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SOME OBSERVATION ON THE STATUS AND CONSERVATION OF SWAMP DEER *CERVUS D. DUVAUCELI* (CUVIER, 1823) IN DUDHWA NATIONAL PARK, INDIA

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INTRODUCTION

Barasingha is one of the large size deer belonging to the family *Cervidae* with characteristic highly branched antler and residing in a marshy habitat, so called swamp deer (Jerdon, 1874; Blanford, 1888-91; Lydekker, 1898, Bhadian, 1934; Pocock, 1943; Schaller, 1967; Krishnan, 1972; Prater, 1971). Brander (1923) mentioned two races of barasingha north-eastern and central Indian races according to their living in two different type of habitat. Ellerman & Morrison-Scott (1951) subsequently distinguished two subspecies: *Cervus duvauceli duvauceli* Cuvier 1823 and *Cervus duvauceli branderi* Pocock 1943. Groves (1982) later described another new subspecies *Cervus duvauceli ranjitsinghai* and thus three different races of barasingha are present today due to geographical variation mentioned as sub-species (Singh, 1985). They prefer hard and soft ground grassy areas near to moisy or swampy soil and sand (Gee, 1964; Martin, 1977; Panwar, 1978). Various worker like Blanford (1888-91), Sterndale (1929), Schaller (1967), Prater (1973), Brander (1923), Martin (1977), Panwar (1978), Schaff (1978), Dinerstein (1979), Singh (1979), Sinha (1986) and Pandey (1986) studied on the various aspects of barasingha like the taxonomy, biology, distribution, ecology and behaviour.

The status of barasingha includes population, group composition and age-sex ratio was assessed by some workers from time to time noatably; Schaller (1967), Martin (1977), Schaff (1978), Khajuria (1982), Singh (1995) and Qureshi (1991). Apart from the above study no any detailed study was found on the present status of barasingha in the park and its adjoining areas.

In the developing world the major habitat of the precious wildlife animal are encroached and degraded by human beings through the industrialization and urbanization. In addition the rapid changes in the various environmental factors and climatic changes possess threats to the various species of animal evolves through the complex phenomenon of evolution. The phenomenal changes in the natural areas of wildlife basically the mammalian fauna are severely affected in comparison to the other animal. Due to these changes, the natural habitat of barasingha is diminishing day to day and as result barasingha is now under unfnerable category (Duekworth *et. al.*, 2013) now this animal the successful conservation and management of in their natural habitat require a detailed study on their surviving population in the various localities.

STUDY AREA

The study was conducted in Dudhwa National Park, U.P. (Fig. 1) and adjoining Kishanpur Wildlife Sanctuary to ertimate the current population status and pattern of

Key words: Barasingha, Age-sex ratio, population, Conservation, Dudhwa National Park.

Fig. 1: Map of Dudhwa National Park

distribution of the barasingha (*Rueervus duvauceli*). Dudhwa National Park comes under core area of Dudhwa Tiger Reserve along with Kishanpur Wildlife Sanctuary. The Park is located on the Indo-Nepal border in the Nighasen Tehsil of district Lakhimpur-Kheri and lies between 28° 18'N and 28° 42'N latitudes and 80° 28'E and 80° 57'E longitudes. The altitude above mean sea level ranges from 182 m in the extreme north to 150 m in the farthest southeast. The Kishanpur Wildlife Sanctuary (KWS) lies in the Lakhimpur-Kheri and Shahajahanpur districts in Uttar Pradesh. It covers an area of about 20341 ha (De, 2000) and lies in southern part of Dudhwa National Park and also on the southern bank of river Sarada. The KSW is about 15 km from DNP and separated by agricultural landscape and divided into Kishanpur and Mailani forest ranges. In general the area of both DNP and KWS is a vast alluvial plain scoured with the channels of numerous large and small watercourses. The surface being formed by the riverbeds and their high banks results the formation of a series of fairly elevated plateaus separated by streams flowing from northwest to southeast bordered by low alluvial belts of varying width. The general slope of the area is from northwest to southeast.

As per the bio-geographic classification of Rodgers and Panwar (1988), the area of the Reserve falls within the Tarai-bhabar bio-geographic subdivision of the Upper Gangetic plain. About 66 % of the Reserve is woodland which provide food and shelter to a vast variety of animals. The main tree species of this National park is Shorea rolurta. The grasslands are a prominent feature of both the National Park and the Sanctuary. They constitute about 19 % of the National Park and 21 % of the Sanctuary. The buffer areas have 31.50% under grasslands. About 22.30% of the park is covered by grasslands. Water logging occurs for some time during monsoon. The area under the National park is characterized by extremes of wet and dry conditions. The soil is permanently saturated and wet; aeration is poor with some water standing round the year. Apart from the swamp deer the other species of deer in this park includes cheetal, sambar, hog deer and other mammalian species like porcupines, wild boar, rats and mice etc.

Fig. 2 : Grass lands at Kakraha, Dudhwa National Park

Fig. 3 : Swamp Deer at Jhandi Taal

MATERIALS AND METHODS

General surveys were conducted to the whole Dudhwa National Park (DNP), UP in the year 2008 for observation of various parameters to assess the habitat and population of the barasingha. The population data was recorded by two teams separately to cover the whole areas of the park for 10 days. The research team recorded population of barasingha based on age-sex categories in the six ranges within the DNP by road side count techniques (Davis, 1982) and Block count techniques (Lancia *et. al.*, 1994).

During surveys, the team moves by vehicles in an average speed of 20 km/h to record the population data on various age-sex individuals of barasingha whenever any group or herd and individual encountered. A total of 560 km were covered during whole survey period for population and in ecological study. The individual of barasingha present on both sides of the road upto 100 meter distance by one observer on each side of the road was noted with the aid of Binocular (8x50 power), Digital Camera (300 mm telescopic lens) and data preferred sheet designed to record all information of the individuals. Age-sex categories of individuals was identified and observed with the help of coat colour, horn length and morphology with standard literatures (Prater, 1971; Singh). Most of the data gathered during morning and afternoon time when visibility was good.

The age and sex of the individuals of the animal were identified according to Schaller (1967), Prater (1971) and Martin (1977). The populations of barasingha present in a distance more than 100 m to the road side and in a specific location like plain grassland, water holes, riverside, bushes and open grassy patches were recorded by making blocks in the whole DNP. During the study period all major type of habitat (Fig. 2 and Fig.3) covered by the survey team have all the grassland surrounded by rivers and open grassy patches inside the sal forests.

Data recorded by the surveys was analyzed, tested and calculated the average size of the herd, age-sex individuals and availability index of barasingha in the various blocks and ranges of Dudhwa National Park, U.P.

RESULTS AND OBSERVATIONS

I. Population structure: In the present study, the population of the various age-sex groups of individuals of barasingha in the various ranges and blocks of Dudhwa National Park were recorded. A total of 831 individuals of barasingha recorded in the DNP out of that 172 male (20.69%), 469 female (56.43%) and 190 (22.86%) were yearling. After analysis of the recorded data it is estimated that the population of barasingha in DNP is about 920. The above record of total population is very similar to the population recorded by Singh (1978). Out of the six ranges of Dudhwa National park the maximum number of barasingha has recorded in Belrayan (290) and minimum in Gauriphanta (42). The mean and Standard error are (8.40±0.90), (22.33±2.34) and (9.04±1.10) in male, female and yearlings respectively (Fig.4).

The total number of individual recorded in various ranges of DNP is given in table 1 and mean number of individual of each age-

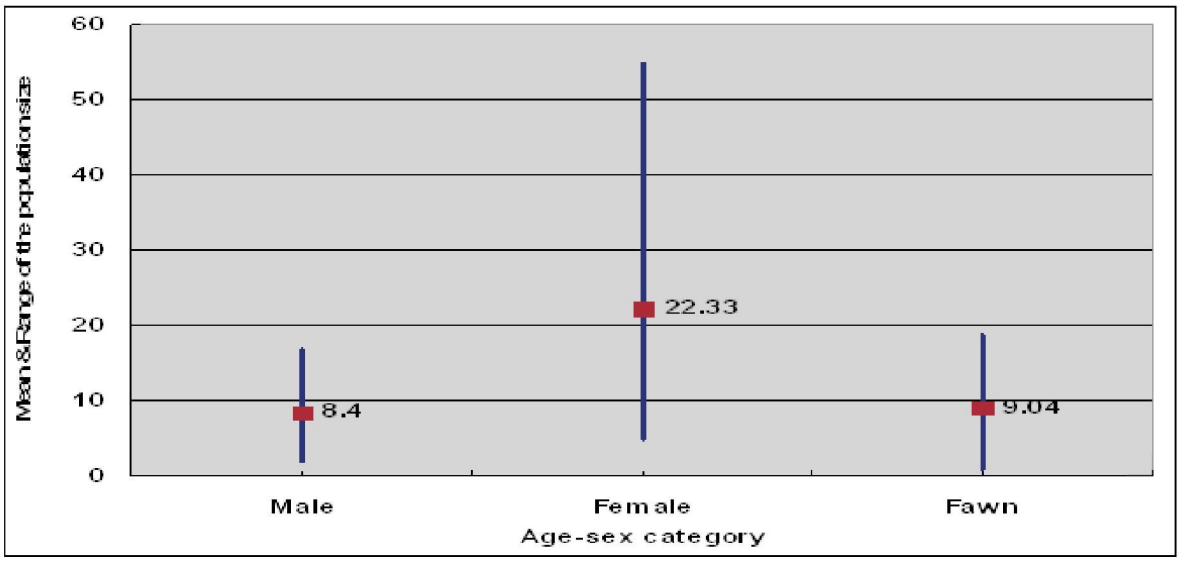

Fig.4: Mean group size of barasingha in Dudhwa National Park, U.P.

sex category in a herd in different forest ranges of DNP is given in table 2. The highest of the mean population of male was recorded in the herd of south Sonaripur (9) and Belrayan and lowest in north Sonaripur (4). Similarly, the highest average number of female and yearling were recorded in the herd of south Sonaripur (23.5 female and 10.75 yearlings) and lowest in North Sonaripur (12 female and 3.33 yearlings).

The population recorded in the present study showed a stable population of barasingha in Dudhwa National Park, U.P. as recorded by earlier workers (Holloway, 1972; Schaaf & Singh, 1977; Singh, 1985; Qureshi, 1991; Shankaran, 1989) time to time in the same locality but the population was estimate more compare to the population recorded by Qureshi (1991) and Shankaran (1989)

II. Herd composition: On analyris of data collected during the study revealed that the mean size of the herd of banasingle was 19.34±3.4 while the rise of the herd between different habitat of Dudhwa National Park was 8.9. This heval size recorded was very much similar to the herd size (18.41) recorded by Shankaran (1989). The above herd size is also comparable to the herd size recorded by Singh (1978) in Dudhwa National Park, India as recorded in summer, monsoon, and winter were 32, 13 and 7 respectively.

In the current survey the age-sex ratio (males: females: fawns) of barasingha recorded in Dudhwa National Park is 1:2.74:1.01 which is significantly different from the ratio recorded in earlier surveys in the various localities by forests department of various states in the 1960's. Among the different ranges of Dudhwa National Park the highest age-sex ratio recorded in Dudhwa range

Table 1 : Age-sex composition of barasingha in Dudhwa National Park, U.P.

Sl. No	Range	Male	Female	Young
1	Dudhua Range	4.28	15.14	5.28
2	Bankati Range	5	13.75	5
3	Gauriphanta	6	14.34	5.6
4	South Sonaripur	9	23.5	10.75
5	North Sonaripur	4	12	3.33
6	Belrayan	9	22.14	10.28

Table 2 : Observed population of various age-sex categories of barasingha in DNP.

Sl. No	Range	Male	Female	Young
1	Dudhua Range	30	106	37
2	Bankati Range	20	55	20
3	Gauriphanta	11	23	8
4	South Sonaripur	36	94	43
5	North Sonaripur	12	36	10
6	Belrayan	63	155	72

Table 3 : Age-sex ratio of barasingha in various the ranges of DNP, U.P.

Sl. No	Range	Male	Female	Young
1	Dudhua Range	1	3.53	1.23
2	Bankati Range	1	2.75	1
3	Gauriphanta	1	2.09	0.72
4	South Sonaripur	1	2.61	1.19
5	North Sonaripur	1	3	0.83
6	Belrayan	1	2.46	1.14

(1:3.53:1.23) and lowest in Gauriphanta (1:2.09:0.72) is shown in table 3. In the present study the maximum number of barasingha was recorded in Belrayan range and minimum in Gauriphanta range (fig. 5). The sex ratio observed was greater in comparison to the sex ratio (1:2) observed by Schaller (1967) and very close to the sex ratio (1:2.5) of Singh (1978). The ratio observed between hind and fawn was 100:40.65 which was greater than the ratio observed between hind and fawn (100:37.14) by Shankaran (1989).

III. **Animal abundance & Availability Index:** A total of 10 day survey to the six ranges of Dudhwa National Parkn was conducted to observe the availability of barasingha for conservation and management.

The population recorded in the various ranges of the park helps the abundance and availability index of the barasingha assess in Dudhwa National Park (Table 3 and Fig. 5). The abundance in term of availability index of barasingha in the DNP was 1.11 animal per sq. km and the availability index of various age-sex categories was 0.23 males per sq. km., 0.63 females per sq. km. and 0.25 yearlings per sq. km. The availability index shows that the maximum abundance of barasingha was recorded in Belrayan (1.18 animal/sq. km.) and minimum in north Sonaripur (0.64 animal/sq. km.). In the various ranges of Dudhwa National Park, the availability index (Table 4) of male was highest in Belrayan (0.4) and lowest in north Sonaripur (0.13). Similarly, the highest availability index of female and yearling found in Belrayan and lowest in North Sonaripur. Schaller (1967) recorded 0.2 individual of barasingha in Kanha National Park, India was less than the present record in Dudhwa

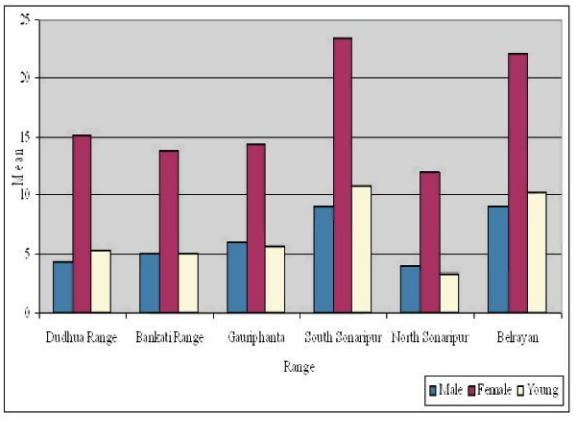

Fig. 5 : Mean size of the population of the different age-sex group of barasingha in Dudhwa National Park, U.P.

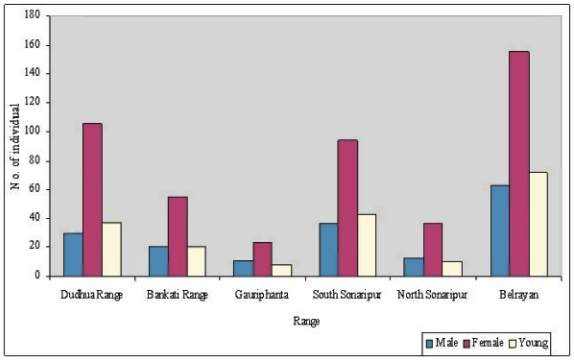

Fig. 6 : Population structure of barasingha in different ranges of Dudhwa National Park, U.P.

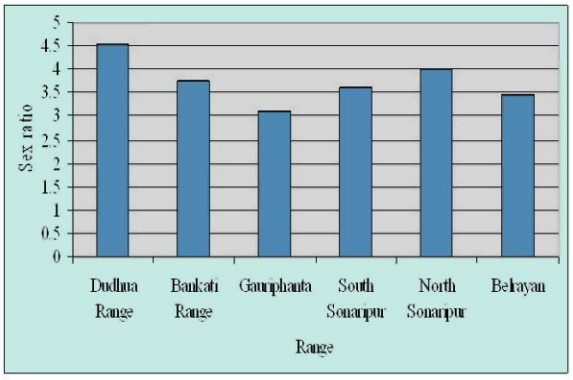

Fig.7: Sex-ratio (Total number of adult individuals/Total number of adult males) of barasingha in different forest ranges of Dudhwa National Park, U.P.

Table: 4 Availability index of each age-sex category individual and total number of animal in Dudhwa National Park, UP

Sl. No	Range	Availability index			
		Male	Female	Yearling	Barasingha
1	Dudhua Range	0.18	0.64	0.22	**1.04**
2	Bankati Range	0.19	0.53	0.19	**0.92**
3	Gauriphanta	0.3	0.62	0.22	**1.14**
4	South Sonaripur	0.19	0.5	0.22	**0.92**
5	North Sonaripur	0.13	0.4	0.11	**0.64**
6	Belrayan	0.4	0.97	0.45	**1.82**

National Park which might be due to the nature of residing in ecologically different type of habitat.

DISCUSSION

The barasingha was formerly located in suitable localities throughout the basins of the Indus, Ganges and Brahmaputra Rivers as well as central India as far south as the Godavari River, generally in areas covered by moist deciduous forests. At one point of time, Barasingha used to inhabit most of the areas of northern as well as central India. However, today their habitat has been restricted to the protected forests of Uttar Pradesh, Assam and Madhya Pradesh only. The area frequency of different ranges was not related with encounter frequency of the no. of individuals of swamp deer. The area frequency of Dudhwa range was higher than that of Kishanpur range. But the encounter frequency was higher in kishanpur range. The Mialani range had more area frequency than some of the other ranges but it had the poor encounter frequency than those areas.

The Swamp Deer in Dudhwa National Park can be said to be occupying two distinct portions – Sathiana grass lands in the west and several grass lands and Taal in the east such as Kakraha, Bankey Taal, Bhadi Taal, Chota Kakraha, Churela Taal and Nagra Taal. There is another populatin in the Kishanpur Sanctuary using single key habitat offered by Jhadi Taal. The Sathiana area is famous for Swamp Deer and the other promising areas are Bhadi and Jhadi Taal and associated grass lands. Both have good populations of Swamp Deer.

The distribution of swamp deers generally depend on the availability of their annual food items. The Swamp Deer typically occurs only in wet grasslands. That's why; they generally prefer those swampy area and water-hole in different ranges and some ranges have good abundances of

food resources having those wet grasslands like Kishanpur, South Sonaripur and Belllraien ranges. The habitat of swamp deer in Dudhwa National Park was divided into two major habitats which are Grassland surrounded by rivers and nalahs, and open grassy patches in sal forests. The first type of habitat is found in Sathiana and Belghat block while the second type of habitat distributed in six blocks of DNP (Singh, 1995).

According to Schaller (1967) in 1965 the population was between 1400 and 1800 in India and about 1600 in Nepal. In 1980 the population of swamp deer was 2000 (Dudhwa National Park, Uttar Pradesh) and in 1995 the population was 4168 (both species). De (2000) recorded 698 barasingha in Dudhwa National Park and 370 in Kishanpur Wildlife Sanctuary. The population sex ratio of barasingha in Kanha National Park was recorded by Martin (1977) as 75 male: 100 female, Schaf (1978) recorded 78 male in 100 female at Royel Sukla Phanta, Nepal and Singh (1978) recorded 43 male in 100 female at Dudhwa National Park. Khajuria (1982) recorded the age-sex ratio i.e male: female: fawn was 1:2.65:0.538 in 1965 and 1:1.65:0.730 in 1971. Qureshi (1991) the age-sex ratio was 57 male: 100 female: 44 fawn in Karkaha range and 37 male: 100 male: 40 female in Sathiana.

In the present study, the population composition of barasingha was 37 male: 100 female: 40 fawn at Dudhwa National Park. The age-sex ratio is 1:2.70:1.07 which reflects with the male-female ratio of Khajuria (1982) while the male-fawn ratio of present study was greater then previous studies by Khajuria (1982) and Qureshi (1991). In the present observation it may be said that the population of barasingha is increasing as the ratio of fawn in the recorded population is high. Qureshi (1997) provided the age-sex ratio of barasingha in different blocks of DNP which is about 54.8 male and 44.30 fawns in per 100 female, but in the present study, the age-sex ratio in the different blocks is less number of male in comparison to the females and more or less same number of fawns.

The density of the barasingha population was more in Dudhwa Range, Gauriphanta and Belryen. This may be due to presence of more number of suitable wet grass lands and availability of more number of water hole, and river flow through those areas. The distribution of swamp deer were generally depends on the availability of their annual food items (Martin, 1977). The Swamp Deer typically occurs only in wet grasslands. That is why; they generally prefer those swampy areas and water holes in different ranges and some of these ranges had good abundances of food resources viz., Kishanpur, South Sonaripur and Belrayan ranges.

The complex of tall wet grasslands and swamps contribute immensely towards making the ecosystem one of the most diverse and productive. They account for a sizable portion of the swamp deer populations of the Park and the Sanctuary. In the Park the key areas are the Southern border along the Suheli River where most of the major grasslands occur. Among the grasslands, the most prominent are the Sathiana and Kakraha areas having healthy population of barasingha. The mosaic of grasslands and high forests form unique niches that are occupied by numerous life forms. Barasingha populations showed the highest preference for open and short grassland. Dudhwa National Park is one of the natural habitats for the barasingha from time immemorial. But in this habitat their population is depleting due to excessive exploitation by poaching and fragmentation of their various localities within this National Park. In this current scenario, a regular study on their various aspects of population dynamics, ecology and behavioural pattern is needed to conserve and adopting proper management to this precious natural beckon in future.

SUMMARY

Barasingha is one of the large size deer belong to the family *Cervidae*, also known as swamp deer. A socio-ecological study on barasingha was conducted in Dudhwa National Park, India by road side count techniques and Block count techniques. A total of 831 individuals of

barasingha recorded in the DNP out of that 172 male (20.69%), 469 female (56.43%) and 190 (22.86%) were yearling; with an estimated population is about 920. The mean size of the herd and age-sex ratio (males: females: fawns) of barasingha was recorded 19.34±3.4 and 1:2.74:1.01 respectively. The abundance in term of availability index was analysed at 1.11 animals per sq. km. In conclusion, the population of barasingha is increasing as the ratio of fawn in the recorded population is recorded high. The recorded population and age-sex ratio revealed that barasingha prefer open and wet grasslands and swamps for survival in Dudhwa National Park.

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