



RESEARCH ARTICLE

A Virtual Survey based Debate on Conservation Strategies of Indian Giant Flying Squirrel (*Petaurista p. philippensis*)

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Study Area: State Gujarat, the Western part of India.

Coordinates: 24°44'22.41" N 72°61'07.70" E to 20°58'67.64" N 73°67'60.04" E

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Abstract

The information on status and distribution of small and rare animals are always necessary for designing, implementation and evaluation of conservation measures was the reason behind origin of this study on the Indian Giant Flying squirrel. Since available information is small and scattered, an attempt was made to collect information from the peoples who are directly or indirectly related with wildlife / forest services. To go ahead with our research on this species, we prepared a structured questionnaire and sent to the individuals through an online survey tool, to whom we know and further the same were also posted on social website for voluntary participation. We have set the time duration of the survey and at the end we received a total of 66 responses from a diverse group of individuals; most of them belong to Gujarat. Responses were analyzed to reach a conclusion that the flying squirrel population has declined from the past few decades.

Introduction

Knowledge on home range and activity patterns, along with their responses to environmental fluctuations, is important for the understanding of wildlife ecology and conservation, but related studies on flying squirrel species (*Petaurista* sp.) are still limited in Indian sub continent and especially of *Petaurista Petaurista Philippensis* in state Gujarat.

The Indian giant flying squirrel, *Petaurista philippensis* Elliot 1839 is a rodent belonging to family Sciuridae and has the widest distribution among all the flying squirrels in the tropical and sub-tropical zones of South-Eastern Asia (Koli *et al.*, 2013). The presence of translucent membrane connecting limbs forms a parachute like structure that helps in gliding through the

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air, covering wide gaps between trees. It is found to occupy tree canopies and holes (Molur *et al.*, 2005). These squirrels are predominately crepuscular in nature. Flying squirrels chiefly take bark of tree, fruits, leaves, flowers as their food but mostly, they consume ficus fruits and mature to immature leaves of trees (Nandini & Parthasarathy, 2008). The species is included in the Schedule II (Part II) of the Indian Wildlife (Protection) Act, 1972 and Least Concern category according to IUCN but, few studies in South India, indicate population decline of this species due to deforestation, forest fragmentation, anthropogenic disturbances, agricultural encroachment, hunting and myths (Koli *et al.*, 2013).

As per Gujarat state Gazetteers of 1961, published by Directorate of Government printing, Gujarat state the species was restricted in well wooded forest of Dangs (South Gujarat), Vansada National Park (South-East Gujarat), Ratanmahal Sanctuary (Central Gujarat), Sabarkantha (Vijaynagar and Polo forest range in North Gujarat) and Kewadi forests. It still survives in Pimpri-Dangs and other areas in South Gujarat but no direct encounter was recorded during biodiversity study in Vansda carried out by Singh (2013).

The purpose of this study was to determine the occurrence and distribution of the Indian giant flying squirrel to identify the critical habitats for its future conservation and management. The initial stage of the study includes a virtual survey with the peoples associated with the wildlife to generate a preliminary data regarding Flying squirrel.

The survey result suggests that as Flying squirrels are crepuscular and arboreal; most people have never seen the spectacular sight of a gliding squirrel or are even not aware about their presence in the area. Further this is not a species which are under the regular research so the information regarding the species is very sparse which makes the species of less important. But their decreasing number in current scenario has made the people to take preventive measures to protect species.

Methodology:

The present piece of work was based on the virtual survey done by authentic literate and relevant people. The online survey was conducted using SurveyMonkey® (website) as a tool, to reach the peoples like researchers, photographers, forest officers and other persons who were directly related to the wildlife service's and aware of using computers and electronic media. This too provides customizable surveys that include data analysis, sample selection, bias elimination, and data representation tools.

The study area covered the whole of Gujarat state of Western India. Indeed the entire study area falls at the edge of the three mountain ranges *viz.* *Aravallis*, *Satpuda* and *Sahyadris* ranges constituting a hilly to undulating terrain having dry mixed deciduous and tropical thorn forests. The climate of this region is usually arid to semi-arid with three distinct seasons.

Perhaps due to the low population density, arboreal, nocturnal and elusive habits, detailed information on the ecology of the flying squirrel are scarce. Thus by keeping the same in mine, we had conducted a modest pilot study to develop preliminary data through the peoples' acquaintance in the hope that our initial results would be sufficiently interesting to motivate



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more extensive and detailed work. We solicited participation from group of people likely to have a keen interest and informed opinion about Flying squirrels, through mailing personally and using social websites for voluntary basis from the audiences of research, education and forest department broadly associated with conservation issues.

The questionnaire for survey was prepared in such a way to collect as detailed information as one can have about the species. The questionnaire had different sections to assess people's views, distribution in the state, habits and most importantly, perspectives for conservation. We had sent the survey through SurveyMonkey® to more than 100 people, within the time duration of 3 months (From February to April, 2015) for collecting the responses. The same survey was also posted on the social website to gather voluntary responses from the people whom we didn't know but have knowledge about the species in the state. We analyzed the results obtained through the survey to simplify the obtained data. The data gathered were well represented by different sectors of the people like rural, urban, Sub urban, Metro and others. All the participants were verified to be well qualified and specialized in their own field and research. Here, we have tried to analyze those data which are important with respect to conservation and management of Flying squirrel.

Results and Discussion:

Responses were received from 66 individuals (49 male, 17 Female) belonging to diverse groups. Most of the participants (of Gujrat) were having degrees in the field of science. Interestingly, the majorities of the individuals (93.8%) were well aware about the presence of the species, in different forest and are regular visitor of forests. The complete educational backgrounds of the participants have been mentioned in Table- 1. Here the results with majority of support have been considered as most suitable or known fact and hence only those responses are discussed. Further the result may vary in percentage as many people have escaped the few questions.

The responses gathered through survey indicate that Flying squirrels are present mostly in North-East to Central and Southern part of Gujarat state where old dry deciduous forests with large trees are survived. The survey reveals that the forests dominated by the tree species like *Mangifera indica*, *Terminalia sp.*, *Tectona Grandis*, *Ficus sp.* can be a good habitat for the survival of flying squirrel as these species are serving as their food sources as well as nesting. The survey has interestingly revealed that the species is referred by different local names within the state depending upon the region such as, *Udan Gilhari*, *Udati Khiskoli* (Central Gujarat), *Haruva alilu*, *Parukkum Anil*, *Shekroo*, *Rajpankhi Lokharke*, *Pankha/Pakhi* (Dangs), *Mor chitri* (North East Gujarat) etc. The 65.2% respondents who were aware about the species distribution had stated that the species are mainly covering from North-East to Central and Southern part of the state. Half of the respondents (58.7%) have encountered the Flying squirrel but the encounter rate is considered to be very low (2.9% per visit) and thus, many individuals assumed that one should need a special visit to see them.

Respondents provided various views on flying squirrel signs; half of the respondents (54.3%) suggested holes, 40% have suggested pellets as signs where as others have also said foliage litter and calls as an important sign of a flying squirrel. Seventy two percent of the respondents believe that the easiest ways to find their presence in an area are the fallen leaf

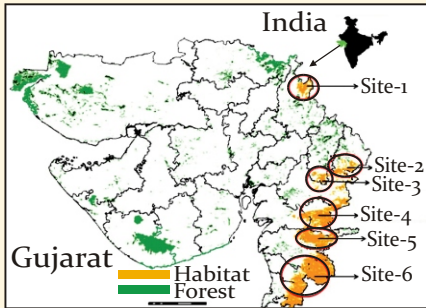


Figure 1: Distribution pattern of Flying Squirrel in state Gujarat, India

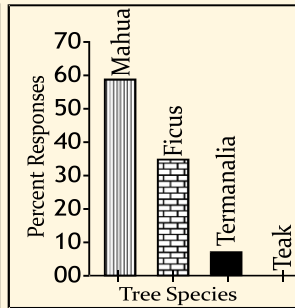


Figure 2: Most preferred food species of Flying Squirrels

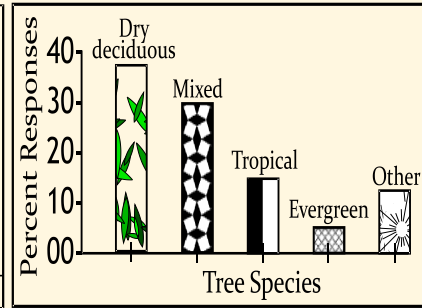


Figure 3: Various Forest habitats where Flying Squirrel were located

litter and branches beneath the trees on which they feed. The most preferred food species of Flying squirrel are Mahua (*Madhuca indica*) (44.7%), Ficus sp. (26.3%) and Terminalia sp. (5.3%) where food consists of Fruits (55.6%), Twigs (13.9%) and Leaves (8.3%) as provided by the individual's responses (Fig.- 2).

Table 1: Summary of respondent's background

Parameters	Education/ livelihood	Rural	Urban	Sub- Urban	Metro	Others	Skipped question
Male		6	29	2	4	2	
Female		4	15	0	2	0	
Total		10	44	2	6	2	2
Qualification	UG*	2	3	0	2	0	
*Undergraduate	PG**	5	25	1	1	2	
**Postgraduate	Doctoral	2	12	0	3	0	
	Others	1	3	1	0	0	
Education	Science	9	34	2	5	1	
Stream	Commerce	0	2	0	0	0	
	Arts	0	1	0	0	1	
	Other	1	5	0	0	0	1
Occupation	Student	5	14	2	4	2	
	Research	5	28	1	4	0	
	Self-employed	1	9	0	0	0	
	Other	1	3	0	3	1	1

While answering for the best season for sighting Flying squirrels, only 46.2% of respondents have indicated cold season (October-February). Further, 58% respondents have said 6:00 pm to 9:00 pm, as the most active time to see their gliding activities. Regarding habitat, the majority of people answered that Flying squirrels are extensively found in Dry deciduous (37.5%) and mixed (30.0%) forest types where the dominating trees are of Mahua (48.7%) or Terminalia (15.4%). Again 12% of respondents were not sure about the distribution of flying squirrel (Fig.- 3).

Home range of an animal is the area where it spends most of its time; it is the region that encompasses all the resources which the animal requires to survive and reproduce (Harested & Bunnell, 2013). Surprisingly, except for the species found in the American continent (Smith,

2012), literature didn't reflect any clue regarding the home range of this particular species. In our survey, we asked about the approximate estimation of home range of Flying squirrel in which 37.8% of the respondents answered that the home range could be in square km where as 13.5% participants were reported that the home range may be in square meters. The size of a home range often depends on the size of an animal.

In Taiwan, the adult flying squirrel was reported to have two breeding phases in a year; February to March and July to August. One female produce two offspring's in a year, 1 young per season. Young flying squirrels are raises by the female only. They keeps them with her until next breeding season (Kuo & Lee, 2012; Lin *et al.*, 2011). However, till date in India no such report is still available, however as per this survey very few respondents (25%) guessed the season winter (November- February) as their breeding season. Maximum two offspring's were reported to be the birth capacity per individual (21.4% respondents), while the majority of respondents were not sure about the breeding ecology of flying squirrel.

Cold season are considered as the best season to locate the flying squirrel as during this season, trees shade their leaves, increasing the visibility further, when activities are more (Koli *et al.*, 2011). Early summer is a good time when one can easily see the species and observe its calling and gliding activities (Koli *et al.*, 2011). Answering about the population estimation of the Flying squirrels in the state, no authentic response came out from the survey.

Flying squirrel are nocturnal in nature so it is difficult to locate them in day, but their holes on tree trunks can be easily identified. Fifty eight percent of the respondents didn't see the nest cavity of the Flying squirrels, whereas 22% respondents have seen their nesting sites and according to which they prefer *Madhuca indica*, *Tectona grandis* or *Anogeissus sp.* as their nesting tree at a height more than 12 m. Study also suggests that the *Madhuca indica* is the most preferable nesting tree for Flying squirrel, which is also its preferred food species (Koli *et al.*, 2013), but this is not the case with our survey as respondents have not suggested any specificity for nesting tree and the distribution of Mahua trees are very patchy and non consistent in the state. Further 59.3% of respondents have said that the species chose natural holes in the large trees as their nesting sites which are prepared through leaf litters (46.4%) and Twigs (42.9%).

Being a crepuscular animal it is also not easy for this species to escape from their predators. Their predators in the area include Owls (47.6%), Snakes (42.9%), and Domestic cats (23.8%) as suggested by the respondents and the literature (Jiang, 2009). Not only predators take their toll over this species but humans also have impacts on their population. Although they don't cause any type of harm to people or economic loss in terms of agricultural damage, human kills them for food, body parts and sometimes the myths dominate as the reason (Koli *et al.*, 2013). These can be considered as the probable cause of decrease in their population. Such as in Rajasthan, flying squirrels are hunted by local tribes with guns and by throwing stones. Main purposes of hunting were flesh consumption, socio-cultural traditions and myths but not commercial. The other reasons include forest deforestation and degradation, habitat loss mainly loss of tall trees and recreational activities in the forest area.

As per the respondents, Flying squirrels don't cause any type of damage to human beings (75%) or any economic loss (48.6%). However, 40.5% of the respondents think that the Flying

squirrel population has decreased over the last ten years (Fig 4). The Probable reasons of their declination are hunting (50.0%), failure in landing (26.7%), Accidents (16.7%), Electric shocks (13.3%) and habitat loss, degradation and deforestation (40.0%). In many parts of the region where this species are known to found, they are killed by the humans due to different reasons. Here also respondents have suggested various reasons of killing the species like for food (27.3%), beliefs and body parts (18.2%), myths (9.1%).

Looking at all the perspectives and the bleak information about the species in the state, a quality research on the species is expected as suggested by the respondents (83.3%) and should be upgraded to Scheduled -I (86.8%) as their population trend in the state is still unknown.

Conclusion:

Information on Flying squirrel is very sparse and most of them do not have come through scientific background. In our effort, most of the respondents were field researchers, having keen knowledge of wildlife but still they failed to provide sufficient data regarding the ecological and biological aspects like time and season of sighting, home range, migration pattern, nesting and breeding information. Like many other species, Flying squirrels are also in the verge of extinction and Gujarat is not an exception to this.

The survey suggests that about a detailed scientific and systematic research and monitoring of this species ecological aspects which can help to generate baseline data and can be used in preparing conservation and management strategy for this animal.

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