

## Kashmir Red deer or Hangul *Cervus elaphus hanglu* at the Brink of Extinction- Conservation Action, the need of an Hour

Khursheed Ahmad<sup>1</sup> and Parag Nigam<sup>2</sup>

<sup>1</sup>Centre for Mountain Wildlife Sciences, Faculty of Veterinary Sciences & Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences & Technology (SKUAST-Kashmir), Shuhama, Alustang, 190006 Post Box 135 G.P.O. Srinagar, (Jammu & Kashmir) India. E-mail: [khursheed47@gmail.com](mailto:khursheed47@gmail.com)

<sup>2</sup> Wildlife Institute of India, Post Box 18, Chandrabani, 248001, Dehradun, Uttarakhand, India

### Abstract

The Kashmir Red deer or Hangul *Cervus elaphus hanglu*, a subspecies of Red deer is endemic to Kashmir and was once distributed widely in the mountains of Kashmir. Hangul deer are presently largely confined to the 141 km<sup>2</sup> of Dachigam National Park although some relic Hangul populations also occur in adjoining areas. Our intensive study (2001-2013) results on the population ecology of this deer indicate that the major factors affecting the long term survival of the Hangul deer are the following: declining population trends and distributional range, very low adult sex ratio (23.18 males: 100 females) and fawn to female ratio (29.85 young: 100 females), excessive predation by common leopard (*Panthera pardus*), predation on fawns by black bear (*Ursus thibetanus*), meso-carnivores and shepherd's dogs, continued Hangul summer habitat loss and degradation due to excessive livestock grazing in the upper Dachigam, biotic interferences in the winter habitats and loss in heterozygosity. The current population trends indicate that the subspecies could go extinct if the necessary serious interventions are not made immediately. We propose urgent measures to counter-arrest the low sex ratio and fawn to female ratio of Hangul and strengthen the conservation breeding programme to repopulate the good habitats in the former Hangul range, imperative for the revival of the population and its distributional range. International conservation support particularly from the IUCN and DSG and need for assessment of this subspecies in the appropriate threat category by the IUCN Red list are necessary to perpetuate the effective population recovery and long term conservation of Hangul.

### Resumen:

El ciervo rojo Kashmir, o Hangul (*Cervus elaphus hanglu*), una subespecie del ciervo rojo, endémico de Kashmir, tenía una amplia distribución en las montañas de Kashmir. Los ciervos Hangul en el presente son limitados al Parque Nacional Dachigam (141 km<sup>2</sup>) y algunas poblaciones están restringidas en áreas adyacentes. Los resultados de nuestro estudio intensivo (2001-2013) sobre la ecología poblacional de este ciervo indican que los factores principales afectando la supervivencia a largo plazo del Hangul son los siguientes: tendencias a disminuir el tamaño de las poblaciones y el rango de distribución, muy baja proporción de sexos en adultos (23.18 machos: 100 hembras) y de cervatos a hembras (29.85 crías: 100 hembras), excesiva depredación por leopardo común (*Panthera pardus*), depredación de cervatos por oso negro (*Ursus thibetanus*), meso-carnívoros y perros de pastores, pérdida continuada de hábitat de verano y degradación debida a pastoreo excesivo de ganado en el Dachigam superior, interferencia biótica en el hábitat de invierno y pérdida de heterocigosis. Las presentes tendencias poblacionales indican que la subespecie podría llegar a la extinción si las intervenciones necesarias y serias no son implementadas inmediatamente. Proponemos medidas urgentes para contrarrestar la baja proporción de sexos y de cervatos a hembras. También proponemos fortalecer el programa de reproducción para repoblar los hábitats buenos del rango histórico del Hangul, imperativo para la recuperación de la población y su rango de distribución. El apoyo

internacional por grupos de conservación como la UICN y el DSG así como la necesidad de evaluación de esta subespecie en la categoría apropiada de amenaza por la Lista Roja de la UICN son necesarios para lograr la recuperación efectiva de la población y conservación del Hangul a largo plazo.

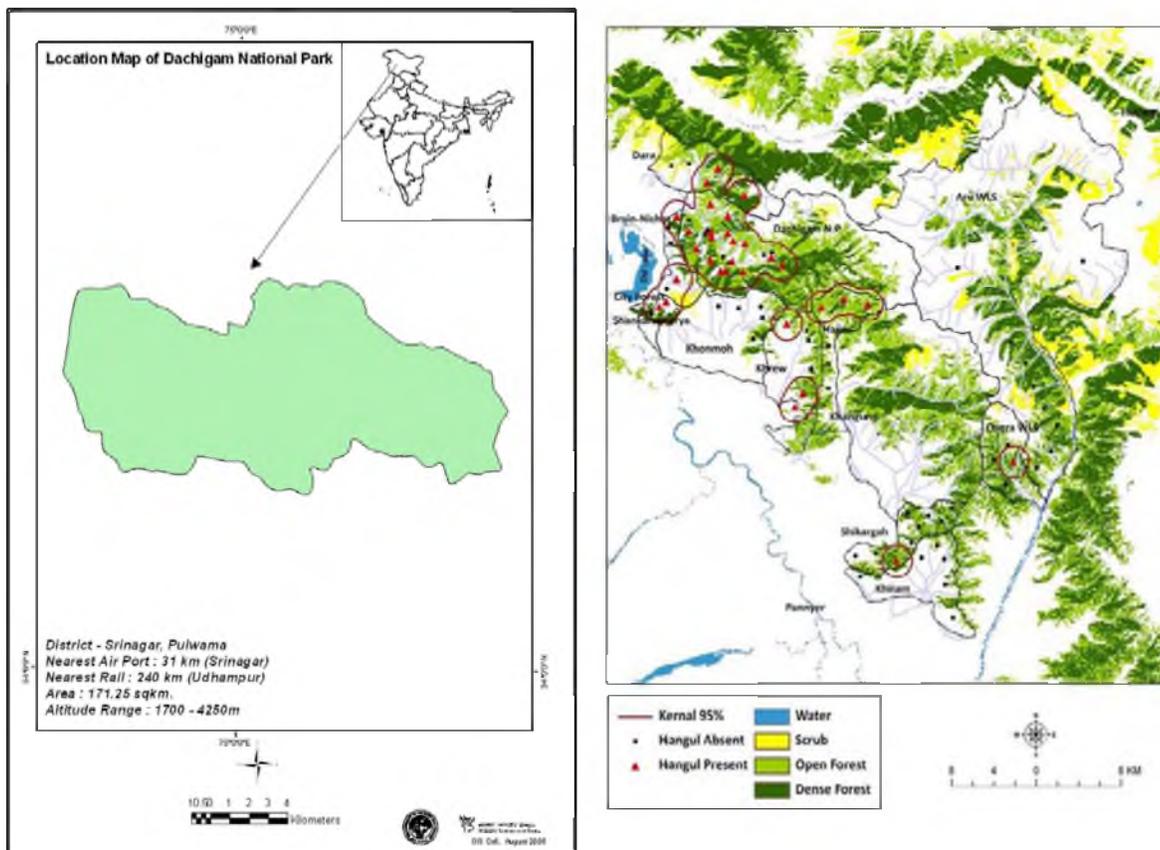
**Key Words:** Hangul, Dachigam, sex ratio, predation, conservation breeding, IUCN

## Introduction

The Kashmir Red deer or Hangul, *Cervus elaphus hanglu*, is one of six Asian subspecies of Red deer and was once distributed widely in the Kashmir Himalayas along the Zaskar mountain range (Gee 1965; Schaller 1969; Prater, 1993; Nowak, 1999) of the Northwest Himalayan biogeographic region zone 2A (Rodgers & Panwar 1988) with the last viable population now existing in Dachigam National Park near Srinagar (Fig.1) (Ahmad *et al.* 2009; Qureshi *et al.* 2009). Among the eight red deer subspecies recognized (Nowak, 1999; Grzimek 1999), the six Asian subspecies include the Sikkim stag or Shou (*Cervus elaphus wallichi*) of East Tibet, the Maral or Caspian red deer (*C. e. maral*) of Asia Minor, Crimea, Caucasus Region and northwestern Iran, Bactrian deer, (*C. e. bactrianus*) of Afghanistan, Kazakhstan, Uzbekistan, Turkmenistan, and Tadjikistan, the Yarkand deer, (*C. e. yarkandensis*) (Xinjiang), MacNeill's deer (*C. elaphus macneilli*) from the upper elevations of the canyons of the Mekong and Yangtze rivers and western China (Grzimek 1999; Nowak, 1999; Ludt *et al.* 2004) and the Kashmir Red deer or Hangul.

The latter is the only surviving race of red deer in the Indian sub-continent (Holloway 1971; Ahmad *et al.* 2009; Qureshi *et al.* 2009). In the current IUCN's Red List of Threatened Species, Red deer (*Cervus elaphus*) is categorized as Least Concern and none of its subspecies has a separate assessment (IUCN, 2012). In India, recognizing the conservation status and declining population trends of this range restricted and endemic deer of Kashmir, it has been officially declared the state animal of Jammu & Kashmir State and listed as a Schedule 1 species in the Indian Wildlife Protection Act 1972 (amended 2002) and Jammu & Kashmir Wildlife Protection Act 1978 (amended 2002) (Ahmad *et al.* 2009). The population of Hangul deer declined drastically in the recent past due to human interferences owing to excessive livestock grazing in Hangul habitats, poaching, urbanization, habitat degradation and fragmentation and loss of corridors for free movement of the animals (Holloway 1971; Kurt 1978). At present a genetically viable population of around 150-170 animals is confined to the 141 km<sup>2</sup> of Dachigam National Park although some isolated populations also occur in adjoining relic range areas (Ahmad 2006, Ahmad *et al.* 2009; Qureshi *et al.* 2009). The Hangul population estimated over the years showed a consistent decline from 5000 deer estimated in 1900, 2000 deer in 1947 (Gee 1965; Schaller 1969) to 218 deer in 2011 (State Wildlife Protection Department; Anonymous 2011). Though efforts have been made in the past to emphasize the conservation problems of Hangul (Gee 1965; Schaller 1969; Holloway and Schaller 1970;

Holloway and Wani 1970; Holloway 1971; Kurt 1978; Inayatullah 1987), there had been a lack of information on the ecology of Hangul, prerequisite for its effective management and long term conservation. Beginning in January 2001, we initiated long term intensive ecological studies in order to understand, monitor and investigate aspects of population dynamics, habitat use patterns, food and feeding habits and ranging and movement patterns of Hangul in Dachigam National Park and the Hangul's historical distribution areas.



**Figure. 1:** Location Map of Dachigam National Park (Left) and the Map of the areas intensively Surveyed and the Hangul Distribution recorded in and Outside Dachigam National Park (2001-2013) (Right)

### Methodology:

Because of the hilly terrain there was no possibility of using distance sampling (Buckland *et al.* 1993) or Line Transect (Burnham *et al.* 1980) methods to estimate this deer population. We designed a standard network of transects along trails, *Nullas* (streams) and contours using strip counts and bounded counts methods following Hayne (1949), Holloway (1971) and Rutledge (1982), which allowed the observers to move as swiftly as possible in

the area. We counted and monitored all deer observed in the fixed seven survey blocks in Dachigam National Park and 35 survey units in the adjoining relic Hangul range areas outside Dachigam N.P (Fig.1). Each such transect was monitored on a rotational basis regularly four times a month to collect data on daily activity patterns of the Hangul deer in relation to the resource availability and habitat use parameters. Furthermore, data on indirect evidences of Hangul (dung/pellets) were collected in (2× 20 m) belt transects randomly laid in the survey blocks. To capture Hangul for radio collaring, animals were monitored regularly, habituated, and lured into a darting site near Oak patch in Lower Dachigam using a variety of lures, including greens, vegetables, rock salt and a mineral mixture. On March 16, 2013, one young adult male Hangul was successfully darted at 1716 hrs, with a remotely administered drug combination of sedative (medetomidine) and dissociative (ketamine) using a Syringe projector (Dan Inject-Mod IM). The animal was successfully captured and collared using a Vectronics GPS Plus-4 IRIDIUM satellite collar (Fig. 2). During the process of capture, the sedation levels safe for handling were assessed (Fig. 3), and it was found that the physiological parameters were within normal limits and corresponded to that of Sambar (*Rusa unicolor*). The collared animal's movements have been tracked on a regular basis since March 16, 2013, through satellite as well as on ground through a VHF receiver and antenna.



**Figure 2:** GPS-Satellite Collar fitted Hangul Male showing recovery following sedation March 16, 2013 (Left); Collared animal in velvet captured in the camera trap exactly 02 months after it was fitted with the Satellite collar (Right).

## Results and Discussion

Our decade long (2001-2013) intensive studies on Hangul deer in Dachigam National Park and range wide surveys and habitat assessments in 35 survey units in its former relic range areas outside Dachigam National Park, indicate that the last viable population of this endemic deer of Kashmir is presently confined to the 141 km<sup>2</sup> of Dachigam National Park. There are a few isolated populations occurring in the adjoining Conservation Reserve areas, restricted to an effective area of 351.15 km<sup>2</sup> outside Dachigam National Park, out of the approximately 884.41 km<sup>2</sup> of its historic distributional range. Based on the total of 326 Hangul sightings in Dachigam National, the recorded Hangul population parameters, as depicted in Table 1, indicate that the Hangul population dynamics vary significantly between seasons. The 153 Hangul sightings outside Dachigam N.P, however, indicate an overall mean Hangul encounter rate of 0.043 Hangul/kilometer walked with an overall Hangul Density of 0.49 Hangul/km<sup>2</sup> and an overall Hangul sex ratio of 11.81 males/100 females and fawn to female ratio of 5.93 fawn/100 females.

**Table 1.** Hangul Population parameters recorded in Different Seasons in Dachigam National Park.

Season	No. of monitoring	No. of Sightings	Male only groups	Mixed groups	Female, young Groups	Female only Groups	Male, female Groups	Encounter Rate Hangul/Hr. Effort	Encounter Rate Hangul/Km Walk	Mean Group Size	Typical Group Size	Density Hangul/Km <sup>2</sup>	Sex Ratio Male/100 female	Female/Fawn ratio Fawn/100 female
Spring	155	85	10	18	27	23	7	2.02	0.67	5.36 ± 0.66 (S.E.)	17.50	8.93 ± 0.17 (S.E.)	14.05 ± 2.92 (S.E.)	2.70 ± 2.49 (S.E.)
Summer	176	55	11	8	21	13	2	0.41	0.14	1.10 ± 0.17 (S.E.)	5.28	0.71 ± 0.05 (S.E.)	14.29 ± 3.87 (S.E.)	34.25 ± 5.79 (S.E.)
Autumn	150	85	31	24	11	7	11	0.93	0.31	2.60 ± 0.27 (S.E.)	7.01	1.79 ± 0.06 (S.E.)	52.30 ± 9.20 (S.E.)	32.19 ± 4.54 (S.E.)
Winter	212	101	3	36	37	17	7	1.17	0.55	4.86 ± 0.50 (S.E.)	15.76	9.02 ± 0.14 (S.E.)	18.19 ± 3.45 (S.E.)	32.96 ± 3.23 (S.E.)
Overall	693	326	55	86	96	60	27	3.54	1.66	3.54 ± 0.23 (S.E.)	14.11	5.6 ± 0.10 (S.E.)	23.18 ± 2.58 (S.E.)	29.85 ± 1.89 (S.E.)

These study results and field observations are indicative of the fact that one of the major issues concerning long term conservation and survival of Hangul has been the declining population trend, the sex ratio and fawn to female ratio. Our studies showed an overall mean Hangul sex ratio of 23.18 males: 100 females and fawn to female ratio of 29.85: 100. The fawn- female ratio declined significantly ( $t=3.4$ ,  $p=0.01$ ) from 23:100 in 2004 to its lowest level of 9:100 in 2006, before showing some recovery. The low fawn to female ratio and fawn survival is presumed to be attributed to stress owing to the heavy biotic disturbance in Dachigam compounded with nutritional stress and fawn predation by common leopard, Asiatic black bear, jackal (*Canis aureus*), red fox (*Vulpus vulpes*) and stray dogs of shepherds and army installations. The predation by leopard and black bear, both of which prey principally on the young deer (Ahmad *et al.* 2009), seems to be the worst threat for Hangul deer. The predation on Hangul by leopard (60% biomass of leopard diet) (Ahmad *et al.* 2009) is very high in winter and summer when the Hangul has a limited distributional range in Dachigam National Park. This is due to the clumped distribution of resources in large areas which are snow bound in winter and possibly because of excessive livestock grazing in the upper alpine areas and even in some of the blocks in Lower Dachigam in summer. We recorded average livestock dung densities of  $25.40 \pm 17.67/\text{km}^2$  for cattle and  $132.77 \pm 92.83/\text{km}^2$  for sheep/goat during summer and autumn seasons in two

blocks of lower Dachigam. The predation, if it continues, will add to the demographic stochasticity and may produce a further future decline in the Hangul population in the future.

The satellite collared animal showed an initial movement pattern of using the lower areas until early summer and the middle Dachigam up to an altitude of 3000 meters (asl.) through summer and autumn using GPS-Satellite telemetry. This animal showed upward movements to Dagwan alpine meadows of upper Dachigam but restricted its movement further in to the alpine meadows, possibly due to heavy disturbances of excessive livestock grazing.

Investigations on habitat use indicate that the Hangul showed significant differences in the use of different habitat types ( $F = 6.49$ ;  $P = 0.00$ ) between seasons. Males showed significant differences in habitat utilization within a season ( $F=3.63$ ;  $p \leq .013$ ) and some differences between the seasons ( $F=1.50$ ;  $p \leq 0.087$ ). The females showed some differences in their habitat use within season ( $F= 2.003$ ;  $p \leq .093$ ) but not between seasons ( $F= 14.771$ ;  $p \leq .577$ ). Hangul showed greater use of lower (1700-1900 m) and middle (1900-2300 m) altitudes and generally south facing slopes. The Hangul feeding habits varied according to their availability in different seasons in Dachigam National Park (Table 2).

**Table 2:** Type of Food Plants consumed (%) by Hangul in different Seasons based on both direct observations and pellet Analysis in Dachigam National Park.

Season	Forbs/fern		Grass/Herb		Browse		Debarking
	Indirect	Direct	Indirect	Direct	Indirect	Direct	Direct
Spring	67.86	36.36	7.14	18.18	25.00	45.45	20.45
Summer	42.86	60.00	19.05	28.00	38.10	12.00	0.00
Autumn	50.00	41.18	0.00	0.00	50.00	58.82	5.88
Winter	32.43	19.23	16.22	0.00	51.35	80.77	50.00

### Recommendations

Our decade long intensive studies on Hangul indicate that the species could go extinct if necessary serious interventions are not made immediately. We suggest that the Hangul population in Dachigam National Park and its adjoining areas needs an intensive population monitoring programme and further reproductive and behavioral ecology studies to better understand factors affecting population growth. In addition to traditional measures of Hangul deer protection, which include providing full protection to the animal and its habitats and strengthening of the conservation breeding programme and the anti-poaching measures, the following key measures are recommended for a rapid recovery of the Hangul population and its lost habitats:

- Steps to ensure the expansion of the range and habitat of Hangul to its alpine meadows in upper Dachigam including the rehabilitation of the livestock owners, providing them with alternate grazing lands and involving them in eco-development and conservation activities.
- Increasing the Hangul movement pattern studies using GPS/satellite telemetry which will help in establishing ecological deer corridors between protected areas.
- Initiation of reproductive ecology studies to better understand factors responsible for low male/female adult sex and fawn/female ratios, which among others could be increased male foetus abortion under stress.
- The former Hangul deer distribution range areas outside Dachigam National Park require immediate management and conservation efforts including the initiation of a scientific monitoring program for collecting baseline information on their habitat conditions and biotic interferences *vis-à-vis* present status and distribution of Hangul. These data would be then interpolated to assess the reestablishment of these relic areas as corridors and reintroduction areas for Hangul.

- There is an urgent need to regulate the common leopard and Asiatic black bear populations in Dachigam National Park to arrest the heavy predation on Hangul. Moreover, the stray dog population which has thrived in Dachigam due to the paramilitary forces in the Park should be eliminated.
- A supplementary diet provided to Hangul during winters should be distributed evenly along the main streams (*nullahas*) so as to ensure the availability of food and minerals to the Hangul in its distributional areas. The provisioning of supplementary food in winters is reported to be useful for both males and females, preventing greater winter male mortalities in red deer and elk (*Cervus canadensis*). ((Smith 2001; Clutton-Brock & Albon 1989)
- The establishment of 3 to 5 enclosures of the dimensions of 50×50 m both in Lower and Upper Dachigam, for *long term* study and monitoring of the impacts of grazing and habitat degradation.

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## Extinction process of the sambar in Peninsular Malaysia

Kae Kawanishi<sup>1</sup>, D. Mark Rayan<sup>2</sup>, Melvin T. Gumal<sup>3</sup> and Chris R. Shepherd<sup>4</sup>

<sup>1</sup> Corresponding author: Malaysian Conservation Alliance for Tigers: kae@malayantiger.net

<sup>2</sup> WWF-Malaysia, Malaysia: mdarmaraj@wwf.org.my

<sup>3</sup> Wildlife Conservation Society-Malaysia Program, Malaysia: mgumal@wcs.org

<sup>4</sup> TRAFFIC Southeast Asia, Malaysia: chris.shepherd@traffic.org

### Abstract

In Peninsular Malaysia, the sambar has lost more than 50% of its historical range in the past century and only a quarter of its current habitat is protected. Although multiple hunting moratoria have existed for five decades, the sambar has been relentlessly poached for local meat consumption. It now persists in only a few areas that receive active protection. Given the massive decline of its historical habitat, current rarity, and the lack of capacity and resources for large-scale restocking, effective protection as well as interest in forest restoration, we believe that the process of extinction will be exacerbated for this species in Peninsular Malaysia. Thus we recommend that the IUCN Red List authority review the Red List category of sambar, presently listed as Vulnerable (VU), but which would warrant listing as Endangered (EN) A2cd, and possibly A4cd, if these observations in Malaysia reflect global trends across the full species' range.

### Resumen

En Malaysia Peninsular, el ciervo sambar ha perdido más de 50% de su distribución histórica en el siglo pasado, y solamente un cuarto de su hábitat actual es protegido de conversión. A pesar que moratorios múltiples de caza han existido sobre las últimas 5 décadas, el sambar ha sido cazado furtivamente para el consumo local de la carne. Ahora persiste solamente en algunas pocas áreas que reciben protección activa. Dado la disminución masiva de su hábitat histórico, bajos números y la falta de capacidad y recursos para su re-introducción en una escala grande, protección efectiva e interés en la restauración de bosques, creemos que el proceso de extinción probablemente va a aumentar para esta especie en Malasia Peninsular. Entonces, recomendamos que la autoridad de la Lista Roja de la UICN repase la categoría del sambar, listada actualmente como Vulnerable (VU), pero que podría merecer categorización como En Peligro (EN) A2cd y posiblemente A4cd, si estas observaciones en Malasia reflejan las tendencias globales del rango entero de la especies.

**Keywords:** conservation, extinction, IUCN Red List, poaching, protection, reintroduction, wild meat

### Introduction

Ungulates (Artiodactyla), in particular, are disproportionately threatened with extinction compared with most other mammals, especially in Southeast Asia, largely due to massive overhunting (Corlett 2007). Large ungulate (species > 5 kg) populations have declined in recent decades due to commercial poaching to supply local and regional demand with meat, antlers and other body parts, causing many site-level extirpations in the region (Bennett &