DISTRIBUTION AND POPULATION STATUS OF HIMALAYAN MONAL PHEASANT (*LOPHOPHORUSIMPEJANUS*) IN SALKHALA GAME RESERVE, NEELUM VALLEY AZAD JAMMU AND KASHMIR (PAKISTAN)

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ABSTRACT

Present study was carried out to determine distribution and population status of Himalayan Monal pheasant (*Lophophorus impejanus*) in Salkhala Game Reserve. This game reserve is an Endemic Bird Area in the Neelum valley within Western Himalayas, situated along ceasefire line between Pakistan and India. For data collection, study area was divided into three localities with eleven sub-localities. Systematic surveys were conducted in each sub-locality from March to September 2014, early in the morning (5:00-9:00am) and half an hour before evening. Distribution was determined by direct and indirect evidences including sighting, ground scratching, feathers, fecal material, foot prints, information collected from hunters, locals and wildlife staff. Populationof the bird was estimated by line transect method, laid down in the habitat of Himalayan Monal. The results indicated that this pheasant is distributed in all localities of the study area, preferring high altitude mountains with different aspects and slopes between 1900 mand 2600 m above sea level (asl). Overall population density of Himalayan Monal in the study area was 5.63 birds/km^2. The highest density (6.81 birds/km^2) was recorded in locality Khikhre-dohre, followed by locality Tehar-chhamman (5.33 birds/km^2) and Chitta-pani (4.76 birds/km^2). The sub-locality Dohre had highest population density (8.15 birds/km^2) among eleven sub-localities.

Key words: Himalayan Monal pheasant, Distribution, Population, Neelum valley, Salkhala Game Reserve, Azad Jammu and Kashmir, Pakistan.

INTRODUCTION

Monal pheasant (Himalayan Monal, *Lophophorus impejanus*; Family Phasianidae, Order Galliformes), distributed throughout the Himalayan mountain system, considered as the most significant bio-geographical zones, is well recognized for its ecological, cultural, and esthetic values (Kaul and Shakya, 2001; Seth, 2019). Pheasants, including Monal, are an important part of ecosystem, useful indicators of environmental quality (Fuller and Garson, 2000; Miller, 2013), therefore can be used to measure the success and failure of wildlife conservation (Severinghaus, 1979). They inhabit difficult terrain (Ramesh, 2003; Jolli and Pandit, 2011) of wooded habitat (Richard *et al*., 2000). They have a strong preference for their habitat and even a little change in their habitat may affect them (Bhattacharya and Sathyakumar, 2007). Himalayan Monal is reported in all Himalayan protected areas and is native to Afghanistan, Pakistan, India, Nepal, Bhutan, China and Myanmar (Yin, 1970; Johnsgard, 1986; Bhuju, 2001; Bhuju *et al*., 2007; Zaman, 2008; Miller, 2013; Xiaochun *et al*., 2011). In Pakistan, this beautiful bird is widely distributed in Kaghan, Swat, Kohistan, Dir, Hazara, and Safaid Koh area of Kurram Agency and to a limited extent in Chitral (Zaman. 2008). In Azad Jammu and Kashmir this species is distributed in Neelum valley (Saber *et al*., 1999; Awan *et al.,* 2006) Jhelum valley (Qureshi *et al*., 1999; Siraj, 2003; Awan *et al*., 2006) and Leepa valley (Ahmed *et al*., 1999). This species has a very wide range, and hence does not approach the thresholds for Vulnerable under the range size criterion (BirdLife International, 2019). Monal pheasant is found in a variety of altitudinal range that varies with habitat, location and seasons. During winter, it descends down to the areas of lower altitude and in summers and during breeding period, it prefers the high altitudinal forest. This type of movement occurs throughout its range. Its altitudinal range is recorded between1220 m -4500 m in different areas of the world in summer (Howman, 1993; Kaul, 1995; Sathyakumar and Kaul, 2007). In Azad Jammu and Kashmir it is distributed between 2600 m - 3200 m elevation range at the steep cliffs near tree line and in the oak trees (Ahmed *et al.,* 1999; Qureshi *et al*., 1999; Saber *et al*., 1999) while in Pakistan it is fairly good between 2700 m - 4000 m elevation (Mirza, 1978; Roberts, 1991).

Previous studies on population parameter, population density and encounter rate of Monal pheasant show variation in population density and encounter rate in different areas (Bhattacharya and Sathyakumar, 2007; Poudyal, 2008; Zaman, 2008; Jolli and Pandit, 2011;

Xiaochun *et al*.,2011). According to IUCN (2019), the Monal pheasant is Least Concern, but this spectacular bird is facing different anthropogenic threats due to which its population is declining throughout its distribution range (Chen *et al*., 2017; Kumar, 2018) including Pakistan and Azad Jammu and Kashmir. Hunting for coloured plumage and meat, habitat degradation, and habitat loss are major threats to this species (Selvan *et al*., 2013). During winter when ground is covered with snow, Himalayan Monal is forced to descend to lower elevations near human habitation, where density dependent and intra-specific competition increases predation and threats of poaching. On the other hand during winter season human presence in lower altitude makes it to restrict to higher range, which causes higher mortality rate during winter. In Pakistan and Azad Jammu and Kashmir hunting pressure is particularly high for Galliformes for food, skins or recreation as well as hunt by local and non-local professional hunters (Awan *et al*., 2012; Kandel *et al*., 2018) but habitat degradation, poaching and developmental activities in most part of their ranges are also among major threats to this species. Thus several of these factors have collectively contributed to the decline of wild populations of pheasants in their native regions (Kandel *et al*., 2018). Diseases in the wild or in captivity are also a source of declining of pheasants populations (Zaman, 2008).

Although some reports are available on occurrence and distribution of Himalayan Monal in Pakistan, existing literature lacks any detailed study on ecology of this precious bird in Azad Jammu and Kashmir and Pakistan. To address this data deficiency and acknowledge about its importance in ecosystem, a field study on various ecological aspects of this bird was need of the time. Therefore, the present study was conducted to determine distribution and population status of Himalayan Monal pheasant in Salkhala Game Reserve, Azad Kashmir, Pakistan.

MATERIALS AND METHODS

Study area: Salkhala Game Reserve (SGR: 34º33′ N, 73º50′ E; 1,320 - 3,150 m above sea line, area 810 ha; Fig.1) was notified as a Game Reserve in 1982 (Dudley, 2008) and lies within an Important Bird Area (IBA) of the Western Himalayas Endemic Bird Area.

It is classified as such owing to the presence of three globally threatened IBA trigger species, *Tragopan melanocephalus*, *Catreus wallichii* and *Ficedula subrubra*. All three species are listed as Vulnerable (IUCN, 2019). In addition, the area is important for a number of mammal species, including *Moschus chrysogaster*, *Semnopithecus ajax* (both Endangered), *Ursus thibetanus* (Vulnerable), *Panthera pardus* and *Naemorhedus goral* (both Near Threatened) (Awan and Awan, 2009). The dominant plant species of the Game Reserve are *Cedrus deodara, Pinus wallichiana, Abies pindrow, Picea smithiana, Taxus wallichiana, Acer caecium, Betula utilis, Berberis* spp*., Quercus* spp*., Juniperus communis, Vibernum* spp*., Indegofera gerardiana, Juglans regia, Aesculus indica.* There are six villages with a total population of about 6,000 individuals adjacent to SGR subsisting on the natural resources of the area, entering the reserve to graze their cattle, cut trees for timber and collect firewood, inflicting severe damages to the forest understory of the Game Reserve (Awan and Awan, 2009)

Methods: Present study was carried out during spring and summer seasons between March 2014 and September 2014. For data collection the study area was divided into three main localities, which in turn were divided into eleven sub localities on the basis of physical features of study area (Fig. 1).

The evidences like direct observation, callings, fresh ground scratches, feathers, information collected from local hunters, shepherds and wildlife staff was main sources of confirmation of presence and distribution of Monal. For Himalayan Monal, direct observations by using line transect is more reliable method (Gaston *et al*., 1983). Himalayan Monal calls sporadic and irregular in the morning and calls throughout the day (Kaul and Shakaya, 2001) and call count cannot give accurate results but readily conspicuously flushes from its perch enables investigator to use line transect for sampling. Line transect is reliable method for Himalayan Monal study (Selvan *et al*., 2013) and many of field workers used this method during their studies (Ramesh, 2003; Miller, 2013). Dawn calling by Monal appears to bear little relationship to the numbers of birds present (Gaston, 1980) as the calling may be initiated only by a stimulus such as a predator (Garson *et al*., 1992). During present study call count was used for calling site density while for population estimation line transect method was used. Site selection for transects was made through reconnaissance surveys and on the basis of information collected from local people, hunters, shepherds, and wildlife staff. In each sub-locality, it was difficult to lay strait transects on steep slopes, we used pre-existing walking tracts in each sampling site for monitoring Himalayan Monal. Eleven transects of various lengths were selected for the study. We walked transect every month in the morning before 10.00 am, when Himalayan Monals forage on the ground around their roosting sites (Ramesh, 2003). Sampling during this time lowers the chance that the villagers and hunters flush the birds as these people occasionally traverse these trails. For each encounter of Himalayan Monal we recorded data on sex, sighting angle, sighting distance, time, aspect, location and slope using compass, clinometer and GPS device. Walking pace was standardized to reduce irregularities in sampling effort and abundance estimation. Stones and

pieces of wood were thrown to disturb the birds from inaccessible cover near transect Shakya, 2001). Indirect evidences such as feathers, faecal material and ground scratches all were noted and photographed using digital camera (Nikon D60). Population density was calculated by dividing total number of birds observed by the total area surveyed in Km^2.

RESULTS

Himalayan Monal was distributed in all eleven sub-localities of three main localities, covering an area of 5.5 km^2, ranging between 1588 m and 2674 m above sea level (asl). Eighteen surveys were conducted in eleven sub-localities of the study area (Fig.2). Sum total of 83 birds were encountered in all localities with 53 female and 30 male individuals. In Tehar-Chhamman (1872m - 2615 m asl), the Monal mostly preferred northern and western aspects. The most preferred aspects of the locality Chitta-pani (1588m-2674 m asl) were north and north eastern aspects. In Khikhre-dohre (1698m-2565 m asl) the most preferredaspects were north and west. An overall population density of 5.63 birds/km^2 was recorded with maximum population density (8.15 birds /km^2) in Dohre and minimum (2.67 birds/km^2) in Danna (Fig.3). A detailed account on the population dynamics of Himalayan Monal is given as under.

Locality Tehar-Chhamman, covering an area of 1.04 km^2, had an estimated population density of5.3 birds/km^2. Sub-locality Awan-wali-rakh (1872m -2327 m asl) covered an area of 0.34 km^2 with7º-30º slope. A transect of 0.77 km was surveyed four times during the study period. Maximum six individuals were encountered between 1988 m and 2228 m asl, ranging in number from 1 to 3 individuals. A population density of 5.44 birds/$km^2$was estimated in this sub-locality. Only one calling site was recorded with calling site density of 2.90 calling sites/km^2 (Table 1). The Himalayan Monal preferred northern and western aspects in this sub-locality. The sub-locality Chhamman-wali-nalean (2115m-2633 m asl), covering an area of 0.27 km^2 with 9º-36ºslope had patchy distribution of trees and thick ground cover. Six individuals were encountered between 2197 m and 2317 m asl, with most preferred aspect of north facing slopes. Total population density of 4.17 birds/km^2 was estimated in this sub locality. One calling site was detected with the calling site density of 3.70 calling sites/km^2 (Table 1). Sub-locality Manager-wali-behak (2065-2615 m asl) was another potential habitat, of Himalayan Monal, with varying slopes (18º-30º). Total area of this sub-locality was 0.18km^2. A 0.8 km long transect was surveyed five times. Total six individuals were encountered between 2072 m and 2340 m asl, ranging in number from 1 to 2 individuals, with preferred north and north-east aspects. Population density of 7.50 birds/km^2 and site density of 5.50 calling sites/km^2 was recorded in this sub-locality (Table 1). A clutch size of three eggs was reported on 16-June-2014. Tehar was a rocky mountain (1872-2532 m asl), covering an area of 0.25 km^2. Habitat was characterized by patchy distribution of grasses and trees with slopes between 18º and 37º. A transect of 0.95 km was surveyed three times during study period. Five individuals were encountered ranging in number from 1 to 3 individuals between 1830 and 2230 m asl. Maximum population density of 4.20 birds/km^2 was estimated in this sub-locality. One calling site was also recorded with calling site density of 4 calling sites/km^2 (Table 1). Insufficient water source, fuelwoodcollection and edible vegetable collection were continuously degrading the habitat.

Locality Chitta-Pani was second main locality between 1588 m -2674 m asl, covering an area of 3.04 km^2 with four sub-localities. Population density of 4.76 birds/km^2 was estimated in this locality. The area was blessed with lush green forest and thick understory vegetation. The first sub-locality Chitta-pani covered an area of about 0.83 km^2 with10º-37º slope. A transect of 1.05 km was surveyed for five times, and total 10 birds,ranging in number from 2 to 3 individuals,were seen between the altitudinal range of 1675 m and 2500 m asl. A density of 4.70 birds/km^2 was estimated in this sub-locality (Table 1). Two calling sites with calling site density of 2.41 calling sites/km^2 were detected in this sub-locality. Fodder collection for animals during summer season had degraded the habitat.Tehar-chor-nar is located between 1916 and 2659 m asl. The area was characterized by 18º-30º slope interspersed with plain areas, blessed with lush green forest and thick undergrowth. A transect of 0.83 km was surveyed four times, during study period. Total six individuals with an estimatedpopulation density of 6.10 birds/km^2 were encountered between 1930 m and 2460 m asl, ranging in number from 1 to 2 individual, preferring northern and north eastern aspects of the sub-locality (Table 1). Only one calling site was recorded with calling site density of 1.67 calling sites/km^2.Danna was another potential habitat, located between 1702-2451 m asl. The area was characterized by 20º-45º steep slope as well as plain areas with lush green forest and thick undergrowth. A 1.05 km long transect was surveyed for five times. Total seven individuals, ranging in number from1 to 3 individuals were encountered between 2065 m and 2365 m asl with population density of 2.6 birds/km^2 and calling site density of 1.2 calling sites/km^2 (Table 1). Three young birds were reported on 12-May-2014. Summer residences were also near to this sub-locality that had caused habitat degradation in the form of grazing by livestock.Sub-locality Nallah is situated at altitude between 2088 m and 2674 m asl, covering an area of 0.77 km^2. The habitat of the area was characterized by varying slopes between 12º-37º and patchy distribution of trees

with sparse ground cover. A transect of 1.58 km was surveyed four times, and total 5 individuals were seen on northern aspect between 2185 m and 2622 m asl, ranging in number from 1 to 2 individuals. Population density of 5.50 birds/km^2 and calling site density of 1.30 calling sites/km^{2}were recorded (Table 1).

Locality Khikhre-dohre (1698 m -2565 m asl), covering an area of 1.53 km^2, had a population density of 6.8 birds/km^2. The sub-locality Dohre, covering an area of 0.52 km^2 with open lofty hills was located between 1703 m and 2546 m asl. Habitat was characterized by slope between 14º to 43º with patchy distribution of trees and very little shrub cover but having thick ground cover of long grasses. *Pinus wallichiana*, *Prunus percisa* were potential species of the habitat. A transect of 0.90 km was surveyed six times, once each month, total 11 individuals were encountered between 1832 m and 2224 m asl ranging in number from 1 to 3 individuals. The highest population density of 8.15 birds/km^2 was estimated in this sub-locality (Table 1). Sub-locality Khikhre with an area of 0.25 km^2 was located between 2197 m and 2565 m asl. Habitat was characterized by rocky cliff with steep slopes (27º-45º)having patchy distribution of trees and less ground cover. A transect, measuring 0.63 km was surveyed five times and total eight individuals were encountered between 2265m and 2367 m asl ranging in number from 1 to 3 individuals. Population density of 7.60 birds/km^{2}was estimated and one calling site was detected with calling site density of 4 calling sites/km^2 (Table 1). Two males flying from one ridge to another was also reported by a shepherd.Sub locality Kaligatti, located between 1698 m and 2342 m asl was characterized by10º-37º steep slope and patchy distribution of trees with thick ground cover. Total area of this sub-locality was 0.76 km^2. A transect measuring 1.18 km long was surveyed five times, and eleven individuals were encountered between 1822 m and 2250 m asl, ranging in number from 2 to3 individuals with a population density of 4.68 birds/km^{2}and calling site density of 1.32 calling sites/km^2 (Table 1).Habitat degradation was high in the form of grazing and fodder collection.

Present study depicted that the Himalayan Monals were found between the altitudinal range of 1900m and 2650 m asl. However, during breeding period most of the individuals were encountered at lower altitudinal ranges. According to the local people, during winter season birds were seen at very low altitudes.High encounter rate was recorded between the months of March and July (Fig.4). Decline in population in the Month of August was certainly due to disturbance by residents who enter the habitat for fodder collection and livestock grazing. Himalayan Monals were encountered on all aspects of the study area, however, majority of the birds were found on northern slopes. Frequency of Himalayan Monal encountered during study period was not uniformly distributed on all aspects χ^2=42.54, df=3, p<0.001) (Fig.5).

Himalayan Monal were encountered at different altitudinal ranges of the study area. Maximum individuals were encountered between 2351m and 2500m asl (Fig.6). However, the difference was statistically non-siginificant and Himalayan Monal was equally distributed at different altitudes of the study area (χ^2=2.48, df=4, p>0.05).The birds were encountered at different degree of slopes with maximum individuals encountered between 26º-30ºslope followed by 35º-40º and 31º-35º (Fig.7). Himalayan Monal encountered at different degrees of slopes indicated that they were not equally distributed throughout the range of slopes between 11º-45º (χ^2=22.33, df=6, p<0.01).

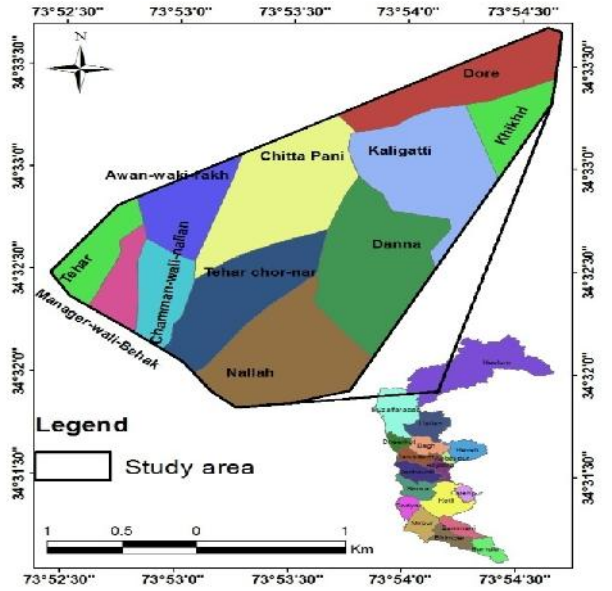

Fig. 1. Location map of Salkhala Game Reserve (SGR) showing study area and sub-localities

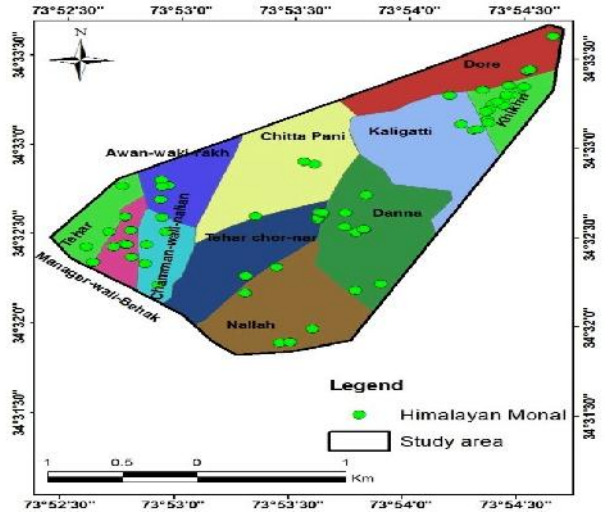

Fig. 2. Distribution of Himalayan Monal in the sub- localities of study area.

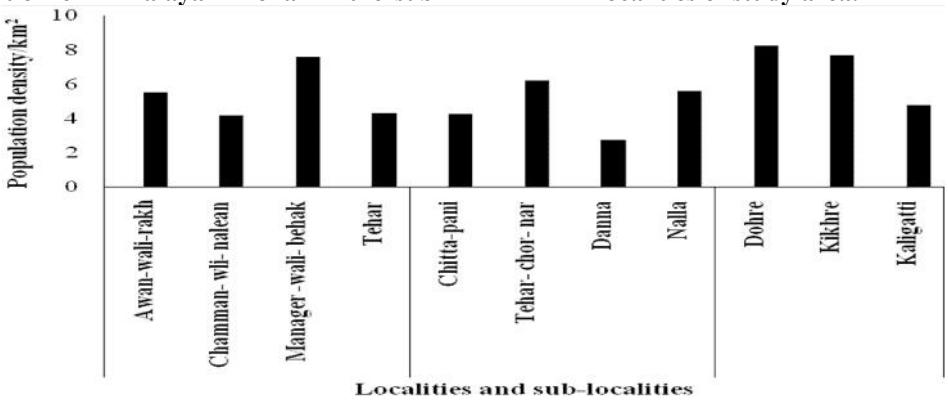

Fig. 3. Population densities of Himalayan Monal in different sub localities of the study area.

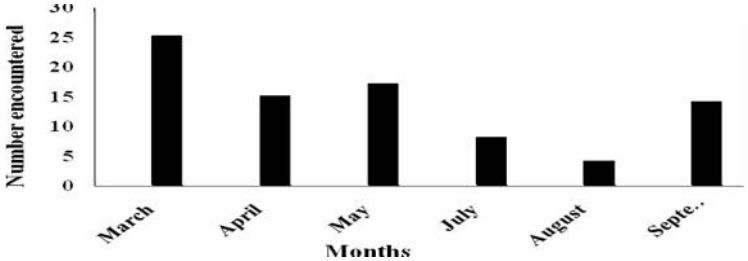

Fig. 4. Fluctuation in encounter rate of Himalayan Monal during different Months of study period

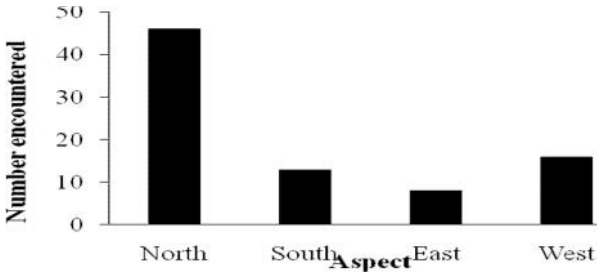

Fig. 5. Fluctuation in encounter rate of Himalayan Monal at different aspects in study area

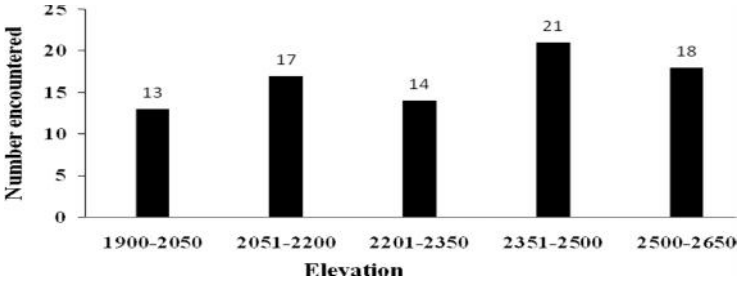

Fig. 6. Fluctuation in Encounter rate of Himalayan Monal at different elevation ranges in study area

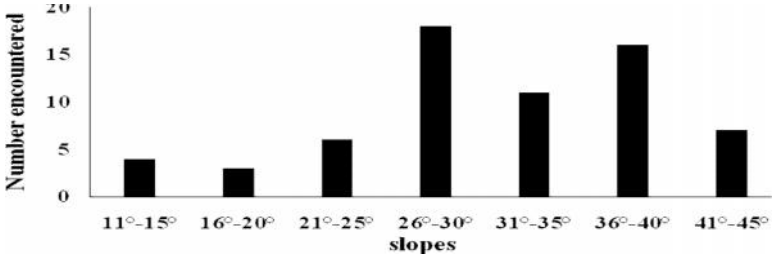

Fig. 7. Himalayan Monal encountered at different slopes in study area.

Table 1. Population parameters of Himalayan Monal recorded at different localities of the study area.

Locality	Sub-locality	Total area (km^2)	Elevation (m)	Calling sites	Calling site density (No of calling site/Area km^2)	Length of transect (km)	Width of transect (m)	Area of transect (km^2)	Total birds encountered (Range)	Population	Population density No of birds/km^2
Tehar-chhamman	Awan-wali-rakh	0.34	1872-2327	1	2.94	0.77	0.40	0.31	6(1-3)	1.85	5.44
	Chhamman-wali-nalean	0.27	2115-2633	1	3.70	1.00	0.20	0.20	6(1-2)	1.11	4.10
	Manager-wali-behak	0.18	2065-2615	1	5.56	0.80	0.20	0.16	5(1-2)	1.35	7.50
	Tehar	0.25	1872-2532	1	4.00	0.95	0.25	0.24	5(1-3)	1.05	4.20
Chitta-pani	Chitta-pani	0.83	1588-2488	2	2.41	1.05	0.50	0.53	10(2-3)	3.90	4.17
	Tehar-chor-nar	0.60	1916-2659	1	1.67	0.83	0.20	0.17	6(1-2)	3.66	6.10
	Danna	0.84	1702-2451	1	1.19	1.05	0.50	0.53	7(1-3)	2.24	2.67
	Nalla	0.77	2088-2674	1	1.30	1.58	0.20	0.32	5(1-2)	4.24	5.50
Khikhre-dohre	Dohre	0.52	1703-2546	2	3.85	0.90	0.30	0.27	11(1-3)	4.24	8.15
	Khikhre	0.25	2197-2565	1	4.00	0.63	0.35	0.22	8(1-3)	1.90	7.60
	Kaligatti	0.76	1698-2342	1	1.32	1.18	0.50	0.59	11(2-3)	3.56	4.68

DISCUSSION

Salkhala Game Reserve is an important habitat of many bird species including Himalayan Monal Pheasant. In study area Himalayan Monal was distributed in eleven sub-localities of three main localities, covering an area of 5.5 km^2 ranging between 1588 m and 2674 m above sea level (asl). According to Poudyal (2008), the species has the widest range from Afghanistan through the Himalayas Nepal, Bhutan and Arunachal Pradesh. Roberts (1970) gloomily reported it from Pakistan. According to him it has become very rare in all the forests where it was plentiful previously.

A total of 83 birds were seen having population density of 5.63 birds/km^2. Different population densities were calculated in three main localities with maximum population density (8.15 birds/km^2) in sub-locality Dohre, and minimum in sub-locality Danna (2.67 birds/km^2). Habitat of the sub-locality Danna was not degraded, however, it was situated at lower altitude and small numbers of individuals were encountered. Being in the vicinity of human habitation, during breeding season (March-May) local people visit these areas for the collection of Mushroom (*Morchella esculenta)* and in the month of August and September fodder collection disturbs the habitat and that might be the reasons for observing low number of individuals in this sub-locality. In Khyber Pakhtunkhawa, population density of Monal was recorded as 3 pairs/km^2 (Zaman, 2008). No previous record of Himalayan Monal is available in SGR, the only early draft by Mirza (1978) documented small number of Himalayan Monal flushed from the Reserve by the combination of call count method and line transect method. He recorded a total of forty-one birds flushed in 41.6 km in the area of Kuttan and Salkhala with population density of 1 bird/km^2. In August 1977 at Machiara, he recorded a total of fifty calling birds and eleven birds sighted in an area of 34 km^2 of comparatively gentle slopes, giving a density of 1.5 to 1.8 birds/km^2. In Azad Kashmir Himalayan Monal was recorded in Machiara National Park with population density of 2.69/km^2 (Latif, 2011).

Himalayan Monal was encountered at different altitudinal ranges of the study area. During breeding season maximum individuals were encountered at lower altitudinal ranges between 1900 m to 2500 m asl. The higher encounter might be due to the reason that in spring, the higher altitudes of the study area are covered with snow, forcing the pheasant to establish territories at lower areas (Soldatini *et al*., 2010). However, in the Month of July and August encounter rate declined due to human interference in their natural habitat. During these months local people visit to their summer residences called as "Behak". Roberts (1991) Ramesh (2003), and Sathyakumar and Kaul (2007) reported that Himalayan Monal exhibit clear altitudinal migration reaching as low as 2000 m during breeding period. In India Himalayan Monal was mostly distributed between 2620 m and 3350 m in summer and between 2000 m and 2800 m in winter (Ramesh *et al*., 1999). Human presence in lower altitude make it restricted to higher altitude during the winter, which may result higher mortality rate during this season (Osmaston, 1927). These previous findings coincide with the result of present study. Maximum individuals were encountered between March and June, and sudden decline was observed in August and September. During April local residents start visiting the forest to collect the fungus, Guchi (*Morchella esculenta)* due to which Himalayan Monal moves to higher altitude and in May it was present at 2439 m (asl) in sub-locality Kaligatti. During the month of June Himalayan Monal was present at 2527 m asl which clarify the human disturbance due to exploitation in their natural habitats. During summer, shepherds along with herds start migration towards pastures, forcing monals to upper meadows at high elevations. Sudden decline in population during August and September might have been due to fodder collection for their cattle, leaving the area uncovered. This is also a time period of vegetable collection locally known as Kunji (*Dryopteris* sp). According to Zaman (2008) pheasants are very shy birds generally, so when they see anyone in their habitats they never remain there for a bit of time, suddenly change their place and move away.

This bird prefers high altitude from June to September and during breeding period in spring it descends to lower altitudes. Large numbers of pheasants are reported to come down these localities during winter season from December to March (Romanov *et al*., 2016). The Himalayan Monal is found between 3000m and 4500 m in summer (Zaman, 2008). In Machiara National Park, Latif (2011) reported Himalayan Monal between 1800 m and 2500 m asl. He also documented it at low altitudeof 1500 m in winter. In Pakistan it is fairly common between 2438m and 3657 m in some valleys (Mirza, 1980). Gaston *et al* (1983) noted that this species seemed to exhibit the greatest altitudinal movement between 2000m and 3000 m in January and March and mostly above 3000 m during September and October. Ramesh *et al* (1999), observed that Himalayan Monal mostly used higher altitudinal habitats, followed by moderate or middle elevated habitats and the habitats of lower altitudes are less used by Himalayan Monal, however lower habitats are mostly used in the winter seasons (Kandel *et al*., 2018).

Himalayan Monal was not equally distributed on all aspects of the study area. Maximum individuals were encountered at northern aspect. Previous studies support our results. Nawaz *et al* (2008) reported this bird at north and south aspects for its gliding movements during breeding period. Himalayan Monal prefers deep south-eastern and northern slopes of huge rocks for roosting, which provide protection from predator such as martin

and foxes as well as suitable sites for display flights (Rimlinger *et al*., 2000). This bird showed preference for south and south-west-facing slopes in the Pipar and Kalki Danda ridges in Nepal (Bhuju *et al*., 2007). Himalayan Monal preferred the habitat with open ground cover and gentle slope between26º-30º. Similar results were reported by Lelliott (1981) and Hill and Robertson (1988) in Pipar Game Reserve in Nepal. The species prefers alpine and sub-alpine areas with open rocky slopes (Mirza, 1980; Dhyani and Dhyani, 2016). Maximum population density (8.15birds/km^2) was calculated in sub-locality Dohre, where habitat was mostly characterized by slope of 14º-43º with patchy distribution of tees, little shrub cover and open slopes with thick long grasses.In addition, the reason for the high density is also likely due to the reason that the area is far from human habitation, without disturbance, near the Line of Control.

Conclusions and recommendations: Himalayan Monal was distributed in all eleven sub-localities of three main localities between the elevation range of 1900 m and 2600m asl. A total of 83 individuals were encountered during study period with overall population density of 5.63 birds/km^2. Maximum population density (8.15 birds/km^2) was calculated in Dohre and minimum (2.67birds/km^2) in Danna. In Salkhala Game Reserve, Himalayan Monal preferred northern aspect with open grassy slopes ranging between 26º-30º slopes. Mushrooms and medicinal plant collection, uncontrolled grazing by the cattle and use of timber wood by the locals are among main factors leading to habitat disturbance and degradation.

In Pakistan/ AJK the population status and detailed habitat analysis of Himalayan Monal are still poorly understood. Present study was conducted in a limited area of game reserve. However, the habitat of Himalayan Monal in the areas extends outside the study area. There is a need for further detail study in remaining areas of its habitat, so the actual status of this precious bird can be documented for its better management. Human activities and livestock grazing observed in the area might be the major threat to the Himalayan Monal in the study area. The minimum population density (2.67 birds/km^2) was recorded in the Danna where the habitat was degradeddue to Mushroom collection and fodder collection. It is strongly recommended that there should be a check on the over exploitation of natural resources extracted from the SGR. Especially, the medicinal plants and mushroom collection should be strictly banned in the game reserve area. Patrolling of the game reserve should be improved to minimize exploitation of natural resources of the area. Long term monitoring of pheasants should be made on priority basis and staff should be educated and empowered to take strict legal action against offenders. There must be strict ban on domestic dogs entering in the habitats, especially during breeding season while collecting mushrooms. For conservation of Himalayan Monal, an integrated management strategy including further scientific investigations, awareness and capacity building programs through the involvement of community as well as other stakeholders is required. It is therefore recommended that further detailed research studies, awareness programs and conservation projects should be launched by the public and private sectors for conservation and improvement of its habitat to maintain its population in Azad Jammu and Kashmir and Pakistan.

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