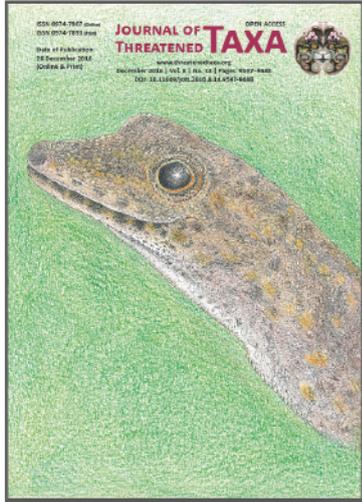


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Journal of Threatened Taxa

The international journal of conservation and taxonomy

www.threatenedtaxa.org

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

COMMUNICATION

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26 December 2016 | Vol. 8 | No. 14 | Pp. 9638–9642
10.11609/jott.2205.8.14.9638-9642



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POPULATION STATUS, DISTRIBUTION AND POTENTIAL THREATS OF THE BLUE BULL *BOSELAPHUS TRAGOCAMELUS* (MAMMALIA: CETARTIODACTYLA: BOVIDAE) ALONG THE TINAU RIVER OF RUPANDEHI DISTRICT, NEPAL

OPEN ACCESS



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Abstract: The status and conservation of the Blue Bull *Boselaphus tragocamelus* is becoming one of the prominent discourses of wildlife research. The study was carried out along the Tinau River at Rupandehi District in western Nepal to ascertain the population status, distribution and potential threats to the Blue Bull. The study was conducted along six transect lines in the forest. A total of 40 Blue Bulls were recorded in different transects. The average group size was five. The average population density was 0.228 Blue Bulls per ha and the sex ratio was 1 male: 3 females. The potential threats of the Blue Bull along the Tinau River were habitat destruction, overgrazing, conflict, flooding and accident.

Keywords: Blue Bull, conflict, conservation, distribution, riverside forest, threats.

DOI: <http://dx.doi.org/10.11609/jott.2205.8.14.9638-9642>

Editor: L.A.K. Singh, Bhubaneswar, Odisha, India.

Date of publication: 26 December 2016 (online & print)

Manuscript details: Ms # 2205 | Received 14 August 2015 | Final received 27 November 2016 | Finally accepted 01 December 2016

Citation: Aryal, M., S. Panthi, M. Bhatta, T.P. Magrati, A.K. Shrestha, P.B. Shrestha & A. Karki (2016). Population status, distribution and potential threats of the Blue Bull *Boselaphus tragocamelus* (Mammalia: Cetartiodactyla: Bovidae) along the Tinau River of Rupandehi District, Nepal. *Journal of Threatened Taxa* 8(14): 9638–9642; <http://dx.doi.org/10.11609/jott.2205.8.14.9638-9642>

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Funding: No funding was available for this study.

Conflict of Interest: The authors declare no competing interests.

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Author Contribution: MA - Data collection; SP - Data analysis and manuscript preparation; MB, TM, AKS, PBS - Manuscript editing; AK - Data analysis.

Acknowledgements: We thank Dr. Narendra Man Babu Pardhan of Bird Conservation of Nepal, Kathmandu, Nepal, Dr. Naresh Subedi of National Trust for Nature Conservation, Lalitpur, Nepal and Mr. Mahendra Sapkota in terms of their support to carry out this study. We also thank Dr. Achyut Aryal (Sydney University, Australia) for his guidance in completing this study.



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INTRODUCTION

The Blue Bull is the largest antelope of Asia. It is the only species in the genus *Boselaphus* (Leslie 2008). Walker (1968) reported that an average adult Blue Bull weighed 200kg. The weight of the adult male ranges from 130–140 kg (Prater 1948; Walker 1968).

The Blue Bull is endemic to the Indian peninsula, from the base of the Himalaya in the north down to the state of Karnataka in the south. The Blue Bull has also been reported in Pakistan, mainly along the border with India (Roberts 1977) and in Nepal (Subedi 2001). Blue Bulls are found near human settlements and crops and fields outside the protected areas. They are found in a variety of habitats, from level ground to undulating hill, thin bush with scattered trees and cultivated plains but are not found in dense forests and steep slope (Blanford 1888; Prater 1948).

In Nepal, Blue Bulls were distributed in open vegetation types especially in the districts of Rupandehi and Kapilbastu (Aryal 2007). Subedi (2001) estimated that there are 241–338 number of Blue Bulls in the whole of Nepal.

According to Aryal (2007) the sex ratio of male and female was 2:3 in Lumbini Development Trust areas in the Lumbini region. Aryal (2007) further reported that the Blue Bull numbers were much reduced even in Lumbini as well as surrounding areas due to habitat destruction and lack of food. Estimation of population of Blue Bull outside the protected areas is more difficult.

According to local people, some decades ago, the population of Blue Bulls was stable in Tarai but during 1998–2000, there was a drastic increase in the deaths of Blue Bulls, which could have been caused by the foot and mouth disease (FMD) (Aryal 2007). Two blood samples were taken during the translocation to Banke forest in 1998 which showed signs of FMD (Subedi 2001). Also the farmers would have killed the Blue Bulls when the animals raided agriculture crops. Another factor for the drastic decline of the Blue Bull population was poisoning and revenge killing by farmers (Aryal 2007). The pressures of overgrazing, agriculture expansion, intensification in human population and infrastructure development have contributed to perpetual habitat degradation and fragmentation. The livelihood of the majority of the Nepalese people still depends on forest product and ecosystem service. Unsustainable use of forest creates negative feedback loops to create unsustainable livelihood.

MATERIALS AND METHODS

Study Area

Tinau is one of the major Rivers of western Nepal which originates from Palpa and Rupandehi districts of the western development region of Nepal. The width of the river ranges from 200–700 m. The study area extends from an elevated latitude in the north and tangled longitude in the east. It covers a total core area of 175km² (Fig. 1). In the western parts of the river, there are Motipur Village Development Committee (VDC) and Sau Farsatikar VDC having six community forests and in the eastern part of River there is Anandaban VDC having two community forests. The study area is rectangular in shape which is approximately 200–700 m wide and on average 10km long on both sides of forests on the river. The elevation ranges from 75–110 m. Finally, the river reaches the Indo-Nepal border at Marchawar region of Rupandehi District (Subedi 2001). Barking Deer, Wild Cat, Blue Bull, Common Leopard, Jackal and a variety of birds are common fauna of this area.

The whole forest region has almost the same type of vegetation on both sides of the Tinau River. Particularly in the western part of the river, the forest adjoins agriculture land and village settlements (<500m far from the forest). In the western region of Tinau River region there are six community forests (CF), namely, Niyantaran CF, Dhandapur CF, Sauraha CF, Sauraihiya CF, Betani CF and Charpala CF. In the eastern part of the river there are two CFs namely, Shankarnagar and Anandaban.

Status and Distribution

An estimation of the population status of the Blue Bull in potential areas was carried out by direct observation. Animals were counted during the morning 06:00hr–10:00hr and in the afternoon 16:00hr–19:00hr from six transects. We walked only one time in each transect. Our transect line areas were far apart from each other to avoid repetition of recording of the same individuals. All tracks of animals were followed to find out the presence or absence of signs of the Blue Bull. Major waterholes were searched to find out indirect marks of the Blue Bull.

Observations were made from wildlife view-towers and hidden points in bushes and trees in potential areas to avoid direct disturbance to the animals. Distribution patterns were determined on the basis of direct observation, presence of dung, tracks and information from interviews with key informants who represented community forest members, labour and focus farmers. GPS points of the Blue Bull distribution area were

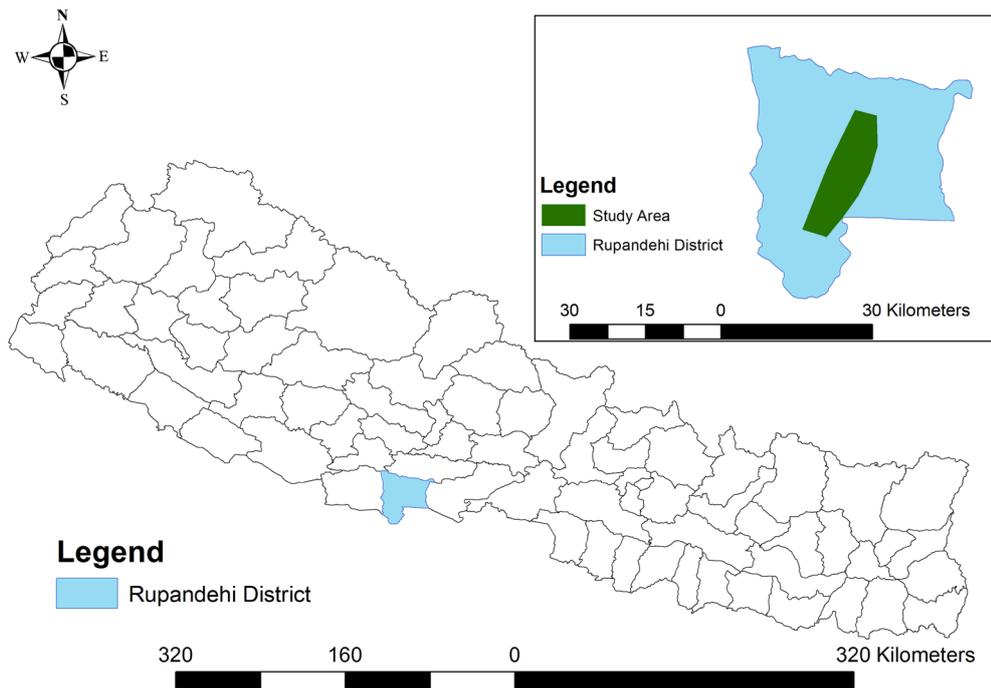


Figure 1. District map of Nepal showing the study area in Rupandehi District.

entered in digitized 1996-Year Topographical map of the study area. Distribution map of this species was prepared by using Arc GIS 10, image of Google earth and ground truth GPS points.

The distribution pattern of Blue Bull was calculated by variance (S^2) to mean (X) ratio (Odum, 1996).

If $S^2/X < 1$; distribution pattern is uniform;

If $S^2/X = 1$; distribution pattern is random; and

If $S^2/X > 1$; distribution pattern is clumped.

A chi-square (λ^2) test was performed by setting the null hypothesis (H_0), that the species were uniformly distributed in all habitat types in the study areas. The hypothesis was tested at 5% level of the significance.

$$\text{Chi-square } (\lambda^2) = (O-E)^2/E$$

Where, O= Observed frequency and

E= Expected frequency

Potential threat to Blue Bulls

The potential threats were listed out through field visits, interview with key persons and focused group discussion. The questionnaires were developed, considering the nature of study and literature review. We took 10m X 10m plot to analyze the status of forest where Blue Bulls were recorded. The status was either 'in good condition' or 'degraded'. Around such occurrence zones and at 500m in random directions we also marked 10m x 10m 'absence plots' to record information on the

status of the forest as 'good' or 'degraded'. We analyzed the correlation of presence of the Blue Bull and the forest condition.

RESULTS

Blue Bull population and distribution

The Blue Bulls were recorded in well-separated six transect lines covering Charpala, Sauraha, Saurahiya, Dhanapur and Anandaban CF (Image 1). The maximum number ($n=12$) of animals were seen in Charpala CF. A total of forty individuals were recorded during the study. The population density was 0.228 individuals per hectare (Fig. 2 & Table 1).

Most of the Blue Bulls were found in Charpala, Betani and Saurahiya CFs on the western part of Tinau River and Anandaban CF on the eastern part of the river (Fig. 2). The habitat comprises abundant grasslands and open forest with less disturbance of any kind due to industry or human activity.

We found 1.54 variance mean ratio so the population distribution of the Blue Bull was clumped. We verified the distribution pattern of this species with Chi-square test and ensured that distribution of this species was clumped (calculated value= 13.6, tabulated value =1.145 at 5% level of significance) (Fig. 2).



Image 1. Blue Bull inside Tinau forest

Table 1. Population of Blue Bull along the transect lines

Transect line	Observed value (O) [Total number of Blue Bull per transect]
1	8
2	4
3	3
4	7
5	12
6	6
Total	40

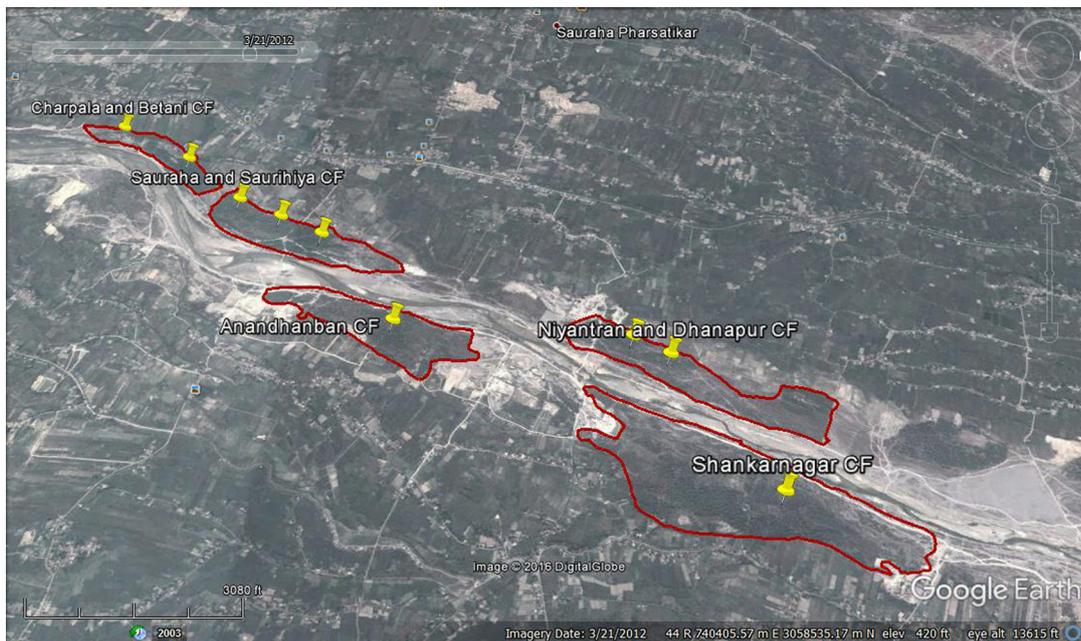


Figure 2. Distribution of Blue Bull in study area

Group Size

The group size of our study animals ranged from 3–12 individuals. The average group size was estimated to be five animals per group. Large groups with 12 animals were recorded in Charpala CF during the study.

Sex Ratio

Out of 40 animals recorded during the study four individuals were male, 12 were female and others remained unidentified. The sex ratio among identified animals was male: female: 1:3.

Potential Threats

Forest Degradation: Forty Blue Bulls were recorded at nine points. Only three observations were made in degraded forests area. The observation of this species

and degraded forest area were negatively correlated (coefficient of correlation = -0.57). The pressures of overgrazing, agricultural expansion, intense density of human population and presence of major infrastructure are noticeable factors that have contributed to habitat degradation and fragmentation in the region.

Human-Wildlife Conflict: People living on the fringes of the Blue Bull habitat often came in close interface and suffered crop damages. These conflicts have bred hostility towards the Blue Bull leading to retaliatory killings on many occasions. The knowledge of local farmers and direct observation during field study were used to recognize damage caused by the Blue Bull from that of other animals. The largest quantity of damage was caused to pulses (45%) followed by maize (31.1%) (Fig. 3). The destruction of paddy and other crops by the

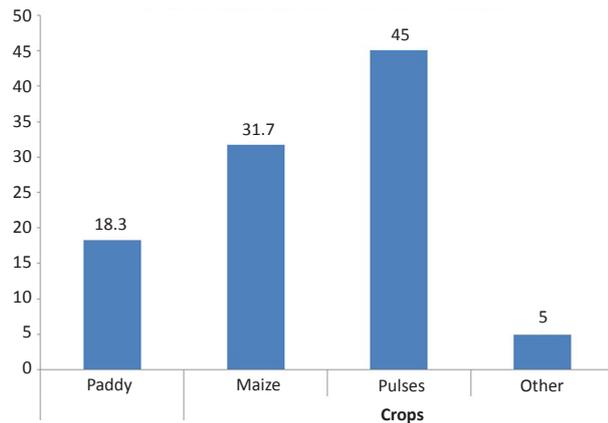


Figure 3. Crops damaged by the Blue Bull (in percent)

Blue Bulls were 18.3% and 5%, respectively. It implied that the Blue Bulls preferred pulses and maize over paddy and other agricultural crops.

DISCUSSION

The Nilgai is rarely consumed by Hindus due to its religious significance; its Hindi name means 'blue cow' so its population is in stable (IUCN 2016). Habitats of the Blue Bull have been reported as decreasing in many parts and it seems also true in the Lumbini region (Aryal 2007). Presently, the Blue Bull in Nepal is found in different areas including Rupandehi District (Subedi 2001), though the statistics on population is not clear. The increase in the population of Blue Bull justify that the Tinau River of the region is a potential habitat for the Blue Bull. The trends of overgrazing, agriculture expansion, human population growth and development of infrastructure like some stone crushing units were responsible for the destruction of habitats of the Blue Bull along the Tinau River. Water logged area was itself a major site for grazing with domestic animals.

The population of Blue Bull was declining from the Terai Arc landscape due to hunting and habitat destruction (Aryal 2007). Cemented pole of some of community forests boundary caused unexpected death of this species during the night time. During the rainy season, chances were high for Blue Bulls being swept away, especially the calves.

CONCLUSION

In this study Blue Bulls were observed mainly in patches of grassland inside the forest along side the River Tinau in Rupandehi district of western Nepal. Habitats of the Blue Bull are close to human settlements and the animals damage crops. They usually came out in agriculture land of villagers during morning and evening.

Population of Blue Bull species inside the forest was at risk as no specific appear targeted towards Blue Bull conservation. The impact of overgrazing by domestic livestock inside the forest has resulted in degradation of quality and species composition of grass and other vegetation leading to their limited availability to Blue Bull in the study area. The Blue Bulls move in search of food to outer environment which create increasing conflict with villagers. Traditional agriculture practices and growing human population were major causes of land encroachment and factors limiting the forest areas and hampering the nature corridor for movement of Blue Bulls.

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ISSN 0974-7907 (Online); ISSN 0974-7893 (Print)

December 2016 | Vol. 8 | No. 14 | Pages: 9597–9688
Date of Publication: 26 December 2016 (Online & Print)

DOI: 10.11609/jott.2016.8.14.9597-9688

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