

Cat Project of the Month – April 2008

The IUCN/SSC Cat Specialist Group's website (www.catsg.org) presents each month a different cat conservation project. Members of the Cat Specialist Group are encouraged to submit a short description of interesting projects

Phylogeography of Indian populations of jungle cat (*Felis chaus*) and leopard cat (*Prionailurus bengalensis*)



The study species: Leopard cat (top, Photo V. Lakshman), Jungle cat (bottom, Photo J. Tiwari).

The family Felidae is well represented in India, with 15 species occurring here, making it the richest in cats worldwide. However, except for the large cats the rest figure very poorly in research and conservation policies in the country, probably because of their rarity and elusive nocturnal habits, coupled with cumbersome bureaucratic formalities in studying rare species. Fortunately, in the past few years non-invasive molecular techniques have been introduced in wildlife research in India, which has made small cat research easier.

Shomita has studied diet and habitat use in fishing cat and jungle cat in Keoladeo Ghana National Park in Rajasthan as part of her Master's dissertation and diet and habitat use in jungle cat, caracal and golden jackal in Sariska Tiger Reserve, Rajasthan for her PhD. Currently she is doing her post doctoral research at the National Centre for Biological Sciences, Bangalore, using non-invasive DNA analysis to address questions related to phylogeography of some small cats, human-large cat conflict and testing molecular techniques to survey small cats in India. Shomita has been a Cat SG member since 1995.

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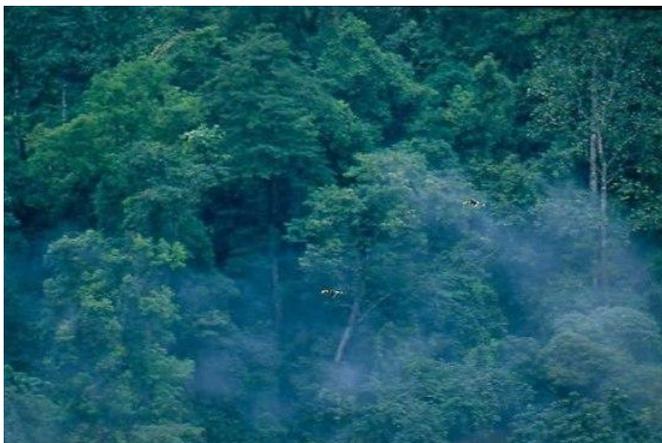


Krishnapriya Tamma and Shomita Mukherjee (Photo Vishnupriya).

Background

Through phylogeographic studies, genetic polymorphisms from various populations of a species can be examined, and populations can be identified and conserved for their uniqueness in an informed manner. The jungle cat (*Felis chaus*) and leopard cat (*Prionailurus bengalensis*) serve as excellent models to study various aspects of phylogeography, due to their wide global spread. The morphology and genetics of these species indicate different origins within Felidae. The jungle cat belongs to the domestic cat lineage with strong morphological affinities to certain scrub dwelling African cats, while the leopard cat lineage is oriental in appearance and distribution (Pocock 1939; Johnson et al. 2006). The jungle cat also shows strong geographical variation in body size and morphology (Mukherjee & Groves 2007). Within India, 5 subspecies of jungle cat have been described based on morphological characters. However, given its wide and almost continuous distribution through much of India (Nowell & Jackson 1996), would these sub-species be valid units? On the other hand the current distribution of the leopard cat in India appears to have a break around the Deccan Plateau in Central India. From historical hunting records and current distribution maps (Pocock 1939; Nowell & Jackson 1996; Sunquist & Sunquist 2002), it is unclear if this gap is wide enough to separate the northern and southern populations or whether it has an ecological or anthropogenic origin. We aim to answer these questions and test the efficacy of molecular tools in small carnivore research in the Indian scenario.

Since it is the first study exploring the utility of molecular tools in small carnivore research in India, we decided to use them on the relatively more common and widely distributed species of cats. Although the jungle cat and the leopard cat are relatively more common in India, they feature prominently in illegal trade for their pelt. Apart from poaching, another major threat they face is habitat degradation due to pressure from a burgeoning human population, and the lack of ecologically sound land policies.



Rainforest in Northeast India, part of the North Zone in the project. Scats collected indicate a higher abundance of leopard cat than the jungle cat for this habitat (Photo S. Kumar).

We aim to compare the genetic structure of the two most common wild small felids of India and relate it to their ecology and distribution. This will contribute to a greater understanding of their evolution, conservation status from a genetic perspective and distribution in India.

The specific objectives of the project are:

- 1 To study and compare population genetic structures of the jungle cat and leopard cat.
- 2 To associate genetic patterns of populations of the 2 species to their distribution, ecology and anthropogenic factors.
- 3 To verify leopard cat distribution in India.
- 4 To demonstrate the importance and power of molecular techniques in small carnivore research in India.

Methods

We use mitochondrial DNA (maternally inherited and slow mutating) for obtaining historical data and nuclear microsatellites for information on relatively recent changes in population size and movement, for both species. In this way if we find a difference between populations of a species, we would be able to compare historical and recent variation and potentially attribute it to ecological/anthropogenic causes.

We began our work by designing appropriate primers for the mitochondrial DNA of the two cats, using the house cat sequence and bits of sequences of the jungle cat and leopard cat (from the NCBI database). We standardised primer conditions with blood from captive individuals. However, most of our samples are scats and some tissue samples from road kills, collected from various habitats across the country. We also plan on analysing historical samples from museums across the world.

We divided the country into three broad zones viz. The Northern zone (including the Himalayas and foothills), the Central zone comprising of the desert, the Deccan plateau and eastern India and the Southern zone (south of the Deccan plateau; see map). We sample from each of these zones, along with GPS records of latitudinal and longitudinal co-ordinates for each sample.



Map of India showing the North, Central and South Zones for the project.



Collecting scats in the desert in Jaisalmer, (Rajasthan, Western India), part of the Central Zone in the project. Being strongly associated with water, the introduction of irrigated agriculture in the desert may have helped the jungle cat spread into this region (Photo N. Manjrekar).

Once the samples are brought to the laboratory, we extract DNA using commercially available Qiagen extraction kits. The extracted DNA is then amplified with primers specific to the jungle cat and leopard cat. This eliminates all other species and we use the positively identified samples for further amplifications and sequencing with other primers, targeting various portions of the mitochondrial DNA.

For microsatellite analysis we use domestic cat primers (Menotti-Raymond et al. 1999; Ernest et al. 2000). We are still in the process of standardising protocols for microsatellites and testing them on our species of interest. Since most of our samples are scats from field, subjected to various levels of degradation, we need to pick out loci that are small and yield good results. Once samples are identified as jungle cat/leopard cat we plot them on a map using the GPS co-ordinates to depict their spatial distribution.

Preliminary results

To date, we have analysed 35 samples each of jungle cat and leopard cat, from various parts of India, for 465 base pairs of the NADH5 gene. Our results so far, show no structure for the jungle cat population in India, indicating continuity in historical distribution and disputing the subspecific classification. On the other hand, for the leopard cat we see a large genetic distance ($F_{st} = 0.86$) suggesting an almost complete break in historical distribution. This is extremely crucial since it suggests potential isolation of the southern Indian population, which consequently requires special conservation consideration. We are currently increasing our sampling for this population of leopard cats and sampling the Central Zone more extensively for obtaining information on leopard cat presence in that region.

A cropfield from the Central Zone. Jungle cats seem to have benefitted from irrigated agriculture. However, it is not known how successful they are in raising their young in this habitat, since their breeding period appears to coincide with harvest in many places (Photo V. Athreya).





Apart from increasing sample sizes to cover all geographical regions for both species, we are also working on microsatellite DNA for both cats to obtain a finer resolution of information, as well as understand the current pattern of genetic variation.

As an outcome of the project we were able to collect several scats from various parts of India that could belong to species of cats that we are not addressing currently. However, we are also in the process of designing species specific primers for all cats in India and hence hope to obtain information on the presence of several other cats in the country.

Moist Deciduous forests from Dandeli in the Southern Zone of the project (Photo Krupakar and Senani).

Acknowledgements

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Project Information

Duration:	2006 – ongoing
Location (see map):	All across India
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