Density and Distribution of Ungulates in Similipal Tiger Reserve, Orissa, India

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Abstract
A study was carried out on ecological density and distribution of ungulates in Similipal tiger reserve, Orissa from the period of November 2010 to June 2011. Line transect method was used for estimation of ungulate density. During the study period 45 transects were laid in the core area of the tiger reserve covering five ranges i.e. upper Barakamuda, Jenabil, National Park, Nawana North and Chahala. The transect data was analyzed using Distance (version 6.0) software. Density was estimated for five species of ungulates such as sambar, barking deer, wild pig and chital. The collected data and its analysis by Distance (version 6.0) software show the highest density of ungulates in the form of wild pig (2.21) followed by mouse deer (1.94), sambar (1.36), barking deer (1.32) and chital (0.92). Analysis for estimation of range wise of ungulates show highest density of ungulates in Jenabil Range (26.05) followed by Nawana North (19.03), Chahala (16.9), Upper Barakamuda (10.58) and National park (4.53).

Key words: Ungulate, Density, Similipal Tiger Reserve, Transect line, Distance (version 6.0) software.

1. Introduction
Food habits comprise one of the major determinants of various life history strategies in carnivores including spacing pattern, movement, habitat selection, social structure, success of reproduction and geographical distribution (Kerbs, 1978; Bekoff et al., 1984; Sunquist and Sunquist, 1989). On the other hand assessing the abundance of animals is an important criterion before implementing any conservation strategy. Ungulate depletion is a major factor driving the current decline of wild tiger (Panthera tigris) populations (Karanth and Stith, 1999). To conserve this globally threatened species, ungulates densities therefore need to be monitored closely. Estimating the population size or density of an animal species in an area is fundamental to understanding its status and demography and to plan for its management and conservation. Since ungulates make up the major part of tigers diet (Schaller 1967; Seidensticker 1976; Karanth and Sunquist, 1995) understanding herbivore populations and their distribution serve as an important part of studies on predator ecology (Karanth and Sunquist, 1995). Karanth and Sunquist (1992) and Srikosasamata (1993) reviewed the data on density and biomass of this region with standard census methodologies. Karanth and Sunquist (1992); Eisenberg and Seidensticker (1976) and Schaller (1967) have all observed a positive correlation between tiger densities and prey biomass densities. Continued depletion of prey population and fragmentation of natural habitats apart from poaching were among two major factors that led to the present plight of tigers in the wild and will determine its survival in the future (Karanth and Stith, 1999; Sunquist et al., 1999). Tigers are obligate carnivore preying upon the largest ungulates, in all the ecosystems in which they occur (Seidensticker, 1997). The information on population abundance is crucial to scientific management of wildlife (Huapeng et al., 1997) and the study of distribution and abundance of organism is considered as an important part of ecology (Burnham et al., 1980). Across the ranges there is a major problem in conserving and managing the ungulate species because the relative lack of reliable quantitative information regarding the distribution, abundance and habitat requirements of the species, which the effectiveness of management practices can be assessed and goals set for the future.

2. Study Area
Similipal Tiger Reserve located in the Mayurbhanj District of Orissa and spreads over 2750 sq. kms of the Chotanagpur plateau and is one of the parts of UNESCO recognized Similipal Biosphere Reserve of India. The Tiger Reserve is surrounded by high plateaus and hills, the highest peak being the twin peaks of Khairiburu and Meghashini (1515 m above mean sea level). At least twelve rivers cut across the plain area, all of which drain into the Bay of Bengal. The prominent among them are Burhabalanga, Palpala Bandan, Salandi, Khairi and Deo. Beautiful waterfalls like Joranda and Barehipani enriches the scenic beauty of the tiger reserve. The riparian zones, perennial streams and meadows form key areas of the reserve. An astounding 1078 species of plants including 94 species of orchids find their home in the Tiger reserve. It hosts 56 species of mammals, 361 species of birds, 60 species of reptiles, 21 species of frogs, 66 species of fishes and 164 species of butterflies (Map 1).

3. Methodology

3.1 Field Method

Line transect method was used to estimate the overall density, relative density, encounter rate and group size. Line transect method is practical, efficient and in-expensive. Forty five transects were laid in the core area of the tiger reserve. Length of each transect is 2 km and the effective strip width of a transect primarily depends on the visibility (vegetation and terrain type) and ability to detect ungulates by different observers and animal behavior (Buckland et al., 1993) The time of survey on transect line in morning 18.00-20.30 and in the evening 16.00-6.30. The species sighted with the number of individuals, transect bearing, animal bearing, date and time of survey all these data were recorded on transect monitoring. The distance to the center of the group or the single animal from the transect line was measured using a range finder. Transect bearing and animal bearing were collected using a compass.

3.2 Analytical Method

The transect data was analyzed using the programme Distance (version 6.0) to estimate species density, mean group size and encounter rate. The minimum Akaike information criterion was used to select the model after checking the heaping effect.

4. Results

4.1 Density of Overall Ungulates

During the study period 186 observations of ungulates were recorded with effort 1035 kms on 45 transects. The density estimated for overall ungulates 4.5 individuals that were varied within 95 % confidence intervals from 3.2 to 6.5 individuals. The estimate of density of clusters was 2.7 individuals that varied within 95 % confidence intervals from 1.9 to 3.8 (Table 1). The encounter rate estimated for overall ungulates 0.17 individuals that were varied within 95 % confidence intervals from 0.13 to 0.23. Fig 1 shows that probability of detection gradually decreases with increase of perpendicular distance.

4.2 Density of Sambar

On 42 transects 72 observation of sambar was recorded with effort 924 kms. The estimate of density of sambar was 1.36 individuals that varied within 95 % confidence intervals from 0.94 to 1.97 individuals. The estimate of density of clusters was 1.32 that varied within 95 % confidence intervals from 0.91 to 1.9 (Table 1). Fig 2 shows that probability of detection gradually decreases with increase of perpendicular distance.

4.3 Density of Chital

On 25 transects 19 observations of chital was recorded with effort 64 kms. The estimate of density of chital was 0.92 individuals that varied within 95 % confidence intervals from 0.42 to 2 individuals. The estimate of density of clusters was 0.36 individuals that
Fig 1: Detection probability plot of Ungulates

Fig 2: Detection probability plot of Sambar

Fig 3: Detection probability plot of Chital

Fig 4: Detection probability plot of Wild Pig
Table 1: Estimated density of ungulates in Similipal Tiger Reserve

<table>
<thead>
<tr>
<th>Species</th>
<th>Density</th>
<th>Density of cluster</th>
<th>Effective stripe width</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>4.59</td>
<td>0.83 3.2 -6.5</td>
<td>2.7 0.47 1.9 -3.8</td>
</tr>
<tr>
<td>Sambar</td>
<td>1.36</td>
<td>0.25 0.9 -1.9</td>
<td>1.32 0.24 0.9 -1.9</td>
</tr>
<tr>
<td>Chital</td>
<td>0.92</td>
<td>0.37 0.4 -2</td>
<td>0.36 0.13 0.1 -0.7</td>
</tr>
<tr>
<td>Wild pig</td>
<td>2.21</td>
<td>0.45 1.4 -3.3</td>
<td>0.64 0.11 0.4 -0.9</td>
</tr>
<tr>
<td>Barking deer</td>
<td>1.32</td>
<td>0.24 0.9 -1.9</td>
<td></td>
</tr>
<tr>
<td>Mouse deer</td>
<td>1.94</td>
<td>0.82 0.8 -4.4</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Range wise density of ungulates in Similipal Tiger Reserve

<table>
<thead>
<tr>
<th>Range</th>
<th>Density</th>
<th>Density of cluster</th>
<th>Effective stripe width</th>
</tr>
</thead>
<tbody>
<tr>
<td>UBK</td>
<td>10.5</td>
<td>2.86 6.1 -18.3</td>
<td>5.6 1.46 3.3 -9.6</td>
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<tr>
<td>Jenabil</td>
<td>26</td>
<td>4.87 1.8 -37.6</td>
<td>21.9 3.88 15.4 -31.3</td>
</tr>
<tr>
<td>National Park</td>
<td>4.5</td>
<td>2.81 1.3 -15.6</td>
<td>2.2 1.27 0.6 -7.3</td>
</tr>
<tr>
<td>Chahala</td>
<td>16.9</td>
<td>6.34 7.9 -36</td>
<td>8.4 2.77 4.2 -16.8</td>
</tr>
<tr>
<td>Nawana North</td>
<td>19</td>
<td>5.56 10.6 -34</td>
<td>7.1 1.51 4.6 -11.1</td>
</tr>
</tbody>
</table>

Abbreviations used in the tables:


4.4 Density of Wild Pig

On 38 transects 44 observations of wild pig was recorded with effort 910 kms. The estimate of density of wild pig was 2.21 individuals that varied within 95% confidence intervals from 1.48 to 3.3 individuals. The estimate of density of clusters was 0.64 individuals that varied within 95% confidence intervals from 0.46 to 0.91 (Table 1). Fig 4 shows that probability of detection gradually decreases with increase of perpendicular distance.

4.5 Density of Barking Deer

On 42 transects 72 observations of Barking deer was recorded with effort 924 kms. The estimate of density of barking deer was 1.32 individuals that varied within 95% confidence intervals from 0.91 to 1.9 (Table 1). The density of clusters was not estimated as the animals sighted solitarily. Fig 5 shows that probability of detection gradually decreases with increase of perpendicular distance.

4.6 Density of Mouse Deer

On 25 Transects 13 observations of mouse deer was recorded with effort 668 kms. The estimate of density of mouse deer was 1.94 individuals that varied within 95% confidence intervals from 0.84 to 4.45 (Table 1). The density of clusters was not estimated as the animal sighted solitarily.

4.7 Range Wise Density of Ungulates

Out of 45 transects laid in the Tiger Reserve 14 transect laid in Upperbarakamuda, 11 transect in Jenabil, 7 transect laid in National park, 7 transect in Nawana North range and rest 6 transect laid in chahala range. The collected data and its analysis by distance (version 6.0) software show highest density of ungulates in Jenabil Range followed by Nawana North, Chahala, Upper barakamuda and National park ranges.

4.8 Density of Ungulates in Upper Barakamuda Range

During the study period 60 observation of ungulates were recorded in upper barakamuda with effort 105 kms on 14 transect. The estimated density of ungulates in upper barakamuda was 10.58 individuals that varied within 95% confidence intervals from 6.1 to 18.3 individuals. The estimate of density of clusters was 5.67 individuals that varied within 95% confidence intervals from 3.34 to 9.63 (Table 2). Fig 7
Fig 5: Detection probability plot of Barking deer

Fig 6: Detection probability plot of Mouse deer

Fig 7: Detection probability plot of Ungulates in UBK Range

Fig 8: Detection probability plot of Ungulates in Jenabil Range
shows that probability of detection gradually decreases with increase of perpendicular distance.

4.9 Density of Ungulates in Jenabil Range
During the study period 74 observations of ungulates were recorded in Jenabil range with effort 64 kms on 11 transects. The estimated density of ungulates in Jenabil Range was 26.05 individuals that varied within 95% confidence intervals from 18.01 to 37.69 individuals. The estimate of density of clusters was 21.93 individuals that varied within 95% confidence intervals from 15.44 to 31.16 (Table 2). Fig 8 shows that probability of detection gradually decreases with increase of perpendicular distance.

4.10 Density of Ungulates in National Park Range
During the study period 15 observations of ungulates were recorded in National park Range with effort 126 kms on 7 transects. The estimated density was 4.5 individuals that varied within 95% confidence intervals from 1.31 to 15.65 individuals. The estimated density of clusters was 2.22 individuals that varied
within 95% confidence intervals from 0.66 to 7.38 (Table 2). Out of 9 transects observation was nil from 4 transects due to nearby village areas and human disturbance. Fig 9 shows that probability of detection gradually decreases with increase of perpendicular distance.

4.11 Density of Ungulates in Chahala Range
During the study period 19 observations of ungulates were recorded in chahala range with effort 36 kms on 7 transect. The estimated density of ungulates in Nawana north was 19.03 individuals that varied within 95% confidence intervals from 7.93 to 36 individuals. The estimated density of clusters was 8.46 individuals that varied within 95% confidence intervals from 4.23 to 16.89 individuals (Table 2). Fig 10 shows that probability of detection gradually decreases with increase of perpendicular distance.

4.12 Density of Ungulates in Nawana North Range
During the study period 19 observations of ungulates were recorded in Nawana north range with effort 36 kms on 7 transects. The estimated density of ungulates in Nawana north was 19.03 individuals that varied within 95% confidence intervals from 10.63 to 34.06 individuals. The estimate of density of clusters was 7.16 individuals that varied within 95% confidence intervals from 4.6 to 11.13 (Table 2). Fig 11 shows that probability of detection gradually decreases with increase of perpendicular distance.

5. Discussion
In a landscape of ever increasing fragmentation of tiger habitat, the potential for sustaining small but productive tiger populations depend primary on maintaining high prey densities (Karanth and Stith, 1999). The local tribes used to move in the forest in search of honey, resin, roots, seed and other forest products with their domestic dog. These dogs found to be one of the threats to smaller ungulates like mouse deer and fawns. Disturbance in the form of livestock grazing also found in some transects. Poaching signs such as body remain of ungulate, machan of poachers, cooking place, places used for dying meat and sometimes small troop of poachers with traditional arrows and bows were encountered several times while monitoring transect lines. Most importantly similipal tiger reserve face the severely Maoist attack in the month of March 2009. After the Maoist attack population of the ungulates decrease during the closing period of the tiger reserve.

Range wise result shows highest density in Jenabil Range followed by Nawana North, Chahala, Upper barakamuda and National park. In case of National park Range sighting occurred only in Nuaogoan and Ransa transect line. But sighting was nil in Kabatghai, Khejuri and Bakua transect lines due to more human disturbance in these areas. This preliminary line transect survey gave an idea about the ungulate density available in core area of similipal Tiger Reserve.

6. Conclusion
The ungulates play very important role in maintaining the population of predator. Thus it is essential to collect the data on the status and distribution of ungulate species and their fluctuations during time intervals. Population size an indicator by which the success of a management programme is ultimately judged. Ecologist have emphasized the important role that wild prey species play in ecosystems through their influences on the composition, productivity, nutrient cycle and succession and ultimately on the population of the predator.

References

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