

TITLE

Population abundance of Royle's pikas (*Ochotona roylei*) along altitudinal gradients in Langtang National Park, Nepal

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ABSTRACT

The study on population abundance of pikas was carried out in Langtang National Park from June, 2011 to January, 2014. Six field works were carried out representing different seasons. The evidence of pika presence was recorded at 3005 masl as lowest elevation. Population abundance was studied categorizing study area into three habitats: forest area, subalpine area and alpine talus. Total 373 pika individuals were observed. Its population abundance was higher in summer than winter. The average density of pikas was 8.98 individual per hectare. Subalpine area had the highest average population density of pikas (12.8/hectare) and the least was in the forest habitat and its edged area (4/hectare). Population abundance of pika in Langtang is decreasing. Pika habitat were shifted upward that shows either location extinction or migration at lower elevation.

Keywords: Altitudinal, Density, *Ochotona roylei*, Population.

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INTRODUCTION

All species of *Ochotona* are remarkably homogeneous in general morphology and body mass (Formozov, 1981; Smith, 1998). Pikas are small mammals related to rabbit and hare that inhabits in rocky talus field in alpine area (Kawamichi, 1968; Kawamichi, 1971). Pikas are fairly uniform in size with body mass ranging generally from 70g to 300g among the species. There is little sexual dimorphism in pika species (Hoffmann and Smith, 2005). The fur coloration of large eared pika (*Ochotona macrotis*) in Langtang vary according to season (Koju et al., 2012c). The fur colour of juveniles are brighter in comparison to adult (Koju et al., 2013a). Its body length range from 150 – 200 mm and the diameter of head of 7 cm are found at 2800 masl to 5000 masl (Fedosenko, 1974; Formozov, 1981). They are small, oval shaped animals with prominent round ears and without external tail.

Pikas have been recorded from mountainous areas within the habitat range of Rhododendron and Oak Forest, Fir and Hemlock Forest, Rhododendron and Juniper Forest to shrubby and alpine meadows. Pikas were seen in agricultural fields, Kharkas (rangelands and pasturelands), and steep slopes to igneous rocks (Kawamichi, 1968). The distribution of pika directly depends on the availability of forage plants species (Kawamichi, 1968; Bhattacharya et al., 2009). Pikas in Langtang were not observed below 3000 masl (Koju et al., 2012a). They were under threat due to pollution around Gosainkunda Lake premises (Koju et al., 2013b). Five species of pikas are reported from Nepal (IUCN, 2010). There are two species of pikas in Langtang (Kawamichi, 1968; Koju et al., 2012a): *Ochotona roylei* and *Ochotona macrotis*. The main objective of this study was to explore the population abundance of Royle's pikas along altitudinal gradient in different seasons.

METHODS

The study was done in Langtang National Park (LNP) that is located in the central Himalayas of Nepal between 85°15' E to 86°0'E and 28°20'N to 28°32'N. Pikas abundance observations were performed standing at vantage point. This field study was conducted from April 2011 to January 2014. The study period was divided to two seasons: rainy and summer (May to October) and winter and dry season (November to April). Six field visits were carried out covering 127 full days. Thirty permanent quadrates of 50 × 50 m were plotted to calculate population distribution and density along transect of 53 Km length and 200m wide from 3000 masl to 5200 masl in two routes. Langtang valley route passes to the settlements of Ghodatabela, to Kyanjing and Langtang Lirung glacier. Second was Gosainkunda route that was started from Dimsa to Gosainkunda at Southwest and Gosainkunda to Magingoth at South. All these locations along altitudinal gradients were categorized into three habitats according to vegetation and topography as follows:

1. **Habitat of pika inside the forest and its edge area:** It belongs to area from Magingoth 2900m to below Thadepati (below 3500m), Dimsa (3000m) to Cholagpati (below 3500m) in

Gosainkunda route and from Ghodatabela (2900m) to Langtang (below 3400m) in Langtang route.

- Habitat of pika in subalpine and broken rocks area:** This habitat represents the area above tree line with some shrubs, rocky areas and boulder. It belongs above Thadepati (3500m) to above Phedi (4000m) and above Cholangpati to Laurebina (3910m) in Gosainkunda route. Similarly, it was areas above Langtang (3400) to Thulo Dhungaa (3810m) in Langtang route.
- Habitat of pika in alpine and talus area:** This is the habitat without bushes and shrubs. It contains alpine meadow and rocks with boulders. The area above Laurebina to Suryakunda, above Phedi to Suryakunda in Gosainkunda route and Langtang Glacier and Langsisha kharka are in this habitat around Kyanjing.

RESULTS

The indirect sign; pellets of pika was observed at 3005 masl at Dimsa near local people's farmland along Gosainkunda route. This was the lowest elevation of pika presence evidence during study period. The live pika was encountered in Langtang route at 3018 masl (28°11'47.60"N 85°27'10.51"E), 2012 April as lowest elevation inside the forest of *Quercus semicarpifolia* and *Rhododendron* near Ghodatabela.

Pika population abundance in forest and its edge area

Total Royle's pika observed in forest and its edge area were 73 in number (mean 7.3 ± 1.46 and SD 4.62) in ten quadrates during six field studies. The number of pikas recorded were sixteen individuals in 2011 July, ten in 2011 October, five in 2012 January, twelve in 2012 March-April, fourteen in 2012 July-August and sixteen in 2013 April. Hence the mean population density of pika in this area was 4.8 individuals per hectare. Population density in summer was maximum in July- August, 2012 (8.4 individual per hectare) and minimum 2 individual per hectare in January 2012. The adult juvenile ratio was 58:15. Juveniles were not observed in winter and dry season.

Pika population abundance in sub alpine area with broken rocks

Total *Ochotona roylei* observed in subalpine rocky area was 182 (mean 18.2 ± 1.54 and SD 4.89) in six field work with adult juvenile ratio 127:55. Population observed in different field survey was 42 (2011 July), 37 (2011 October), 34 (October, 2012), 34 (January, 2012), 40 (2012 March-April) and 27 in April 2013 for *Ochotona roylei*. The mean population density of *Ochotona roylei* was 12.13 individual per hectare. It was maximum in July 2011 (16.8 individual/hectare) and minimum in April 2013 (10.8 individuals/hectare).

Pika population abundance in alpine area

A total of 118 *Ochotona roylei* were observed in this area (mean 11.8 ± 1.95 and SD 6.17) with Adult Juvenile ratio 81:37. Population of *Ochotona roylei* observed in different field survey was 47 (2011 July), 17 (October, 2012), 6 (January, 2012), 14 (March-April, 2012), 24 (July-August, 2012) and 10 in April, 2013. Here population density of *Ochotona roylei* was 7.86 (mean), maximum 18.8 individual per hectare in July 2011 and minimum 2.4 in January 2012.

Population density in different season and habitat

Total Royle's pika observed were 373 individual (mean 13.18 ± 1.02 , SD 7.27) with average density of 8.28. The total population of pika observed along altitudinal gradient shows its abundance at elevation range of 3600 to 4000 masl (41.11%) was the highest and lowest below 3400 masl (3.25). The value of Durbin-Watson Statistic = 1.2359, the value of Normality Test p value = 0.0046, K-S Statistic = 0.1288 with Significance Level= 0.0046, for Constant Variance Test $P = <0.0001$ which does not show significance relation between elevation and population abundance.

DISCUSSION

Kawamichi (1968) studied the winter behaviour of *Ochotona roylei* in Gosainkunda Lake side. He explained that the pika's pellets were observed at 2800 masl which is the lowest elevation for the occurrence of pika. However, Abe (1971) reported three species of pika (*Ochotona macrotis*, *Ochotona roylei* and *Ochotona* species) from different part of Langtang National Park during his small mammal research in Central Himalaya of Nepal in the same year (May to July, 1968). The lowest elevation of pika occurrence was 2180 masl, May 12, 1968 at Langtang National Park.

Khanal and Shrestha (2000) had reported two species of pika (*Ochotona roylei* and *Ochotona macrotis*) too in Langtang region. They observed 81 individuals of pikas, among them 15 were *Ochotona macrotis*. They had reported the observation of three individuals of Royle's pika (*Ochotona roylei*) at Lama Hotel area (2800 masl) as lowest elevation of pika occurrence in June, 1999. The team of researchers (June 2006) from Natural History Museum led by Dr. T. Yasunaga (a JICA volunteer in Nepal), had reported the observation of two species of pikas in this region. (Deo et al., 2008) did exploration again on pika in 2008 and observed the two species of pikas. The lowest elevation of pikas they observed in those periods was 2900m above Lama Hotel in the route to Langtang-Kyanging.

In the present study, two species of pikas were observed in Langtang National Park. *Ochotona roylei* were found in all habitats above 3005 masl. The lowest elevation of pika observation record is increasing along time which suggests either pika migrating upward or are locally extinct in lower elevation due to several reasons.

Bhattacharya *et al.* (2009) had recorded mean density of Royle's pika 15.3 individual per hectare in Uttarkhanda, North-Western India. Similarly Kawamichi (1968) and Smith *et al.* (1990) found the density of Royle's pika 14.1 individual per hectare and 12.5 individuals per hectare respectively in Nepal. Koju and Chalise (2013) reported the population density of pika in Api Nampa Conservation area was 7.2 individual per hectare in July 2012 and 8 individual per hectare in July, 2013. Haleem *et al.* (2012) recorded the mean density of Royle's pika maximum 48.44 individual/hectare in tree-line region and minimum 20.76 individual/hectare in alpine region of Kedarnath Wildlife Sanctuary, India. The population density of *Ochotona roylei* in the current study was 4.8 individual per hectare in forest and its edge area, 12.13 in subalpine area (with maximum 16.8/ha and minimum 10.8 per hectare) and 7.86 individual per hectare in alpine area (with maximum 18.8/hectare and minimum 2.4/hectare) with average mean 11.6 individual per hectare. This is less than the population density mentioned by Kawamichi (1968) and Smith *et al.* (1990) for Nepal and Bhattacharya *et al.* (2009) in Uttarkhanda. Population density of pika in Langtang is very less than the Indian population density observed by (Haleem et al., 2012).

Population abundance of pika in Nepal along elevation is just opposite to finding of Haleem (2012). In Langtang, population density of *Ochotona roylei* was maximum (16.8/hectare) in subalpine area (3500 masl to 3900 masl) followed by Alpine area with density 7.86 individual per hectare and the least in forest and its edge area (4.8 individual per hectare in 3000masl to 3500masl). Here the population density explain by Haleem et al. (2012) and Bhattacharya *et al.* (2009) are three times (15/hectare and 48.44/hectare) different in same study area in interval of three years. Thus, there might have some methodological differences. Bhattacharya *et al.* (2009) concluded in his study that pikas were relatively more abundant at man-made walls in the alpine zone and on broken slopes in the subalpine zone. The highest relative abundance was recorded around the man-made walls in June and on broken slopes in May. The lowest relative abundance was found in alpine meadows in October and November 2008. This phenomenon was also explained by Kawamichi (1968) in Gosainkunda region too. The current research support these researches. The population density recorded by Kawamichi (1968) was 14.1 in Gosainkunda region and 12.5 by Smith *et al.* (1990), we can conclude population density of pika in Langtang is decreasing. The research of Kawamichi (1968) was in winter and dry season; while in current study the population density at this season is less than 5 individuals per hectare which suggest population density of pika in Langtang is decreasing.

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