

## Original Research

Population density of Indian giant squirrel *Ratufa indica centralis* (Ryley, 1913) in Satpura National Park, Madhya Pradesh, India**Authors:**

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**ABSTRACT:**

Information on population and distributional status of Indian giant squirrel *Ratufa indica centralis* is poorly known from central Indian hills. The species is endemic to India and widely distributed in Western Ghats, Eastern Ghats and Central India. In this study using line transect distance sampling we estimated population density of giant squirrel in Satpura Tiger Reserve (STR), which is a major biosphere reserve in central India that harbors wide variety of rare endemic and endangered species. Density estimate with total effort of 276km line transect shows 5.5 ( $\pm$  0.82) squirrels/Km<sup>2</sup>. This study provides first baseline information on ecological density estimate of *Ratufa indica centralis* in central Indian landscape. Reduction of anthropogenic pressure should be the first priority for park managers in Satpura Tiger reserve.

**Keywords:**

Central Indian landscape, Distance sampling, density estimation, *Ratufa indica centralis*.

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Population density of Indian giant squirrel *Ratufa indica centralis* (Ryley, 1913) in Satpura National Park, Madhya Pradesh, India.

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## INTRODUCTION

Habitat fragmentation is cited one of the major reason for the decrease in abundance of arboreal mammals and isolation of many species into small population (Umapathy and Kumar, 2000). Indian Giant Squirrel *Ratufa indica centralis* is a maroon and buff colour and is endemic to India with four sub-species. The conservation status of Indian giant squirrel (IGS) is the “least concern” category of IUCN, Appendix II of CITES and Schedule II (part II) of Indian Wildlife (Protection) Act 1972 (Molur et al., 2005). Giant squirrels occur across a wide range of natural forests. They have been reported from moist deciduous, dry deciduous and riparian forests (Datta and Goyal, 1996; Baskaran et al., 2011; Kanoje, 2008; Jathanna et al., 2008; Srinivas et al., 2008), old mature teak forests (Ramachandran, 1988) and teak-mixed forests (Kumara and Singh, 2006). Habitat fragmentation is one of the major threats which influence giant squirrel population due to its arboreal nature. Throughout India several investigators already studied on population status of Malabar giant squirrel in Western Ghats (Baskaran et al., 2011; Ramachandran, 1988; Ganesh and Davidar, 1999; Madhusudan and Karanth, 2002; Kumara and Singh, 2006; Jathanna et al., 2008; Ramesh et al., 2009; Umapathy and Kumar, 2000). In central India though there are studies available on ecobiology of *Ratufa indica centralis* (Datta, 1993, 1998, 1999; Datta and Goyal, 1996; Kanoje, 2008; Kumbhar et al., 2012; Pradhan et al., 2012; Rout and Swain, 2006) but there is no study available on status and population density of this species from central Indian landscape.

In the current study we tried to estimate population densities of *Ratufa indica centralis* by line transect distance sampling (Jathanna et al., 2008) in Satpura Tiger Reserve of central India. It believes that this kind of effort will help forest department to take better management and conservation strategies.

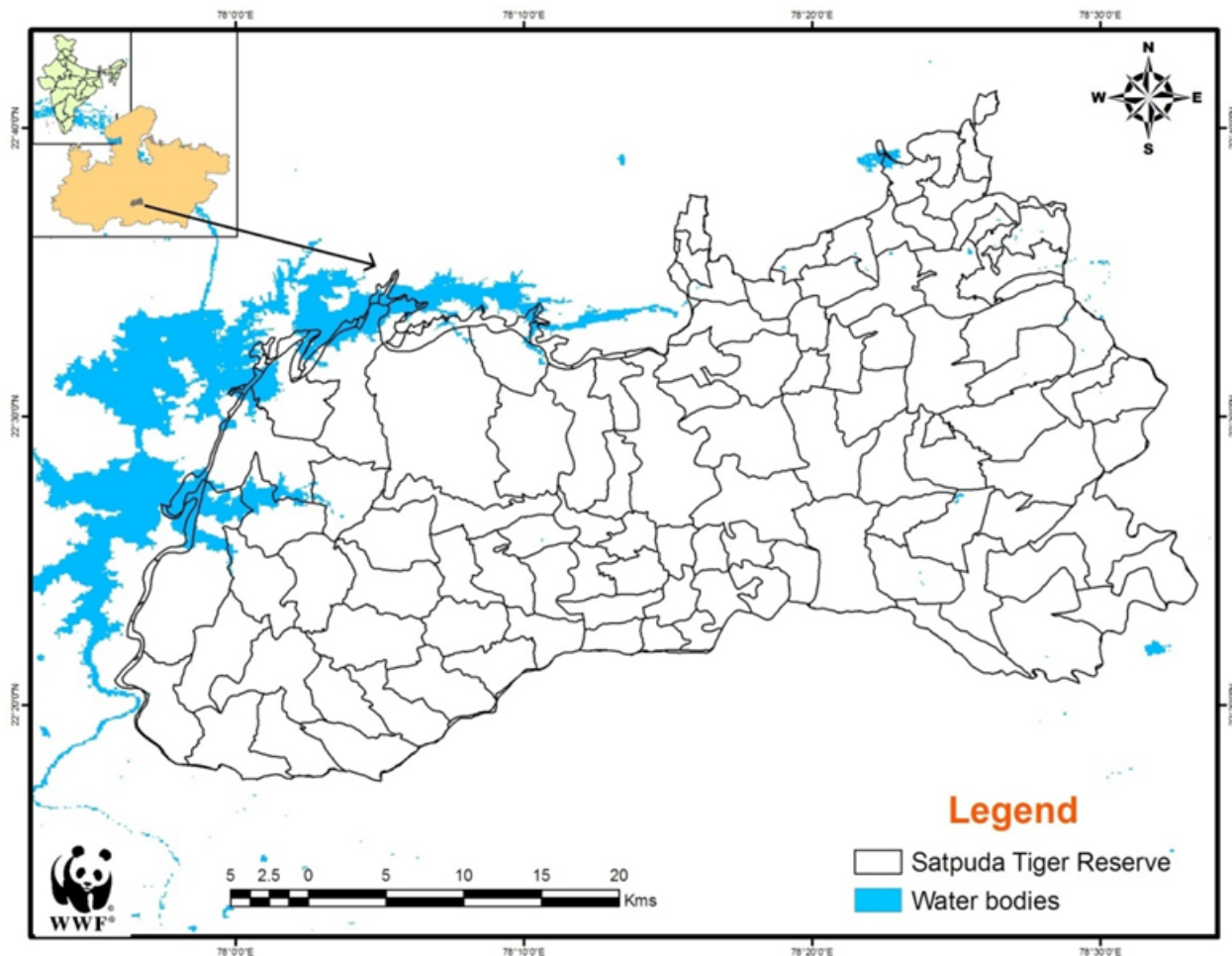
## MATERIALS AND METHODS

### Study area

The Satpura Tiger Reserve (22°19' - 22° 30'N and 77° 56' - 78° 20'E) covers an area of 1427.87 km<sup>2</sup> (Figure 1) in south east border of Madhya Pradesh state, it extends from east to west in the southern part of the district Hoshangabad in Satpura ranges of Central Indian landscape. The forest types of satpura tiger reserve consist of southern moist mixed deciduous forest, southern dry mixed deciduous forest and dry peninsulas Sal forest (Champion and Seth, 1968). The terrain of park is hilly and highly undulating, with dominated tree species such as *Tectona grandis*, *Shorea robusta*, *Buchanania latifolia*, *Terminalia arjuna*, *Emblica officinalis*, *Madhuca indica* and *Rauwolfia serpentina*. The faunal diversity comprises of major carnivore such as Tiger (*Panthera tigris*), Leopard (*Panthera pardus*), Dhole (*Cuon alpinus*) and other small carnivores including Jungle cat (*Felis chaus*), Palm civet (*Paradoxurus hermaphroditus*) as well as ungulates such as Spotted deer (*Axis axis*), Sambar (*Cervus unicolor*), Wild boar (*Sus scrofa*), Barking deer (*Muntiacus muntjak*), Rhesus macaque (*Macaca mulatta*) and Common langur (*Semnopithecus entellus*). In satpura birds of prey like crested hawk eagle, black eagle and crested serpent eagle were major predators of *Ratufa indica centralis* (Datta, 1999; Kumbhar et al., 2012). Also Mehta (1997) reported leopard attempted to prey on giant squirrel.

### Sampling

Line transect methodology was adopted (Buckland et al., 2001; Jathanna et al., 2008) and distance sampling methodology was used to estimate population density of giant squirrel in our study area. Field sampling was carried out in the months of December to February 2011 – 2012. Dur-ing this period 39 permanent transects were established in different habitat types including riparian patches. Each transect was surveyed thrice by well trained observer be-tween



**Figure 1: Location of Satpura Tiger Reserve in India.**

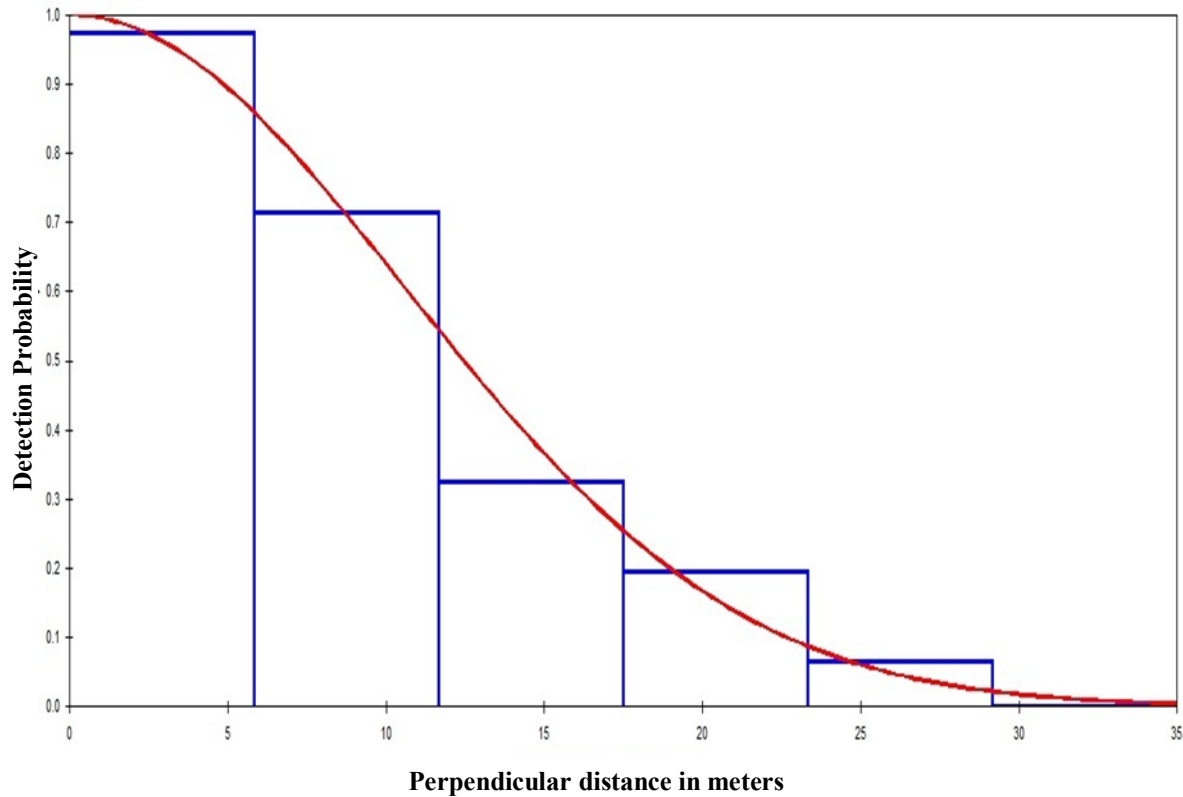
0600–0900 hr. Each transects differed in length, the average transect length was 2km to 4km. Every time the species was detected group size, sighting distance and angle of sighting were recorded. Sighting distances were measured using lesser rangefinder and the angle of sighting was recorded using a liquid filled compass. The field protocols were followed described in Jhala *et al.*, (2009). The density of Indian giant squirrel (IGS) was calculated using DISTANCE program version 6.0 (Laake *et al.*, 1994). The best model was selected on the basis of the lowest Akaike Information Criteria (AIC) (Burnham *et al.*, 1980; Buckland *et al.*, 1993).

## RESULTS AND DISCUSSION

A total of 35 Giant squirrel sights comprising 42 individuals were recorded during the study period in

total efforts of 276km. Analysis were done by fitting different detection functions to the observed data for the estimation of density. Based on minimum AIC value (94.9), half – normal with cosine proved to be the best fit for giant squirrel data. As giant squirrel is a arboreal species its visibility is very high when we compare it with other terrestrial animals so detection in uniform manner is normal, AIC value also supports the model selection. The encounter rate was  $0.12 \pm 0.06/\text{km}$  walked, IGS known to be a solitary animal, maximum two individuals were recorded in a group and mean group size was calculated as  $1.2 \pm 0.6$  in Satpura Tiger Reserve.

Studies conducted elsewhere on Indian Giant Squirrel (IGS) have shown different estimates of population density (Table. 2). The variation in different



**Figure 2: Result of model fitted in the DISTANCE to estimate detection probability and effective strip width of giant squirrel in Satpura Tiger Reserve.**

estimates in different studies could be due to the different habitat types in the different study areas; also seasonal annual variation and observer differences put limits of comparison. The present study is the first attempt to provide baseline information on ecological density status of Indian giant squirrel in Central Indian landscape (Table. 1). IGS distribution in STR was observed in *Terminalia arjuna*, *Madhuca longifolia* and *Tectona grandis*. These trees are mostly used for feeding and

nesting (Kumbhar *et al.*, 2012). Maximum IGS sightings were recorded in riparian patches of churna, moist and dry deciduous forest of watch tower and semi-evergreen forest of Nimghan to pachmarhi. A viable population is one that maintains its genetic vigor and potential for evolutionary adaptation (Kumar *et al.*, 2007), therefore continuous monitoring of the population status of this lesser-known mammal in central India should be given high conservation priority. Excessive amount of

**Table 1: Population density and average group size of Indian Giant Squirrel (density /Km<sup>2</sup>) estimated in Satpura Tiger Reserve.**

Parameter	Point Estimate	Standard Error	Percentage Coefficient of variation	95% Confidence Interval	
DS	4.786	0.66	13.83	3.62	6.31
E(S)	1.169	0.59	5.05	1.05	1.29
D	5.595	0.82	14.73	4.17	7.49
N	6.000	0.88	14.73	4.00	7.00

Note: DS- estimate average group size; E(S) – estimate expected value of cluster size; D – estimate of density of animal; N – estimate no. of animals in specified area; Chi-square value P – 0.969.

**Table 2: Density of Indian Giant Squirrel (individual/Km<sup>2</sup>) from other part of India.**

Study site	Density of IGS /Sqkm	Authors
Anamalai Hills	11.4 - 64	Umapathy and Kumar 2000
Kudremukh NP	0.25	Madhusudan and Karanth 2002
Bandipur TR	2.36	
Nalkeri	4.55	
Sunkadakatte	4.86	Jathanna et al., 2008
Muthodi	10.19	
Lakkavalli	12.25	
Madumalai TR	2.9	Baskaran et al., 2011
	1.6	Ramesh et al., 2009
Kalakad-Mudanthurai TR	1.7	Ramesh et al., 2012
Kakachi	1.42	Ganesh and Davidar 1999
Bhimashankar W Sanctuary	12.4	Borges et al., 1999
	15.89	Mehta et al., 2012

poaching pressure and habitat fragmentation has been reported in Orissa (Pradhan et al., 2012) which can lead to population decline. We hope this baseline study will encourage long-term study, which includes on nesting breeding habits and resource availability of IGS populations in Central Indian Forest. Further research study about population status for this species and conservation strategies in the central Indian landscape are recommended.

#### CONCLUSION:

The present population density of Indian giant squirrel  $5.5 \pm 0.8$  / Sq Km in Satpura tiger reserve in central Indian forest is very important as it is first density estimates from any central Indian forest and will provide baseline data for future study. Present study is address the issue of urgent need of survey the status, distribution and abundance of Indian giant squirrel in central Indian landscape.

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