FEEDING BEHAVIOR OF VULTURES IN DUMPING SITE OF DAMAULI, TANAHUN DISTRICT, NEPAL

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Zoology with special paper "Ecology and Environment"

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RECOMMENDATIONS

This is to recommend that the thesis entitled **"Feeding Behavior of Vultures in the Dumping Site of Damauli, Tanahun District, Nepal"** has been carried out by **Ms. Rebecca Gurung** for the partial fulfillment of the requirements for the Degree of Master of Science in Zoology with special paper Ecology and Environment. This is her original work and has been carried out under our supervision. To the best of our knowledge, this thesis has not been submitted for any other degree in any institutions.

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CERTIFICATE OF ACCEPTANCE

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DECLARATION

I hereby declare that the work presented in this thesis has been done by myself, and has not been submitted elsewhere for the award of any degree. All sources of information have been specifically acknowledged by reference to the author(s) or institution(s).

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ABSTRACT

Study of feeding behavior of vultures in dumping site of Damauli was conducted in Damauli, the headquarters of Tanahun District, Nepal from December 2010 to November 2011. The main objective of research was to study the feeding behavior of vultures in the dumping site of Damauli on seasonal variation and identification of threats and use of NSAIDs in the study area. The study was conducted during December 2010 to November 2011. The study focuses on the five species of vultures that were recorded in the site during the study period; they are White-rumped vulture (*Gyps bengalensis*), Red-headed vulture (*Sarcogyps calvus),* Himalayan Griffon (*Gyps himalayensis*), Cinereous vulture (*Aegypius monachus*) and Egyptian vulture *(Neophron percnopterus).* The use of Kruskal Wallis test showed, there was a significant difference between the total number of vulture and different species of vulture feeding in the dumping site of Damauli with Asymp. Sig=0 during different seasons. The most abundance species was Egyptian vulture which was recorded in all seasons for feeding where as Cinereous vulture and Himalayan Griffon were found only in spring. White-rumped vulture was recorded in every season but it was least in number during winter. In addition Red-headed vulture was observed in all season except summer. Diclofenac, one of the primaries NSAID that kills the vulture was not recorded in the study area during Agro-vet questionnaire survey. The main threat posed to the vulture species is the use of NSAIDs that still has to be tested for the toxicity to the vultures in the site.

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ABBREVATIONS

Abbreviated form	Details of abbreviations
BCN	Bird Conservation Nepal
BBC	British Broadcasting Corporation
CV	Cinereous Vulture
DNPWC	Department of National Parks and Wildlife Conservation
EV	Egyptian Vulture
GoN	Government of Nepal
HG	Himalayan Griffon
ISARPW	International South Asian Recovery Plan Workshop
IUCN	World Conservation Union
KNP	Keoladeo National Park
MoFSC	Ministry of Forest and Soil Conservation
NSAID	Non-Steroidal Anti-Inflammatory Drugs
NTNC	National Trust for Nature Conservation
ReSoN	Research Solution Nepal
RHV	Red-headed Vulture
RSPB	Royal Society for the Protection of Birds
SPSS	Statistical Package for Social Sciences
VCBC	Vulture Conservation Breeding Center
VDC	Village Development Committee
VSZ	Vulture Safe Zone
WRV	White-rumped Vulture
ZSL	Zoological Society of London

1. INTRODUCTION

1.1 Background

Vultures are scavenging birds, feeding on the carcasses of dead animals. They are found in every continent except Antarctica and Oceania (Del Hoyo et al. 1994). The particular characteristic feature of vulture is that most of them have bald head, devoid of feathers and have keen eyesight. The bald head and neck is unique because a feathered head would become spattered with blood and other fluids and thus will be difficult to keep clean. Physiologically the bare skin areas in Griffon Vultures play an important role in thermo-regulation (Ward et al. 2008). Vultures occupy an important niche in the ecosystem by safely disposing of dead animals and help in preventing the spread of the zoonotic diseases (BCN 2010). They are diurnal birds.

Nine species of vultures are found in South-Asia of which eight are resident and one is migratory (Table 1). Eight species have been recorded in Nepal (Grimmett et al. 1999) but recently a Long-Billed Vulture (*Gyps indicus*) was recorded at vulture restaurant in Pithauli (DeCandido et al. 2012, BCN and DNPWC 2012). Among them, Himalayan Griffon (*Gyps himalayensis)*, Lammergeier (*Gypaetus barbatus)*, and Egyptian Vulture (*Neophron percnopterus)* breed at higher elevation (Inskipp and Inskipp 1991). Eurasian Black Vulture (*Aegypius monachus)* is a winter visitor to Nepal. Eurasian Griffon (*Gyps fulvus)* and Red-Headed Vulture (*Sarcogyps calvus)* probably breed in mid-hills but their breeding has not been confirmed yet. In low land White-Rumped Vulture (*Gyps bengalensis)* and Slender-Billed Vulture (*Gyps tenuirostris)* are resident to Nepal and other higher elevation breeders also descend to low land during winter (Baral et al. 2002).

1.1.1 Population decline and causes

Populations of three resident species of *Gyps* vultures, 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 two decades, and they are now classed as 'Critically Endangered' (IUCN 2012). The mortalities were first observed in 1997 among Oriental White-Backed Vultures in Keoladeo National Park in India (Prakash 1999). The study indicated the decline of the *Gyps* vultures by about 95% (Prakash et al. 2003). Similar percentage was also found to be present in Sudano-Sahelian

Savannas of West Africa, during past 30 years. The drastic decline of vultures in Nepal was first observed by Inskipp and Inskipp (2001). Recent research in India shows a sharp decline in the population of Red-Headed vultures and Egyptian Vultures (Cuthbert et al. 2006). Red-Headed Vulture declined by 91% and Egyptian Vulture declined by 80% (Vulture Conservation and Breeding Program, 2010). So Red-Headed Vulture and Egyptian Vulture are listed as critically endangered and endangered list respectively (IUCN 2012).

Table 1. Vulture in South Asia (Source: Vulture Conservation Action Plan for Nepal: 2009)

SN	Species	Range Countries	Resident/Migratory	Conservation Status
1	White- Rumped Vulture	Nepal,India, Pakistan, Bangladesh	Resident breeder	Critically endangered
2	Slender-Billed Vulture	Nepal,India, Bangladesh	Resident breeder	Critically endangered
3	Long- Billed Vulture	India, Pakistan, Nepal	Resident breeder	Critically endangered
4	Himalayan Griffon Vulture	Nepal, India,Pakistan	Resident breeder	Least concern
5	Eurasian Griffon Vulture	Nepal,India, Pakistan	Winter visitor	Least concern
6	Red-Headed Vulture	Nepal, India	Resident breeder	Critically endangered
7	Egyptian Vulture	Nepal,India, Pakistan	Resident breeder	Endangered
8	Cinereous Vulture	Nepal,India, Pakistan	Winter visitor	Near threatened
9	Lammergeier	Nepal,India, Pakistan	Resident breeder	Least concern

Considerable evidence now indicate that the catastrophic decline has been caused by the non-steroidal anti inflammatory drug (NSAID) diclofenac, which was 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 treated 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). Vultures that consume sufficient tissue from treated carcasses die from the effect of diclofenac which induces kidney failure with clinical signs of visceral gout (Oaks et al. 2004, Swan et al. 2006). Recently proof has emerged that diclofenac is also toxic to Himalayan Griffon vulture (Das et al. 2010). It is unknown if diclofenac is affecting populations of the vulture species and scavenging birds in the region, but numbers of Red-Headed Vulture (*Sarcrogyps calvus)* and Egyptian Vulture (*Neophron percnopterus)* have recently undergone rapid declines in India (Cuthbert et al. 2006).

Within Nepal, research and monitoring of vulture species has been undertaken in lowland areas and has revealed similar declines of 91% for OWBV and 96% for SBV between 1995 and 2011 (Chaudhary et al. 2012) (in excess of 90%) in populations of Oriental White-backed and Slender-Billed Vultures (Baral et al. 2002, 2004).There are less than 1000 pairs of Slender-Billed Vultures in Nepal. The current rate of decline in Nepal is estimated to be 40% and the rate of decline within a decade is estimated at 90 to 95% (Nepal Country Report 2006).

The major cause of the massive mortality in vulture population is the veterinary use of diclofenac (Green et al. 2004, Oaks et al. 2004). Studies have pointed out that apart from diclofenac; some other NSAIDs like ketoprofen (Naidoo et al. 2010) are harmful to vultures and other scavenging birds (Cuthbert et al. 2006). A new research has emerged which considers a derivative drug of diclofenac called Aceclofenac as potential threat to critically endangered vultures (Sharma 2012). Carpofen and flunixin were associated with mortality, with deaths observed in 13 and 30% of cases respectively (Cuthbert et al. 2006). Other aspects like food shortage, habitat loss, poisoning, pesticide use and human persecution may have caused a gradual population decline over the long run (Baral and Gautam 2007, Gautam and Baral 2009). Deliberate poisoned carcasses that are placed for killing other animals (dogs, foxes, jackals etc), felling of the nesting and roosting trees, disturbances and destruction of nests to prevent vulture nesting above agricultural land

and dwellings exclusion from feeding sites through disturbance or alternative carcasses disposal methods like burial and direct persecution and hunting of vultures either for medicinal purposes could also lead into population decline of vultures in Nepal (DNPWC 2009).

1.1.2 Action against the decline

When diclofenac was identified as the main cause of the vulture population in South Asia, governmental and non-governmental organizations tried to establish vulture restaurants since 2000 (ISARPW 2004). A Vulture Summit Meeting was organized in Kathmandu, Nepal followed by International Vulture Recovery Workshop in New Delhi, India. The workshop advocated removing diclofenac for veterinary use. To identifying an alternative safe drug to diclofenac and establish conservation breeding programs in Nepal, India and Pakistan were also its main objectives (ISARPW 2004). The relative safety of meloxicam supports other studies indicating the suitability of this NSAID to replace diclofenac (Cuthbert et al. 2006). So after identifying the safe alternative drug meloxicam to diclofenac for vultures (SAVE 2011) the Government of Nepal, India and Pakistan banned the production and import of diclofenac for the veterinary use and agreed to replace it with meloxicam. Ban on veterinary diclofenac, exchange of diclofenac with meloxicam, establishment of Vulture Safe Zones (VSZ), monitoring of vulture colonies and raising conservation awareness are some strategies to save critically endangered vultures from the brink of imminent extinction.

The Government of Nepal approved the Vulture Conservation Action Plan 2009-13 to revive viable populations in the wild (DNPWC 2009). The document emphasizes on ex-situ conservation measures such as the establishment of holding and breeding centers for vultures. These can be considered as long-term strategies and may be less effective to eliminate imminent threats. Two in-situ conservation measures mentioned in the document appear to be short-term strategies: (i) elimination of diclofenac through replacement, by meloxicam, and (ii) provision of safe food by establishing vulture restaurants near by the breeding colonies. These strategies are best suited at the national level and may not address challenges at the local level. For example, the destruction of nesting habitats is a major challenge for vulture conservation in Rampur (Baral et al. 2005), but the plan is not explicit about how to protect critical nesting and roosting habitats that are outside the protected areas system in Nepal (Gautam and Baral 2010).

In response to such massive challenges Saving Asia's Vultures from Extinction (SAVE) was formed formally on Feb 2011 which is the collaborative efforts among a large number of conservation and research enthusiastic lending a hand so that the outcome will be effective enough to overcome vulture conservation crisis. The main mission of SAVE has been to "Respond to the vulture crisis in Asia by striving to halt vulture population declines and working to minimize their negative impacts on ecological and human health". But this was not the only meeting by SAVE, they had met in Pinjore in Nov, 2011 before the inauguration of SAVE on Feb 2011. The SAVE met on Pinjore had aimed to achieve the following objectives:

1. To stop the use of injectable human diclofenac those are produced in vials or ampoules larger than 3ml.
2. To establish "Provisional Vulture Safe Zones" network all over South Asia to save Gyps species with active participation of government and related NGOs.
3. To commit the pharmaceutical industries and government as required.
4. To breeding and releasing vulture program must be within 100km radius of the diclofenac free area/zone.
5. To engage in obtaining the important support and funding to meet the above over all objectives.

SAVE has been active in advocacy program aiming to the vets and farmers in order to stop the use of diclofenac and controlling the manufacture of the drugs through legislation. It gives emphasis on the in-situ conservation programs with more useful research works (SAVE 2011). On May, 2012 the Save meeting held in Delhi between representatives from India, Pakistan, Bangladesh and Nepal signed the declaration paper that had aimed to secure the future of three threatened Gyps species in Asia which has foreseen the urgent need to stop on use of human diclofenac (SAVE 2011).

1.1.3 Conservation practices

Apart from banning Diclofenac, establishment of captive breeding centre, safe feeding sites (Jatayu/Vulture restaurant), provisional vulture safe zones (VSZ), regular monitoring of vulture colonies and nests also raising awareness about the conservation are some of the strategies that have been effective in Nepal. For the long term conservation in vultures recently Nepal has also developed vulture action plan (2009-2013) which advocated

preventing the extinction of the vulture species by ensuring the re-introduction, safe food supply, maintenance of suitable habitat and ensuring understanding of the ecological importance of these raptors in Nepal (DNPWC 2009). In addition to this, for the recovery of the vulture population, Vulture Conservation Breeding Center was established in Kasara, Chitwan on 5th November, 2009 (Vulture Conservation and Breeding Program, 2010). The center is planning to introduce other two species in the breeding center is on process (Shrestha 2012, Vulture Bulletin). These captive vultures can be reintroduced in the wild once the effect and eradication of diclofenac is successful. The establishment of Vulture Conservation Breeding Centre (VCBC) is a prudent choice since it promotes the number of the WRV otherwise it is very possible that resident *Gyps* vultures will become extinct across South Asia (www.vulturerescue.org) .

In-situ conservation

The two in-situ conservation practice that has been fruitful in Nepal is;
1-the exchange of diclofenac with alternative drug meloxicam
2-the provision of vulture safe food near breeding colonies (DNPWC 2009).

Ban on production and import of veterinary drug Diclofenac, a Non-Steroidal Anti-Inflammatory Drug (NSAID), was done in Nepal since August 2006 shortly after the ban in India in May 2006 and the same has been done in Pakistan. Promotion of meloxicam in wider scale has already been started.

In order to involve the local communities in conserving the potential vulture nesting colonies, Bird Conservation Nepal came up with an idea of setting up safe feeding stations as vulture restaurant in these sites. This was first initiated at Pithauli, Nawalparasi in the buffer zone of Chitwan National Park (Thapa 2009). There are now six such safe feeding sites (Jatayu restaurant) namely Pithauli and Kawasoti VDC of Nawalparasi, Gaidahawa Lake of Lumbini, Lalmatiya and Bijouri VDCs of Dang, Samaiji community forest of Shreepur VDC of Kailali and Ghachowk VDC the latest in Kaski (BCN 2010).

Ex-situ conservation

The rapid decline of the of wild vulture population 25-48% per annum (Green et al. 2004) urgently brought the need to establish the Vulture Breeding Centers. With an aim to establish captive population of critically endangered vultures for the purpose of conservation breeding and subsequent reintroduction to a diclofenac free environment, a

captive breeding centre has been established in partnership of Department of National Parks and Wildlife Conservation (DNPWC), National Trust for Nature Conservation (NTNC) and Bird Conservation Nepal (BCN) supported by Royal Society for the Protection of Birds (RSPB, UK) and Zoological Society of London (ZSL,UK). The Vulture Conservation Breeding Centre (VCBC) has been established at Chitwan National Park at Kasara. A new colony aviary was added to the VCBC which has provided the space for 60 WRVs (BCN 2012). Annual vulture health check up was done in March 2012 strengthening the position of vultures (Danphe, 2012).

Despite numerous challenges, efforts are ongoing for both in situ and ex situ conservation of these critically endangered vulture species both in Nepal and other range countries.

1.1.4 Statement of the problem

Vultures have been declined in great number so in Nepal, among nine, four are listed by IUCN as critically endangered and one as endangered (Table 1). In Nepal studies on vultures have been done mostly in Terai region and the information regarding the vultures in hills and high altitudes is limited. This dearth of information of the species is sole reason why we need to do more study. Diclofenac being the main reason behind their decline the presence or absence of the drug must be surveyed. So the food availability and their habits must be studied. If the place has food available for vulture, we need to find if the food is safe enough for them. And the study of the condition of the place must be studied and its sustainability for the feeding must be taken into account. Since the dumping site provides food, rest and water for them. The number of species arriving in the dumping site is also important; this study will provide the number visited by vultures for feeding. The study of vultures isn't done in this area so far. This place must be further studied to find facts about the vultures in Damauli, thus giving new perspective to these scavenging birds for conservation. Damauli lies between the Vulture Safe Zones Nawalparasi and Ghachowk of Kaski district along the Seti-madi river, which is the migratory corridor so the safety of vulture can be ensured. Such new potential places where the vultures roost and feed must be monitored and follow up studies is also essential.

Without the comprehensible study of the population and existing threat no any reasonable action can be planned to save these majestic scavenging birds from being extinct.

1.2 Objectives

The main objective of this research was to investigate the feeding behavior of vultures in the dumping site of Damauli. Specific objectives were:

1. Report the seasonal variations in composition of vulture species and their numbers
2. Identify threats and use of non-steroidal anti-inflammatory drugs (NSAID) – Diclofenac in the area

2 LITERATURE REVIEW

Fleming et al. (1984) mentioned that the White-Rumped Vulture (WRV) has been the most common vulture in lowland in Nepal. Inskipp and Inskipp (1985) recorded small population of White-Rumped Vulture in Kathmandu valley ranging from 30-40 in years1980-1982.

Prakash (1999) observed the decline of population of WRVs in Keoladeo National Park (KNP) which was associated with and attributed to unprecedented and unusual pattern of mortalities, first observed in 1996-1997 nesting seasons. “Birds dropped dead from their roosts and died perched and remained suspended in branches or died in nests” Virani et al. (2002) and found 45 White-Rumped Vultures dead in eastern Nepal and five in western part. Inskipp and Inskipp (2001) observed the drastic decline of the vultures in different parts of Nepal. During present survey also showed the declining trends of WRVs. Baral et al. (2002) studied lowland vultures of Nepal and result showed a declining trend in number of vultures from 310 from April 1993 to 160 in July 2000 and 64 in March 2002, in Rupandhehi district near Lumbini. Chaudhary et al. (2012), surveyed the number of vultures in the road transect which showed the absent of vultures from central and eastern regions of Nepal indicating the low levels by 2002.

Oaks et al. (2004) indicated that vultures are exposed to diclofenac when they feed from carcasses of livestock that have died within a few days of treatment and contain toxic residues of the drug. And he concluded the diclofenac was the main cause in vulture decline. Baral et al. (2005) calculated population size of total nested vultures in Rampur, Nepal and falling of Kapok trees, use of diclofenac poisoning were threats for vulture population. Prakash et al. (2007) studied on the decline of vulture population since mid 1990s according to which 97% of WRV, SBV and LBV have declined. In India, numbers of WRV have declined by 99.9% from 1992 to 2007. Monitoring of vultures in Nepal by Baral et al. (2004) indicated similar decline with greater than 90% decrease in number up to 2001.

Das et al. (2010) and Green et al. (2007) argued that diclofenac was the main reason for the decline of three *Gyps* vultures in Indian sub-continent. Pain et al. (2008) showed majority of death of the vultures was due to visceral gout caused by diclofenac. Oaks et al. (2004) and Swan et al. (2006) examined the main reason for the declining of number

of vultures and found that the use of non-inflammatory drug diclofenac in livestock. Shultz et al. (2004) described the effects of diclofenac after post-mortem examination of dead or dying birds and the result indicates that diclofenac is poisonous to vultures, causing the kidney failure with clinical signs of visceral gout prevalent. Prakash et al. (2003) and Anderson et al. (2005) concluded that both increase in putrefying carcasses and change in the scavenger population also have associated disease risks for wildlife, livestock and human and spread of rabies and livestock borne diseases like anthrax, TB and brucellosis.

Green et al. (2004) described other reasons of the mortalities of vultures other than diclofenac. Other sources of mortality include poisoning through feeding deliberately poisoned carcasses that are placed to kill the other animals (e.g. leopard, dogs), the falling of nesting trees especially those with active breeding attempts, disturbances and destruction of the nests to prevent vultures nesting above the agricultural land and dwellings, exclusion from feeding sites through disturbances or alternative carcass disposal methods and direct persecution and even hunting (medicinal purposes). In past these additional sources of mortality have been minor and population has been able to withstand in Nepal. However, with a very small remaining and still declining population, such additional sources of mortality may play more significant role (DNPWC 2009). Hernandez and Margadila (2009) argued about some other factors that affect the remaining population of vultures like accidental poisoning, human persecution, electrocution and localized shortage of food due to alternative disposal of carcasses.

Swan et al. (2006) discovered the NSAID meloxicam to be safe to India's critically endangered *Gyps* spp. and several other scavenging birds. In vultures dosed with meloxicam, there was no change in feeding behavior or body mass or any increase in uric acid and Alamine Transferase levels related to treatment, as occurred in vultures dosed with diclofenac.

3 STUDY AREA

3.1 Physical description

The dumping site at Damauli is known as a site frequented by large number of vultures. The place lies at 27° 58' 40" N latitude and 84° 19' 34" E longitude. The area is surrounded by hills and is warm place. The dumping site is at the bank of Madi River. Seven tons of wastes are thrown and dumped here on the daily basis (Vyas Nagarpalika Tanahun- 2067 BS annual). Nearly 1.56 kg of waste is produced from each household in this place. The main bazaar i.e. Damauli produces 72% of biodegradable wastes and 28% non-biodegradable wastes (Vyasnagar Gatividhi-2064). A concrete bridge is on the north of the site and to the south is Damauli bazaar. Manugha dada is on the west of the dumping site. On the opposite shore of the river are cliff and few trees where the vulture roost and rest. During the rainy seasons the whole area is inundated by water. Damauli is the headquarters of Tanahun district. Tanahun district is located in the Gandaki Zone of central Nepal.

After the onset of democracy, the Damauli VDC and parts of Shyamgha VDCs were relocated as Vyas Municipal in year 2048 BS. Pokhari Bhanjyang , Ghasikuwa and Barbhanjyamg VDCs lie to the east whereas Jamune, Mangpang and Shyamgha VDCs to the west of the city. To the north are Kyamin and Tanahusur VDCs and to the south are Kot Durbar and Kahushivapur VDCs of the municipal. The city covers 59 square km. and consists of 11 ward numbers where ward number 2, 10 and 11 are parts of the city, 1, 7 and 8 are sub-urban and others are rural parts (Vyas Nagarpalika Tanahun- 2067 BS annual).

3.2 Population composition

The total population of the municipal was 42899 in 2011 (http://cbs.gov.np/wp-content/uploads/2012/11/VDC_Municipality.pdf). Bhramins, Magars, Chettris, Darai, Newars, Gurungs, Kamis, Damais, Kumals, Botes, Sarkis, Thakuris and other castes live in this area. Most of the residents are Hindus. The second most followed religion is Buddhism but other religions like Christianity and Islam are also followed by the people (http://cbs.gov.np/wp-content/uploads/2012/Pocket%20Book%202010/Chapter01/Chapter_1_6.pdf).

The place is 310-1120m high from sea level and lies just 50km away from city of Pokhara. The temperature ranges from 8.4-37°C. (Vyas Nagarpalika Tanahun - 2067 AD annual).

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4 MATERIALS AND METHODS

4.1 Preliminary Survey

Different reports and journals were studied at pre-survey period as references. The preliminary survey was done at the beginning of January 2010 in dumping site of Damauli in Tanahun district. The survey was useful for further planning of the research.

The field work started from January 2010 onwards to November 2011.

4.2 Count at carcass/food:

In order to assess the availability of food in the study area, the number of carcass found as well as the number of vultures attending them was to be noted.

4.3 Direct observation:

Number of different species of vultures was noted in the dumping site and other scavengers associated with the carcass or food was also noted during the day time (from 8am-6pm) staying at a fixed place during the time of observation. Other activities like foraging, roosting, basking, fighting, soaring etc were studied by scanning and direct observation. Roosting and foraging tree species were also noted as habitat used by vultures. The observation and enumeration was done with the aid of binocular and telescope and their activities were captured in camera.

Observations were done regularly for five days from 8am-6pm during summer and 8am-5pm during other seasons for three months each. Thus the observations were done for 20 days in each period of three months. The numbers of vulture species that fly there to feed were recorded. Numbers of vultures that visit site were also recorded.

4.4 Questionnaire survey:

Questionnaire, document review, interview and field observations were done for the identification and monitoring of NSAID in the area. Questionnaire survey was done with the local vet shops separately around the vicinity of study area to get general information about NSAID and attitude towards vulture. The Agro-vet shops (veterinary pharmacies) and Veterinary professionals were asked regarding the status of diclofenac in the market

and the effectiveness of diclofenac replacement by meloxicam. A form designed by Bird Conservation Nepal (BCN) was used for surveying.

4.5 Allocation of different seasons:

The seasons were varied in Damauli. The coldest days were of December and February. March to May were dry days with winds. And the rains poured mostly during June-July.

Table 2. Allocation of seasons

SN	Months	Seasons
1	Dec-Feb	Winter
2	Mar-May	Spring
3	Jun-Aug	Summer/monsoon
4	Sept-Nov	Autumn

4.6 Data Analysis:

The collected data were analyzed using SPSS 16.0, SAS and MS Excel software. Since the data was non parametric, Kruskal K- independent test was done to test the significance of the hypotheses:

H_0: There is no difference between the total number and different species of vulture who feed in dumping site of Damauli during various seasons.

H_1: There is difference between the total number and different species of vulture who feed in the dumping site of Damauli during various seasons.

5 RESULTS

5.1 Abundance of different vulture species and other bird species visiting the site

Five species of vultures were recorded in dumping site of Damauli. The most abundant vulture species was Egyptian Vulture with mean rank 90.5 and the least was CV (Table 1). White-rumped Vulture was second in number with 56.92 mean rank.

Some common birds like Pigeon *(Columba livia)*, Black Drongo *(Dicrurus macrocerus)*, Common Myna *(Acridotheres tristis)*, House Crow *(Corvus splendens)* and Black Kite *(Milvus migrans*) were seen in the dumping area foraging in the dumping site (Table 1) usually in morning hours.

Table 3. Abundance of different species of vultures in descending rank with other species of birds

S.N.	Vulture species	Rank	Mean Rank
1	Egyptian Vulture	1	90.5
2	White-Rumped Vulture	2	56.92
3	Red-Headed Vulture	3	43.10
4	Himalayan Griffon	4	32.85
5	Cinereous Vulture	5	29.12
6	Black Drongo	_	_
7	Black Kite	_	_
8	Rock Pigeon	_	_
9	Common Myna	_	_
10	House Crow	_	_

5.2 Test for significance of hypothesis

Since the Asymp. Sig. is 0.00 i.e. with p-value <0.05; at α 0.05, having Chi-square 62.632 and DF=4, the null hypothesis is rejected and alternative hypothesis is accepted. The accepted alternative hypothesis is "There is significant difference between the total number of vulture and different species of vulture feeding in the dumping site of Damauli during different seasons".

5.2.1 Seasonal variation of vulture species in the study site for feeding

Vultures mostly fed during morning at 8-11am (n=25). But there was variation in feeding hours for EVs (Figure1). They were seen actively foraging during noon in winter and in afternoon in autumn. EVs were shy and did not interfere with other species of vultures while feeding.

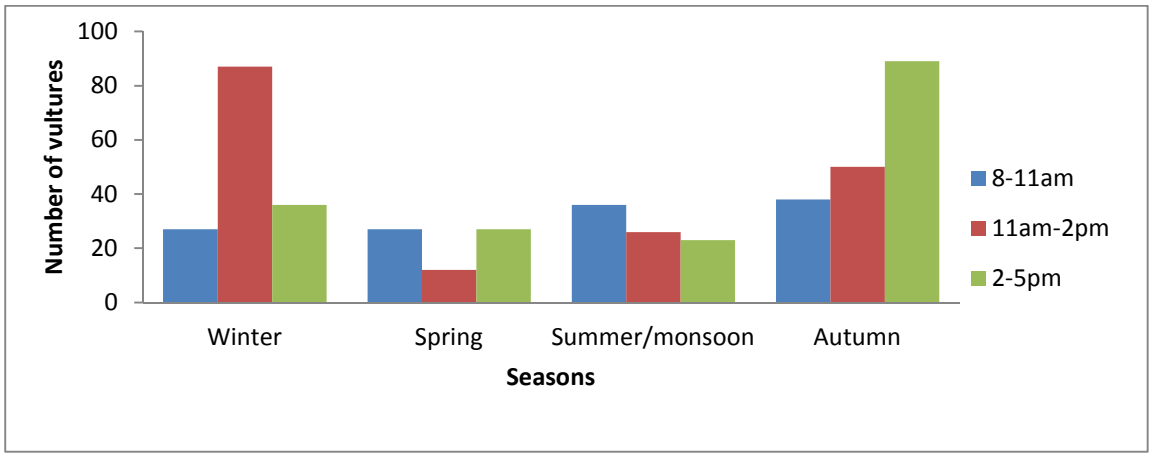

Figure 1. Number of Egyptian vulture in different seasons for feeding

RHVs were observed more in the morning than after noon in winter and spring for foraging (Figure 2). It was not seen in summer and autumn. Sometimes they only landed on the site but did not feed on the slaughter remains.

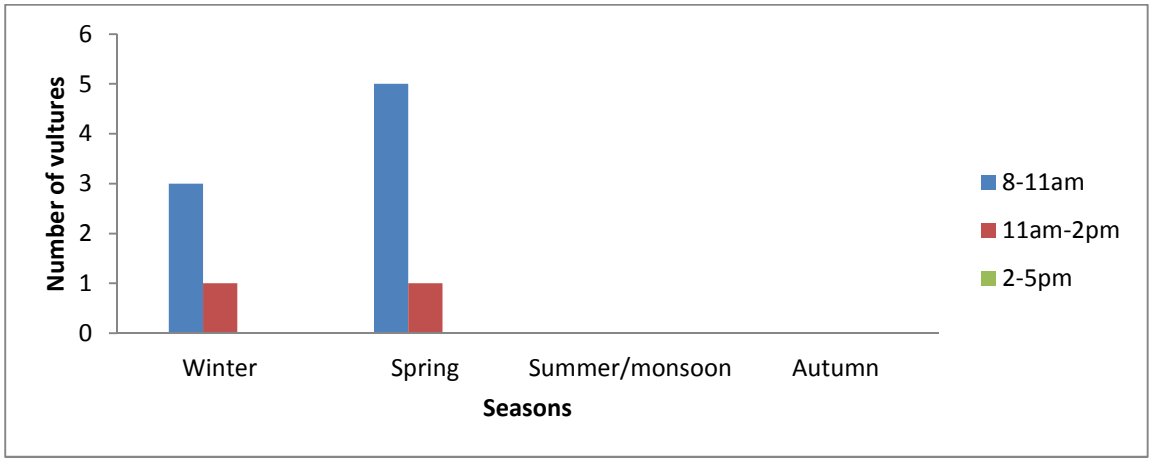

Figure 2. Number of Red-headed vultures in different seasons for feeding

WRVs were observed more in spring than in any other seasons and did not visit the dumping ground during (n=25) (Figure 3). WRVs were seen fighting with HGs while feeding. There was an intraspecific competition among the HGs and interspecific competition between HGs and WRVs.

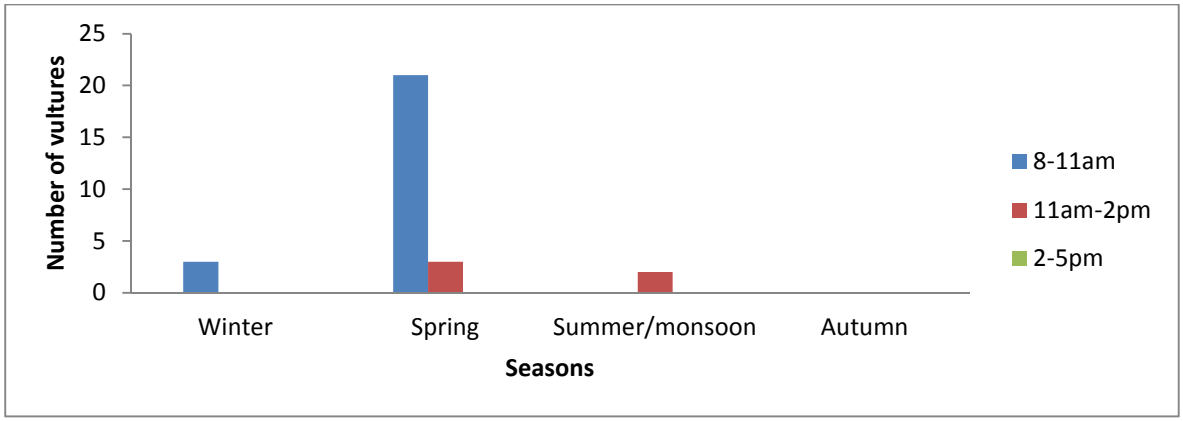

Figure 3. Number of White-rumped vulture in different seasons for feeding

HGs were only recorded during spring and more active for feeding during the morning hours (n=25) (Figure 4). The intraspecific competition among the HGs was seen in foraging ground.

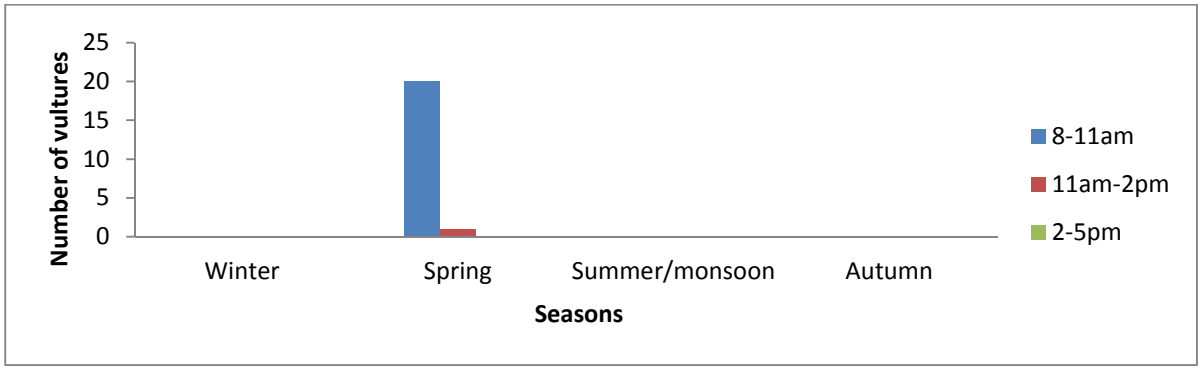

Figure 4. Number of Himalayan Griffon in different seasons for feeding

CVs were more active in morning regularly foraging from 8-2 pm. They were observed during spring (n=25) (Figure 5) only. They directly attacked the food where as this behavior was not observed in other species of vultures in the field.

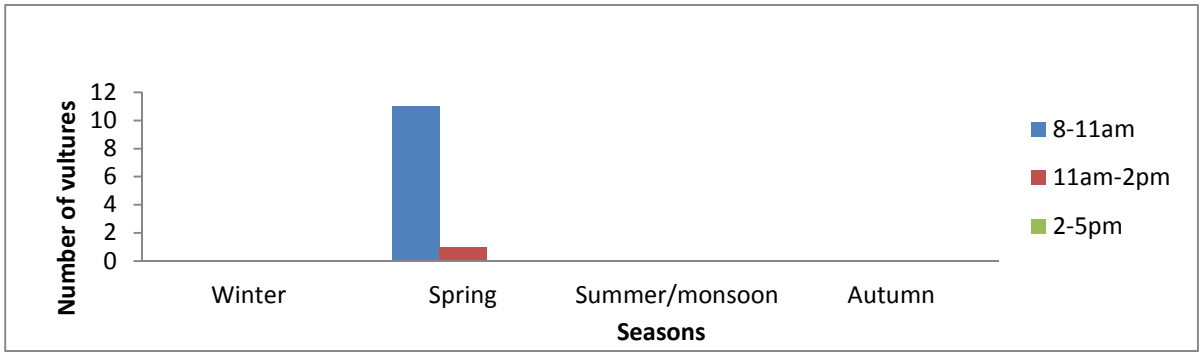

Figure 5. Number of Cinereous vulture in different seasons for feeding

5.2.2 Number of vulture species visiting the site: seasonal variation

On an average 107 (sd=36.47, n=25) EVs visited the dumping site daily during winter. The number was lower ($\bar{x}$=26, sd=1.48, n=25) during spring and higher ($\bar{x}$=28, sd=7.12, n=25) during summer and increased ($\bar{x}$=103, sd=15.07, n=25) during autumn (Figure 6).

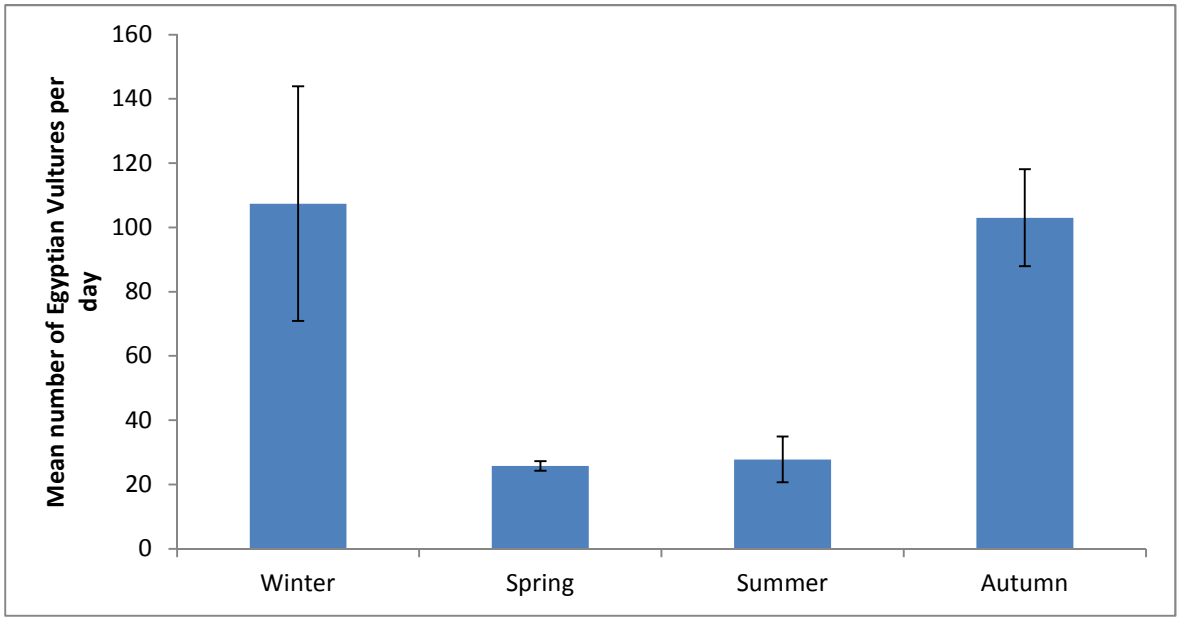

Figure 6. Number of Egyptian Vultures in the dumping site of Damauli

The average of CVs visiting the dumping site daily was three (sd=2.61, n=25). The number lowered to one (sd=1.40, n=25) during spring but there were none in summer and autumn (Figure 7).

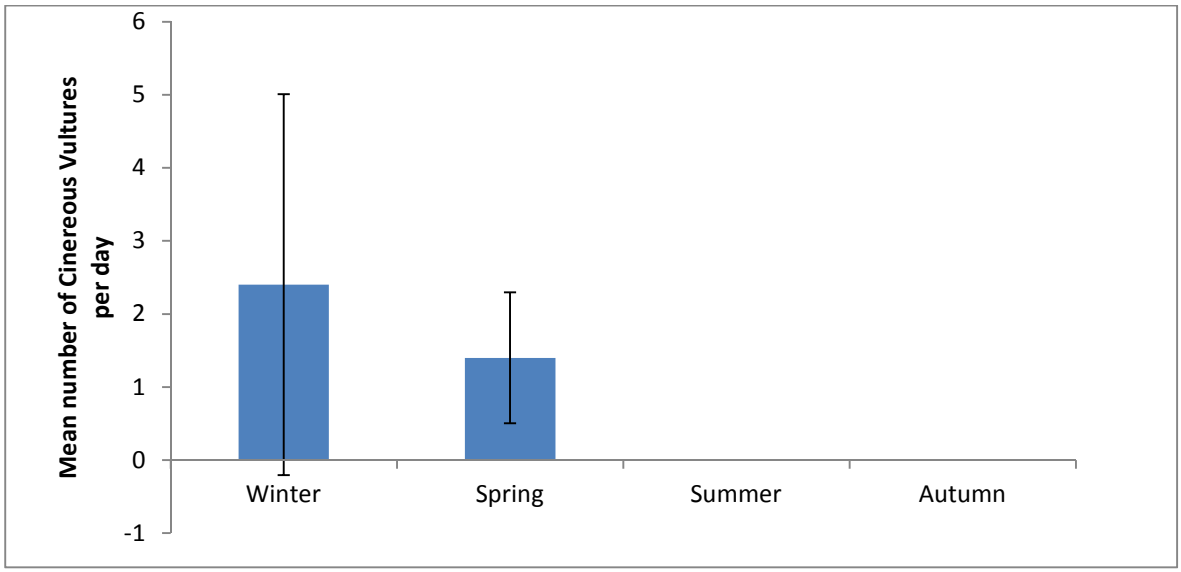

Figure 7. Number of Cinereous Vultures in the dumping site of Damauli

WRVs visited the site during winter on an average of one (sd=1, n=25) daily. It increased to eight (sd=3, n=25) during spring and reached 14 (sd=15, n=25) during summer. The number decreased to three in autumn (sd=4, n=25) (Figure 8).

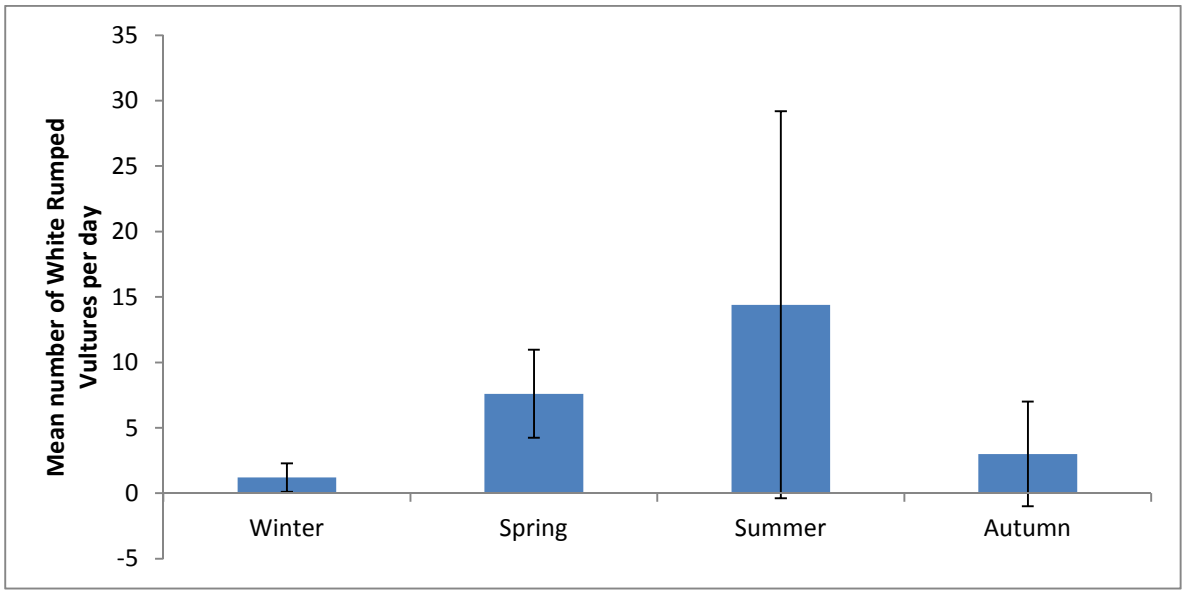

Figure 8. Number of White-rumped Vultures per day in dumping site of Damauli

During winter, one RHV visited the site on an average daily (sd=1, n=25). The number increased to two RHVs (sd=1, n=25). During summer and autumn they were not recorded in the site (Figure 9).

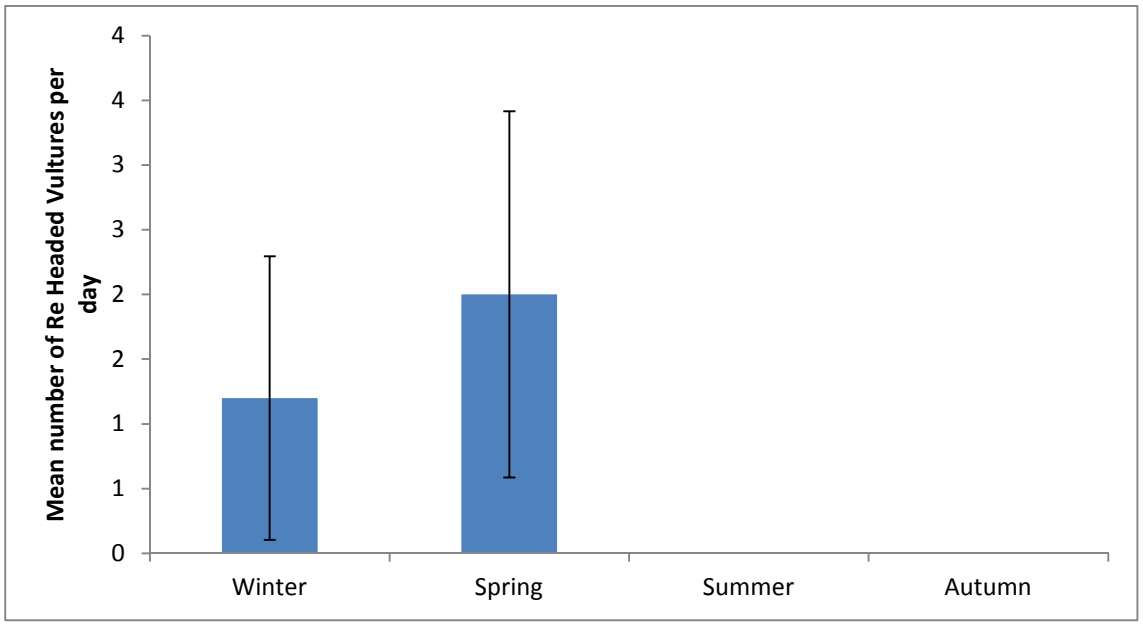

Figure 9. Number of Red-headed Vultures per day in the dumping site of Damauli

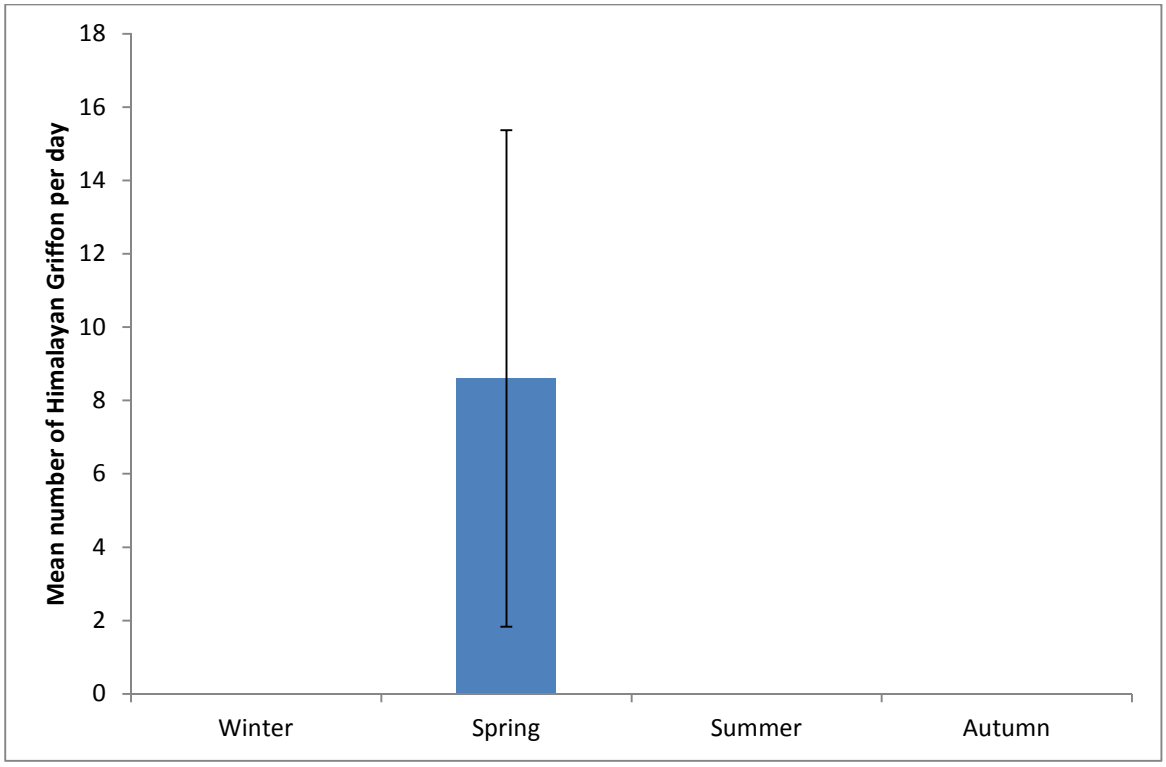

Figure 10. Number of Himalayan Griffon Vultures in the dumping site of Damauli

More than eight (sd=6.77, n=25) HGs visited the dumping site in spring but none during winter, summer and autumn (Figure 10).

5.2.3 Food availability

The foods used by vultures were waste produced by the city which was available for 24 hours. The tractors collected wastes from the city and visited the place at least 4 times each day for dumping. The carrion part thrown during 9-11am was mostly from the slaughter house which only threw bones and remains of the animals mostly buffalos. Further no any dead vultures were found during the observation time.

5.3 Questionnaire survey in Agro-vets

The six veterinary-pharmacists were interviewed with the help of the questionnaire form designed by BCN in Damauli. One of the respondents was District Vet Hospital. The main focus of the survey was to study the use of NSAIDs-diclofenac in the area and the threats caused by the drug.

The survey showed absence of the diclofenac and meloxicam being used widely in the agro-vets. However they claimed that diclofenac was more liked by the farmers because

of its instant effectiveness (Figure 12). According to the agro-vet professionals of Damauli, NSAIDs are supplied from Pokhara and Chitwan which are diclofenac free zones and occasionally from Kathmandu as well. Most of the agro-vet professionals were aware about the killer drug-diclofenac which has been discarded by the vets since it was banned in Nepal in 2006. Recently in 2012, the area was declared diclofenac free zone.

Sixty-seven percent of the respondents were positive about the decline of vultures in these areas and 33% were unheard about the decline (Figure 11). And 28% of them agreed that diclofenac is primary cause of the decline and 29% concur in the fact that many other factors play the role in decreasing the number of vultures (Figure 12). The other causes or threats of the vulture decline in the Damauli region were use of diclofenac, population increase, deforestation and food shortage.

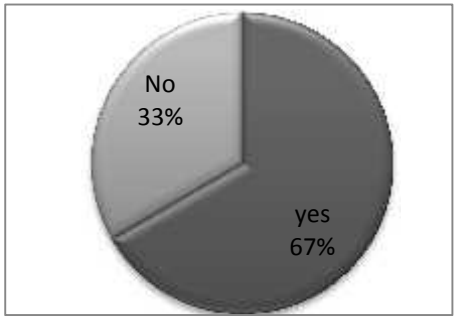

Figure 11. Response of to decline of vulture

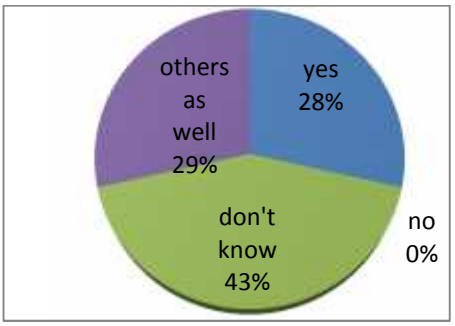

Figure 12. Response in favor of diclofenac being cause of decline

5.3.1. Performance of Meloxicam

Sixty-seven percent of veterinarians were satisfied with the performance of meloxicam where as 33% of them gave the drug average marking (Figure 13). Some of them complained about the ineffectiveness of meloxicam as compared with diclofenac in livestock.

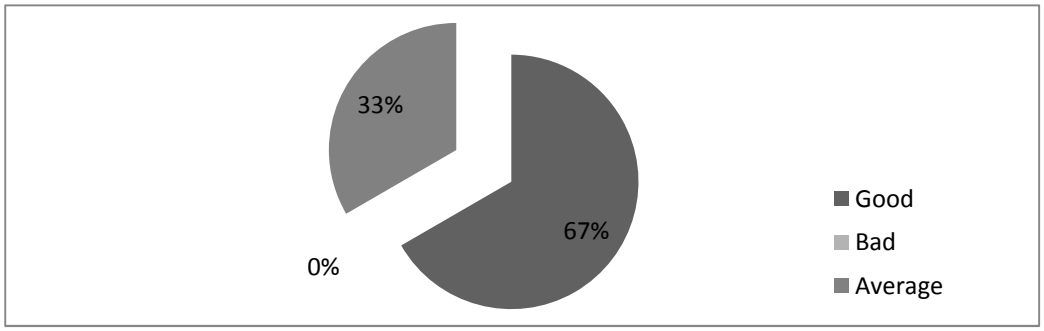

Figure 13. Performance of the drug Meloxicam on the livestock

5.4 Use of different NSAIDs used in Agro-vets of Damauli

The abundant use of NSAID in the region was found to be meloxicam combined with paracetamol and the second was the drug containing meloxicam only. Other drugs like nimesulide united with paracetamol, procaine penicillin, enrofloxacin and amoxicillin sodium were also used in Agro-vets of Damauli (Figure 14).

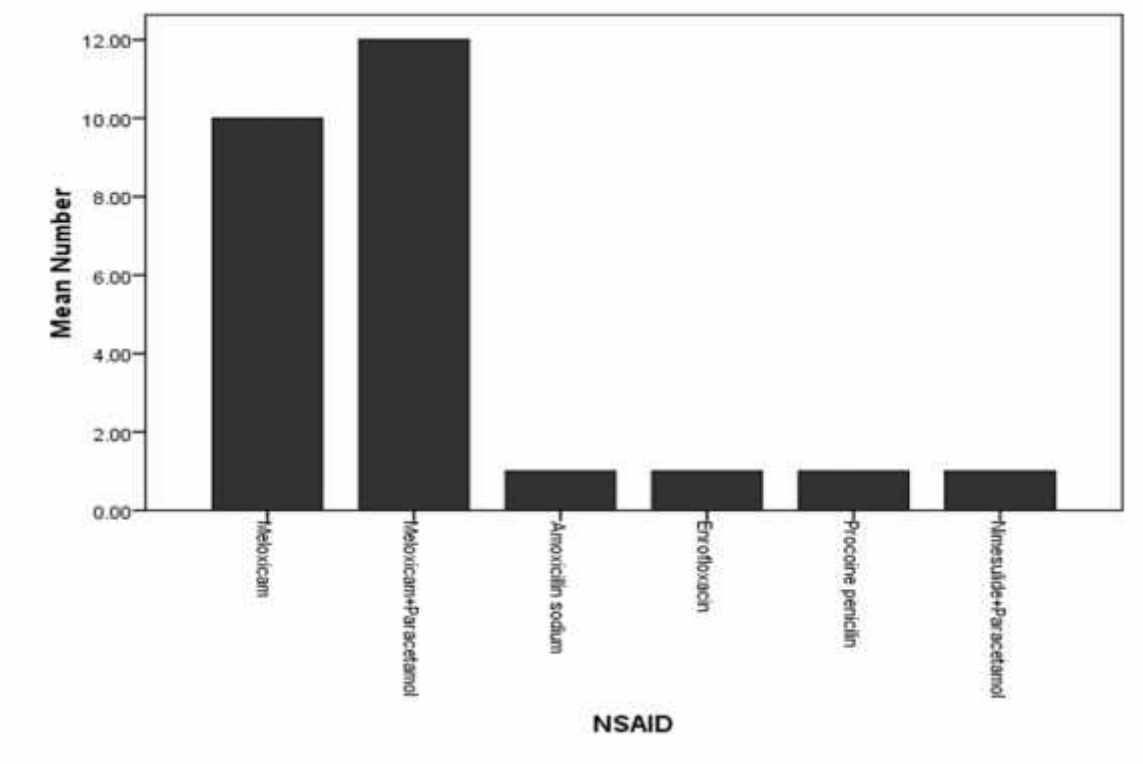

Figure 14. Different kinds of NSAIDs used in Agro-vets of Damauli

6 DISSCUSSION

6.1 Number and Seasonal Variation of vultures

Vultures are attracted towards the site that provides leftover from slaughter houses and waste disposal from the human settlements (www.birdlife.org\factsheets). EV was recorded in all seasons and was abundant during spring but scarce during winter. EV migrates to south during the winter but its tropical population is sedentary. Bhusal (2011) recorded the population of EV from January to June i.e. during winter, spring and summer in Gherabhir, Argakhachi. Even Gautam and Baral (2009) also recorded the EV in their breeding colonies in Pokhara valley which is 53km from Damauli. In the site, CV and HG were recorded only in spring and sighting of WRV was high in spring than in other seasons. This pattern was observed by Dhakal (2011) in his study at VSFS in Dang and Rupandehi which showed highest number of WRV during spring where as HG was recorded high during winter since HG migrates to lowlands during winter and recorded foraging in mixed group (Baral et al. 2000, Chaudhary and Pariyar 2004) in spite of its less gregarious nature (Naoroji 2006). HG has ability to migrate as low as 175m during winter (Ferguson-Lees and Christie, 2001). In contrary to this, study done by Bhusal (2011), estimated high population of HG during spring (May) in Gherabhir. RHV was seen in all the seasons (Dhakal 2011) but Bhusal did not record RHV during winter (February) and spring (May). Also, the study in vulture restaurant of Nawalparasi (Chaudhary et al. 2010), recorded these five species of vultures with addition to *Gyps fulvus* and *Gyps tenuirostris*, where the WRV was reported in largest number and the second was HG while feeding and the least was RHV. Similarly, Chhangani and Mohnot (2008) recorded seven species of vulture that feed in the dumping ground of Jodhpur, India where as there were five species that feed in dumping site. Both dumping ground had EV, CV, WRV, RHV and HG. Even in absence of carcasses the population of WRV was high, it is due to the presence of slaughter house waste disposal which is supported by the survey done in Gujrat (Hiren 2007). This difference in number of sighting may be due to the migratory behavior of the vulture species with accord to seasons.

There was a significant difference between the total number of vulture and different species of vulture feeding in the dumping site of Damauli in different seasons. But the result of work by Dhakal (2011) showed no any significant difference with reference to four seasons in his observation. “This might be the result of counting all the species of

vulture as a whole", Dhakal (2011). Another cause may be the difference in place of study, as he conducted his study in Tarai where as this one was carried out in mid-hills. But the number of birds arriving at the feeding station was found undubiously affected by different seasons when the census of vultures in Herzegovina was conducted (Sasa et al. 2007). Although , according to Gilbert et al. (2007) basically during post breeding time, the seasonal variations occur in foraging behavior of the vultures affecting the number of vultures using supplementary food in vulture restaurants in Asia.

EV exploited large carcasses, also consumes small and medium sized vertebrates and even garbage (Donazar 1993) whereas *Gyps* species exclusively includes only carcasses of medium and large sized mammals. Further *Gyps* species scavenge soft parts of the carcasses which are usually large ungulates (Pain et al. 2003). EV usually fed after the carrion is left by larger feeders especially *Gyps* species (Krik and Houston 1995). Donazar and Ceballos (1990) found EV foraging in the garbage dump containing remains of slaughter sheep. The increment in the feeding of vultures throughout the day was due to increase in temperature, HG, WRV, RHV and CV were seen more in feeding activity when the sun was warmer as Ghogbo and Awotwe-Pratt (2008) claimed that the vultures await thermals to assist their foraging activities. CV directly landed on the feed during the study, although less in number dominated the foraging ground, this fact is supported by Mundy et al. (1992) and Donazar (1993) who concluded that CV are at the top most of the food web as focus consumer of carcasses and has wide foraging range. It is able to dominate the resource because it is more energetic and has large body size (Donazar 1993) in addition its stronger bill enables to capture its food (Konig 1983). The observation done by Ferguson-Lees and Christie (2001) showed absence of CV, HG domination over other vultures while foraging at a carcass. Clearly competition between the vultures for the resource was observed. Whenever there is high diversity of vulture species the more chances for the competition for the food (Koing 1983). The interspecific competition between WRV, CV and HG was common during the foraging on same feed in the dumping site of Damauli. Blanco et al. (1997) reported two severe cases of interspecific and intraspecific aggression provoked by the competition over food between Griffon species and CV in western Spain. He further observed the aggression among them on account of nest site as well. In the both cases CV was aggressive than the former. Hiraldo et al. (1979) evinced intraspecific aggressiveness among Griffon vultures while foraging. Such behavior is common when carrion is scarce creating interspecific overlap

of the unpredictable food resources among the vultures which are found in same area for feeding.

6.2 Threats and use of NSAIDs in Agro-vets

The questionnaire survey and visit in every Agro-vet shops in study site showed absence of diclofenac-the killer NSAID which is responsible for the decline of vulture. The study evinced that the diclofenac was absent since the time it was banned in Nepal for the vet uses. Same was the case in the study done by Bhusal (2011) in Gherabhir. In addition the site was declared diclofenac free zone on 2012. There has been regular monitoring of diclofenac from year 2006 and replacement of the diclofenac with meloxicam is done in regular basis in Nepal. The drug has been absence in the market since 2008 (Paudel 2012, Vulture Bulletin). There was maximum use of the drug meloxicam both in vial and bolus form in the site. Further the practioners in the study area complained that meloxicam not being as effective as diclofenac in action on live stocks and another factor is high price of the drug. But meloxicam is the only alternative safe drug for vultures. Many newer drugs are in markets which might hinder in saving the vultures from extinction. Ketoprofen was regarded unsafe for the vultures in 2008 (Naidoo et al. 2010). And recently Aclofenac is also looked upon with doubt, considered as potential threat to the critically endangered vultures (Sharma 2012).Drugs like nimesulide, analgin, ibuprofen etc combine with paracetamol. These are certainly questionable drugs (Paudel 2012). Since combination of these ibuprofen, ketoprofen, carprofen when administered to the different species of vultures showed toxic nature causing death as well (Taggart et al. 2009). However such extensive data is lacking. He observed that flunixin is also dangerous to the avian family and Cuthbert et al. (2006) found the mortality of *Gyps* species due to phenylbutazone. Further studies are required to analyze the effects of various such drugs that may harm avian family including vultures. Therefore more works must be done to test the toxicology of the NSAIDs on vulture species like nimsulide, analgin, ibuprofen which have been used in the areas. Another factor which will be interesting enough for research is the effect of toxic drugs to kill the pest animals that may be consumed by vultures.

7 CONCLUSIONS AND RECOMMENDATIONS

Five species of vultures were recorded during the study in the dumping site; they were EV, WRV, CV, RHV and HG (Table 3). There was a significant seasonal difference between the total number of vulture and different species of vulture feeding in the dumping site of Damauli. The vultures feeding in the site were EV which was the most abundant in all seasons (Figures 1 and 6) due to its wide preference of food. Others were WRV, HG, RHV and CV (Figures 2, 3, 4 and 5). The Agro-vets survey showed the absence of killer drug diclofenac in the study area (Figure 14). Threats were mainly due to the use of different kinds of NSAIDs which are still prescribed by vets. They have to be investigated whether their use on livestock are really safe for vultures.

Although vultures were common in the site no study has been done in this site before. Following points should be considered for the protection of vultures:

1. Comparative studies regarding the behavior of vultures and factors that influence them should be done in the area with that of captive vultures
2. Potential nesting sites nearby area must be identified. The range of feeding area used by vultures can be taken as reference
3. As the site is declared diclofenac free area, monitoring of the NSAIDs must be continued
4. Awareness about critically endangered status of vultures is important where participatory community conservation approach may help in vulture conservation
5. More works on the NSAIDs that are frequently used on live stocks must be tested for their toxicology in vultures

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9 ANNEXES

ANNEX I. Data sheet for number of vulture species visiting the site: seasonal variation (Sample Size=25)

Species	CV				
S.N.	Day/Seasons	Spring	Summer	Autumn	Winter
1	Day 1	2	0	0	4
2	Day 2	1	0	0	0
3	Day 3	2	0	0	2
4	Day 4	0	0	0	0
5	Day 5	2	0	0	6
	EV				
6	Day 1	26	22	98	75
7	Day 2	26	37	116	109
8	Day 3	25	34	98	169
9	Day 4	28	23	83	92
10	Day 5	24	23	120	92
	HG				
11	Day 1	20	0	0	0
12	Day 2	8	0	0	0
13	Day 3	7	0	0	0
14	Day 4	6	0	0	0
15	Day 5	2	0	0	0
	WRV				
16	Day 1	13	14	1	2
17	Day 2	8	16	10	0
18	Day 3	6	4	2	0
19	Day 4	7	0	0	2
20	Day 5	4	38	2	2
	RHV				
21	Day 1	2	0	0	0
22	Day 2	2	0	0	0
23	Day 3	4	0	0	2
24	Day 4	2	0	0	2
25	Day 5	0	0	0	2

ANNEX II. SAS analysis data sheet:

EV	Mean	Upper	Lower	Std Dev	WRV	Mean	Upper	Lower	Std Dev
Winter	107.40	36.47	36.47	36.47	**Winter**	1.20	1.10	1.10	1.10
Spring	25.80	1.48	1.48	1.48	**Spring**	7.60	3.36	3.36	3.36
Summer	27.80	7.12	7.12	7.12	**Summer**	14.40	14.79	14.79	14.79
Autumn	103.00	15.07	15.07	15.07	**Autumn**	3.00	4.00	4.00	4.00
CV	**Mean**	**Upper**	**Lower**	**Std Dev**	**RHV**	**Mean**	**Upper**	**Lower**	**Std Dev**
Winter	2.40	2.61	2.61	2.61	**Winter**	1.20	1.10	1.10	1.10
Spring	1.40	0.89	0.89	0.89	**Spring**	2.00	1.41	1.41	1.41
Summer	0.00	0.00	0.00	0.00	**Summer**	0.00	0.00	0.00	0.00
Autumn	0.00	0.00	0.00	0.00	**Autumn**	0.00	0.00	0.00	0.00
			-0.21		**HG**	**Mean**	**Upper**	**Lower**	**Std Dev**
					Winter	0.00	0.00	0.00	0.00
					Spring	8.60	6.77	6.77	6.77
					Summer	0.00	0.00	0.00	0.00
					Autumn	0.00	0.00	0.00	0.00

NOTE:

Error bars represented by this analysis have 95% confidence interval.
Sample size=25

ANNEX III. Questionnaire survey form used for Agro-vets in Damauli:

ONE FORM TO BE COMPLETED FOR EACH SHOP/VET/PRACTISE VISITED

Agro-vet survey form 1

Date: ……..

Name: ……..

Profession: ……..

Education: ……..

Contact number: ……

Shop name: ……..

Street address: ……..

Village: ……..

District: ……..

GPS coordinates (if available): ……..

Instructions

- **Fill in one form for each shop/vet**
- **Answer every question**
- **Where answers are a) b) c) etc then <u>underline</u> or circle the answer**
- **Where there is a dotted line**…… **then fill in required information in this space**

1. How many years have you been working in Veterinary/Pharmaceutical Practice?
a) 1 – 5 years b) 5 – 10 years c) More than 10 years

2. Which animal species do you work with?
a) Livestock b) Pets c) Both

3. What livestock species do you treat (list in order of abundance [a>b>c etc])

……

4. What painkillers do you use commonly in your practice?
a) Diclofenac b) Meloxicam c) Other

d) If other then list them here……..

5. What form of drugs do you use
a) Injection b) Oral (bolus) c) Both

6. For how many years have you used NSAIDs in your practice? (answer for each drug)
Drug name 1……..a) 1-2 years b) 2-5 years c) >5 years d) Don't know

Drug name 2……..a) 1-2 years b) 2-5 years c) >5 years d) Don't know

Drug name 3……..a) 1-2 years b) 2-5 years c) >5 years d) Don't know

Drug name 4……..a) 1-2 years b) 2-5 years c) >5 years d) Don't know

7. Which animal do you use NSAIDs for?
a) Domestic livestock b) Pets c) Both

8. How many doses of NSAIDs did you treat/sell in the last month (record number for each drug in b)

Drug name 1……..a) Number……..…….. b) Don't know

Drug name 2…….…….. a) Number……..…….. b) Don't know

Drug name 3…….…….. a) Number……..…….. b) Don't know

Drug name 4…….....…….. a) Number……..…….. b) Don't know

9. Have you noticed a decline in vulture population?

a) Yes b) No c) Don't know

10. If yes, why do you think vultures have declined?

……

11. Does it relate to introduction of Diclofenac?

a) Yes b) No c) Don't know

12. Have you heard about the new drug Meloxicam?

a) Yes b) No

12a) If yes, have you used this drug?

a) Yes b) No

12b) If yes, did you like the performance of this drug?

a) Yes b) No

12c) If No to question 11, why do you not like this drug?

……..

13) How do you obtain NSAIDs that you use?

……

14) Have you been interviewed before regarding NSAIDs and Vultures?

a) No b) Yes…… (no of times)

Agro-vet survey form 2

Shop name: Street address: Village: District:

GPS coordinates (if available):

Name of NSAID	Active Ingredient(s)	Manufacturing company name	Manu address and country	Manu date	Expiry date	Strip or vial (vial size)	Price per strip or vial	Quantity in stock

Note: 1 Bolus Strip = 4 tablets

1. Did you discuss problems of vultures and diclofenac and safety of meloxicam? a) Yes b) No
2. Did you hand out leaflets or posters (circle which) to this shop/vet clinic? a) Yes b) No
3. Did you replace diclofenac with meloxicam at this shop/vet clinic? a) Yes b) No If yes then detail below
   a) number of bolus given out and product name……
   b) number of vials given out and product name……..

ANNEX IV. The list of different brand names of NSAIDs used in Agro-vets of Damauli:

NAME OF THE VET	NAME OF THE NSAID	ACTIVE INGREDIENT(s)	BOLUS/INJECTION	PRICE PER STRIP OR VIAL(RS)	COMPANY
District Vet Hospital	Diclovet M	Meloxicam	Injection	72	Umedica Lab.Pvt.Ltd, India
Dibash Vet 1	Melox Veterinary Bolus	Meloxicam	Bolus	30	Medivet Pharma LabPvtLtd, Nepal
	Diclovet M	Meloxicam	Injection	72	Umedica Lab.Pvt.Ltd, India
	Moxet D Injection	Amoxicillin sodium	Powder	40	Astral Pharmaceutical Industries, India
	Molfen	Meloxicam	Bolus	74	Medivet Pharma Distributers, Nepal
	A_3 Vet Bolus	Meloxicam and Paracetamol	Bolus		Briham Laboratories, India
	Meloxiliv-P	Meloxicam and Paracetamol	Bolus	48	Livcare Pharma Pvt Ltd, Nepal
Vyas vet	Melox-P	Meloxicam and Paracetamol	Bolus	48	Medivet Pharma LabPvtLtd, Nepal
	Oxalgin-NP Vet Bolus	Meloxicam and	Bolus	48	Zydus Animal Health Ltd,

		Paracetamol			India
	Meloxiliv-P	Meloxicam and Paracetamol	Bolus	48	Livcare Pharma Pvt Ltd, Nepal
	ProxyVet MP	Meloxicam and Paracetamol	Injection	91.2	Workhardt Ltdckhar, India
Bahujanahit Vet	Kflox	Enrofloxacin	Injection	178.4	Karataka antibodies and Pharma Ltd, India
	Diclovet M	Meloxicam Injection	Injection	72	Umedica Lab.Pvt.Ltd, India
	ProxyVet MP	Meloxicam and Paracetamol	Injection	91.2	Health and Biotech Ltd, India
	Fortofied Procoine Penicillin	Procoine Penicillin	Bolus	28.928	Alembic Ltd, India
	Mloxicam	Meloxicam	Bolus	32	CTL Pharma LTd, Nepal
	Melox-P	Meloxicam and Paracetamol	Bolus	48	Medivet Pharma LabPvtLtd, Nepal
	Molfen	Meloxicam	Bolus	72	Qmed Formulation Pvt.Ltd, Nepal
Sharmila Agro-Vet	Diclovet M	Meloxicam injection	Injection	72	Umedica Lab.Pvt.Ltd, India
	Melox	meloxicam bolus	Bolus	30	Medivet Pharma LabPvtLtd, Nepal

	ProxyVet MP	Meloxicam and paracetamol	Injection	91.5	Health and Biotech Ltd, India
	Meloxiliv-P	Meloxicam and paracetamol	Bolus	48	Livcare Pharma Pvt Ltd, Nepal
Dibash Vet 2	Molfen	Meloxicam	Bolus	74	Medvet Pharma Qmed, Nepal
	Meloxiliv-P	Meloxicam and Paracetamol	Bolus	48	Livcare Pharma Pvt Ltd, Nepal
	Melox-P	Meloxicam and Paracetamol	Bolus	48	Medivet Pharma, Nepal
	Diclovet M	Meloxicam	Injection	72	Umedica Lab.Pvt.Ltd, India
	Oxalgin-NP	Nimesulide and Paracetamol	Bolus	48	Zydus Animal Health Ltd, India

ANNEX V. Photo plates:

A. Egyptian Vulture and House Crow in the dumping site of Damauli

B. Remains of slaughter house

Plate 1. Dumping site of Damauli

A. Cinereous Vulture and Himalayan Griffons in the feeding site

B. White-rumped Vulture and Himalayan Griffon at conflict during feeding

Plate 2. Aggression among different species of vultures in the study site