

# INTRODUCTION

## 1.1 Background

Nine species of vultures are found in Indian Subcontinent (Prakash et al. 2007, Khan and Murin 2011), and all of them are recorded in Nepal BCN and DNPWC 2012). (They are obligate scavengers, which primarily feed on large ungulates (Pain et al. 2008). They are mostly colonial, roost and nest in the cliffs and tall trees (Pain et al. 2008). In the past, vultures were widely distributed and common in Asia, but now they are localized and dramatically declined from Indian Subcontinent due to diclofenac poisoning in cattle carcasses (Green et al. 2004, Cuthbert et al. 2006). 80-95 % of *Gyps* vultures had declined from South Asian countries (Khan and Murin 2011). White-rumped Vulture (*Gyps bengalensis*), Indian Vulture (*Gyps indicus*), Slender-billed Vulture (*Gyps tenuirostris*) and Red-headed Vulture (*Sarcogyps calvus*) are now critically engendered in IUCN Red list category (IUCN 2004).

## 1.2 Himalayan Griffon (*Gyps himalayensis* Hume, 1869)

Out of nine species of vultures found in Nepal, Himalayan Griffon (*Gyps himalayensis*) is widely distributed, locally common and resident usually from 900-4000m in Nepal Himalaya (Inskipp and Inskipp 1991) . It is the largest vultures with 115-125 cm, broader pale bluish body, long tail, has contrast dark flight feathers, pinkish legs and yellowish bill with no streaked underparts in adult (Grimmett et al. 2000, 2011). The wingspan is about 206-289 cm and weighs about 8-12 kg (BirdLife International 2004). Pronounced white bands across the underwing-coverts and streaked underparts distinguish the juvenile from that of Cinereous vulture (Grimmett et al. 2011).

Besides Nepal, it is native to Afghanistan, Bhutan, China, India, Kazakhstan, Kyrgyzstan, Malaysia, Mongolia, Pakistan, Tajikistan, Thailand, Uzbekistan and vagrant in Singapore (BirdLife International 2012). It is usually found in the mid hills and trans-Himalaya of Nepal. Usually, downhill during the winter season (65m). It gregariously roost in crags in

mountains and soars over the mountains at great height and long distances according to the air current (Grimmett et al. 2011).

It is an obligate scavenger of wild and domesticated carcasses (Pain et al. 2008, Prakash et al. 2012). It produces different grunts and hisses sound and is very aggressive during the feeding and dominant over the other vultures, except Cinereous vulture (Grimmett et al. 2011). The breeding season is in between January to May in the Himalaya (Acharya et al. 2009). The nest is usually large, untidy pad of sticks and rubbish along the cliff of the mountains. The egg is usually a singleton and white, but sometimes blotched with pale reddish to deep reddish brown (Karmacharya 2011). The incubation period is nearly two months (Ali and Ripley 1968).

The population of Himalayan Griffon is large and stable, so the species does not approach for vulnerable, so it is Least Concern (Birdlife International 2012). However, there occurs a 30% decline in the population of the species over ten years Bird life International (2012). The population is highly threatened and death is accelerating by Non- Steroidal Anti-Inflammatory Drug (NSAID), diclofenac which is used as a veterinary drug in cattle (Acharya et al. 2009, Das et al. 2010). The construction of vulture's restaurants in different parts of Asia has helped to reduce the diclofenac and overall decline in population of the vultures (Gilbert et al. 2007).

### **1.3 Rational of the study**

The population of Gyps vultures declined dramatically in the Indian Subcontinent since early 1990s (Prakash 1999, Prakash et al. 2003, Pain et al. 2008). The three Gyps vulture, Slender-billed Vulture (*Gyps tenuirostris*), White-rumped Vulture (*Gyps bengalensis*) and Indian Vulture (*Gyps indicus*) are critically endangered (Pain et al. 2008). Himalayan Griffon is in the shed of this critically endangered species and is getting less attention.

Nepal holds considerable breeding population of Himalayan Griffon (Grimmett et al. 2000). They are fairly and locally common in Nepal. So, most of the research are in other critically endangered species. People are regularly using diclofenac in most part of Nepal (Acharya et al. 2009, Das et al. 2010). Mostly awareness programs are carried out in lowlands, but people at high lands are still unknown about the effect of diclofenac in vultures (Acharya et al. 2009). As diclofenac is lethal to the Himalayan Griffon as like to

other lowlands vulture (Swan et al. 2006, Acharya et al. 2009, Das et al. 2010), constant monitoring and comprehensive research is important to know about the status of the Himalayan Griffon from different parts of Nepal.

In Nepal, most of the studies are made inside the protected areas, large population of the vulture species are still available outside the protected areas (Baral et.al.2002, Virani et.al.2008). Khodpe lies in Far western Nepal. People are not educated and aware about the importance of vultures in their livelihood. This study is carried out to monitor the population and breeding success of the vulture in successive year and to find out the real threats of the Himalayan Griffon.

#### **1.4 Objectives of the study**

The main objective of the study was to study the vulture species around the Khodpe, Baitadi, Nepal. Whereas the specific objectives were to

1. estimate the population of Himalayan Griffon in the area
2. study the breeding success of the Himalayan Griffon from the area
3. find out the major threats to Himalayan Griffon within the area

#### **1.5 Limitation of the study**

The study was conducted only in the cliffs of Khodpe during breeding seasons. The steepness of the cliffs and physiographic condition and weather (fog) were real challenges during the study. Due westward facing of Harichan cliff visibility was less during morning which was another challenge to monitor before afternoon.

## **2. LITERATURE REVIEW**

### **2.1 Population of Himalayan Griffon**

The Himalayan Griffon is fairly common and widespread in Indian Subcontinent (Grimmett et al. 2011). It is mostly residential and distributed in the mid-hills of the Himalaya with stable population Acharya et al. (2009). In Nepal, study in Himalayan Griffon is in shade of other three lowland critically endangered species. However, few studies can be observed in Nepal. Altogether 129 Himalayan Griffon from Marpha to Lete and Ghasa to Tatopani, 43 from Tukuhe to Ghasa (Chaudhary 1998), 51 from Ghasa (Collins and Grindle 2001), and Virani et al. (2008) observed 934 adults Himalayan Griffon during his survey of Himalayan griffon from November 2001 to May 2006. Baral et al (2002) surveyed Himalayan Griffon's in the Nepal Himalaya. They found considerable population of Himalayan Griffons in Annapurna Conservation Area, Langtang National Park and Sagarmatha National Park. Tyabji (2006) recorded three adult and more than 40 juveniles of Himalayan Griffon complete feeding in caresses of donkey in 2004 in Pokhara. Virani et al. (2008) reported no such decline in population of Himalayan Griffon during their study period 2001-2006. Acharya (2006) observed altogether 333, 235 and 185 Himalayan Vultures in the successive year 2002, 2003 and 2006 in Mustang. However, Acharya et al. (2009) reported the rapid decline in population of Himalayan Griffons in Upper Mustang which is the important breeding place in Nepal because of having suitable climatic condition and cliffs. Acharya et al. (2009) surveyed Himalayan Griffon during the year 2002, 2004 and 2005 along 188 km long transect and found 67% and 70% decline of vulture per day and per kilometer during the study. Karmacharya (2011) reported 12 individuals as jackknife estimation as a population size of Himalayan Griffons from Khodpe, Baitadi. Bhusal (2011) also estimated 57 individual as a population size from Argakhachi, Nepal.

### **2.2 Breeding of Himalayan Griffon**

The breeding behavior of Himalayan Griffons was least studied. The breeding season usually lies in between January to May in Nepal (Baral et al 2002). They collect sticks

and rubbished of different materials to build their nests in the cliff (Karmacharya 2011). So it is difficult to observe and monitor its breeding activity in the wild. It usually lays white single egg but sometimes blotched with pale reddish to deep reddish brown (Karmacharya 2011). During the survey of vultures in lowland Nepal, Baral et al (2002) reported three occupied nests out of 17 unoccupied nest in February 2002 and five occupied nests out of 11 unoccupied nests in April-May 2002. Acharya (2006) observed eight active nests 17 occupied and 33 unoccupied nests in 2004 and this active nests increased to nine, 16 occupied and 36 unoccupied in 2006 in Mustang. Similarly, Karmacharya (2011) reported three successful nests with 75% breeding success rate out of four active and 11 occupied nests in Khodpe. Bhusal (2011) reported 13 productive nests out of 20 active nests, which account for 65% breeding success. The breeding of *Gyps* vultures have started in South Asia in captive in 2002 (Bowden 2009). Total of 177 individuals of White-rumped Vulture, 71 Indian Vulture and 35 Slender-billed Vultures were held for captive breeding in India, Nepal and Pakistan in 2009 (Bowden 2009).

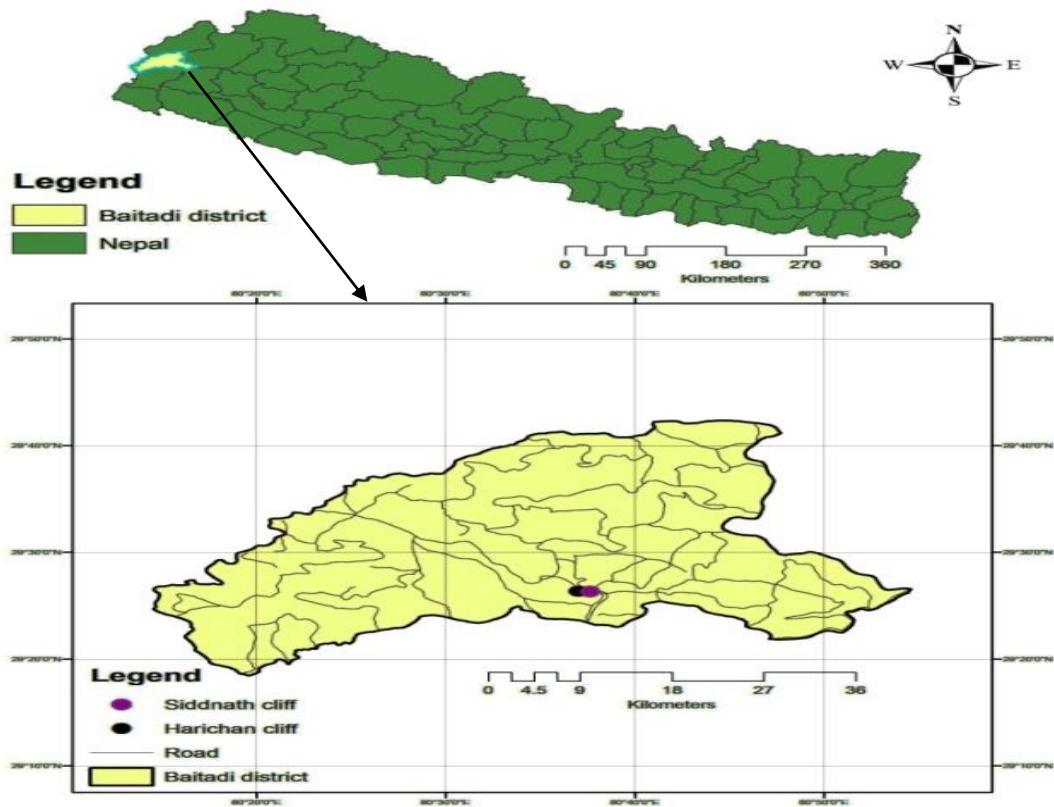
### **2.3 Diclofenac poisoning in Himalayan Vulture**

Diclofenac is a non-steroidal anti-inflammatory drug which is nephrotoxic to birds (Cuthbert et al. 2009). Experimental work conducted by Naidoo et al. (2009) also demonstrated that diclofenac and Ketoprofen are toxic to *Gyps* vulture. *Gyps* vultures (Slender-billed Vulture *Gyps tenuirostris*, White-rumped Vulture *Gyps bengalensis* and Indian Vulture *Gyps indicus*) were declined by 98% due to excessive use of diclofenac in Indian Subcontinent (Cuthbert et al. 2009, Das et al. 2010, Chaudhary et al. 2011). Not only to *Gyps* vultures, Acharya et al. (2009) reported that the death of the Himalayan Griffon is being accelerated with the use of diclofenac in the cattle's. Das et al. (2010) during their study found that the death of Himalayan Griffon due poisoning of diclofenac showing similar clinical sign of visceral gout. The government of Nepal has banned the use of diclofenac in cattle but is still available in the markets. Recently Prakash et al. (2012) reported lower decline rate of population of *Gyps* vulture due to ban of Veterinary Use of Diclofenac in Nepal and India. Veterinary use of diclofenac should be discouraged to save the remaining population of vultures (Chaudhary et al. 2011).

### 3. MATERIALS AND METHODS

#### 3.1 Topography of study area

The study was carried out in Far-western development region of Nepal. Khodpe the study area lies in Siddheswor Village Development Committee (VDC) at Baitadi district. The area is surrounded by Bhajang and Doti in East, Darchula from North, Dadeldhura from South and India in West. The coordinate of the cliff at the study area along far western was  $29^{\circ}25'51''\text{N}$  to  $29^{\circ}26'29.2''\text{N}$  and  $80^{\circ}37'50.7''\text{E}$  to  $80^{\circ}36'56.9''\text{E}$  within the elevation of 2260m asl.



**Figure 1:** Map of study area at Khodpe, Baitadi district.

**Table 1:** Topographic distribution of Baitadi, Nepal.

(Area in Hectars)

Physical condition	Agriculture		Pastures	Forest	Other	Total
	Cultivated	Non cultivated				
High mountain	0	0	185	0	0	185
Mid-mountain	31,485	19,018	19,014	78,721	225	148,493
Total	31,485	19,018	19,199	78,721	225	148,678

Source: VDC profile 2008

### 3.2 Climate

Baitadi districts has humid sub-temperate monsoon climate (Karmacharya 2011). The summer is relatively hot. The mean maximum temperature varies from 25°C to 33 °C. The temperature drops to 3-13 °C in average in winter.

The monsoon starts in the month of May and maximum precipitation occurs in the month of August. Similarly, the relative humidity is also high. It is mostly about 85% during morning and evening.

### 3.3 Flora and Fauna

Vegetation pattern varies with the elevation in Khodpe. It mainly comprises subtropical (1000-2000m), temperate (2000-3000m) and alpine forest (above 3000m). The subtropical forests mainly contain Sal *Shorea robusta*, Pine *Pinus wallichinia*, Kafal *Myrica esculenta*, Saj *Terminalia* spp., Alder *Alnus nipalensis*, Rhododendron etc. Temperate vegetation comprises with Tej Pat *Cinnamomum tamala*, Horse chestnut *Aesculus indica*, Maple *Acer* spp. etc. However, the alpine forest comprise with Oak *Quercus* spp, Birch *Betulla utilis* and Guras *Rhododendron* spp.

Similarly, many diverse fauna can be found in Baitadi districts. The mammalian fauna mainly includes Wild Boar *Sus scrofa*, Himalayan Ghoral *Nemorhaedus goral*, Himalayan Black Bear *Ursus thibitanus*, Yellow-throated Marten *Martes flavigula*, Golden Jackal *Canis aureus*, Leopard *Panthera pardus*, Rhesus monkey *Macaca mulatta*

etc. Common birds found in the study area are Himalayan Vulture *Gyps himalayensis*, Lammergeier *Gypaetus barbatus*, different species of Bulbuls, Woodpeckers, Flycatchers and Cuckoos. Similarly, different species of herpeto fauna and butterflies are also common in the area.

### **3.4 Research methods**

#### **3.4.1 Population estimation**

The study was carried out in October 2010-May 2011. Two visits were made in November to January and only one visit in rest of the months. The vultures were observed in both Harichan cliff and Siddhnath cliff. Both cliffs were approximately 250m. apart from each other. Siddhnath cliff lies eastward facing whereas Harichan cliff faces westward. Vultures were observed between 8:30-10:30 hr in the morning and 14:00-17:00 hr. in evening. All the Himalayan Griffons within the cliffs were counted through absolute count as the area was small (Annex.1). Other associated vultures were also monitored and recorded from Khodpe.

#### **3.4.2 Nest census**

Nests were also searched and recorded from the area during the study period (Annex.2). Active nest was considered as the nests where the egg has been laid and occupied nest was one where the egg has not been laid, but has some nest building activity (Postupalsky 1974). Unoccupied nest was considered as the nest with materials and old droppings.

#### **3.4.3 Questionnaire survey**

Threats of the vultures were obtained through questionnaire method. Local people were interviewed about the NSAID drugs Diclofenac and current status of vultures in the area from three VDC's Harichan, Salmadi and Ranga Jajuna. Out of 110/115 households total 100 people were questioned from the area. Semi structure questionnaire(Annex.3) were conducted. Questionnaire survey to the locals were asked in Nepali language The questionnaire survey was also conducted to the people of Agro-Vet and Veterinary shops (Annex.4), they were questioned about the abundance of NSAID drug Diclofenac,



NSAID drug Meloxicam in the markets and NSAID drug were searched in the veterinary shops (Figure 6). Because of such drug used to cattle might kill the vultures.

### **3.5 Data Analysis**

The Himalayan Griffon population was estimated with the help of Jackknife estimation (cited in Rodgers 1991) of population assuming the repetition count theoretically is the probability of counting all the species.

$$\text{Total count (N)} = 2n_{\text{max}} - (n_{\text{max}} - 1)$$

Where n is the number of individuals of species observed in maximum at one time count Chi-square goodness of fit test was performed to test the no significance difference in flock size of Himalayan Vultures in different months of visits. Similarly, we performed Chi-square test to test the no significance difference in Himalayan Vultures roosting in both Harichan and Siddhnath cliffs during the different visits. Both active and occupied nests were census and breeding success was calculated with the working formula:

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

Data from the questionnaire were first entered and encoded in Microsoft Excel 2007 spread seat and checked prior to analysis , data were analyzed using SPSS for window version 2007 frequencies and percentages variable occurrences were calculated using cross tabulation and Chi-square was used to determine the association between categorical variables .

## **4. RESULTS**

### **4.1 Field efforts**

The preliminary survey done in October to identify the probable nesting and roosting sites of vultures in the cliffs near Khodpe, Baitadi. Total 26 days were spent in the study area starting from October 2010 to May 2011. On average 6 hours were spent in the field per day (Annex 5) altogether 156 hours were spent at Khodpe during survey period.

Repeated surveys were conducted to estimate population size. One local student was trained for the monitoring of nest.

#### 4.2 Vultures species in Khodpe

Besides Himalayan Griffons, two Slender-billed Vultures and eight Egyptian Vultures were also recorded during the study period. The slender-billed Vulture was recorded in December and January whereas Egyptian Vultures were observed in all of the months except February 2011 (Table 2).

**Table 2:** Vultures species observed during the field visit (October-2010 to May-2011).

Vulture species	2010					2011							Average
	Oct	Nov		Dec		Jan		Feb	Mar		Apr	May	
		I	II	I	II	I	II		I	II			
Himalayan Griffon	27	26	12	28	24	24	25	27	32	21	39	25	25.83
Egyptian Vulture	1	2	-	1	-	2	-	-	-	1	-	1	0.67
Slender-billed Vulture	-	-	-	-	1	-	1	-	-	-	-	-	0.16

#### 4.3 Population estimation of Himalayan Griffon

Himalayan Griffon was observed in all of the months with average flock size of 25.833 species (Figure 1,2). Altogether 310 individuals of Himalayan Griffons were recorded during 26 days visits. The maximum 39 individual was recorded in 5<sup>th</sup> April 2011 and minimum 12 was recorded in 20<sup>th</sup> November 2010 (Table 2). The Jacknife population

estimate was found to be 40. Almost equal number of Himalayan Griffons was recorded during each of the study period. Chi-square test revealed no significant difference in number of vultures sighting during different visits ( $\chi^2= 17.08$ ,  $df = 11$ ,  $p\text{-value}>0.1$ ).

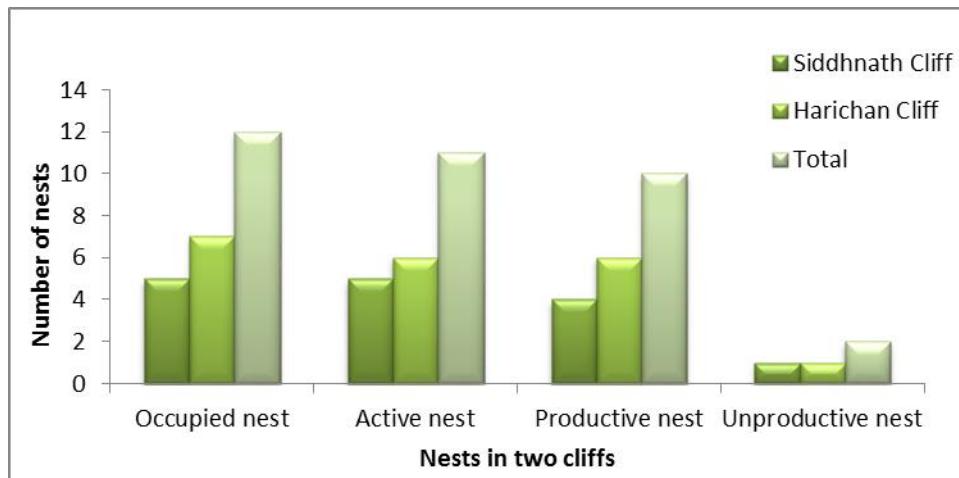
**Table 3:** Numbers of Himalayan Griffon observed in two different cliffs at Khodpe, Baitadi.

Cliffs	2010					2011							Average
	Oct	Nov		Dec		Jan		Feb	Mar		Apr	May	
		I	II	I	II	I	II		I	II			
Siddhnath cliff	12	12	5	15	12	11	12	13	14	10	15	12	11.91
Harichan cliff	15	14	7	13	12	13	13	14	18	11	24	13	13.91
<b>Total</b>	<b>27</b>	<b>26</b>	<b>12</b>	<b>28</b>	<b>24</b>	<b>24</b>	<b>25</b>	<b>27</b>	<b>32</b>	<b>21</b>	<b>39</b>	<b>25</b>	<b>25.83</b>

Altogether 143 individuals with average 11.91 were observed in Siddhnath cliff while 167 individuals with average 13.91 in Harichan cliff (Table 3). However, Chi-squared test showed no significant difference ( $\chi^2=48.9$ ,  $df=42$ ,  $p>0.1$ ) in vultures aggregation in two different cliffs.

#### 4.4 Breeding success of Himalayan Griffon

The nest of Himalayan Griffons were observed frequently in both Harichan and Siddhnath cliffs. Five occupied and active nests were observed in Siddhnath cliff but only four were productive one, i.e. chicks hatched. So, the breeding success accounts only 80% in Siddhnath cliff. However out of seven occupied nest only six were active and productive as well in Harichan cliff. Thus the breeding success was cent percent based on active nest while the breeding success reduces to 85.7% based on occupied nest in the Harichan cliff. In total out of 12 occupied nests, 11 were active and ten were productive, only two nests were unproductive, which accounts 83.33% breeding success as occupied nest and 90.90 as active nest during the study period in Khodpe.



**Figure 2:** Types of nests in two cliffs at Khodpe, Baitadi.

#### 4.5 Questionnaire survey

##### 4.5.1 Social background of Local peoples

Questionnaire survey was conducted with total 100 individuals from three villages nearby the vulture colonies (Figure 5). Out of 100 respondent most of them fall on age group 20-40 with male percent being higher than female (Table. 4).

**Table 4.** Gender and age composition of Respondent.

Age group	Gender		Total
	Male	Female	
10-20	13	11	24
20-40	18	24	42
40-60	13	9	22
60-80	7	5	12
<b>Total</b>	<b>51</b>	<b>49</b>	<b>100</b>

Out of total respondent 37 were found SLC passed in which 22 were males and 15 females, 36 (10 males and 26 females) respondents were uneducated and 14(11 males and 3 females), were having higher education while 13(8 males and 5 females) were primary passed (Table 5)

**Table 5.** Education level of respondent.

Education level	Gender		Total
	Male	Female	
Illiterate	10	26	36
Primary level	8	5	13
Secondary level	22	15	37
Higher education	11	3	14

There was no association between sex, education and age with queries, (do you know vultures and why vulture should be conserved), there is highly positive association between education and following queries (birds that feed on carrion, are vulture declining, do you know diclofenac, effect of diclofenac, alternative drug Meloxicam and should vulture be conserved), in similar there is highly association between age and following queries (what types of birds are they and are vulture declining).

**Table 6.** Degree of association between different variables and queries.

Variable	Bird that feed on carrion	Do you Know vultures	What are they	Are they Increasing	How can you say	Main cause of declining	Do you know diclofenac	Effect of diclofenac	Do you know about Meloxicam	Should vulture be conserved	Why
Sex	<b>0.006*</b>	0.680	<b>0.045*</b>	0.603	0.915	<b>0.01*</b>	<b>0.018*</b>	0.058	0.179	0.075	0.437
Age	0.296	0.108	<b>0.009*</b>	<b>0.012*</b>	0.176	0.537	0.780	0.448	0.772	0.948	0.386
Education	<b>0.010*</b>	0.091	0.054	<b>0.027*</b>	0.457	0.057	<b>0.007*</b>	<b>0.016*</b>	<b>0.018*</b>	<b>0.026*</b>	0.495

Significant code: \* = 0.05

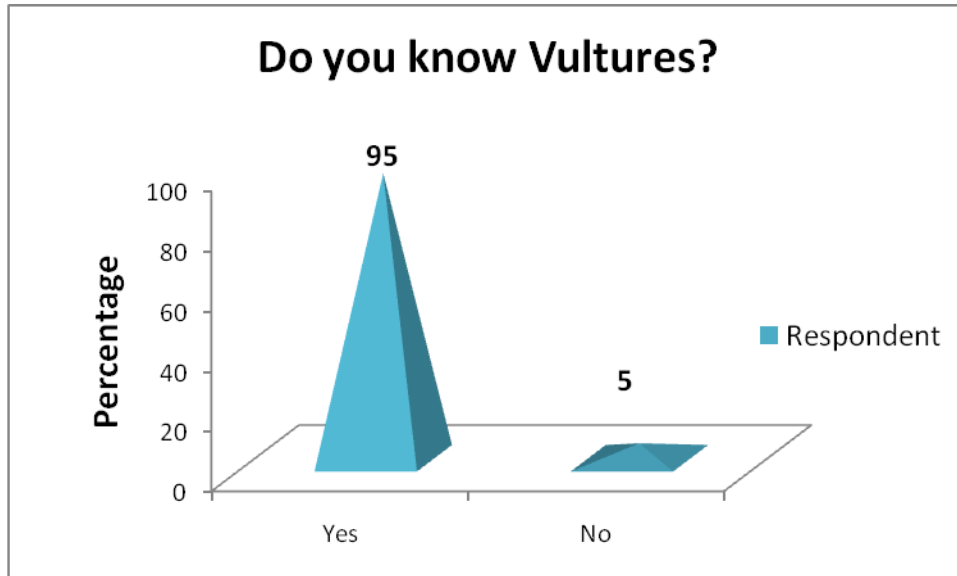
There is high significance among sex and following queries (birds that feed on carrion, what types of birds are they, main cause of declining and do you know diclofenac).

#### 4.5.2 Attitude of local respondent toward vultures and threats

Most of the respondents have misconception toward vultures, about 78% used to recognize vulture as an Eagle, 21% as Vulture and remaining 1% as Hawk. 57% respondent know that vulture are natural scavenger, 39% as bad omen while 4% don't know about

vultures. About 95 % of respondents know vultures while remaining 5% were unknown about vultures (Table no. 6).

**Figure 3:** Respondents views about vultures



Total 76% respondents believed that vultures were declining from their local area, 17% don't believe that they were declining while remaining 7% were unknown about their conditions (Figure no. 6). Out of 76 respondents 66(86.4%) said that vultures are not seen as much as in past decades, 3(3.9%) said they have heard in news that vultures are declining, 3(3.9%) said they have heard for elderly peoples and remaining 4(5.3%) said that they don't know (Table no .7)

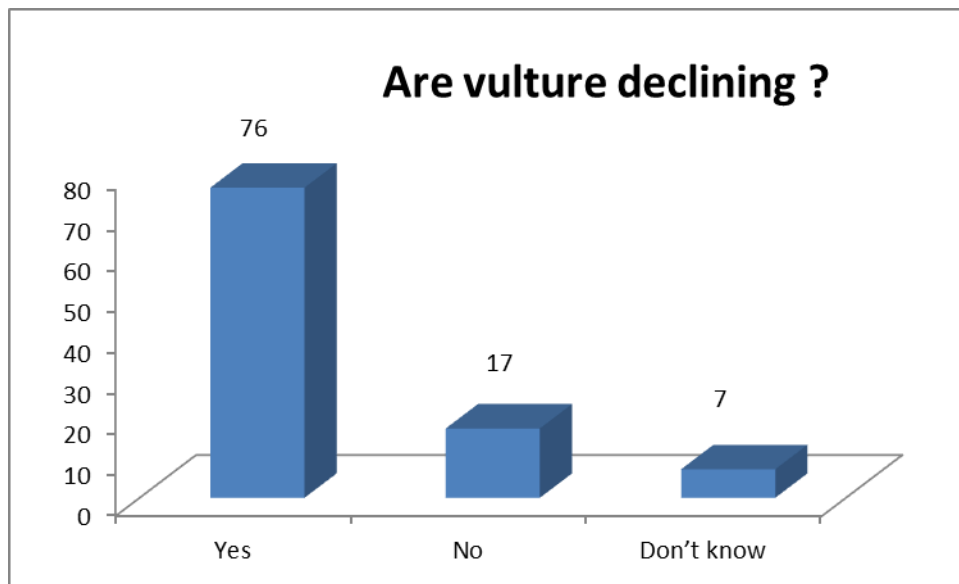
**Table no.7:** Response toward the Declining of vultures.

On what basis you say vultures are declining	Frequency (no. of respondent)	Total/Percentage (out of 76 respondent)
From news	3	3.9
From Elderly people	3	3.9
Not seen nowadays	66	86.4
Others	4	5.3
<b>Total</b>	<b>76</b>	<b>100</b>

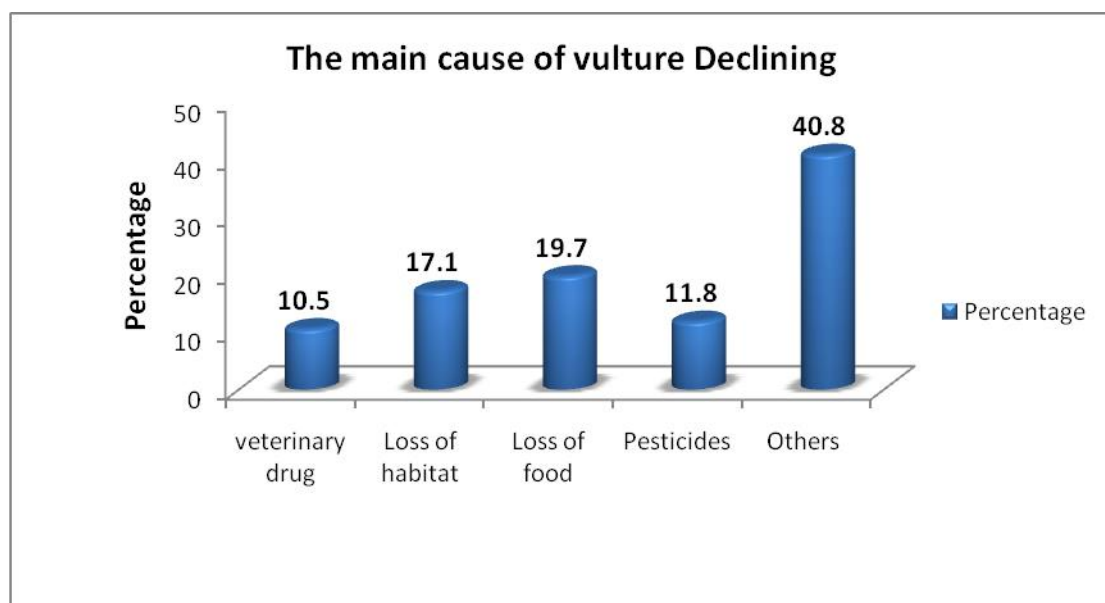
Out of 76 respondent which believe that vulture are declining from their area, 8(10.5%) believed that vultures are declining due to veterinary drug, 13(17.1%) believed due to loss of habitat, 15(19.7%) loss of food, 9(11.8% pesticides) and remaining were unaware about it. Out of 100 respondent 76 agreed that vulture should be conserved, remaining 24

disagreed. 57 (73.1%) respondents said vulture should be conserved because they are natural scavenger, 13 (16.7%) said they do not harm us while 7 (9%) believed that they live away from us in cliffs remaining 1 (1.3%) said they don't know why vulture should be conserved.

**Figure 4:** Response toward declining of vultures



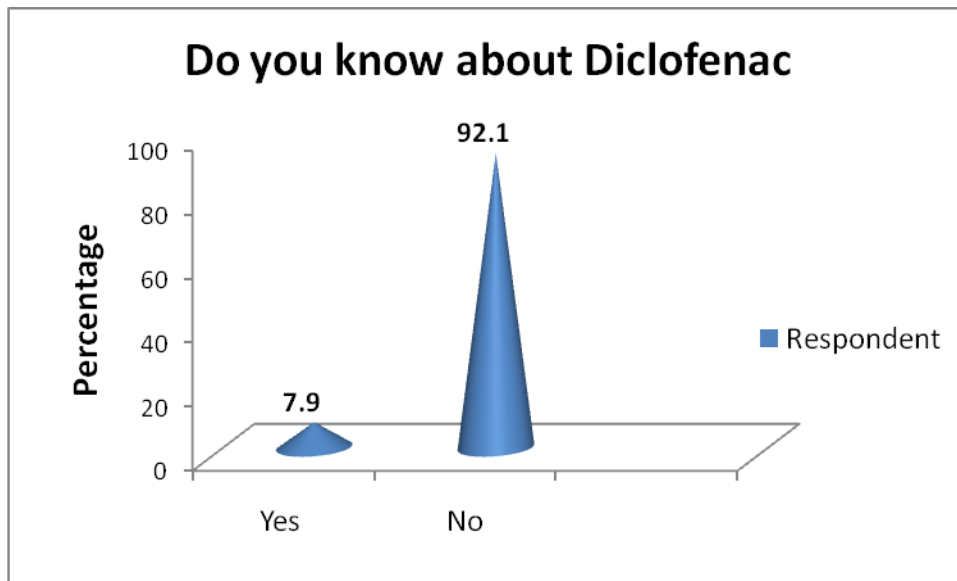
**Figure 5:** Response toward the cause of declining of vultures



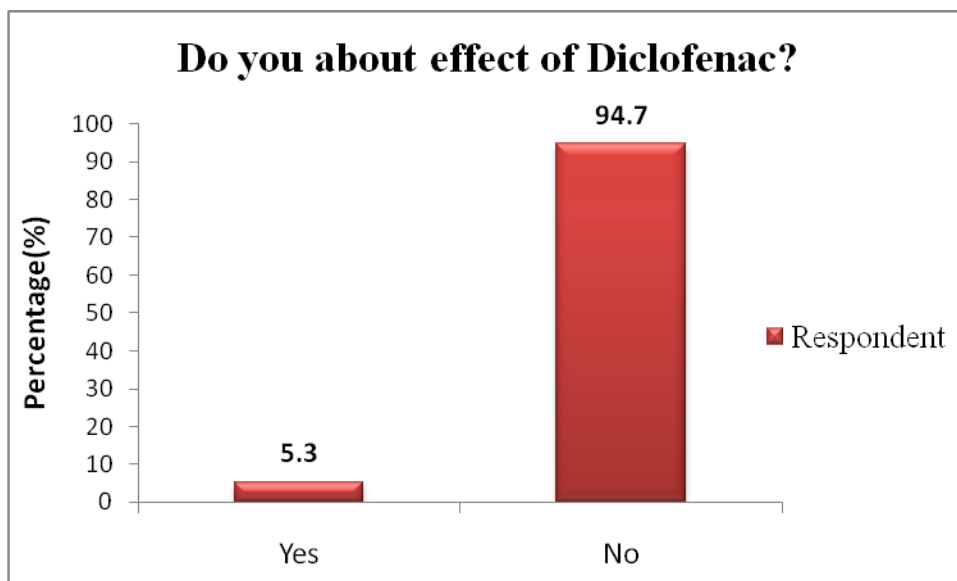
#### 4.5.3 Attitude of local peoples toward NSAID drug Diclofenac and Meloxicam

Almost 70 (92.1%) respondent were unaware about drug Diclofenac while only 6 (7.9%) were known to Diclofenac, about 72 (94.7%) respondents were unknown to the effect of Diclofenac on vultures whereas only 4 (5.3%) know about the renal failure caused by Diclofenac on vultures. Majority of the respondent 75 (97.4%) do not know about alternative drug Meloxicam only 2 (2.6%) have heard about it.

**Figure 6:** Response toward Diclofenac

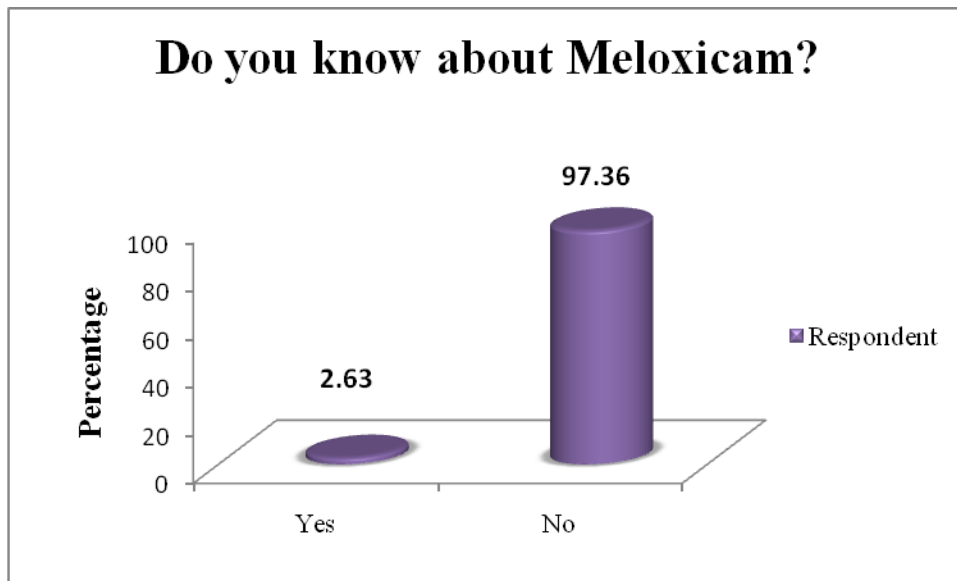


**Figure 7:** Response toward effect of Diclofenac on vultures





**Figure 8:** Response toward Alternative drug Meloxicam



#### **4.6 NSAID survey with Agro-vet and veterinary personals**

The questionnaire was conducted with two agro-vet personals one from Khodpe (Baitadi) and one from Dadeldhura District, during survey period no NSAID drug Diclofenac was found in shop according to the agro-vet they were using Meloxicam instead of Diclofenac.

## 5. DISCUSSION

### 5.1 Himalayan Griffons and other vultures' in Khodpe

Himalayan Vultures were studied mostly in the protected areas of Nepal (Chaudhary 1998, Collins and Grindle 2001, Baral et al 2002, Virani et al. 2008, Acharya et al. 2009). However, few studies reported from outside the protected areas (Tyabji 2006, Karmacharya 2011). Nepal has considerable population of Himalayan Vulture (Grimmett et al. 2000). In present study altogether, in average flock size 25.83 Himalayan Griffon were recorded in Khodpe and Jacknife Population estimated about 40 individuals of Himalayan Griffon in the area. Karmacharya (2011) estimated 12 individuals with average flock size 7.9 with standard deviation 1.58 of Himalayan Vultures from his 2010 field visits in the same area. So, there was 30% increase in the population of Himalayan Vultures. Virani et al. (2008) also did not found sharp decline in Himalayan Vultures species in Mustang. Karmacharya (2011) had studied vultures in only Siddhnath cliff, whilst the present study was conducted in Siddhnath and Harichan cliff. Survey in additional cliff might have increased the population of Himalayan Vultures. Same topographic features had sustained almost equal number of vultures' within two cliffs of the area. However, it is difficult to determine the Himalayan Vulture population from the area. Bhusal (2011) also recorded considerable population (58 individuals) of Himalayan Vultures from Argakhachi district.

Besides Himalayan Griffon, 8 Egyptian Vulture and 2 Slender-billed Vultures were also recorded from the area. However, Karmacharya (2011) had reported additional population of Egyptian and Lammergier Vultures from the area. The sighting of Lammergier was very low similar to Slender-billed Vulture.

### 5.2 Breeding success of Himalayan Griffons

Himalayan Griffons breed in the Nepal Himalaya (Grimmett et al. 2000). The factors like weather conditions, food availability, topographic features and anthropogenic influences directly affect the breeding of the birds. Total 12 Occupied nest and 11 active nest were recorded from both cliffs 7 from Harichan and five from Siddhnath which is greater than that of Karmacharya (2011) in his study he found 11 occupied and 4 active nest. Increase

in the number of active nest may be due to increase in the number of nesting cliffs, during the study period Karmacharya (2011) found only one nesting site. The breeding success of Himalayan Griffons was observed very high (90.90%) in the Khodpe, however, it was slightly varied within two cliffs. Harichan cliff had 100% breeding success as active nest whereas Siddhnath cliff had only 80% breeding success. Siddhnath cliff has human influence due to presence of temple of Siddhnath, so the breeding success may have reduced than Harichan cliff. Active nest was more in Harichan cliff which resulted more breeding success. Karmacharya (2011) reported 75% of breeding success in Siddhnath cliff. So, reason behind in increase in breeding success might be higher number of active nests. Acharya et al. (2009) reported 84% decline in nests number of Himalayan Vultures during 2002-2005 in Mustang, Annapurna Conservation Area. However, Bhusal reported 65% of breeding success from Argakhachi district.

### **5.3 Breeding behavior of Himalayan Griffon**

Himalayan griffon lives in a higher altitude up to 4100m it use to build nest in the cliffs , Breeding season is mainly December to March (Shrestha 2001). Incubation period is of two months; usually Himalayan Griffon lays Single eggs in a year (Ali and Ripley 1968). Karmacharya (2011) reported two nests with having two eggs while in the present study the nest with single eggs were recorded.

### **5.4 Diclofenac and Meloxicam**

The diclofenac was predicted to be lethal to Himalayan Griffon (Swan et al. 2006). But it depends upon the area of the study. As Baitadi was declared diclofenac free zone no diclofenac was found in Agro-vet and veterinaries and Meloxicam's were abundant in Agro-vets. Virani et al. (2008) reported that Himalayan Griffons were suffering from the diclofenac as other *Gyps* vultures..But most of the studies were concentrated to the other *Gyps* vultures (Cuthburt et al. 2009, Das et al. 2010, Chaudhary et al. 2011).

### **5.5 Questionnaire and threats to Himalayan Griffon**

Karmacharya (2011) has reported that 81% of respondent knows vultures and 65% support that vultures are declining from their area but in the present study almost all

respondent were known to vultures 95% , 76% believed that vultures are declining. All the respondents were unaware about the drug Diclofenac and Meloxicam in past but in the present study 7.9% were known to Diclofenac and two respondents were known to Meloxicam. During the study Karmacharya (2011) found that 74.60% of respondent were in the support to conserve Vultures while in the present study 76% of respondent were with it.

Besides Diclofenac there are many other factors, such as loss of nesting and roosting site due destruction of forest, human influence around the nesting area, loss of food due burial of dead animal to prevent from disease use of excessive amount of pesticides and chemical that also plays vital role in population declining. People only think veterinary drug as the reason but are unaware about the diclofenac drug. (Baral et al 2002) found many descendent of Himalayan Griffon feeding on carcasses in Low lands with other species of vultures these may lead to the infections and transfer of communicable disease. However, present study the breeding success was observed to be 90% in the year 2011. This shows increase in the population and breeding success than previous year.

## **6. CONCLUSIONS AND RECOMMENDATIONS**

The population estimation and breeding success of Himalayan Griffons were carried out in Khodpe, Baitadi, Nepal. Vultures were surveyed in two cliffs of from October 2010-May 2011. During the study period Himalayan Griffons were recorded with average flock size of 25.833 individuals. However, Chi-squared test showed that there was no significant difference in Himalayan Griffons sighting in the area. Through Jackknife estimation, population was estimated about 40 individuals. Chi-square test revealed that there is no significant difference in vultures' aggregation in Harichan and Siddnath cliffs.

Slender-billed Vulture and Egyptian Vultures were also recorded in small population from the study area.

The breeding success was increasing in the area. Out of 12 nests, 11 were active and ten were productive, only two nests were unproductive which accounts 90% breeding success. The breeding success was 100% in Harichan cliff and 80% in Siddnath cliff. 74% of the respondents thought that the population of Himalayan Vultures was decreasing from the area. Food availability was the main factor for such decline. Nevertheless, the actual increase or decrease could not be concluded due to lack of literatures of the previous year from the area.

Based on the field surveys following recommendations were forwarded for the conservation of vulture from being extinct from the area:

- The carrion should be managed effectively to increase the food availability.
- All the probable nesting habitats should be protected
- Community awareness program for the identification of vultures and about their role in locality should be conducted.

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ANNEXES

Annex 1. Population monitoring form.

**Bird Conservation Nepal  
Vulture Conservation Program  
(Population Monitoring Form)**

S.N	Date	Time	Site	GPS reading	Vulture species	Number	Stage	Remarks

Annex 2. Nest monitoring form

**Bird Conservation Nepal  
Vulture Conservation Programme  
(Nest Monitoring Form)**

Unique No.

GPS Location:

Species:

Location :-

Nesting tree species:

Height of Tree (by Abney's level):

Observer:

Other wildlife encountered at survey:

Address:

Nest Height:

Associated Tree species:-

Nesting on:

Altitude:

No. of visit	Date	Time	Active Nest	Fledgling in Nest	Weather	Visibility	Remarks
1							
2							
3							
4							
5							
6							
7							

Weather Code:-

1. Sunny (S)

2.Highly Cloudy (HC)

3. Moderately Cloudy (MC)

4. Rainy (R)

Annex 3. Questionnaire survey form

**lu4 ;+/lf0f ;r]tgf ;j]{ kmf/d**

gfd M	lnË M	pd]/ M
lzlff M		
7]ufgf M (GPS)	;j]{stf{sf] gfd M	ldlt M

!= d/]sf] hgj/sf] l;gf] vfg] r/fnfO{ s'g gfdn] lrGg'x'G5 <  
s\_ lu4 v\_ lrn u\_ afh 3\_ yxf 5}g  
@= s] tkfO{F lu4nfO{ lrGg'x'G5 <  
s\_ lrG5' v\_ lrlGbg  
#= lu4 r/fnfO{ tkfO{F s;/L lng'x'G5 <  
s\_ cz'e r/f v\_ k|fs[lts s'lrsf/ u\_ yxf 5}g  
\$= xfn cfP/ lu4sf] ;+Vof 36]sf] 5 jf a9]sf] 5 <  
s\_ 36]sf] 5 v\_ a9]sf] 5 u\_ yxf 5}g  
obL k|Zg g+= # df 36]sf] 5 eg] k|Zg g+= \$,%^,! ,!!  
%= s] sf] cfwf/df lu4 36]sf] 5 eGg ;Sg'x'G5 <  
s\_ ;dfrf/af6 v\_ a'9fkfsfaf6 u\_ b]v]sf] 5}g 3\_ cGo  
^ lu4 36\g'sf] k|d'v sf/Of s] x'g ;S5 <  
s\_ kz' pkrf/df k|of]u ul/g] cf}iflw v\_ af;:yfgsf] sdL u\_ cxf/sf] sdL  
3\_ laiff lb<sup>a</sup> \_ cGo  
&= lu4sf] ;+Vof 36\g'df b'vfO{ sd ug}{ cf}iflw 8fO{Snf]km]g]s sf] af/]df  
yxf 5 <  
s\_ 5 v\_ 5}g  
\*= 8fO{Snf]km]g]s n] lu4nfO{ s] c;/ ub{5, yxf 5 <  
s\_ 5 v\_ 5}g  
(= o; cf}iflwnfO{ g]kfn ;/sf/n] k|ltaG3 u/]sf] yxf kfpg' ePsf] 5 <  
s\_ 5 v\_ 5}g

!)= lu4 ;+/lf0f ;DalGw /]l8of] ;'rgf sfo{qmdx? ;'Gg'ePsf] 5 <  
s\_ 5 v\_ 5}g  
!!= s] tkfO{nfO{ lu4nfO{ ;+/lf0f ug{'k5{ h:tf] nfU5 <  
s\_ k5{ v\_ kb}{g  
!@= lsg lu4sf] ;+/lf0f ug{'k5{ xf]nf <  
s\_ k]fs[lts s'lrsf/ ePsf] v\_ xfdLnfO{ xfgL ub}{g u\_ kx/dfd a:b5 3\_  
yxf 5}

Annex 4.

Annex 5. Population monitoring form.

S.N	Visited date	Duration	Working hours
1	23 <sup>rd</sup> -24 <sup>th</sup> October	2 days	12 Hrs
2	8 <sup>th</sup> -9 <sup>th</sup> November	2 days	12 Hrs
	20 <sup>th</sup> -21 <sup>st</sup> November	2 days	12 Hrs
3	9 <sup>th</sup> -10 <sup>th</sup> December	2 days	12 Hrs
	24 <sup>th</sup> -25 <sup>th</sup> December	2 days	12 Hrs
4	6 <sup>th</sup> -7 <sup>th</sup> January	2 days	12 Hrs
	20 <sup>th</sup> -21 <sup>st</sup> January	2 days	12 Hrs
5	18 <sup>th</sup> -20 <sup>th</sup> February	2 days	12 Hrs
6	7 <sup>th</sup> -8 <sup>th</sup> March	2 days	12 Hrs
	26 <sup>th</sup> -27 <sup>th</sup> March	2 days	12 Hrs
7	4 <sup>th</sup> -5 <sup>th</sup> April	2 days	12 Hrs
8	22 <sup>nd</sup> -25 <sup>th</sup> May	4 days	24 Hrs
<b>Total</b>	<b>October-May</b>	<b>26days</b>	<b>156Hrs</b>

**Photplates**



1. Himalayan Griffon at roosting site



2. Himalayan Griffon at nesting site



3. Himalayan Griffon with newly hatched off-spring



4. Himalayan Griffon with young one



5. Questionnaire with locals



6. Questionnaire survey with Agro-vet personal

**Bird Conservation Nepal**  
**Vulture Conservation Programme**  
**Agro-vet Survey Form**

Date:- \_\_\_\_\_ Name of Shop: \_\_\_\_\_  
 Proprietor: \_\_\_\_\_ Unique No. \_\_\_\_\_ Contact No: \_\_\_\_\_  
 Village: \_\_\_\_\_ Street: \_\_\_\_\_ District: \_\_\_\_\_  
 GPS Co-ordinates: \_\_\_\_\_

Active ingredient(s)	Ingredient Concentration	Manufacturing company	Manufacture address & Country	License number	Batch number	Manufactured date	Expiry date	Strip/vial size	Pri Str

Note:- 1 Bolus Strip = 4 Tablets

Did you replace diclofenac with Meloxicam at this shop/vet clinic? a) Yes b) No

If yes, then please fill the details below:

a) Number of bolus given out and product name.....

b) Number of vials given out and product name.....

Researcher Name:-