

The Rufford Foundation

Final Report

Congratulations on the completion of your project that was supported by The Rufford Foundation.

We ask all grant recipients to complete a Final Report Form that helps us to gauge the success of our grant giving. The Final Report must be sent in **word format** and not PDF format or any other format. We understand that projects often do not follow the predicted course but knowledge of your experiences is valuable to us and others who may be undertaking similar work. Please be as honest as you can in answering the questions – remember that negative experiences are just as valuable as positive ones if they help others to learn from them.

Please complete the form in English and be as clear and concise as you can. Please note that the information may be edited for clarity. We will ask for further information if required. If you have any other materials produced by the project, particularly a few relevant photographs, please send these to us separately.

Please submit your final report to jane@rufford.org.

Thank you for your help.

Josh Cole, Grants Director

Grant Recipient Details	
Your name	Tulsi Ram Subedi
Project title	Raptor Migration Study and Conservation Camps Along the Migration Corridor and Wintering Ground in Nepal
RSG reference	14391-2
Reporting period	March 2014 to Feb 2015
Amount of grant	£5990
Your email address	Tulsi.biologist@gmail.com , info@birdsofnepal.org
Date of this report	11-02-2015

1. Please indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Study on total number and species of raptors that migrates along the migration corridor of Thoolakharka Nepal			Fully achieved	An extensive study on migration of raptors in Thoolakharka raptor migration watch site is conducted for 85 days (15th Sept to 8th Dec 2014) and observed total of 9,565 individuals of 32 different species on migration.
Determine the extent, timing and age class migration phenology of the steppe eagle (<i>Aquila nipalensis</i>) and other raptors			Fully achieved	Steppe eagles were categorised into three different age categories: juveniles or 1 st plumage, sub-adults or 2 nd to 4 th plumage and adults or ≥ 5 th plumage. Total of 67% of steppe eagle passing through the watch site were aged during migration study.
Study of resident vulture flock and age structure		Partially achieved		For the Himalayan vulture first plumage and second plumage is very similar. So that it was very difficult to observe details of plumage characteristics on each birds. Therefore we only categorised them as adults and immature (Juveniles+Sub-adults). Most of the Himalayan vulture seen were juvenile and sub-adults birds in Thoolakharka.
Conduct raptor conservation camps in 40 schools along the migration corridor and wintering areas in Pokhara valley, Lumbini and Kapilvastu.			Fully achieved	Total of 40 conservation camps were conducted for 2708 students in Kaski, Lumbini and Kapilvastu.

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled (if relevant).

3. Briefly describe the three most important outcomes of your project.

This project was a part of Raptor Migration Project in Nepal for which preliminary study was conducted in November 2011 and study is continuously conducted in each autumn migration season (September to December) from 2012. In this period we are able to set baseline data for the population trend of several raptor species (more than 35 species) that were observed during the

migration; as well as few resident raptors. We have also collected data on demographic structure of the steppe eagle which is the most numerous seen raptor (somewhere between 6,000 to 10,000 individuals) in our study site. The demographic data will be helpful to predict/analyse status of this eagle species whose population is believed to be declining. Objective wise major achievement and output is summarise below.

Total raptor species and their number:

During our three years of study we have observed and identified total of 37 species of raptors during the migration. If we go through yearly basis, total of 30 species in 2012, 35 species in 2013 and 32 species in 2014 were observed. Except single species (Indian spotted eagle), all other species were recorded in 2013 observation. Similarly in 2013 we also able to photograph shikra *Accipiter badius* in our watch site and which is added on migration list in 2014 that made us 37 migratory species of raptors in Thoolakharka. In 2012 we have counted black kite *Milvus migrans govinda* and black-eared Kite *Milvus migrans lineatus* together, however these two subspecies were split and given the status of separate species. Therefore from 2013 study we have recorded those as a different species. Among the species we observed during our observation; eagles (12 species), falcons (6 species), Accipiter (3 species), Buteo (3 species), kites (2 species), vultures (5 species), harriers (4 species), osprey and Oriental honey buzzard. Detail about the number and species recorded each year is presented below in table 1.

SN	Species	Highest Daily Count	Total Count (2012)	Total Count (2013)	Total Count (2014)
1	Oriental Honey-buzzard	60	381	642	561
2	Himalayan Buzzard	12	180	102	66
3	Long-legged Buzzard	3	4	11	3
4	Upland Buzzard	2	4	8	7
	<i>Unidentified Buteo</i>	1	3	3	2
5	Northern Sparrowhawk	7	107	110	103
6	Northern Goshawk	4	3	10	15
7	Shikra	2	---	---	13
	<i>Unidentified Accipiter</i>	1	9	1	3
8	Steppe Eagle	1,102	6,597	8,684	6,166
9	Booted Eagle	15	155	109	118
10	Short-toed Eagle	1	2	2	0
11	Crested Serpent-eagle	4	26	5	6
12	Pallas's Fish Eagle	1	2	1	2
13	White-tailed Eagle	1	0	2	0
14	Imperial Eagle	2	0	1	3
15	Indian Spotted Eagle	1	3	0	0
16	Greater Spotted Eagle	1	3	2	0
17	Bonelli's Eagle	8	13	30	23
18	Mountain Hawk-eagle	4	1	6	9
19	Golden Eagle	1	7	4	3
	<i>Unidentified Eagle</i>	1	8	2	1
20	Black Kite	40	324	356	287

21	Black-Eared Kite	25		153	110
22	Osprey	2	3	5	2
23	Hen Harrier	4	19	9	19
24	Western Marsh Harrier	1	0	1	1
25	Pallid Harrier	2	1	2	2
26	Pied Harrier	1	0	1	0
	<i>Unidentified Harrier</i>	1	3	0	4
27	Peregrine Falcon ssp. <i>calidis</i>	3	29	18	16
28	Saker Falcon	3	5	1	1
29	Northern Hobby	33	80	211	100
30	Amur Falcon	24	78	90	20
31	Lesser Kestrel	29	66	69	22
32	Common Kestrel	29	83	318	197
	<i>Unidentified Falcon</i>	2	21	14	17
33	Egyptian Vulture	6	24	40	19
34	White-rumped Vulture	17	0	127	138
35	Himalayan Vulture	221	1,270	2,215	1,415
36	Cinereous Vulture	11	73	57	47
37	Griffon Vulture	14	85	44	25
	<i>Unidentified Vulture</i>	1	3	1	0
	<i>Unidentified Raptor</i>	3	79	18	19
	Total	1,238	9,754	13,485	9,565

Table 1: Raptor species identified and number counted at Thoolakharka watch site (Nepal), 15th September through to 4th December 2012 and 15th September through to 8th December 2013 and 2014 including highest daily count and unidentified raptors. The total comes from daily observations made of migrants heading east to west by Tulsi Subedi, Sandesh Gurung and others.

Timing and migration phenology of Steppe Eagle and other raptors

During autumn migration study (15th September through to 8th December) in 2014 steppe eagles were the common migrant in Thoolakharka raptor migration watch site and counted 6,166 which is the lowest number recorded in our study since 2012 (6,795 in 2012 and 8,684 in 2013). In 2014 first date of the steppe eagle arrival in Thoolakharka was 3rd October which was 2 days earlier than in 2012 and 4 days earlier than in 2013 study, in all years of study Steppe Eagle migration was continued till the last date of observation (8th December). Thus we believe steppe eagle has the longest migration period among all the raptor species seen in this watch site. The highest single day Steppe Eagle count was on 7th November 2014 – 614 individuals passed by the watch site, while the peak date was 3rd November 2012 (572 birds) and 20th November 2013 (1102 birds).

During the peak day of steppe eagle migration in 2014 we recorded 2 to 6 km/hr of wind from north-west to east with 50 to 100% cloud cover, while in 2012 we observed 4 to 9 km/hr of south to south-east wind with no cloud which pushed the birds towards north very close to the Himalayas approximately 20 km from us, while in 2013 we observed 2 to 5 km/hr of wind from north-east with 20 to 100 % of cloud cover. Therefore it is very difficult to conclude the local weather condition associated with peak migration of steppe eagle from the 3 years of study and we assume the peak migration could be associated with the overall regional weather condition of the Central-South Asian Flyway. Figure 1 below shows the migration pattern of steppe eagle observed in our study.

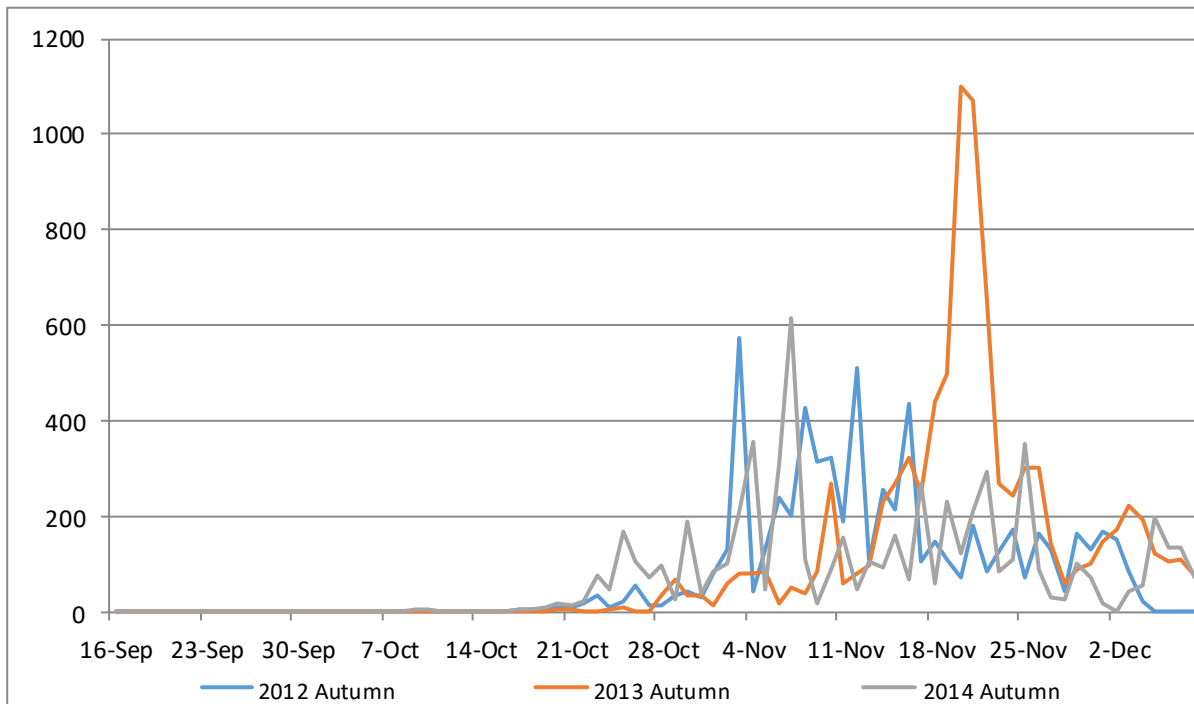


Figure 01. Migration pattern of steppe eagles (2012 to 2014) autumn in Thoolakharka Raptor Migration Watch Site Nepal.

In our studies from 2012 steppe eagles passed us from the reasonable distance so that we could age most of the individual eagles and approximately 67% (4128) in 2014, 57% (4967) in 2013 and 60% (3956) in 2012 were aged. In our study migration of juvenile steppe eagle was found greatly outnumbered by adults and sub-adult birds. Figure 02, 03 and 04 below shows the age composition and migration timing of different age group.

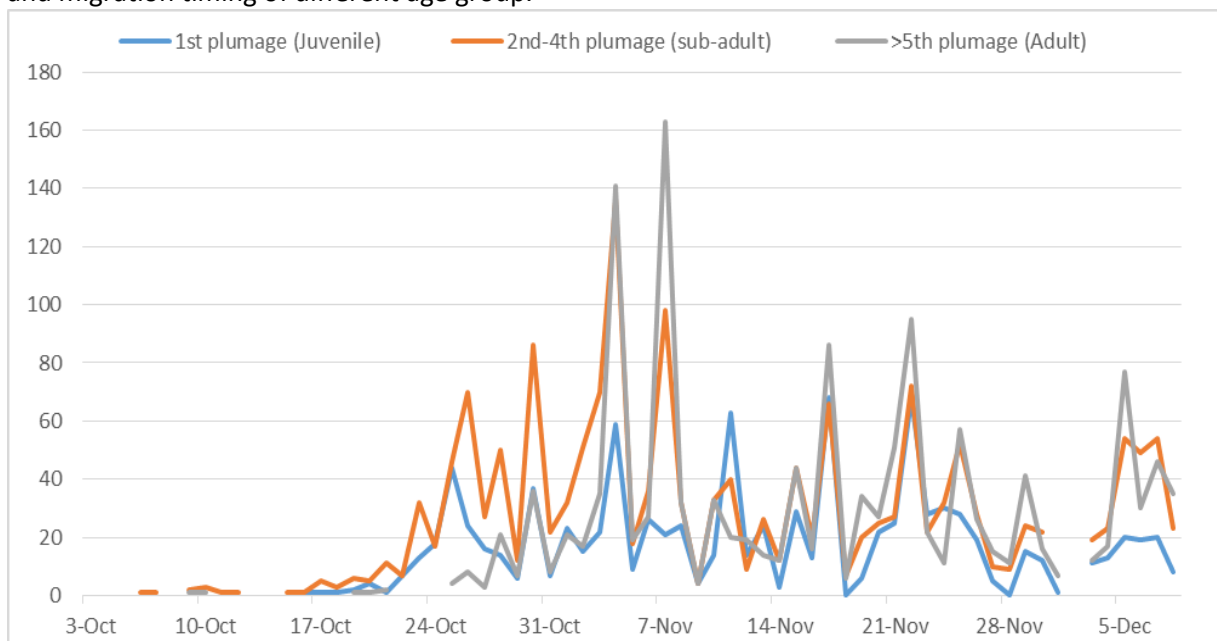


Figure 02. Age composition of steppe eagles on daily basis crossing the raptor migration watch site at Thoolakharka, Nepal 2014 (n=4128) autumn

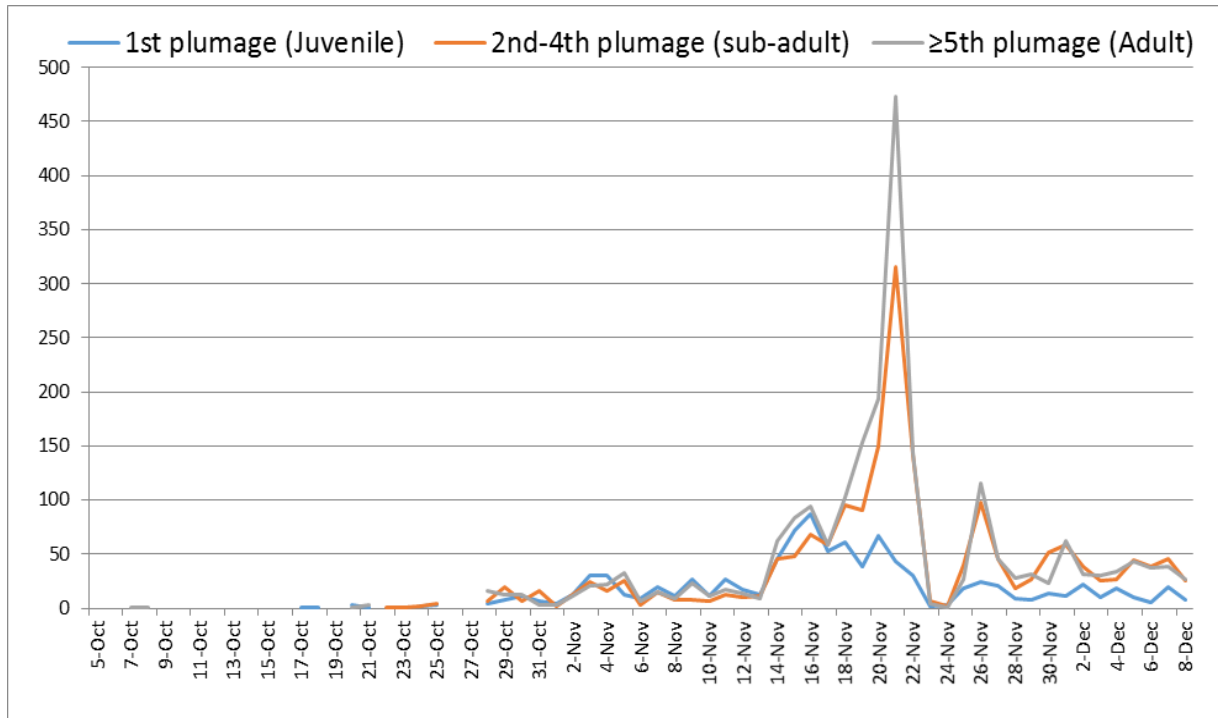


Figure 03. Age composition of steppe eagles on daily basis crossing the raptor migration watch site at Thoolakharka, Nepal 2013 (n=4967) autumn

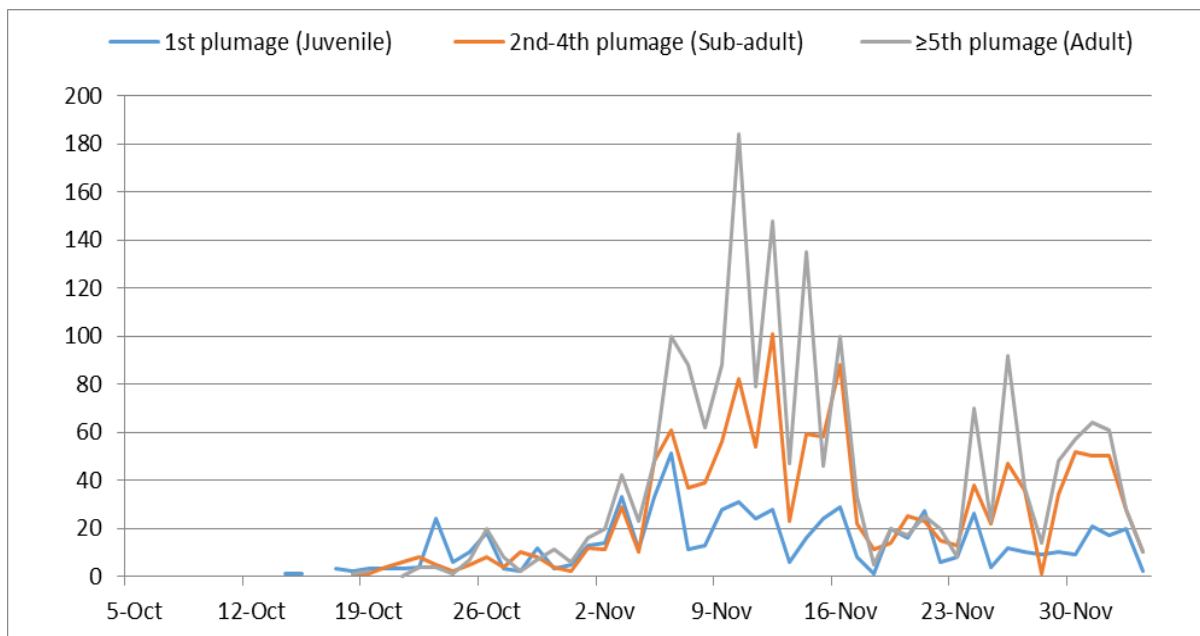


Figure 04. Age composition of steppe eagles on daily basis crossing the raptor migration watch site at Thoolakharka, Nepal 2012 (n=3956) autumn.

During our study the ratio of 1st plumage (juvenile) birds was seen higher during the beginning of migration for 2012 and 2013, while 2nd to 4th plumage (sub-adults) birds was seen in higher

proportion on 2014 migration season. According to our observation median date for juvenile birds was 15th November, sub-adult was 18th November and for \geq plumage (adults) was 19th November. T-test was done to find out is there significant different on the timing of migration of different age class. For this test our assumption was; there is no significant difference between migration timing (date) of different age group of steppe eagle during autumn migration so we set the null hypothesis (H_0) as there is no significant difference on the time (date) and age of migrating steppe eagles in autumn migration. T-test was conducted between different age categories; for juvenile and adults migration date; t-test rejects the null hypothesis ($t=3.55$, $df=83$, $p=0.0006$) which indicates there is statistical significant difference on the migration date of juvenile and adult steppe eagle. For sub-adult and adult migration date; t-test can't rejects null hypothesis ($t=0.72$, $df=119$, $p=0.47$) which indicates there is no statistical significant difference on the migration date of sub-adults and adults steppe eagles. Similarly for juvenile and sub-adult; t-test rejects null hypothesis ($t=3.64$, $df=98$, $p=0.0004$) which indicates there is statistical significant difference on the migration date of juvenile and sub-adult steppe eagle. From the above statistical test it is concluded that juvenile birds proceed their migration earlier than adults and sub-adult steppe eagle while sub-adults and adults may proceed the migration during the same time of the year.

We also assume there is similar pattern (date) of steppe eagle migration for year to year. For this ANOVA test was conducted and null hypothesis (H_0) was set up as there is similar date of migration of steppe eagle for year to year (2012, 2013 and 2014) during autumn migration. ANOVA test can't rejects null hypothesis ($F=0.96$, $df=196$, $p=0.38$) and statistically proven there is no yearly significance difference on migration date of steppe eagle between 2012 to 2014.

In all 3 years of study higher number of steppe eagles were seen in the afternoon hours, and 14h00-15h00 time frame was the peak time/hour to see migration through the season 2012 and 2013 however in 2014 peak time for the steppe eagle passage was seen between 10h00-11h00 which was followed by 14h00-15h00. In average only 32.55% of steppe eagles passed before noon (between 07h00 – 12h00) and 67.45% were passed after noon (between 12h00 to 17h00). This likely has to do with the way clouds build over the nearby Annapurna Range, so that the eagles shift their migration to the south, particularly if there is a light to moderate wind from the northeast. In 2014 southerly moist air was hitting Thoolakharka raptor migration watch site and just over the watch site that meet the cold air from the north and cloud formed. This cloud often obscured the views to the south valleys. We assume there might be a continuous movement of the eagles over the south valley, we couldn't see those. Detail about the daily migration timing of the steppe eagle is given in the figure 05.

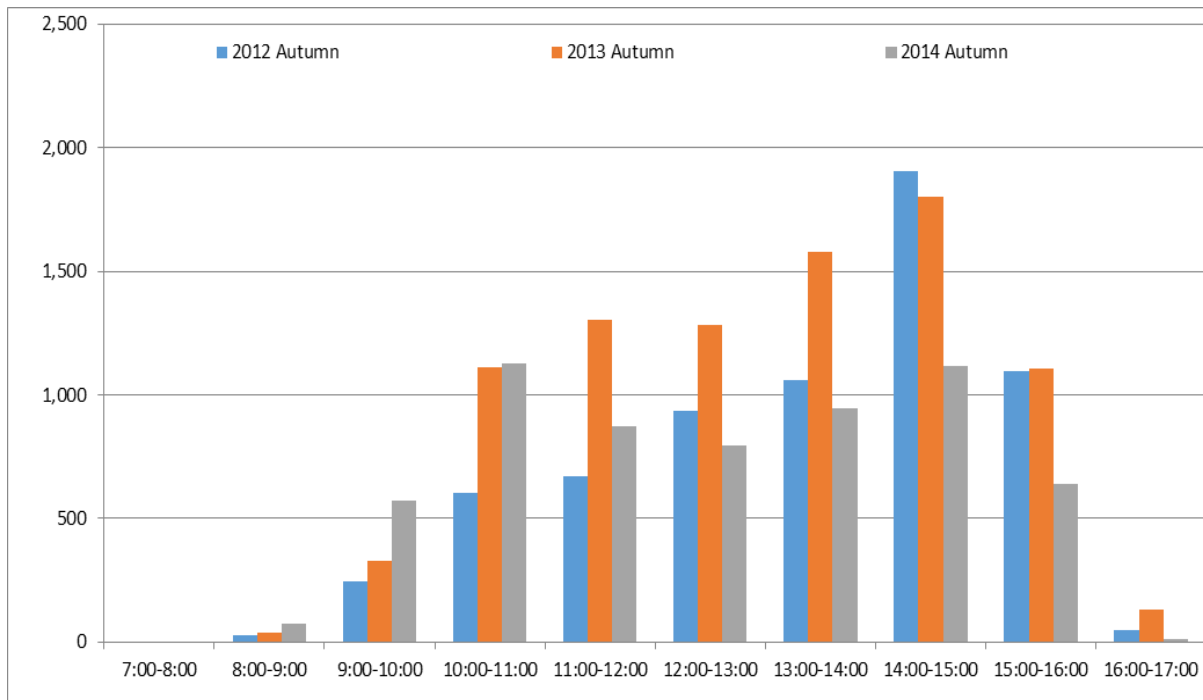


Figure 05. The number of Steppe Eagles on migration counted per hour at Thoolakharka, Nepal (autumn 2012 to 2014).

Status and timing of migrant vulture:

Of the nine vulture species found on the Indian sub-continent including Nepal, eight species have been observed at Thoolakharka watch site. Out of these species five species were migratory: white-rumped vulture (*Gyps bengalensis*), Egyptian vulture (*Neophron percnopterus*), cinereous vulture (*Aegypius monachus*), griffon vulture (*Gyps fulvus*) and Himalayan vulture (*Gyps himalayensis*). Three other species: bearded vulture (*Gypaetus barbatus*), red-headed vulture (*Sarcogyps calvus*) and slender-billed vulture (*G. tenuirostris*) were strictly resident in the region. In this study, the most common vulture species seen (> 85% of all migrating vultures) was the Himalayan vulture with 1270 individuals in 2012, 2,215 individuals in 2013 and 1,415 in 2014. Figure 06 shows their migration through the season with the latter half of November through early December being the peak period. However, flocks of resident vultures were seen throughout the study. To test statistical significance for the number of Himalayan vulture migration on different date, null hypothesis (H_0) was Himalayan vulture had similar migration date in every year of the study. ANOVA test can't reject the null hypothesis ($F = 2.58$, $df = 205$, $p = 0.07$) and which statistically proven there is no yearly significance difference on migration date of Himalayan vulture between 2012 to 2014.

According to Figure 07, most of the vultures (of all species) we saw on migration were observed from 10am through 3pm (10h00 – 15h00). Compared to the pattern of steppe eagle migration, greater percentage of vultures passed earlier in the day. However for both eagles and vultures, 14h00 – 15h00 time frame was the peak hour of migration in 2012 and 2013 and it was 10h00 – 11h00 in 2014.

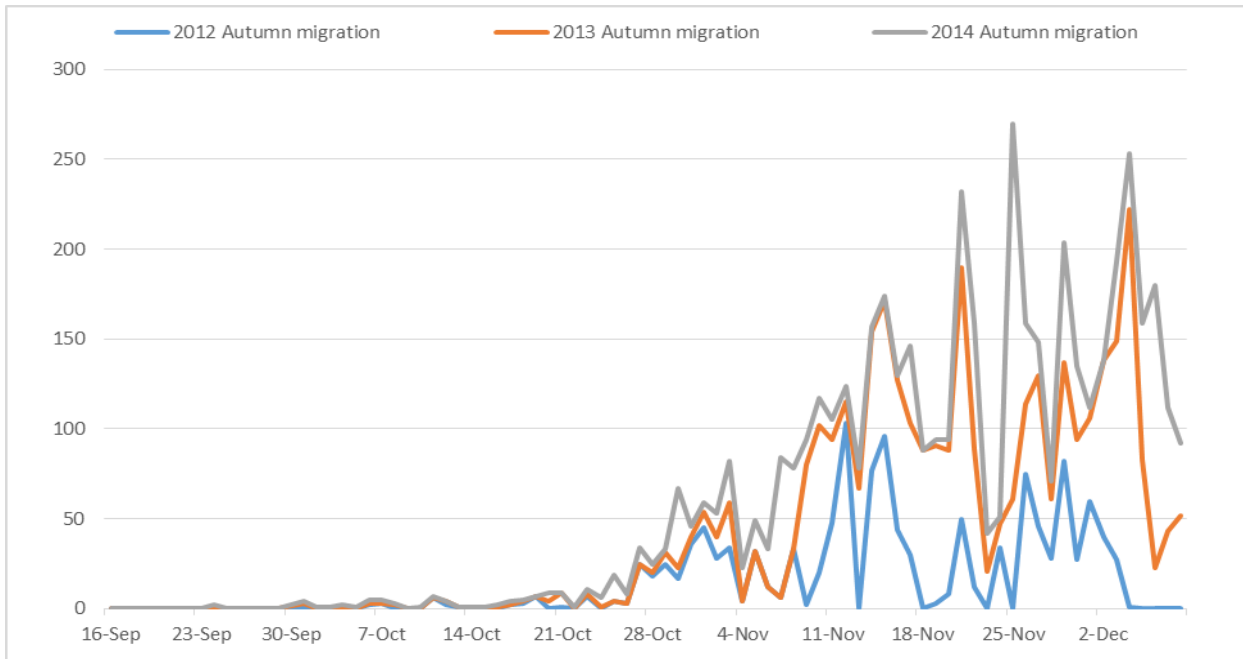


Figure 06. The number of migrating Himalayan vultures counted per day in autumn 2012 to 2014 at the Thoolakharka Migration Watch site in Nepal.

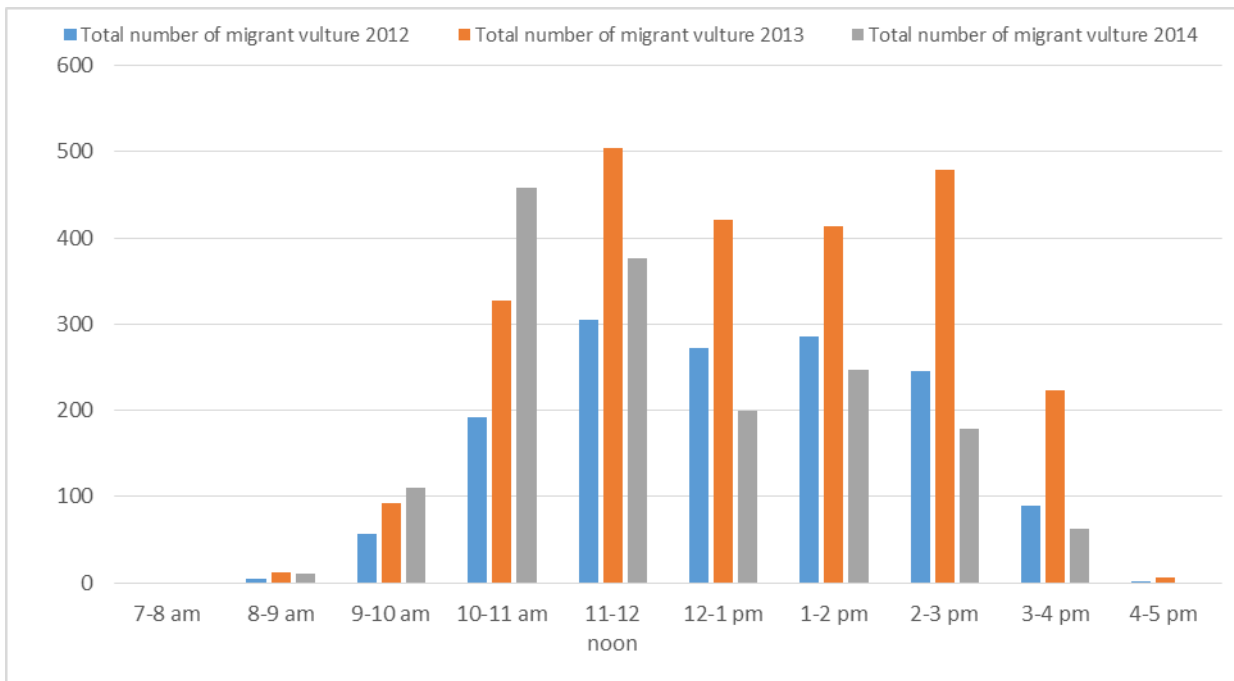


Figure 07. The total number of *all* migrating vultures counted per hour during autumn 2012, 2013 and 2014.

Resident vulture flock size:

In Thoolakharka three species of vulture seen red-headed, slender-billed and bearded vulture were strictly residentially and seen throughout the season, while white-rumped, Himalayan and Egyptian vulture were partial migrants. Among all the species vast majority of the vulture seen were Himalayan vulture (juveniles and sub-adults). Highest flocks of the vultures seen were between

10h00 to 14h00 in both years (Fig 08). In 2014 total of 47 resident vulture flocks were seen while the number of flocks were 178 in 2012 and 135 in 2013.

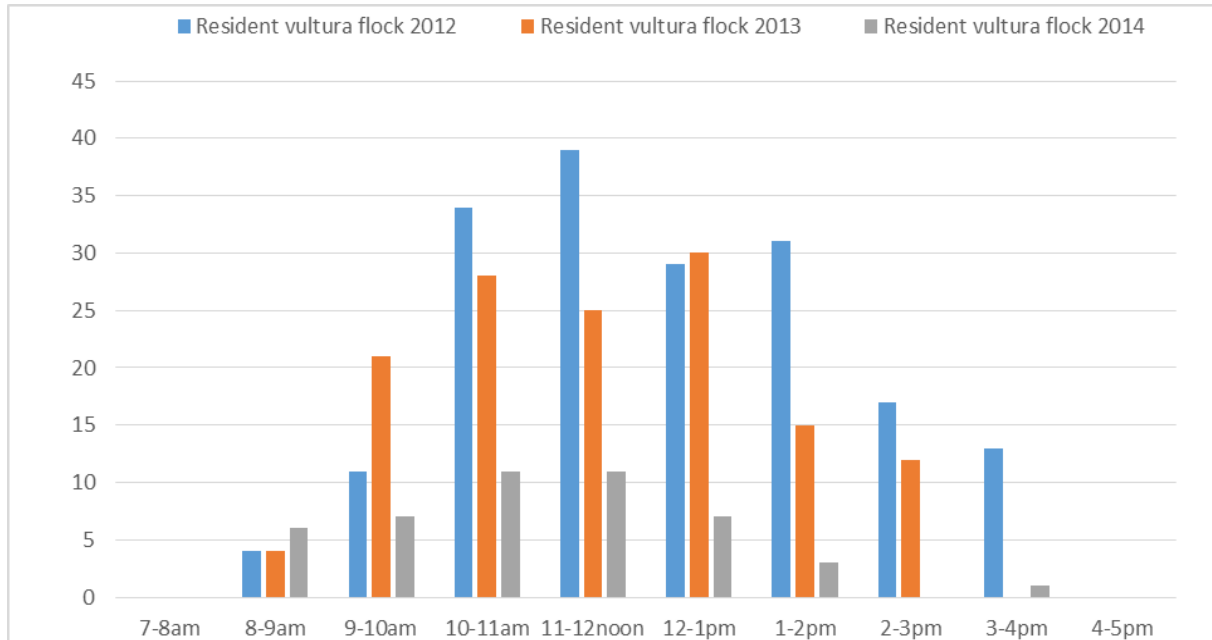


Figure 08. Total resident vulture flocks counted per hour in Thoolakharka watch site in 2012, 2013 and 2014 study.

Raptor Conservation Camps:

Raptor conservation camps were conducted in total of 40 schools (20 schools in Kaski, 10 in Lumbini and 10 in Kapilvastu) and covered 2708 students. Besides the conservation camps two events of essay competition, one event of drawing competition and one event of quiz competition were also organised. Conservation camps were supported by the several flex banners produced for the programme as well as multimedia projector whenever possible.

4. Briefly describe the involvement of local communities and how they have benefitted from the project (if relevant).

During the project implementation phase, University students were involved in the conservation camps and migration study. Three months of extensive field study training was provided to Mr. Sandesh Gurung who is doing Master Degree in Zoology. He is now capable for the future work on raptor conservation and research in Nepal. Beside this few graduate students from university and local youths were also involved in the migration study who learnt basics on raptor migration and capable of identify few species of raptors. During the migration studies more than 70 international hawk watcher were visited the site in 2014. Hawk watchers visited here also used many local peoples as a porters. They stayed approximately from one week to one month in local hotels near to the raptor migration watch site. Therefore this study also helped on the growth of local economy.

5. Are there any plans to continue this work?

Several studies indicate the population of raptors is declining and 41% of raptors in Nepal are nationally or globally threatened. Population decline on the vulture and effect of diclofenac is well documented since early 2000. Recently two more vulture (Himalayan and bearded) are up listed as Near Threatened species due to their moderate population decline over last few years. Therefore long term study of raptor population from the migration corridor will give an idea on the demography of each species and regional population trend. For this I have a plan to continue migration study for several years. Beside the migration counting it is necessary to know about the movement pattern of several species and proximate cause of decline based on movement ecology. Therefore my next plan is study on movement ecology of few species including bearded vulture, Himalayan vulture and steppe eagle.

6. How do you plan to share the results of your work with others?

The research activities and preliminary findings have been published on several national and local print media and radios including BBC Nepali service. To share the research updates/findings we have used blog (<http://raptorsofnepal.blogspot.com/>) and social media (<https://www.facebook.com/raptorsofnepal>). Previous years of studies were presented on “I Worldwide Raptor Conference” in Argentina and “8th Asian Raptor Research and Conservation Network (ARRCN) Symposium” in India. Presentation of the updated research result will be done at scientific conferences (Planning for 9th ARRCN Symposium – October 2015 in Thailand) and articles will be published in scientific journals like Forktail, Birding Asia and Journal of Raptor Research.

7. Timescale: Over what period was The Rufford Foundation grant used? How does this compare to the anticipated or actual length of the project?

The project was planned for one year (March 2014 to February 2015) period. First part of the project was mainly focused on conservation camps and which was completed in May 2014 and which was according to the plan mentioned in the proposal. Second part of the project was extensively focused on research (migration study) from 15th September till 15th December. Field research was started from 15th of September and continued till 8th December. In the previous year we had a trend to wrap up migration count from 8th December and same protocol was followed in this year of study. So the actual field length was 7 days earlier than proposed time.

8. Budget: Please provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Transportation	600	500	100	
Intern cost	1200	1200	0	
Field accommodation	780	680	100	
Food cost	1290	1140	150	
Educational poster/banner and print	120	150	-30	flex design

Expenditure for Conservation camps	2000	2200	-200	
Camera equipment purchase (Canon 7d Used)	0	260	260	Camera equipment is very useful tool for the correct identification of confusing raptors through the study of picture. Therefore Canon 7D was purchased using some surplus amount.
Total	5990	6130	-140	

9. Looking ahead, what do you feel are the important next steps?

Two sites in Nepal are recognized as globally significant raptor migration corridors. However according to the information we get from different birdwatchers, there might have additional potential migration study sites and it is necessary to cover those areas. It is not known from where these birds return in spring. Is there any spring migration sites in Nepal or do they follow same route as in autumn migration? In the present situation these questions are unanswerable. Therefore I think it is very important to conduct some research during spring migration as well. Little is known about the migration route and wintering areas of eastern race of steppe eagle *Aquila nipalensis nipalensis*, also it is believed bearded vulture *Gypaetus barbatus barbatus* is altitudinal migrant and little is known about the movement ecology of this elegant species therefore it is important to do in-depth study on these species through the use of satellite telemetry.

10. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the RSGF receive any publicity during the course of your work?

For the conservation camps we have designed and printed flex banners to use during the presentation and Rufford Foundation logo was used there.

11. Any other comments?

Raptor migration research in Nepal is now marketed throughout the world and there is growing interest of many peoples to participate on research activities. In past years of studies many peoples from several countries of the world have already visited this study site and directly involved in the research activities. Based on the research and conservation work on raptor migration, I have now received the USM-TWAS 2014 PG Fellowship Award for PhD studies on movement ecology of Bearded Vulture in Annapurna Range of Nepal. My study will be starting from September 2015. I believe this award will help me to use new technologies for the raptor migration study in Nepal.