ESTIMATION OF ENCOUNTER RATE AND POPULATION STRUCTURE OF UNGULATES BY USING VEHICLE ROAD TRANSECTS IN RANTHAMBORE NATIONAL PARK, INDIA

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ABSTRACT

Encounter rate and group composition of chital (*Axis axis*), sambar (*Cervus unicolor*), nilgai (*Boselaphus tragocamelus*), wild pig (*Sus scrofa*) and chinkara (*Gazella bennetti*) were studied in the Ranthambhore National Park, Rajasthan, India during 2010-2011. 93.65 Km vehicle road transect was done to conduct the study. The encounter rate of chital (3.91) was found highest followed by sambar (1.29). The average group size of chital (3.36±0.866) was also found highest followed by sambar (1.70±0.37) and nilgai (1.31±0.46). The ratio of young to adult females was found highest in wild pig (71.42: 100 females), followed by sambar (12.60:100 females) and chital (11.8: 100 females). The ratio of number of adult male to adult females was found highest in sambar (49.30: 100 females) followed by nilgai (31.42:100 females). However, the adult female ratio constituted the main bulk of all ungulates population. The road transect was found to be an effective way for the continuous monitoring of the ungulate population in the park and can be implemented as a rapid assessment technique.

Key words: Encounter Rate, Group composition, Ungulate, Vehicle transect.

Introduction

The size of groups of social mammals is often considered a fundamental attribute of the social organization (Jarman, 1974; Wilson, 1975; Clutton-Brock *et al.,* 1982; Wittenberger, 1980; Rodman, 1988). The group size is explained as arising from a balance between various advantages of group-living (such as better foraging efficiency, safety from predators, or thermoregulation), and costs (such as competition for food and susceptibility to parasites or diseases) (Pulliam and Caraco, 1984; Giraldeau, 1988). The average size of their group size changes over different season has been studying by various workers (Schaller, 1967; Sharatchandra and Gadgil, 1975; Mishra, 1982; Khan *et al.,* 1995; Bagchi *et al.,* 1998).

Large ungulates have lot of fundamental importance including dispersal of seeds (Prasad *et al.,* 2006), influencing spatial patterns of vegetation (Adler *et al.,* 2004) and most importantly the principal food for the tigers and other sympatric carnivores (Karanth *et al.,* 2004). Age sex of an individual animal is the first step towards defining the sex ratio and age structure of a species' population. The information regarding sex ratio provide important imminent into the population recent history, current status and also future trend.

Relative abundance and population estimation of prey animals have been one of the key issues for most of wildlife managers. Strong emphasis has been made for the ecological monitoring of ungulates as it is a vital component for any conservation project which would enable managers to assess the effects of management (Kremen *et al.,* 1994).

Nevertheless Ranthambhore has a very high density of prey base making it a very suitable site for high densities of tigers (Karanth *et al.,* 2004) thus this paper aim to present a simple and cost effective method to the park manager for rapid assessment of ungulate population to update information regarding the abundance, group composition of ungulates of Ranthambhore National Park. The study was done as a byproduct of the of the country's largest project "Monitoring tigers, co-predators, prey and their habitat-2010-11" conducted by Wildlife Institute of India.

Material and Methods

Study area

The study was conducted in the Ranthambhore National Park, Rajasthan, India located at longitude of 76.23^0E to 76.39^0E and latitude 25.84^0N to 26.12^0N in the Sawaimadhopur district of Rajasthan. The Park has the total area of 392.50 Km^2. and a core area of 274.5 Km^2. Ranthambhore National Park at the junction of the Aravalis and the Vindhyas, is unique juxtaposition of natural and historical richness, standing out conspicuously in the vast, arid and denuded tract of eastern Rajasthan in western India. In 1973, it was included as a potential area under Project Tiger' and was

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the smallest of the nine areas selected. It was estimated that this 392 Km². of dry deciduous habitat could viably sustain healthy tiger populations. In 1980, it was notified as a National Park. The present Project Tiger Ranthambhore is responsible for the management of 627.13 Km². According to the Bio-geographic classification (Rodgers and Panwar, 1988) Ranthambhore Tiger Reserve falls in 4 B (Semi-arid zone and Gujrat-Rajwara biotic province). Champion and Seth (1968) have described vegetation of Ranthambhore National Park as being comprised of –Tropical dry deciduous forest and Tropical thorn forest. Climatic condition in Ranthambhore tiger reserve is sub tropical with distinct cold, hot and rainy seasons viz, summer (March-June). Monsoon (July-August), post monsoon (September-October) and winter (November-February). Temperature varies from a maximum of about 47^0C in May-June to minimum of 4^0C in January. Average annual rainfall over past two and half decade is 687.3 m and in good rainfall year it may exceed 900 m. However, the landscape of Ranthambhore Tiger Reserve is semi arid and it is prone to frequent drought condition. Ranthambhore Park is home to more than 40 species of mammals, 320 species of birds and 35 species of reptiles. Ranthambhore supports five species of ungulates viz Sambar (*Rusa unicolor*), Chital (*Axis axis*), Nilgai (*Boselaphustragocamelus*), Wild pig (*Sus scrofa*) and Chinkara (*Gazella gazelle*). Carnivores other than tiger are: Leopard (*Panthera pardus*), Hyena (*Hyaena hyaena*), Jackal (*Canisaurus*) Caracal (*Caracal caracal*), Jungle cat (*Felischaus*).

Method

The encounter rate and sex age proportion of tiger's prey (*i.e.,* ungulates) were obtained by counting animals by using roadside "Vehicle Transect" (variable fixed count) (Norton-Griffiths, 1978) method which is considered to be simple, unbiased, and robust methods for estimating ungulate abundance (Laake *et al.,* 1993) from November 2010 to January 2011. This method has been widely applied to estimate densities and group size of prey species in tropical forests (Varman and Sukumar, 1993; Ramesh *et al.,* 2009). As many as 12 (total 93.65 Km) Vehicle Transects were monitored across various lengths in different terrain and vegetation features.

Three main ranges of the park (Ranthambore Project Tiger, Kunders and Khandar) were selected for the study. Previously Jhala *et al.* (2011) alsoused the same study area for the density estimation of tigers. New model Gypsy (2009 model), was used during transect count. The speed was constantly maintained at 25 Km/hr. Group size, sexes were recorded for each observation. In the present study the sex and age classes were categorized in a simpler form for the regular monitoring purpose *viz.,* adult male, adult female and juvenile. Data were collected by two experience observers and a data recorder accompanied for the systematic record. GPS locations were recorded for each transect with waypoints to prepare a road map. The data were analysis with computer program SPSS (SPSS 2007).

Results

Number of detections in case of chital (total no. of observations =367) and sambar (total no. of observations =121) were found highest followed by nilgai (total no. of observations =54) and wild pig (total no. of observations =41), which were comparatively low, and chinkara was lowest (total no. of observations =03) (Table 1 and Fig 1). Among wild ungulates chital was most abundant (ER: 3.91) followed by sambar (ER: 1.29) and nilgai (ER: 0.57) (Table 1). The major ungulate species was chital (Precent contribution: 61.89), followed by sambar (Precent contribution: 20.40) (Table 1 and Fig 1).

Group Size and Structure

Average mean group size was estimated by taking the average of different group sightings and group size
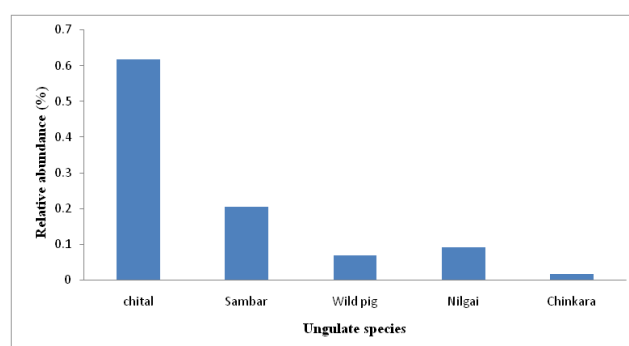

Fig. 1 : Relative abundance of Ungulate species in Ranthambhore NP

Table 1 : Encounter rate and percent contribution of each species during study period

Species	ER/ Km (Total = 93.65 Km)	# of animal seen (N=593)	Group size (± SE)	Percent contribution
Chital	3.91	367.0	3.36±0.866	61.89
Sambar	1.29	121.0	1.70±0.37	20.40
Nilgai	0.57	54.0	1.31±0.46	9.10
Chinkara	0.10	10.0	-	1.69
Wild Pig	0.43	41.0	8.38±1.44	6.91

Table 2 : Proportion of ungulate species in different age –sex categories derive from count of overall 593 animals. Notations used are ADM-adult male; ADF- adult female and JUV- juvenile.

Species	ADM	ADF	JUV
Chital	31.8	56.9	11.3
Sambar	29.41	57.98	12.60
Nilgai	22.0	70.0	4.0
Chinkara	-	-	-
Wild Pig	14.28	14.28	71.42

was classified into different class intervals for better interpretation. Group size varies in different ungulates ranging from 1 to 26 individuals (Fig. 2). The largest congregated group size was found in the chital (23) (no. of sightings =1), followed by wild pig (26) (no. of sightings =1), sambar (22) (no. of sightings =1) and nilgai (6) (no. of sightings =1) (Fig. 2). Average group size of chital (3.36±0.866) was found highest followed by sambar (1.70±0.37), nilgai (1.31±0.46) and wild pig (8.38±1.44) (Table 1). The highest frequency of group size observed in all four ungulates was 1-4 animals in a group/observation (Fig. 2).
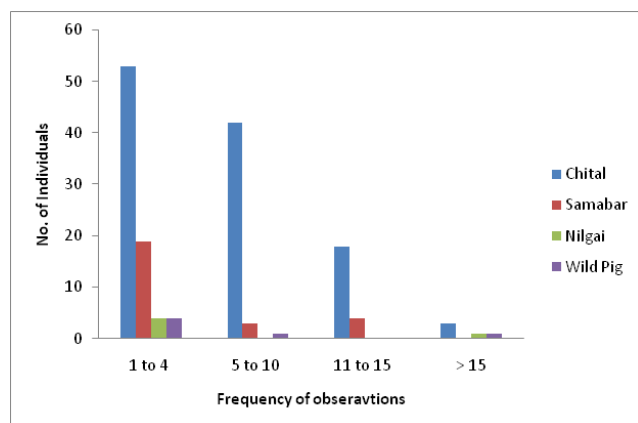

Fig. 2 : Group size of different ungulate species found in Ranthambhore NP.

Sex age ratio

Adult Female Ratio (ADF) ratio contributes the main bulk population of all ungulates (Table-2). The ratio of the number of young animals (juvenile) to adults in wild pig was highest (71.42), followed by samber (12.60), chital (11.8) and nilgai (4.0) (Table 2). The ratio of number of young animals (juvenile) to every 100 adult females was highest in sambar (21.12), followed by chital (14.96) and nilgai (11.42) (Table 3). The ratio of number of adult male to every 100 adult females was highest for sambar (49.30), followed by nilgai (31.42) and chital (29.53) (Table 3).

Discussion

Road count or road transect was found to be a useful and cost effective tool in the study site for the understanding of the pattern, distribution, and abundance of ungulate for the regular monitoring prospects. Previously, the method has been successfully applied in the African open forest (Norton-Griffiths, 1978). The road creates opening and provides a foraging ground to the ungulates. Precaution should be taken while calculating density with the help of road transect, as road transects some time makes more animal sightings than the conventional line transects laid inthe forest. This is because, animals congregate along the road, so it violates the assumption of distance sampling that the animals are randomly distributed instudy area (Buckland *et al.,* 1993)

Chital was the most abundant prey species in the study area probably due to the availability of open habitat with edible short grasses. Sambar was the second highest abundant species. Abundance and distribution of sambar in the study area was influenced mainly by the cover and water. Nilgai was mostly found in the open areas with scrubs and grassland. The males are mostly solitary or some time observed insmall groups. The females were always living in groups with fawn, juvenile and some time with male. The wild pig was generally observed with groups but some time solitary male were also observed. The population of the chinkara was restricted in a small pocket of the park, so detailed study could not be performed during the study period.

Formation of the group can increase foraging ability. Schaller (1967) and Eisenberg and Lockhart (1972) reported that chital and sambar do not remain in

Table 3 : Group size, sex- age ratio of adult male and young (Juvenile) to adult female

Species	Sample size		Ratio/ 100 female	
	Groups	Individuals	Male	Young
Chital	80	367	29.53	14.96
Sambar	46	121	49.30	21.12
Nilgai	21	54	31.42	11.42
Chinkara	03	10	-	-
Wild Pig	5	41	-	-

permanent social groups. Smaller group sizes in forest habitats are presumably a consequence of food being more dispersed and scattered throughout the habitat (Jarman, 1974; Mishra, 1982; Johnsingh, 1983) The mean group size is a more sensitive measure of changes in group size due to the individuals remaining solitary or joining groups (Barrette, 1991; Sankar and Acharya, 2004). The large group size (15-22 animals) of chital and sambar could be the reason of temporary feeding aggregation on a suitable place where both grass and water was available. Large group size of sambar was found in the open habitat than the inside forest (Bagchi *et al.,* 2008). The group size of chital was found highest followed by sambar. Artificial and natural water holes/tanks play an important role in that aspect. During the survey many bachelor male groups of chital composing adults and subadults. They have also considerable amount of contribution to the mean size of group size in chital. The distribution and size of the water holes/tanks mostly restrict the large ungulate distribution in the park during the dry season and subsequently influence the distribution of predators too.

Acknowledgements

रणथम्भौर राष्ट्रीय पार्क, भारत में वाहन मार्ग ट्रांजेक्टों का उपयोग करके खुरदार की मुठभेड़ दर एवं आबादी संरचना का आकलन

दिपांकर लहकर

सारांश

रणथम्भौर राष्ट्रीय पार्क, राजस्थान, भारत में 2010–11 के दौरान चीतल (*एक्सिस एक्सिस*), सांबर (*सीर्वूस यूनिकॉलर*), नीलगाय (*बोसीलेफूस ट्रेगोकेमीलस*), जंगली सुअर (*सूस स्कोरोफा*) तथा चिंकारा (*गेजीले बीनाटी*) के समूह संयोजन एवं मुठभेड़ दर का अध्ययन किया गया। अध्ययन करने के लिए 93.95 कि.मी. वाहन मार्ग ट्रांजेक्ट किया गया। चीतल (3.91) की मुठभेड़ दर उच्चतम पाई गई इसके बाद सांबर (1.29) की थी। चीतल का औसत समूह आकार भी उच्चतम (3.36 ± 0.866) पाया गया इसके बाद सांबर (1.70 ± 0.37) एवं नीलगाय (1.31 ± 0.46) का था। युवा से वयस्क मादाओं का अनुपात जंगली सुअर में उच्चतम (71.42 : 100 मादाएं) पाया गया, इसके बाद सांबर (12.60 : 100 मादाएं) एवं चीतल (11.8 :100 मादाएं) का था। वयस्क नर से वयस्क मादाओं की संख्या का अनुपात सांबर में उच्चतम (49.30 : 100 मादाएं) पाया गया। इसके बाद नीलगाय (31.42 : 100 मादाएं) का था। तथापि, वयस्क मादा अनुपात में सभी खुरदार आबादी का मुख्य परिमाण था। पार्क में खुरदार आबादी के सतत अनुवीक्षण के लिए सड़क ट्रांजेक्ट एक प्रभावी तरीका है तथा एक त्वरित मूल्यांकन तकनीक के रूप में कार्यान्वित की जा सकती है।

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