GROUP SIZE AND HABITAT USE OF HOG DEER IN ALLUVIAL FLOODPLAINS OF DUDHWA NATIONAL PARK, UTTAR PRADESH, INDIA

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ABSTRACT

We studied group size and habitat use of hog deer in Dudhwa National Park using line transect and pellet group count. Density of hog deer was 3.09/km$^2$. The overall mean group size was 2.81±0.17 animals/group. Mean group size in winter was higher (2.11±0.14) as compared to summer (3.42±0.29) and difference was found to be significant (F=14.34, df=1, P=0.01). Sex ratio favored females with male: female: fawn ratio was 60:100:45. The chi-square goodness-of-fit test indicated a significant difference between in overall habitat availability and usage ($x^2 = 656.19$, d.f. = 5, $P = 0.05$). Hog deer used all habitat types except Sal forest and showed a strong preference for upland grassland ($P_w < P_t$). The overlap indices of hog deer with swamp deer was 55% ($r = 0.205$, $P = 0.05$) and with chital 75% ($r = 0.600$, $P = 0.01$).

KEYWORDS: Group Size, Habitat Use, Hog Deer, Niche Overlap, Dudhwa

INTRODUCTION

Hog deer (Axis porcinus) is the only other species belonging to genus Axis that is found in India. Unlike Chital (Axis axis), hog deer is a grassland specialist and restricted to the alluvial grasslands of Indo gangetic and Brahmaputra flood plains (Schaller 1967, Prater 1980). They are especially adapted to living in tall grass which is highly dynamic in nature (Dinerstein 1979). The fertility of these grassland soils also make them vulnerable to be brought under plough. Over the years the survival of hog and other deer like barasingha has doomed over the rate of this exploitation. The position of hog deer in such ecosystem is significant, since they form important prey species of the endangered tiger (Stoen and Wegge 1996).

Hog Deer earlier reported in the past from 64 places have been restricted to 29 places in western and eastern terai, out of which only 6 (7.8%) places have the maximum potential to sustain hog deer and in future only 1.7% of area is expected to be able to support the species in future (Biswas, et al. 2002). Despite such shrinking spatial distribution of hog deer has not been studies in detail in India except casually by Schaller (1967). Compared to other deer species we do not have much information available on this shy and cryptic natured species. In Nepal however, hog deer was studied in detail by Dhungel and O’Gara (1996) and Mishra (1982). In the scenario of limited scientific information on population structure and habitat use of hog deer, it is difficult to predict the ability of this species to withstand environmental changes caused by habitat degradation and habitat destruction.

Hog deer in Dudhwa shares its habitat with other five cervids including endangered swamp deer, elephant and rhino. Its choice of habitat use and preference can be hypothesized to depend on its interaction and inter-specific completion with other sympatric species. Studies of habitat selection of individual or population continue to play an important in the efforts to generate sufficient knowledge for effective wildlife management (Otis 1997). However decision
about how to manage wildlife often depends on whether population is increasing or decreasing James et al. (1996). This is important for Dudhwa National Park in the sense that many techniques are used for the management of grasslands. In such situation, the knowledge of population status, its local distribution and habitat use by hog deer shall equip the managers and ensure the long term survival of the species.

STUDY AREA

The study was carried out in Dudhwa National Park (DNP), which lies in the state of Uttar Pradesh (28° 18’N -28° 42’N, 80° 28’E - 80° 57’E and covers an area of 614.32 km². The tenure of the study was 16 months, from December 2005 to March 2007. The annual climate cycle of DNP includes three seasons: Summer (mid March to mid June) monsoon (mid June to mid October) and winter (mid October to mid March) and receives a mean annual rainfall of 150cm. The temperature ranged from 8°C in winter to 45°C in summer during the study. The vegetation is chiefly moist deciduous forest, dominated by Sal (Shorea robusta). Typical of terai, these forests are interspersed with tracts of low lying grasslands which tend to get flooded during the monsoon. About 60% of the park is woodland providing food and shelter to a vast variety of animals. These grasslands are the prominent feature of the National Park and cover about 19% of the National Park and can broadly be classified into two types, Wet low lying areas are dominated by tall grass species such as Schlerostachya fusca, Phragmites karka, Arundo donax and Saccharum spontaneum. While the drier high ground is dominated by grasses like Imperata cylindrical, Desmostachya bipinnata, Erianthus munja, Cymbopogon martini (Sankaran, 1990, Kumar et al. 2002, Ahmed 2008). Majority of the areas are upland phantas and form the major habitat of barasingha and hog deer and Rhino.

METHODS

To collect data on the group composition of hog deer, field surveys were carried out in different grassland patches of DNP. In each area, hog deer was counted by elephant back; machan and vehicles. Apart from this, random searches were also attempted in different grassland patches. Hog deer were counted mostly from vehicle, occasionally on foot from machans in the study area and less frequently from elephant back. The grassland area of Kakraha, Satiana and Sonaripur were surveyed regularly through fixed routes between dawn and dusk. The areas not accessible by road network were visited on foot. All encountered hog deer, were aged and sexed whenever possible and location and activity of each group was also recorded during the time of observation. Three sex and age classes were distinguished. These were a) males, b) females, c) fawns. To quantify habitat use and density, five permanent transects of one km each were established in different grassland patches based on grassland type (upland and lowland). To sample the pellet groups, permanent circular plots of 10 m radius were established at 50 m distance interval on all transects. These plots were cleared before onset of each season. Pellet groups were counted at the end of each season. A total of 100 plots were established along the transects. Data on habitat parameters as well as various disturbances attributes such as grass cutting by local people distance from metalled and unmetalled, cattle dung piles were also recorded at each sampling plot.

STATISTICAL ANALYSIS

Chi-square goodness-of-fit test was employed to examine the difference between the habitat availability and their usage. Bonferroni confidence intervals were calculated to determine which habitats were preferred or avoided (Neu et al. 1974, Byers et al. 1984). If expected proportional availability ($Pw$) of one habitat lies above the upper limit of the use confidence interval, then it is truly used less than expected, it is ‘avoided’ by animals; if its proportional availability lies
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below the use lower confidence interval, it is selected more than expected and it is ‘preferred’. Person Product Moment Correlation Coefficient was used to know correlation between pellet group densities of hog deer with different habitat variables. Niche overlap was calculated by using Pianka Index (Pianka 1973). The pellet group density of hog deer were converted into animal density (individuals/km²) by dividing the total no of pellet groups recorded on a transect with the mean defecation rate and number of days over which pellet groups were accumulated Mayle et al. 1996).

Animal density = Observed pellet group density per time period/ Defecation rate X time period

RESULTS

In absence of data on defecation rates of hog deer an average value of 13.5 pellet groups per day was used in density estimation considering the range of defecation rate reported in the literature varies from 12 to 15 pellet groups/day/deer (Neff, 1968). The density of hog deer derived from pellet group density was found to be 3.09 individuals/km².

The overall mean group size of hog deer in the Dudhwa National Park, based on observation of 151 groups, was 2.81 ± 0.17 animals/group with a range of 1-15. The winter mean group size was higher (2.11±0.14) as compared to summer (3.42±0.29) and difference was found to be significant (F=14.34, df=1, P=0.01). The mean group size of hog deer was higher in upland grassland as compared to lowland grassland (1.75±0.31), sal forest (1.50±0.50), mixed forest (2.62 ±0.31) and swamps (2.00 ±0.57) and difference was found to be significant ((F=2.932, df=4, P = 0.036). Out of a total number of 425 individuals observed in DNP, 121 (28.47%) were males, 201 (47.29%) females, 92 (21.65%) were fawns and 13 (3.06%) were unclassified. The male to female and female to fawn ratio of hog deer based on above data was 1 male: 1.66 female and 2.18 female: 1 fawn.

We sampled 100 plots to determine overall habitat availability of hog deer in different grassland patches of DNP. The chi-square goodness-of-fit test indicated a significant difference between overall habitat availability and usage ($\chi^2 = 656.19$, d.f. = 5, $P = 0.05$). Hog deer used all habitat types expect Sal forest and showed a strong preference for upland grassland ($P_w < P_t$). Two habitat types, lowland grassland and swamp were avoided ($P_w > P_t$). Mixed forest was used in proportion to its availability (Table 1). The pellet density of hog deer showed negative correlation with grass diversity grass height ($r = -0.571$, $P = 0.01$), Saccharum munja density ($r = -0.402$, $P = 0.01$), and showed positive correlation with Imperata cylidrica density ($r = 0.509$, $P > 0.01$), fire ($r = .590$, $P = 0.01$). We used Pianka’s Index for measuring ecological niche separation of hog deer with chital and barasingha. This index ranges in value from 0 (indication no overlap between two species) and 1.0 (complete overlap). The overlap indices of hog deer in Dudhwa with barasingha was 55% ($r = 0.205$, $P = 0.05$) and between hog deer and chital was 75% ($r = 0.600$, $P = 0.01$) between hog deer and chital.

DISCUSSIONS

Our mean density estimates of hog deer in DNP were lower than reported in other sites Siedensticker (1976), Schaff (1978), Tamang (1982) and Dhangel and O’Gara (1991). However, it was near to 4.7/km² observed by Dinerstein (1979) in Nepal. None of the above study was carried in DNP hence difference can be expected. Even though assuming similar density estimate in Chitwan and Dudhwa there can still be difference because deposition rate vary with age class and ungulates do not defecate evenly through their home ranges, adding to bias. However it was reported that density of chital and barasingha in grassland of DNP was 7.20 and 1.02 individuals km² respectively (Ahmed 2007). Thus chital was most abundant among the three. Higher density of hog deer than barasingha, which both occupy grassland, show the
success of hog deer in better adapting the condition and threat faced by the both species.

Table 1: Availability and Usage of Habitat by Hog Deer in DNP

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Expected Usage</th>
<th>Actual Usage</th>
<th>Bonferroni Interval for Pi</th>
<th>Preferences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sal forest</td>
<td>63.777</td>
<td>2</td>
<td>0.000 ≤ Pi ≤ 0.000</td>
<td>0</td>
</tr>
<tr>
<td>Mixed forest</td>
<td>27</td>
<td>14</td>
<td>0.032 ≤ Pi ≤ 0.155</td>
<td>-</td>
</tr>
<tr>
<td>Upland grassland</td>
<td>12</td>
<td>113</td>
<td>0.663 ≤ Pi ≤ 0.844</td>
<td>+</td>
</tr>
<tr>
<td>Lowlands grasslands</td>
<td>37</td>
<td>20</td>
<td>0.062 ≤ Pi ≤ 0.205</td>
<td>0</td>
</tr>
<tr>
<td>Swamps</td>
<td>8</td>
<td>3</td>
<td>0.000 ≤ Pi ≤ 0.049</td>
<td>0</td>
</tr>
</tbody>
</table>

Average group size found in this study was higher than observed by Dhangel and O’Gara (1991). The largest group of up to 15 were observed. The reason for large group size in summer is due to the availability of new grasses after burning which leads to congregation of population. However, as grass grows tall and dense the visibility is reduced and we might be unable to sight all the members of the group. The same might be the reason for large group size in upland grassland compared to lowland grassland.

Sex ratios favouring females has been shown in various other studies on hog deer (Dhangel and O’Gara 1991, Seidenstcker 1976, Mishra 1982). Sex ratio favouring hinds are characteristic of polygamous species. Male: female: fawn ratio was 60:100:45, which was similar to 59:100:55 Mishra (1982), but healthier than 51:100:24 by Seidensticker (1976). The disparity in adult sex ratio in favor of females has been attributed to several factors such as misclassification of individual (Sharatchander and Gadgil 1975, Mishra 1982), higher mortality of male fawn (Schaller 1967, Johnsingh 1983), selective predation on males (Schaller 1967 for sambar, (Karanth and Sanquist 1992) for chital, sambar and wild boar). Karanth and Sanquist (1992) suggested that female bias may be due to male’s solitary habitats, proneness to injuries from intra –specific aggression, lack of alertness during rut and dispersal behaviour may render them vulnerable to predation. Earlier it was found that hog deer contributes only 6.48% in tiger’s diet and kill recorded did not suggested any male preference (Ahmed (2007), hence we believe that the female biasness is mainly due to solitary nature of male. Sex ratio is generally an indicator of the reproduction potential of the species. A high percent of fawn indicates the reproductive success of the hog deer, though the conversion of this young population into adults is yet to be ascertained.

Comparison between habitats shows high preference for upland grassland and total avoidance of sal forest. Similar use of grassland habitat by hog deer was also found in Chitwan National Park Dhongel and O’Gara (1991) and Mishra (1982). Dhongel and O’Gara (1991) reasoned that individual preferences may, to some extent, determine habitat selection by hog deer, but hiding cover to escape predators, food and water availability and accessibility and human activities influence this selection. The use of mixed forest may be due to the presence of *Bombax ceiba*, *Albezia lebbek* etc upon whose fruits and tender leaves it feeds. However it was also warned that when interpreting these results one must take into account that ranking primarily reflects the relative amount of time spent in a habitat and not necessarily quality in terms of contribution to individual fitness Garsheli’s (2000). For instance, animals may choose to feed and rest in different habitats as a trade-off between foraging and predator avoidance (Mysterud et al. 1999). *Imperata cylindrical* and *Saccharum spontaneum* which are preferred diet of hog deer ⁶ are present in upland grassland (Dhongel and O’Gara 1991. The average height of grasses is 1.5-2 m which may also provide cover against predation. The low presence of hog deer in tiger and leopard diet is the indication of this strategy (Ahmed 2007, Ahmed and Khan 2008). Thus hog deer choice does not seem to be tradeoff among habitat. However, within upland grassland hog deer seems to trade off between availability of food and cover. Just after grassland burning hog deer occupied area in burnt patches where new grasses had come out but
were in the vicinity of the unburnt grasses for cover. Species coexisting together tend to have developed strategies to reduce competition. Barasingha prefer swamp habitat (Ahmed 2007) and hog deer prefers short grassland, thus seem to avoid direct competition. The high overlap between hog deer and chital is more seasonal in nature. The high overlap occurs when grasses are burnt and new grasses come out. These new succulent grasses are nutritious and liked by both chital, hog deer and barasingha. It is evident that management practices have an important implication on the habitat use and selection by hog deer.

CONCLUSIONS

The critical status of hog deer in the Indian terai and the magnanimous loss of some endemic species like Bengal florican, hispid hare from the entire illuminate the need to have a broader perspective to terai conservation especially in DNP. Since hog deer is a specialized and narrow ranging species, areas with hog deer would possibly have a higher probability of supporting other species of the region. Hence there is a need to introduce a landscape approach towards the conservation of entire grassland patches of terai to ensure the conservation of the unique flora and fauna of the terai. An ecological study with radio telemetry in DNP will be the needs of the hour. Since hog deer is grassland specialist species so, there is also need to check the effect of different grassland management practices on this as well as other species of Dudhwa national Park.

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