspects to compare our results with Karmacharya (2011) who carried out a similar study in the area. Further, we wished to understand the attitude of the local human population towards the vultures and their decline.

Materials and Methods

Study area

Khodpe lies in Siddheswor Village Development Committee (29^{0}25'51"–29^{0}26'29.2"N & 80^{0}37'50.7"–80^{0}36'56.9"E) at an elevation of 2,100m in Baitadi District, Far-west Nepal (Fig. 1). It is surrounded by Bhajang and Doti districts in the east, Darchula in the north, Dadeldhura in the south and Uttranchal Pradesh in India in the west. Baitadi has humid sub-temperate monsoon climate with relatively hot summer. The mean maximum temperature varies from 25–33 ^{0}C. The average winter temperature drops between 3–13 ^{0}C. The monsoon starts in May and maximum precipitation occurs in August. The relative humidity is ca. 85% in the morning and evening (DHM 2011).

Methods

The study was conducted during eight consecutive months from October 2010 to May 2011. We made only one visit in the months of October, February, April and May and two visits in the months of November, December, January and March (Table 1). The vultures were observed from a fixed point in both the Harichan cliff at an elevation of 2070m and Siddnath Cliff at an elevation of 2140m. Siddnath Cliff faces east whereas Harichan Cliff faces west. We observed vultures between 08:30–10:30 hr and 15:00–17:00 hr. From the fixed points, we counted all the Himalayan Vultures on

Image 1. Himalayan Vulture with chick

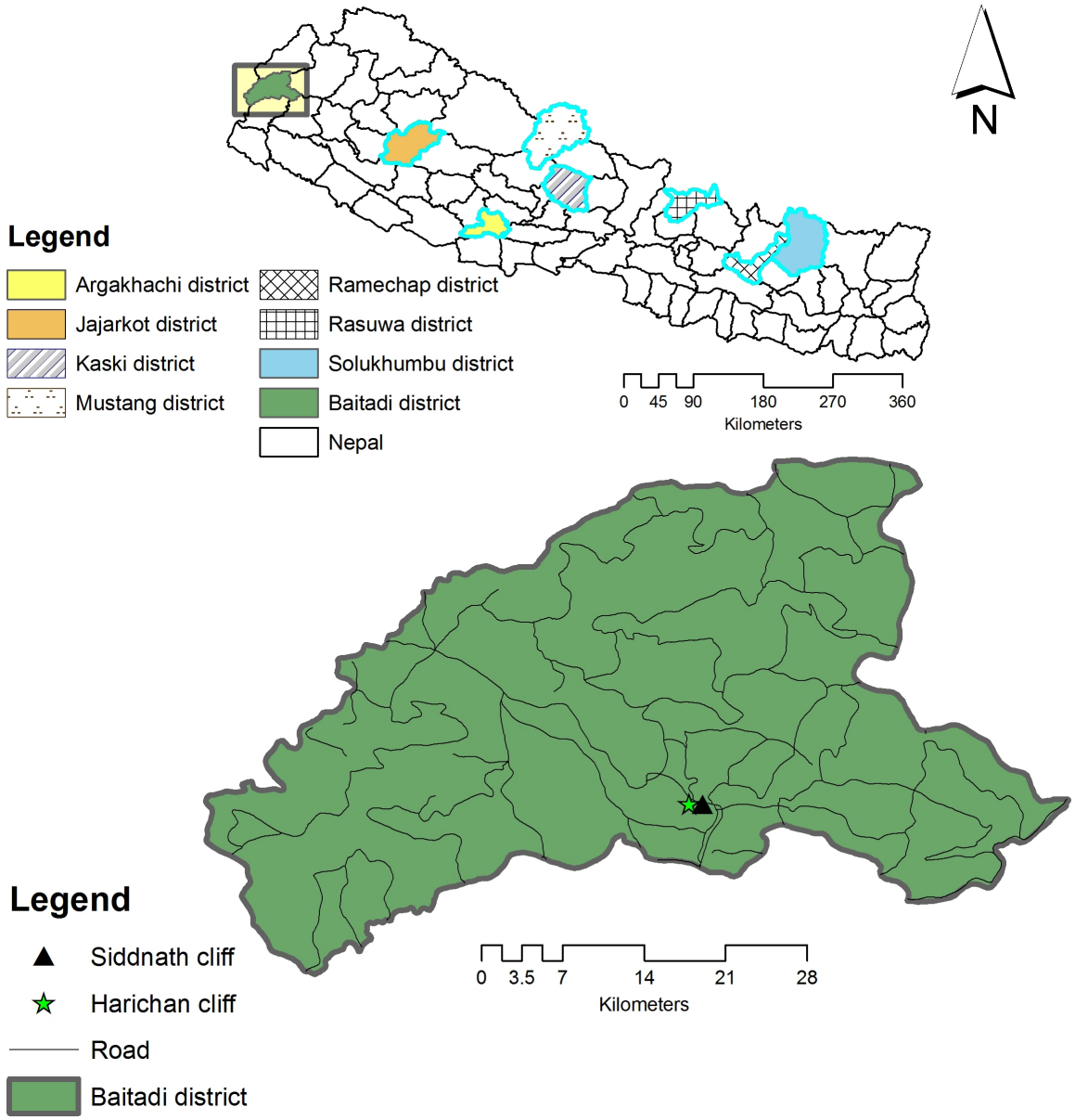

Figure 1. Study area showing two cliffs at Baitadi District (Khodpe), Far-west Nepal and other districts where Himalayan Vultures were studied after 2000: Baitadi District (Karmachaya 2011), Argakhachi District (Bhusal 2011), Jajarkot District (Bhusal 2014), Kaski District (Gurung et al. 2004; Tyabji 2006; Subedi et al. 2013), Mustang District (Virani et al. 2008; Acharya et al. 2009; Paudel et al. 2015), Ramechap District (Phuyal 2012), Rasuwa District (Baral et al. 2002) and Solukhumbu District (Baral et al. 2002).

the cliffs using an absolute count method as the area was small. Other species of vultures seen during the study were also recorded.

Nests were classified as 'occupied' if no eggs were laid but there was evidence of nest building activity and 'active' if they had eggs (Postupalsky 1974). We also considered a productive nest as a successful nest if chicks fledged (Image 1) and unproductive if no chick was fledged. We recorded both occupied and active nests; however breeding success was calculated based on active nests using the formula:

$$\text{Breeding success} = \frac{\text{Productive nests}}{\text{Active nests}} \times 100\%$$

We conducted a semi-structured interview and questionnaire survey (Newton et al. 2008) with 100 respondents randomly from different disciplines like school teachers, herders, community forest user groups, forest officers, local people etc. in order to identify associated threats to the Himalayan Vultures.

Additionally, people were interviewed about the use of the NSAID's drugs, diclofenac and meloxicam. We estimated the mean flock size of the Himalayan Vulture population. Chi square test was performed to find the significance differences in vulture sightings between the months of visits. Finally, we analyzed probable threats in percentile. For all the calculations, R Console version 2.15.2 (R Development Core Team 2012) was used and results reported with 95% confidence interval.

Results

Population of Himalayan Vulture

The total count of Himalayan Vultures for 12 visits was 310 individuals with a mean flock size of 25.83±6.33 (Table 1). Highest numbers were seen in April whereas the lowest in November; numbers observed between visits were not significant (χ^2 = 16.15, df = 11, p>0.1). Larger aggregations were found at Harichan cliff (13.91±4.07) than Siddnath cliff (11.91±2.64) (Table 1).

We also recorded a small number of Slender-billed Vulture *Gyps tenuirostris* and Egyptian Vulture *Neophron percnopterus*. The Slender-billed Vulture was recorded in December and January while the Egyptian Vulture was recorded in all months except February.

Breeding success of Himalayan Vulture

We recorded five occupied and five active nests in Siddnath Cliff but only four were productive, one egg did not hatch (80% breeding success, Table 2). On Harichan cliff, out of seven occupied nests, six were active and all produced young (100% breeding success, Table 2). Overall, breeding success was 90.9% based on active nests.

Threats to Himalayan Vulture

We found that 57% of the respondents knew that vultures were natural scavengers and 76% were aware that the vulture populations were decreasing in their area. Local people cited loss of food (19.7%), loss of habitat (17.1%), lack of proper nest sites (17%), use of pesticides (11.8%) and veterinary drugs (10.5%) as possible reasons for the decline of the vultures. We also found lack of awareness about the effects of diclofenac on vulture declines (94.7%), as only very few of respondent (2%) knew about meloxicam. Most (73.1%) thought that vultures should be conserved because they feed on carrion.

Discussion

We recorded only a small breeding population of Himalayan Vultures (11 pair) in Khodpe, though it is a widespread elevational migrant in Nepal (Grimmett et al. 2000; Virani et al. 2008; Acharya et al. 2009; BirdLife International 2014; Paudel et al. 2015). Higher numbers and densities of Himalayan Vultures have been reported in other parts of Nepal away from our study area; e.g., Annapurna Conservation Area, Langtang National Park, Sagarmatha National Park, Argakhachi, Pokhara Valley,

Table 1. Number of Himalayan Vulture observed on two different cliffs at Khodpe, Far-west Nepal. I and II denote the number of visit to the region. The mean flock size of Himalayan Vultures from January to May 2010 in Siddnath cliff only (no record in Harichan cliff) by Karmacharya (2011) is also shown in the table.

Himalayan Vultures	2010						2011							Mean flock size
	Jan–May	Oct	Nov		Dec		Jan		Feb	Mar		Apr	May	
			I	II	I	II	I	II		I	II			
Siddnath Cliff	7.9±1.58	12	12	5	15	12	11	12	13	14	10	15	12	11.91±2.64
Harichan Cliff	-	15	14	7	13	12	13	13	14	18	11	24	13	13.91±4.07
Total counts	-	27	26	12	28	24	24	25	27	32	21	39	25	25.83±6.33

Table 2. Breeding success of Himalayan Vultures in two different cliffs of Khodpe, Far-west Nepal. Breeding success of Himalayan Vulture in 2010 in Siddnath cliff only (no record in Harichan Cliff) by Karmacharya (2011) is also shown in the table.

	2010	2011			
Himalayan Vulture	Breeding success (based on active nests)	Occupied nest	Active nest	Productive nest	Breeding success (based on active nests)
Siddnath cliff	75%	5	5	4	80%
Harichan cliff	-	7	6	6	100%
Total	-	12	11	10	90.90%

etc., (Baral et al. 2002; Gurung et al. 2004; Acharya et al. 2009; Bhusal 2011; Subedi et al. 2013). This is mainly because our study site, Far-west Nepal lies at a remote area and is far from the major cities, so fewer studies have been carried out. In case of Khodpe, a higher number of Himalayan Vultures were recorded than by Karmacharya (2011), where his mean flock size was 7.9±1.58. This is because his study was focused only on Siddnath cliff, no record on Harichan cliff, whilst we recorded vultures on Harichan cliff also which has increased our number of vultures' population in the area. We believe that due to fewer disturbances at Harichan than Siddnath, which has a famous temple of Siddnath Baba just above the cliff where people usually come to worship, we recorded higher numbers on Harichan cliff. The overall change in population between the months of visits might be due to fluctuation in food availability and the migration behavior of the species. Based on the discussions with local people, we were told there is insufficient food in the area which might induce migration to other areas. Also, Himalayan Vultures are recorded as an elevational migrant in Nepal (BirdLife International 2014; Paudel et al. 2015), cover large areas for foraging and migration during winter which ultimately affect their population size. Such migrating populations of Himalayan Vultures were also reported by DeRoder (1989), Gurung et al. (2004) and Subedi et al. (2013) during their raptor count program at Pokhara. Thus not all vultures in our study area were resident and this could be the reason for variation in vulture numbers between counts.

Himalayan Vultures breed in Nepal (Grimmett et al. 2000) but its breeding success is declining. Acharya et al. (2009) observed decline of 84% within the period of 2002–2005 in Mustang district, West Nepal. We recorded only a small breeding population in the area. The breeding success in our study is slightly higher than Karmacharya (2011) and Bhusal (2011). This might be due to the record of less number of occupied nests than others and almost all occupied nests were active and were finally productive. While the number of active nests (having an egg) is relatively lower than occupied nests in others studies (e.g., Acharya et al. 2009; Bhusal 2011; Karmacharya 2011; Thakur 2014), this ultimately affects the breeding productivity figure. Due to record of vultures at an additional cliff (Harichan), we recorded higher breeding productivity than by Karmacharya (2011). Though, there is a slight increase in breeding success at Khodpe, however, the actual decline or increment cannot be compared or determined accurately at this time due to the small sample size. The vultures at the Siddnath cliff are disturbed by the children who visit the temple of Siddnath Baba, which is just a few meters from the top of the cliff. The unhatched egg at Siddnath might have been due to excessive human activity near the cliff. Nevertheless, actual reasons behind the decrease of occupied nests and ultimately active nests to productive nests need further investigation. Thus conservation and monitoring of this small breeding colony is necessary to prevent decline of Himalayan Vultures from far-west, Nepal.

Carcasses of domestic animals constitute a major proportion of the diet of vultures in the area (DNPWC 2015). The Government of Nepal has banned the veterinary use of diclofenac in Nepal, but illegal availability of diclofenac cannot be ignored because animal husbandry is one of the important sources of income in the high lands (Acharya et al. 2009; Lu et al. 2009; Chaudhary et al. 2011; DNPWC 2015). Like in our study, Karmacharya (2011), Bhusal (2011) and Harris (2013) also speculated loss of food, loss of nesting sites, poisoning of carcasses, pesticides, forest fire and destruction of cliffs for roads as limiting factors for the survival of Himalayan Vultures. Thus, we recommend for continuous monitoring of this species to understand the population change because the studied colony is one of the few remaining known breeding populations from Far-west of Nepal.

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