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POPULATION DENSITY AND HABITAT STATUS OF PUNJAB URIAL (*Ovis vignei punjabiensis*) IN DILJABBA-DOMELI GAME RESERVE, PUNJAB PAKISTAN

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ABSTRACT

Present study provides information on population and habitat status of the Punjab urial (*Ovis vignei punjabiensis*) in Diljabba-Domeli Game Reserve located in District Jhelum. Data regarding population density of urial was collated through direct observations using line transects and vegetation survey of the study area using the quadrat method. A total of 51 urials; 37 females (30 adult, 7 young) and 14 males, were recorded. The urial population density was estimated at 2.68 animals/km^2. Population density varied among four transects/study sites but largely remained non-significant. Occurrence of the Punjab urial was found between 330m and 600m elevation in the reserve, and predominant plant species in its habitat were *Acacia modesta, Capparis aphylla, Ziziphus nummularia, Prosopis glandulosa, Adhatoda zeylanica, Sageretia theezans, Maytenus royleana, Dodonea viscosa, Grewia tenax, Lantana camara, Cynodon dactylon, Sonchus arvensis* and *Suaeda fruticosa.* Types of grasses found here ranged to about 31.25%. Terrain comprised of foothills with medium gentle slopes, mixed with flat plain areas, and also the gravels and boulders. Major threats to the urial population included a rapid decline in their present habitat, poaching, competition with livestock, habitat fragmentation, scarcity of water during summer season and capture of urial lambs which are largely kept as pet. Therefore, it seems pertinent for the wildlife managers to maintain and enforce wildlife laws for conservation of Punjab urial and its habitat in the reserve.

Key words: Punjab urial, population density, habitat use, threats, habitat loss, hunting.

INTRODUCTION

In Pakistan, the tribe *Caprinae* is represented by three sub-species; Ladakh urial or Shapu (*Ovis vignei vignei),* Afghan or Baluchistan urial (*Ovis vignei blanfordi)* and Punjab urial (*Ovis vignei punjabiensis).* The Punjab urial is endemic to northern Punjab and is the principal mammalian game species of scrub forest in Salt Range and Kala Chitta Range (Aleem, 1977; Mirza *et al.,* 1980; Chaudhry *et al.,* 1988; Roberts, 1997). Apart from its award value in hunting, it is also traditionally prized as a pet by animal collectors. The Punjab urial ram attains full size at the age of seven years. It has long massive horns, curved outwards and backwards (Schaller and Mirza, 1974; Roberts, 1997).

Punjab urial is generally territorial, gregarious, sexually dimorphic and promiscuous ungulate. Their herd size and composition varies with season (Schaller and Mirza, 1974). Feeding activity is confined to the early morning and late evening in the summer months, often commencing well before dawn. Its preferred food is grasses, which grow in scattered clumps, and in the Salt Range *Tetrapogon villosus, Eleusine flagellifera, Digitaria bicornis* and *Cenchrus pennisetiformis* are believed to be favored species (Schaller, 1977). The mating season begins in September when rams (which live separately at other times) select four or five ewes (Grubb, 2005). Females give birth to one or two lambs in early April (Awan *et al*., 2004). Gestation period varies from 134 days to 150 days (Roberts, 1997; Grubb, 2005).

Punjab urial has a restricted distribution range and found only in the Salt and Kala Chitta Mountain Ranges and is confined by a coniferous forest belt in the north of Jhelum River and in the west of Indus River (Schaller and Mirza 1974, Schaller 1977). In the Salt Range, they are typically associated with low rounded stony hills dotted with *Olea ferruginea* and *Acacia modesta* (Roberts, 1997). Urial are mostly offended by local communities who predate them for their food as they inhabit relatively accessible lower hills. They have been exterminated in many former parts of their occurrence in the 20th century. Current distribution range of Punjab urial in the Salt Range has declined by about 70 percent and their population by 56 percent from its historic range since 1976 (Awan *et al.* 2004). Chumbi Surla and Jalalpur Wildlife Sanctuaries and Kalabagh Game Reserve have comparatively better urial population than other areas (IUCN, 1997).

Urial is currently listed as 'Vulnerable' globally (IUCN, 2012) and Punjab urial is listed 'Endangered' in Pakistan (Sheikh and Molur, 2005). Present study was, therefore, carried out to assess population density, habitat utilization and major threats to Punjab urial in Diljabba-Domeli Game Reserve of District Jhelum and to suggest measures for their sustainable survival.

MATERIALS AND METHODS

Study area: Study was conducted in Diljabba Domeli Game Reserve in the District Jhelum, comprising an area of 118,106 ha (Fig. 1). This game reserve is part of Salt Range in the Northern Punjab with a sub-humid and sub-tropical climate. This region receives a substantially high rainfall during monsoon season (July and August). Mean monthly temperature ranges from 5.9-38.4 C°, January being the coldest and June the hottest month of the year (GOP, 2010). The habitat is characterized by steppe mountains and rocks of sandstone and limestone, with only a little cultivated area.

Soil profile of the study area varies from sandy loam to clay loam. The characteristic feature of the area is red soil, the red marl which imparts red color to the soil, is dominant. The vegetation is dry sub-tropical, semi-evergreen scrub forest having dominant plant species of *Acacia modesta, Olea ferrugenia, Salvadora alights, Zizyphus nummularia, Dodonea viscosa, Prosopis glandulosa, Adhatoda zeylanica, Calotropis procera* and some more similar species, while the shrubs are sparse with scattered *Zizyphus nummularia* except in some ravines and on the high ridges where *Dodonea viscosa* is prominent and grasses like *Cymbopogon jwarancusa, Eleusine compressa, Heteropogon contortus, Aristida adscensionis, Cynodon dactylon and Saccharum spp* are found (Roberts, 1997).

Methodology: After a careful survey of the whole area, selection of four sites was made based on elevation, aspect and vegetation type, to monitor the population density of the urial (Table 1). Data were obtained by direct observations using line transect method for simple count of animals. For this purpose, four line transects were run, one in each study site. Length of these transects was 12, 8, 11 and 7 km in study site 1, 2, 3 and 4, respectively which was worked out by using GPS. Width of each transect was taken as 250 m on each side.

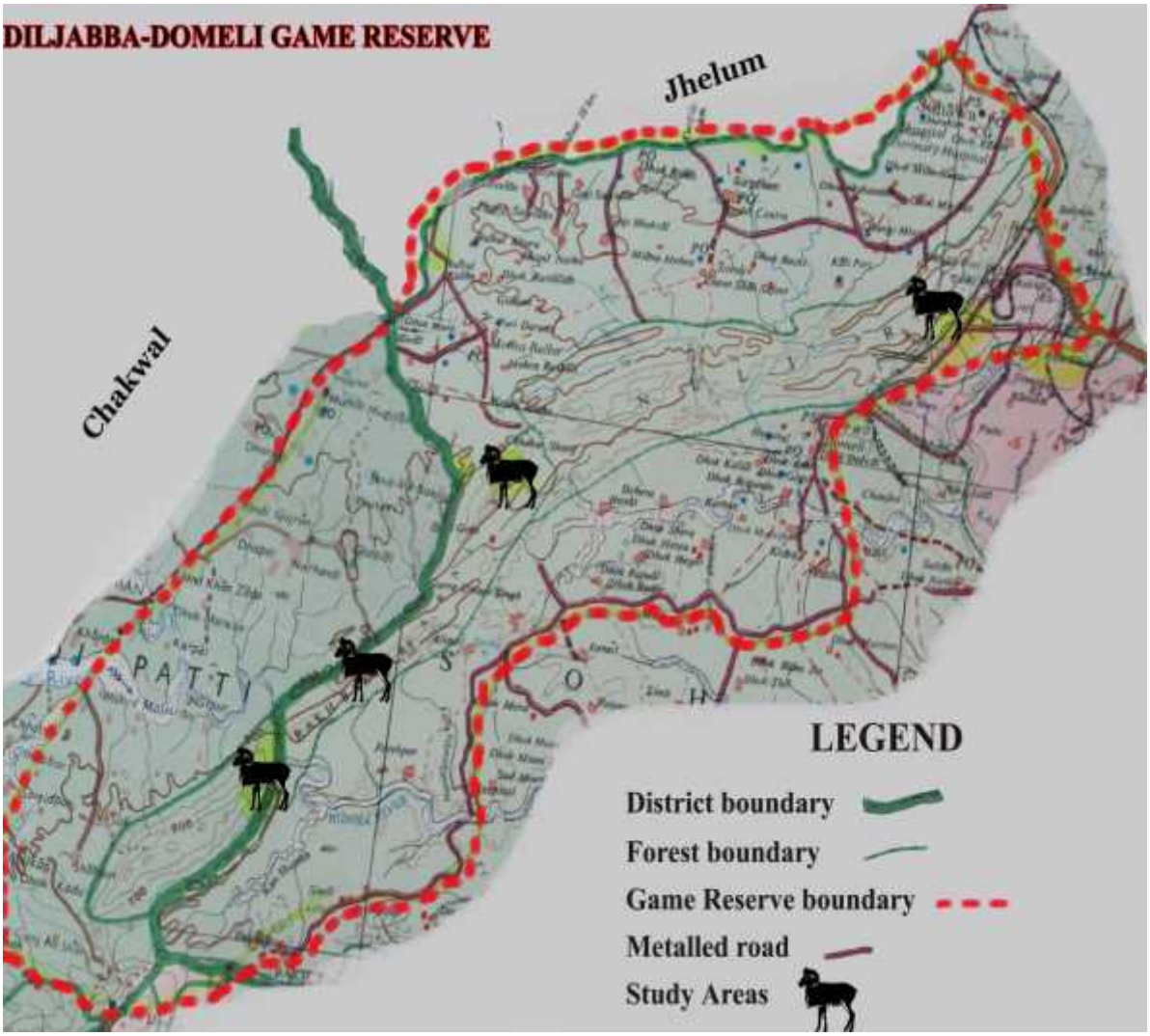

Fig 1. Map of the study area of the Punjab urial- Diljabba Domeli Game Reserve

Table 1. Study Sites for the Punjab urial in Diljabba-Domeli Game Reserve

Study Site	Name of study site	Location
1	Tarakki mountain	33° 03.287N and 73° 24. 180E
2	Chabber Syedan	32° 59.702N and 73° 14. 355E
3	Trutta mountain	32° 54.267N and 73° 10. 275E
4	Diljabba mountain	32° 54.423N and 73° 09.420E

Transect routes were assessed through walking along the ridges and ravines in the early morning and late afternoon in potential habitat of Punjab urial, sometimes sitting on cliffs and watching the aspects facing the observer. On spotting an urial herd, number of individuals, their age and sex were noted. It was ensured that during the numerical counts, no duplication of the data occurred. During transect walk, general habitat type and weather conditions were noted. Population density for a transect was calculated by using the following equation and total population of Punjab urial was calculated by multiplying its population density with total area of game reserve (Bumham *et al*., 1980).

$D = \Sigma n / L \times 2W$

where L = Total length of Line transect.

n = Number of objects detected.

W = Width of transect.

D = Density

Habitat analysis was carried out through vegetation sampling using quadrate method taking a quadrat size of 4×4 m^2 (Schemnitz, 1980). A total of 92 quadrates were laid down between 330 m - 600 m elevations. Importance Value of plant species was calculated by adding relative density, relative frequency and relative cover. Physical features of habitat such as elevation, cover (broken, smooth, boulder or small rocks), erosion, water sources, etc were also noted.

RESULTS AND DISCUSSION

Population density: A total 51 urials were observed during the present study from four locations of the study area (Table 2). Overall population density of Punjab urial in four study sites (transects) was 2.68 animals / km^2. Population density at the fourth location remained maximum as compared with other sites (table 2). It is important to mention that habitat at this site is regarded ecologically more suitable for the Punjab urial owing to least human interference and low grazing by livestock. However, the difference in population density was not statistically significant among four study sites (P=1.00, X^2=0.00, d.f=3). Study site one was highly disturbed due to stone crushing and other human activities. Resultantly, urial population had moved to the surrounding areas within and along the outside boundary of game reserve. Urial population at study site two seemed to be comparatively less disturbed, however, the site had intensive soil erosion and degraded vegetation at lower hill slopes. Study site three had more disturbance due to human activities and high livestock grazing pressure owing to a number of villages located very close to this area.

Earlier, Schaller (1977) has reported urial densities of 11-13 animals / km^2 at Kalabagh Game Reserve located in extreme south of Salt Range. This is a private game reserve where the Punjab urial and its habitat is better protected by the owners. Population density of Punjab urial in a nearby Jalalpur Wildlife Sanctuary was reported to be 4.89 animals / km^2 (Azam *et al*. 2006). One probable reason for low population density in the study area as compared to Jalalpur Wildlife Sanctuary could be the hunting of the urial which is legally allowed in a game reserve but not in a wildlife sanctuary. Better protection of population and habitat of the urial and low human disturbance in the sanctuary could be other reasons for this difference.

Table 2. Population density of Punjab urial in Diljabba-Domeli Game Reserve during 2009-2010.

Study sites	Area of transect (km^2)	No. of animal sighted	Population density/km^2
1	6	12	2
2	4	8	2
3	5.5	10	1.8
4	3.5	21	6
Total	**19**	**51**	**2.68**

The population of the Punjab urial in the study area was distributed in fragments mainly based on condition of their natural habitat. Animals were mostly found at lower elevations, on undulating ground, deeply intersected with narrow gullies and ravines, sharp edges / ridges of red marl, against which their foxy red coats were highly camouflaged.

Population structure: Population structure of the urial was determined based on age classes proposed and defined by Schaller and Mirza (1974). Out of 51 animals observed, 37 were females and 14 were males (Table 3). Thirty seven females consisted of 30 adult animals and seven lambs. Among 14 males, four were yearlings, three of Class I, four of Class II, one of Class III and two of Class IV. The largest proportion of male population was yearling (7.84%), Class II (7.84%) and Class I (5.88%), indicating good survival of lambs and yearlings. The urial population was female biased with male-female ratio of 1:2.6 (Table 3). Female-biased sex ratio for adult urials has also been reported at Kalabagh Game Reserve by Schaller and Mirza (1974) and Schaller (1977) who suggested the same for entire Salt Range. They reported that in sexually dimorphic ungulates, male mortality is typically higher than females leading to female-biased adult sex ratios. In Punjab urial, additional factor for the female-biased adult sex ratio may be the selective harvest of males as trophies. Male lambs also fetch higher price than female lambs (Geist, 1971; Clutton-Brock *et al*., 1982; Jorgenson *et al.,* 1997: Loison *et al.,* 1999). In the Punjab province, keeping of the Punjab urial as pet is permitted which has increased the removal of lambs from the wild. Edge and Edge (1987) reported male-female ratio 0.58:1 for adult urials in Kirthar National Park, Sind province.

Table 3. Composition of the Punjab urial population in Diljabba-Domeli Game Reserve during 2009 -2010

Category	Females		Males				
	Adult	Young	Yearling	Class I	Class II	Class III	Class IV
Number	30 (58.82%)	07 (13.72%)	04 (7.84%)	03 (5.88%)	04 (7.84%)	01 (1.96%)	02 (3.92%)
Total	37 (72.5%)			14 (27.5%)			

Habitat Characteristics: The Punjab urial were observed between 330 m and 600 m elevation in the reserve. They favored foothills of medium and gentle slopes interspersed with small plain areas, frequent gravels and boulders, and patches of grey and green colored soil. Natural springs are the only source of water for them which mostly become dry during summer and urial had to travel to areas outside the reserve in search of water where they become vulnerable to hunting. *Acacia modesta* was dominant tree species in the urial habitat followed by *Capparis aphylla*, *Ziziphus nummularia* and *Prosopis glandulosa* (Table 4). Dominant shrubs included; *Adhatoda zeylanica*, *Sageretia theezans*, *Maytenus royleana*, *Dodonea viscosa* , *Lantana camara* and *Grewia tenax*. *Cynodon dactylon*, *Saccharum bengalense*, *Eulaliopsis binata* and *Eragrostis cynosuroides* were the dominant grasses of study area. Dominant herb species included *Pergularia tomentos* , *Sonchus arvensis* and *Suaeda fruticosa*. Grasses (31.25%) and forbs (22.91%) dominated the composition of natural flora in the Punjab urial habitat (Fig. 2). Roberts (1997) had also reported *Acacia modesta* and *Olea ferruginea* as dominant plant species in the Punjab urial habitat.

Table 4. Major plant species in the Punjab urial habitat in Diljabba-Domeli Game Reserve during 2009-2010

S. No.	Plant species	Relative Density	Relative Frequency	Relative Cover	Importance value index
1	*Adhatoda zeylanica (S)*	18.852	69.565	22.386	110.803
2	*Acacia modesta (T)*	63.04	3.66	22.64	89.34
3	*Sageretia theezans (S)*	8.66	46.74	8.175	63.575
4	*Cynodon dactylon (G)*	14.918	29.347	2.994	47.259
5	*Maytenus royleana (S)*	2.213	34.782	4.168	41.163
6	*Dodonea viscosa (S)*	3.907	30.434	6.149	40.49
7	*Lantana camara (S)*	2.185	29.347	0.921	32.453
8	*Saccharum bengalense (G)*	8.387	15.217	5.757	29.361
9	*Eulaliopsis binata (G)*	5.71	16.304	3.8	25.814
10	*Sorghum hellepense (G)*	4.89	9.782	5.573	20.245
11	*Capparis aphylla (T)*	0.737	15.217	2.095	18.049
12	*Eragrostis cynosuroides (G)*	3.715	11.956	1.45	17.121
13	*Zizyphus nummularia (T)*	0.3	8.69	0.829	9.819
14	*Ischaemum rugosum (G)*	2.049	5.434	2.026	9.509
15	*Grewia tenax (S)*	0.683	7.608	0.898	9.189

16	*Eleusine indica (G)*	1.42	6.521	0.207	8.148
17	*Otostegia limbata (S)*	0.519	5.434	0.598	6.551
18	*Paspalidium flavidum (G)*	1.994	3.26	0.391	5.645
19	*Andropogon contortus (G)*	0.956	4.347	0.184	5.487
20	*Prosopis glandulosa (T)*	0.163	3.26	2.049	5.472
21	*Olea ferruginea (T)*	0.163	4.347	0.253	4.763
22	*Cymbopogon sessilis (G)*	0.628	3.26	0.115	4.003
23	*Pergularia tomentosa (H)*	0.191	3.26	0.092	3.543
24	*Acacia nilotica (T)*	0.027	1.086	1.934	3.047
25	*Suaeda fruticosa (H)*	0.355	2.173	0.092	2.62
26	*Sonchus arvensis (H)*	0.218	2.173	0.046	2.437
27	*Verbena spp. (H)*	0.081	2.173	0.069	2.323
28	*Fagonia indica (S)*	0.054	2.173	0.046	2.273
29	*Paspalum floridanum (G)*	0.956	1.086	0.092	2.134
30	*Torilis leptophlylla (H)*	0.273	1.086	0.046	1.405
31	*Desmostachya bipinnata (G)*	0.136	1.086	0.069	1.291
32	*Tephrosia uniflora (H)*	0.109	1.086	0.023	1.218
33	*Capparis spinosa (S)*	0.081	1.086	0.046	1.213
34	*Cenchrus pennisetiformis (G)*	0.081	1.086	0.023	1.19
35	*Dichanthium annulatum (G)*	0.081	1.086	0.023	1.19
36	*Grewia optiva (T)*	0.081	1.086	0.023	1.19
37	*Imperata cylindrica (G)*	0.081	1.086	0.023	1.19
38	*Psammogeton biternatum (H)*	0.081	1.086	0.023	1.19
39	*Echinochloa cruss-galli (G)*	0.054	1.086	0.023	1.163
40	*Dicliptera roxburghii (H)*	0.027	1.086	0.023	1.136
41	*Polypogan monspeliensis (G)*	0.027	1.086	0.023	1.136
42	*Rhynchosia minima (H)*	0.027	1.086	0.023	1.136
43	*Solanum incanum (H)*	0.027	1.086	0.023	1.136
44	*Tribulus terrestris (H)*	0.027	1.086	0.023	1.136

Key: T-tree, S-shrub, G-grass, H-herb

Acacia modesta was the dominant tree species in urial habitat providing them shelter as their fecal pellets were frequently found under this tree. In addition, urials were also reported to feed on lower branches of *Acacia modesta*, *Olea ferruginea* and *Zizyphus nummularia* in Chak Jabbi area of Kala Chitta Range (Aleem, 1977). Being grazer in nature, urial spend more time in grazing of forbs and grasses including *Cynodon dactylon*, *Saccharum bengalense*, *Eulaliopsis binata* and *Eragrostis cynosuroides* which were believed to be their favorite grass species in the study area. However, they shift to browsing on *Acacia modesta*, *Zizyphus nummularia*, *Olea ferruginea* and *Grewia optiva* during summer when green grass is not available (Awan, 1998).

Habitat Utilization: Population density was used an indices to determine preferred habitat of Punjab urial in the study area. Study site four had the highest population density of 6.0 urials / km^2, hence, was considered its preferred habitat. This site was characterized by comparatively scattered trees and shrubs and more grass cover which is major source of their food. It is important to note that an herbal plant, *Suaeda fruticosa*, was recorded only at site four which is salty in taste and succulent in nature and is considered preferred food of urial especially in dry season when water is scarce. However, their distribution in the study areas may not be solely attributed to natural vegetation structure. Other factors such as disturbance by human activities, livestock grazing competition, availability of preferred forage, etc might also be influencing their distribution and population density in the study area.

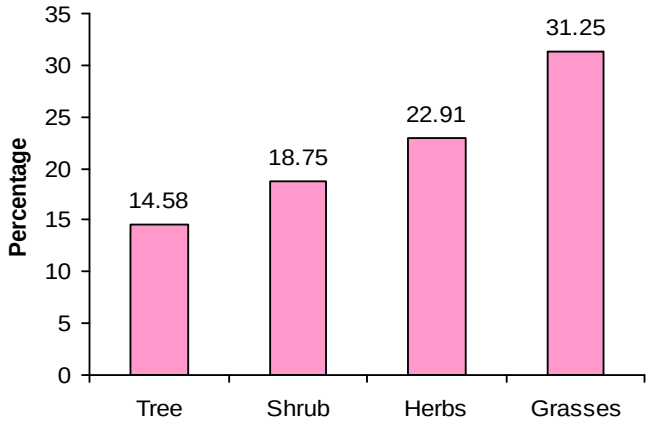

Fig 2. Composition of vegetation types in the Punjab urial habitat in Diljabba-Domeli Game Reserve

Management Implications: Major threats to the Punjab urial population in the reserve include; loss and degradation of habitat due to livestock grazing, fuel wood collection, expanding agricultural practices, mining and stone crushing activities. Limited water availability in the reserve particularly during summer months force the animals sometimes to move outside the game reserve which increases the chances of road kill and hunting. Illegal hunting for meat and trophies and poaching of lambs for keeping as pet are other reasons for decline in urial population. For releasing pressure on natural vegetation in urial habitat, it is suggested to provide alternative energy sources to human population living close to the reserve, establish forage reserves for livestock and abolish stone quarrying activities immediately. Strict law enforcement is required to check illegal hunting and pet trade. Officials of wildlife department should involve local communities and NGOs in the conservation campaign of the Punjab urial.

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