Population and breeding success of Red-headed Vulture *Sarcogyps calvus* and Egyptian Vulture *Neophron percnopterus* in central west Nepal

Tulsi R. Subedi[1*] and Robert DeCandido[2]

[1]Himalayan Nature, P.O. Box 10918, Kathmandu, Nepal

[2]1831 Fowler Avenue, Bronx, New York, 10462, USA

*Corresponding author: Tulsi.biologist@gmail.com

Summary

This study on population and breeding success of Red-headed Vulture (*Sarcogyps calvus)* and Egyptian Vulture (*Neophron percnopterus*) was carried out in the middle mountain region of central west Nepal covering Arghakhanchi, Kaski, Palpa, Salyan and Pyuthan districts. A total of 34 days of study were conducted from October 2011 to February 2013 and on each study day observation was conducted between 9h00 to 15h00. We did absolute counts of vulture aggregations in flight in Arghakhanchi, Palpa, Pyuthan and Salyan districts, and on a garbage dump in Kaski district, and used a jack-knife technique to estimate the population size of each vulture species. We estimated a total of 24 Red-headed Vultures and 241 Egyptian Vultures across these five districts. Periodic monitoring of each identified nest was done to determine breeding success and we followed Postupalsky (1974) for the categorisation of nests. Based on active nests as a primary unit, the breeding success of Egyptian Vulture was 62.5% for nine nests identified in breeding year 2012; average nesting cliff/tree height was 27.8 m and that of nests was 14.8 m. In the study we did not find any Red-headed Vulture nests, however fresh juvenile birds were recorded repeatedly in the autumn season. Historical reports indicate Red-headed Vultures and Egyptian Vultures were abundant in Nepal, but have undergone rapid population decline across their ranges in the recent past, which

is likely to continue into the foreseeable future. Recent information from India indicates the rate of population decline is 44% per year for Red-headed Vultures and 35% per year for Egyptian Vultures.

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Introduction

The collapse in numbers of three resident species of *Gyps* vulture in South Asia has become one of the most urgent issues in bird conservation, with four of the nine vulture species recorded in Nepal now listed as Critically Endangered and one species as Endangered (Birdlife 2007). Widespread veterinary use of the non-steroidal anti-inflammatory drug (NSAID) diclofenac is now widely accepted as the main reason of dramatic declines in vulture numbers in South Asia (Oaks *et al.* 2004, Green *et al.* 2004, Green *et al.* 2007, Pain *et al.* 2008), and populations of several vulture species have undergone some of the most rapid declines ever recorded (Prakash *et al.* 2003, Prakash *et al.* 2007, Cuthbert *et al.* 2006, Chaudhary *et al.* 2012). Studies conducted in Nepal, India and Pakistan show three species of resident *Gyps* vulture (White-rumped *Gyps bengalensis*, Long-billed *Gyps indicus* and Slender-billed Vulture *Gyps tenuirostris*) have undergone >97% population declines (Baral *et al.* 2004, Prakash *et al.* 2007). Studies conducted in Pakistan showed the complete loss of a large breeding colony of White-rumped Vulture within a short period of 2001 to 2003 (Gilbert *et al.* 2006).

Although not known to be susceptible to NSAIDs, populations of Red-headed (*Sarcogyps calvus*) and Egyptian (*Neophron percnopterus*) Vultures in India have also undergone declines by 90% and 68% respectively (Cuthbert *et al.* 2006). It is now recognised that populations of the above vulture species are declining throughout their ranges, however there are no data on the population trends of Red-headed and Egyptian Vultures in Nepal, where this study was undertaken.

Large-scale surveys of domestic ungulate carcasses (the principal food source of vultures in South Asia) across India indicate that 10-11% of carcasses are contaminated with diclofenac (Cuthbert *et al.* 2011b). Other causes of mortality include

deliberate and accidental poisoning (Margalida *et al*. 2008, Hernández & Margalida 2009), as well as human persecution (Subedi 2013). Although the production and use of veterinary diclofenac has been banned in Nepal, Pakistan and India since 2006, illegal use of human diclofenac for livestock is still a problem (Cuthbert *et al.* 2011a).

The Red-headed Vulture occurs in Nepal, India, Pakistan, Bangladesh, Bhutan, Myanmar, Laos, Vietnam, and Cambodia (Birdlife 2012). It has been extirpated from its historical ranges in China, Thailand, Malaysia and Singapore. Those historical reports indicate it was widespread and generally abundant, but it has undergone a population and range decline in the last half-century (Birdlife 2012). Given its rarity in South-East Asia, it is unlikely that more than a few hundred individuals remain (Birdlife 2012). In Nepal, the Red-headed Vulture is a rare resident bird distributed below 2000 m (Grimmett *et al.* 2000). It occurs at lower densities than *Gyps* vultures (Naoroji 2006). Recently this species has been listed as Critically Endangered (Birdlife 2007). The total population in Nepal is estimated to be less than 500 birds (BCN and DNPWC 2011).

The Egyptian Vulture occupies a large range, occurring in Europe, Asia and Africa. This is a resident as well as a migratory species. Northern breeders conduct long-distance intercontinental migrations. The bulk of the resident population occurs in Ethiopia and East Africa, Arabia and the Indian Subcontinent. Migratory birds breed in southern Europe from Spain in the west, through the Mediterranean, the Caucasus and central Asia to Pakistan, northern India and Nepal (Birdlife 2012). The global population estimate is between 21,900 - 30,000 individuals (Birdlife 2012). In Nepal, the Egyptian Vulture is distributed below 915 m throughout the year and up to 2000 m in summer, and the population is estimated to be between 300 to <1000 birds (Grimmett *et al.* 2000; BCN & DNPWC 2011). It is resident as well as migratory in Nepal, typically nesting on low cliffs and rocky outcrops, foraging in lowland and montane regions over open country. These vultures also scavenge at human settlements and their diet includes carrion, organic waste, insects, young vertebrates and even eggs (Birdlife 2012). It is usually

solitary, but will congregate at feeding sites such as garbage dumps near large towns. Recently this long-lived species has been listed as Endangered following an extremely rapid population decline in the Indian subcontinent (Cuthbert *et al.* 2006).

Methodology

This study was carried out in the middle mountain range of the western and mid-western development region of Nepal in the Arghakhanchi, Kaski, Palpa, Salyan and Pyuthan districts. The study area consists mainly of steep topography with many rocky cliffs. Vegetation is primarily Pine *(Pinus roxburghii)* forest in the high elevation areas along with Needlewood tree *(Schima wallichii)* and Chestnut *(Castanopsis indica)*. At lower elevations, the predominant tree species are Sal *(Shorea robusta)* and Silk cotton *(Bombax ceiba)*. For effective work in the field, a series of community consultations were done among community groups including forest user groups, the district forest office, and community based organisations and community leaders. The goal of the consultation was to find out basic information about the presence of nesting and roosting habitat of vultures in different sites of the study area.

For the population study, an absolute count of all vultures seen was conducted. The count of the birds was conducted in 2011 (October), 2012 (March, April, May, September, October and December) and 2013 (February). In each day, observation of vultures was carried out between 09h00 to 15h00; a total of 34 days and 204 hours of observation was conducted. Two different observation methods were used during the study. In Arghakhanchi, Palpa, Pyuthan and Salyan districts, observation was conducted from hill tops to count soaring vultures (144 hours), while in Kaski district observation was conducted only at the garbage dump (60 hours). During hill top observations all soaring vultures were counted within the maximum surrounding view. We used Zen-ray ED3 10 x 43 and Nikon 7 x 35 binoculars to identify species and age class (adult and immature). We used Jack-knife techniques (cited in Rodgers (1991)) to estimate the population size. The method requires at least five repeated absolute counts. Therefore, for the validation of the method we conducted a total of nine observations in Arghakhanchi district,

five observations each in Palpa, Pyuthan and Salyan districts and 10 observations in Kaski district. The method uses the difference between the highest count (n_{max}) and the second highest count (n_{max-1}) to calculate N, the estimated total number, where $N = 2n_{max} – n_{max-1}$. No immigration to, or emigration from the area is assumed.

Based on local information and existing knowledge of the study team, careful observations of potential vulture nesting habitat were made. Nesting vultures were thoroughly searched for by scanning potential cliffs and nesting trees in open areas. Nest occupancy was recorded in order to study breeding success of vultures. According to Postupalsky (1974) an active nest is one in which eggs have been laid, an occupied nest is one in which eggs have not been laid but some nest-building activity has taken place. If a nest was observed we made careful examination of it using binoculars for the correct identification of species, number of individuals and status (nesting/roosting/perching). We avoided climbing on possible nesting trees/cliffs to minimise disturbance to the breeding pairs. Also, we kept a sufficient distance between the study team and nesting spot. We recorded relevant data regarding the nesting characteristics such as geographical coordinate, location of nest, approximate height of nesting cliff/tree and nest, activity of parent bird and nestling (if possible). Each nest was monitored monthly to find out the breeding success, and we calculated the percent of successful nests by dividing the number of productive nests by active nests and times by 100.

RESULTS

Population status

During the study Egyptian Vultures were recorded in all five districts surveyed. Red-headed Vultures were recorded in four districts (except Salyan). Based on the Jack-knife technique, the total estimated population of Red-headed Vultures was 24 and the observed maximum was 19. For Egyptian Vulture, the estimated population was 241 and the observed maximum was 217. The observed and estimated total populations of Red-headed and Egyptian Vulture in the study site in each district has been given in Table

1 and age class (adult and immature) is given in Table 2.

Table 1: Maximum observed and estimated population of Red-headed and Egyptian Vultures in five western and mid-western region districts of Nepal

		Red-headed Vulture		*Egyptian Vulture*	
SN	**District Name**	**Maximum Observed Population**	**Estimated Population**	**Maximum Observed Population**	**Estimated Population**
1	Arghakhanchi	4	6	24	30
2	Pyuthan	2	3	6	8
3	Salyan	0	0	7	8
4	Palpa	5	6	5	6
5	Kaski	8	9	175	189
	Total	**19**	**24**	**217**	**241**

Table 2: Age composition of Red-headed and Egyptian Vultures based on highest count during observations.

		Age composition of vultures in study area					
		Red-headed Vulture			*Egyptian Vulture*		
SN	**District Name**	**Adult**	**Immature**	**total**	**Adult**	**Immature**	**total**
1	Arghakhanchi	2	2	4	10	14	24
2	Pyuthan	2	0	2	4	2	6
3	Salyan	0	0	0	5	2	7
4	Palpa	4	1	5	3	2	5
5	Kaski	5	3	8	Not	counted	175
	Total	**13**	**6**	**19**			**217**

Breeding success and Nest monitoring

We recorded nine Egyptian Vulture nests in different districts, and those were monitored periodically to determine breeding success. Out of nine nests, eight were active and one nest was occupied. Chicks fledged from five nests. Based on occupied nests as a primary unit the breeding success was 55.5%. Based on active nests as a primary unit, breeding success was 62.5% for the Egyptian Vulture. Out of nine nests recorded, seven were on rocky cliffs, and two were on pine trees. The maximum, minimum and average height of the nesting cliff/tree was 40m, 11m and 27.8m and that of nests was 28m, 8m and 14.8m respectively. Both nests on trees failed. We did not find a Red-headed Vulture nest in the breeding year 2012.

Discussion and conclusion

In this study we estimate the total Red-headed Vulture population in the five districts of Nepal to be 24 individuals. For Egyptian Vulture in this same area, we estimate the population to be 241 individuals. The State of Nepal's Birds (2010) gives the total population of Red-headed Vultures to be less than 500 and Egyptian Vultures to be less than 1000 birds (BCN & DNPWC 2011). This literature also indicates the highest number of Red-headed Vultures to be in Kaski district of Nepal. In a study conducted by Gautam and Baral (2009) they found that the number of Egyptian Vultures increased from 52 to 75 in the Pokhara area. Our study finds the number is far higher than that study. We suggest that the regular source of food in garbage dumps of this area might attract more vultures from surrounding regions, thereby increasing the count of Egyptian Vultures here. The smaller number of Red-headed Vultures estimated in this study could be due to their highly territorial behaviour. Road transect surveys conducted by Chaudhary *et al*. (2012) also revealed very low numbers of Red-headed Vultures in lowland areas of the country. In South Asia and a country such as Nepal, where wild ungulates are no longer a primary food source, the Red-headed Vulture is largely dependent on the carrion of domestic livestock (Birdlife 2012). By comparison, Egyptian Vultures take a wide variety of food including garbage (Birdlife

2012). As a result, it might be that Egyptian Vultures have less potential exposure to diclofenac than Red-headed Vultures.

In our study we did not find any nest of the Red-headed Vulture, but we learned that this species was nesting in a pine tree in Chidapani village Arghakhanchi district in 2011 and one chick was successfully fledged. Sometime around the year 2000, one nest was observed in Bardia National Park in mid-western Nepal by Dr. Hem Sagar Baral. For Egyptian Vulture, in the breeding year 2012, we found a total of nine nests. Most were on cliffs, and only two nests were in trees. Based on the active nests as a primary breeding unit, success of the Egyptian Vulture was 62.5%, which is slightly higher than the study conducted by Bhusal and Dhakal (2011). They found 50% breeding success out of two nests.

Threats to vultures include human disturbance of nesting habitat (especially of nesting trees). This study found both Egyptian Vulture nests on trees failed. This could be due to a high disturbance rate: (a) branches of nesting trees were cut for firewood; and (b) local people told us that they wanted to chase off the vultures from their fields due to their taboo (superstition that vultures bring bad luck) – so they cut the branches of the trees containing vulture nests. We also found that people started to cut large trees on their private land, and sell the wood in the market due to the access of roads in the village, and a good price for the wood. This has a high impact on tree-nesting raptor species. The production of veterinary diclofenac is already banned in Nepal, Pakistan and India since 2006, but still there is some problem with human diclofenac produced in large vial sizes (30 ml). The large-sized (30 ml) human diclofenac vials are available in pharmacies. Human diclofenac is illegally used in livestock treatment in some places because, compared to vulture-safe meloxicam, diclofenac is cheaper and faster acting in cattle. Also there are other NSAIDs in the veterinary market like nimesulide, ketoprofen, piroxicam, analgin and aceclofenac which are not tested or proven safe for vultures or other scavenger birds. Therefore use of non-tested NSAIDs and the illegal use of human diclofenac is still a big problem for existing vulture populations.

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Key words: Breeding Success, Diclofenac, Egyptian Vulture, Nepal, Population, Red-headed Vulture

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