Application of Photographic Capture-Recapture Sampling for Estimating Abundance of Indian Mouse Deer Moschiola indica

Amol Kumbhar, Charles Leo Prabhu, Jaya Kumar Yogesh, Pichaiyan Francies, Gaurang Patwardhan, Qamar Qureshi and Yadavendra Jhala

1World Wide Fund for Nature - India, Nisha building, Near Forest Barrier, Katra, Mandla - 481661, Madhya Pradesh, India
2Wildlife Institute of India, P.O. Box: 18, Chandrabani, Dehradun, Uttarakhand, India

Abstract: The Indian Mouse Deer or Spotted Chevrotain (Moschiola indica) is a species of even-toed ungulate in the Tragulidae family found in India. Its nocturnal behaviour makes difficult to study its population size in forest In current paper we have tried to estimate population through camera trap capture-recapture sampling method in tropical semi-evergreen forest of Periyar Tiger Reserve. Estimated population for mouse deer was 108±25.8 and density was 21±2.1 per sqkm in our intensive study area of 114 sqkm. Method used in current paper can help to explore mouse deer status in Indian landscape.

Key words: Density · Indian Chevrotain · Periyar Tiger Reserve · Population Estimation

INTRODUCTION

Mammals exhibit a rich and varied spectrum of coat pattern [1]. The different types of natural marks that can be used as photographic tags are particularly used for capture - recapture study when animals are difficult to capture physically [2]. However, mouse deer have historically been difficult to monitor because of its being solitary, nocturnal and cryptic behavior as well as smallest deer in size.

The Indian chevrotain or mouse deer Moschiola indica (Gray 1852) is distributed across Peninsular India, Nepal [3] and Sri Lanka [4]. The species is listed in schedule -I of the Wildlife Protection Act (1972) and is categorized as least concern in the IUCN Red Data Book [5]. Mouse deer is the smallest ruminant with body length 50 - 58 cm; Shoulder height 25 - 30 cm, Tail length 3cm and body weight about 3kg [5]. Body coat is reddish brown with lighter spots and stripes on the body [6].
deciduous forests [9]. The elevation of Periyar Tiger Reserve ranges from 800 to 2019m with the highest point at Vellimala. The Periyar Lake, which was formed as a result of the construction of the Mullaiperiyar Dam, has a total area of 26km² [10]. Major carnivores of Periyar include tiger (*Panthera tigris*), leopard (*Panthera pardus*), wild dog (*Cuon alpinus*) and jackal (*Canis aureus*).

**MATERIALS AND METHODS**

Camera trap was systematically distributed within the study area by superimposing a 2x2 km grid and deploying double sided camera unit Moultrie D-40 (www.moultriefeeders.com/game-spy-d40) of 36 trap locations covered Minimum Convex Polygon of 114km² (Image 1). Total sampling effort accumulated to 2772 trap nights of 77 days. We first examined the reliability with which Indian chevrotain can be identified from their spots and stripes pattern following double-blind observer identifications [11]. We used body fore-, mid- and hind-quarters spots and stripes pattern (Figure 1) for individual identification, providing additional supplementary information about mouse deer identification to three investigators. We built capture histories in “X-matrix” format and associated model were estimated using programme CAPTURE in MARK [12, 13]. To use closed population model, the population should be demographically and geographically closed [12], to test our closure assumption program CloseTest 3 was used [14].

**RESULTS AND DISCUSSION**

Analysis was done with right flank of mouse deer which yielded maximum number of unique individual (*M_t*). A total of 90 photographs of Indian chevrotain were taken, 45 of left flank which identified 32 unique individuals and 47 of right flank with having 36 unique individuals were identified by all three investigators. All the individual photo captures were identified by pelage pattern using their fore-, mid- and hind-quarter were consistent among all investigators, with not only number but also id that is each photo goes to same individually each observer being identified. The capture probability (p - hat) of mouse deer was 0.005 for right flank which yielded the maximum number of captures. Model
Table 1: Population and density estimate of mouse deer in Periyar Tiger Reserve based on the best model suggested M(h) Jackknife, all three investigators were identified same numbers of individuals.

<table>
<thead>
<tr>
<th>No. Individuals identified</th>
<th>( \chi^2 )</th>
<th>( P )</th>
<th>Trap nights</th>
<th>( P )- hat</th>
<th>N ± SE</th>
<th>ETA(km(^2))</th>
<th>D ± SE /Km(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n = 36</td>
<td>32.7</td>
<td>0.2</td>
<td>2772</td>
<td>0.005</td>
<td>108±25.8</td>
<td>5.04</td>
<td>21.4±2.1</td>
</tr>
</tbody>
</table>

Note: n - Number of individuals identified, \( \chi^2 \) - Chi-Square statistic for closure test, \( P \) - Capture probability, N - estimated population, SE - Standard error, D - Density of animal in effective trapping area.

This study can further support that photographic capture-recapture sampling through camera trap is reliable technique to study abundance of mouse deer which is individually identified from their natural marking of spots and stripes. Density estimates of mouse deer was available from other areas of world using different methods for *Tragulus javanicus* based on distance sampling at the two primary forest sites ranged between 21 and 39 animals/km\(^2\) while those of *T. napu* range between 37 and 72 animals/km\(^2\) in tropical rainforest of the Ulu Segama Forest Reserve in Sabah, Malaysian Borneo [16]. Density of African water chevrotain *Hyemoscus aquaticus* was 7.7 to 28 animals/km\(^2\) in Gabon [17]. Nag [18] estimated abundance of Indian mouse deer *Moschiola indica* 1.52 ± 1.11 animals/km\(^2\) through site occupancy modelling in Bhadra Wildlife Sanctuary.

In our study, identification using fore-, mid- and hind-quarter was consistent across investigators with all photographs. This camera trap study was design primarily to estimate density of tiger and leopard. However it should be noted that for obtaining good recaptures, size of sample area should be greater than the home range of mouse deer. Also keeping species biology in mind, camera placement should be optimized for mouse deer by proper sign survey in terms of distance from the path, height of placement. Indian chevrotains are among the most frequent hunted animal by indigenous and local communities along the Western and Eastern Ghats [19, 5] and biomass extraction and intense use of forest patches by livestock was found to be major threat [20].

We demonstrate the potential to use camera trap base mark capture-recapture for better population assessment of the illusive nocturnal mouse deer. Such estimates are needed for conservation and management of species.

**ACKNOWLEDGEMENTS**

We thank national tiger Conservation Authority for their financial support. We acknowledge the Director and Dean of WII for their facilitation during study. We thank Bidyut and Anil who participated as observer for individual identification of mouse deer from photographs. We thank Ujjwal for assistance in data analysis.

**REFERENCES**


