Estimation of Population Trend of Lesser Cats in Buxa Tiger Reserve (BTR), West Bengal

(A Pilot Phase Study Report)

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Estimation of population trend of Lesser Cats in Buxa Tiger Reserve (BTR), West Bengal-

Report of the pilot phase -

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Abstract

Lesser wild cat populations are widely threatened with habitat loss, human-wildlife conflict and wildlife trade throughout their extant range in the world. Until now, for the most part information on small cats in India has been in the form of natural history notes on distribution and habits, ad-hoc records on sightings and behavior or short studies on diet and habitat use. Our study was conceptualized to assess population trend of lesser wild cats in Buxa Tiger Reserve (BTR) in Duars, West Bengal. We investigated on their ecology through three fold survey strategies 1) Questionnaire survey, 2) Sign survey and 3) Camera trapping. n=11 single camera units were used for 160 days study in three different ranges (Jayanti, Hatipota and Kumargram) of BTR with effort of 1760 trap nights. We obtained photo captures of 10 different mammalian families with 17 different species. Of them 4 species were of endangered (EN) in IUCN (International Union for Conservation of Nature and Natural Resources) category of threatened taxa. Camera trapping revealed the existing distribution of four sympatric wild lesser cats in BTR; Leopard cat Prionailurus bengalensis, Fishing cat Prionailurus viverrinus, Jungle cat Felis chaus and Marbled cat Pardofelis marmorata. Calculated RAI (Relative abundance index) revealed that for the entire occasion leopard cats were found the most abundant species (0.85) among all the existing lesser wild cats, followed by other sympatric species, fishing cat (0.06), marbled cat (0.06) and jungle cat (0.06). All the four species of lesser wild cats were found only in Kumargram Range and in other two ranges only leopard cat was photo captured. More research needs to be done and the continuation of the study has a scope to reveal the population status of lesser wild cat population in BTR landscape for developing conservation management and firm scientific planning to ensure the long term survival of these four existing sympatric species.
Introduction

There are existing 28 species of lesser wild cats in the world among them 10 species are thriving in India, the highest number any country has (Nowell and Jackson 1996). The increasing human population, the spread of settlement and the exploitation of natural resources of wild lands, together with persecution, are threatening some species with extinction. For other cat species we observe worldwide population decline. Conservation initiatives were taken in every part of the world to ensure survival of threatened species. For effective species conservation and management, an understanding of species ecology with population trend is vital, particularly if the species forms an important constituent of the lesser mammalian guild and regulates small mammal and bird populations. Few studies on their ecology (Distribution and abundance) and ethology were carried out in India. Yet, apart from the four big cats the small ones do not feature in any major research or conservation planning. The ecological role of the lesser wild cats in the eastern Himalayan habitats is not well known and gathering such information on elusive species in remote and intricate Himalayan habitats has always been challenging since conventional sampling protocols have been proven inadequate in such areas (Sathyakumar et al. 2011). Over the last two decades, the use of various noninvasive techniques for the sampling of animal populations has increased significantly. Technological advances have allowed practitioners to sample and monitor animal populations without invasive methods. Reducing of time, effort and expenses in the collection of scientific data with more efficiency have increased interest towards noninvasive sampling methodologies. Noninvasive sampling methods are particularly well suited to animals that are elusive, often occur at low densities, and are difficult to capture or detect. Arguably, the most popular noninvasive sampling technique among those reviewed by Long et al.
(2008) is remote photography using camera traps. Camera trapping has emerged as an efficient noninvasive monitoring tool with wide applicability in ecological studies in varied habitat conditions and proved very effective in this kind of study. Much attention also has been focused on using camera-trapping to detect otherwise elusive species, including charismatic examples such as tigers (*Panthera tigris*) (Karanth et al. 1995), snow leopards (*Panthera uncia*) (Jackson et al. 2006), giant pandas (*Ailuropoda melanoleuca*) (Li et al. 2010), Jaguar (*Panthera onca*) (Silver et al. 2004) and others.

The project was conceptualized to assess abundance of different available lesser wild cats by using camera trapping technology and accordingly develop their conservation strategies in Buxa Tiger Reserve (BTR), West Bengal. The Reserve lies in the Biogeographic zones of Central Himalayas (2C) and Lower Gangetic Plains (7B) (Rodgers & Panwar, 1988). We assessed the species occurrence, population status and activity pattern of lesser wild cats in the study area, part of Buxa Tiger Reserve, India, based on questionnaire survey, sign surveys and camera trapping.

Lesser wild cat populations are threatened throughout their extant range in India by habitat loss, conflict and wildlife trade. For BTR where the population status of the four sympatric lesser wild cats are unknown there conservation management and firm scientific planning are essential for these species before the situation reaches the point, of beyond recovery. This current project is designed to promote the *in-situ* conservation of all the lesser wild cats in the study area.
Objectives

- To assess abundance of four sympatric lesser wild cats in BTR

- To identify spatial distribution of the four sympatric lesser wild cats in BTR
Study Area

Buxa Tiger Reserve is situated between 26° 40' 30" N, 89° 44' 30" E coordinates of Alipurduar sub-division of Jalpaiguri District, West Bengal. The location of the Reserve is in the tri-junction of three major bio-geographic zones viz. Lower Gangetic Plains, Central Himalayas and Bramhaputra Valley. Representation of multi strata vegetation assemblage from the plains to an elevation of 1750m in the hills, coupled with a good number of perennial water streams, enables this Reserve to be an excellent harbour for various wild animals.

The Tiger Reserve covered 760.87 Sq. Km of multi strata vegetation assemblage. In the plains the forest is composed of Sal (Shorea robusta) along with its associates like Champ (Michelia champaca), Chilaune (Schima wallichi), Chikrasi (Chukrasia tabularis), Bahera (Terminalia beilerica), Sidha (Lagerstroemia parviflora), Toon (Toona ciliata), Lali (Amoora wallichi), Lasuni (Aphanomixis polostachea), Lampati (Duabanga grandiflora), Simul (Bombax ceiba). In the river banks Simul, Sisoo and Sirish are commonly found, while in the hills Katus (Castanopsis indica), Mandane (Artocarpus fraxinifolius), Bhalukath (Talauma hodgsoni), Phalame(Walsura tabulata) associated with Kimbu (Morus laevigata), Panisaj (Terminalia microcarpa), Gokul (Ailanthus grandis) are common. The grasses mostly used by the wild ungulates and other herbivores are Imperata cylindrica, Arundo donax, Themeda arundinacea, Phragmites karka, Paspalidium punctuatum, Panicum maxima, Seteria glauca, Oryza sp., Saccharum sp., Andropogon sp., Thysanolana sp.
Buxa Tiger Reserve (BTR) West Bengal
Altitudinal variations with its geographical position in the tri-junction of the biogeographical zones eventually develop high floral diversity which in turn elevates faunal species variation in Buxa Tiger Reserve (BTR). The existing large carnivores of Buxa Tiger Reserve are Bengal tiger (*Panthera tigris*), leopard (*Panthera pardus*), clouded leopard (*Neofelis nebulosa*). Other lesser carnivores are hog badger (*Arctonyx collaris*), jungle cat (*Felis chaus*), leopard cat (*Felis bengalensis*), fishing cat (*Felis viverrina*), wild dog (*Cuon alpinus*), jackal (*Canis aureus*), mongoose (*Herpestes edwardsi*), fox (*Vulpes bengalensis*). Among herbivores, predominant are Asian Elephant (*Elephas maximus*), Gaur (*Bos gaurus*), Sambhar (*Rusa unicolor*), Chital (*Axis axis*), Barking deer (*Muntiacus vaginalis*), Hog deer (*Axis porcinus*), Wild pig (*Sus scrofa*) and Hispid hare (*Caprophagus hispidus*). Many other animals like Porcupine (*Hystrix indica*), Rhesus macaque (*Macaca mulatta*), Common Pangolin (*Manis crassicaudata*) also frequent in these forests. Varieties of fishes are present in the rivers and streams flowing inside the forest, most commonly found are Chela, Boroli, Puti, Hum, Sole etc. Among reptiles tortoise, lizards, gecko, various kinds of snakes such as King cobra (*Ophiophagus hannah*), Russell’s viper (*Daboia russelii*), Black krait (*Bungarus niger*), Indian Python (*Python molurus*) and Reticulated Python (*Python reticulatus*) are found in this region.

Avifauna

More than 227 bird species were reported from this IBA site by Allen et al. (1996). But, if we include the birds seen earlier by Inglis et al. (1918-1920), Stevens (1923-1925), Inglis (1952-69), Law (1953) and Sanyal (1995), the total comes to 359 species for the IBA. During a one-year BNHS study, 221 species were sighted by Prakash et al. (2001). The Greater Adjutant *Leptoptilos dubius*, an Endangered
(EN) species, was earlier seen by Inglis et al. (1918-1920) but not by Allen et al. (1996) or Prakash et al. (2001). Similarly, the following species were not sighted in recent surveys: Manipur Bush Quail *Perdicula manipurensis*, Pallas’s Fish Eagle *Haliaeetus leucoryphus*, Bengal Florican *Houbaropsis bengalensis*, Lesser Florican *Sypherotides indica*, White-bellied Heron *Ardea insignis*, Wood Snipe *Gallinago nemoricola*, Jerdon’s Babbler *Chrysomma altirostre* and Finn’s Weaver *Ploceus megaphrynchus*. A part of Buxa Tiger Reserve lies in the Eastern Himalayas Endemic Bird Area (EBA 130) where Stattersfield et al. (1998) have listed 21 restricted range species. Red-breasted Hill Partridge *Arborophila mandelli*, Yellow-vented Warbler *Phylloscopus cantator*, Hoary-throated Barwing *Actinodura nipalensis* and White-naped Yuhina *Yuhina bakeri* are found in the higher reaches of Buxa. Most parts of Buxa are plains and would come under the Assam Plains Endemic Bird Area (EBA 131) where three species are considered restricted range. Only the Black-breasted Parrotbill *Paradoxornis flavirostris* has been reported from this IBA, although earlier even the Manipur Bush Quail was found at the foot hills. Prakash et al. (2001) recorded 32 species of raptors, including the two Critically Endangered *Gyps* vultures. Allen et al. (1996) report five species of hornbills (Indian Grey *Ocycercos birostris*, Oriental Pied *Anthracoceros albirostris*, Great Pied *Buceros bicornis*, Rufous-necked *Aceros nipalensis* and Wreathed *Aceros undulatus*). Some species of conservation interest seen by them are: Chestnut-breasted Partridge *Arborophila mandellii* (5 individuals), Rufous-necked Hornbill (one pair), Beautiful Nuthatch *Sitta formosa* (2-4 birds), Long-billed Wren-Babbler *Rimator malacoptilus* (one pair), Black-headed Shrike-Babbler *Pteruthius rufiventer* (small numbers), Yellow-throated Fulvetta *Alcippe cinerea* (small party), White-naped Yuhina *Yuhina bakeri* (small flocks) and Greater Rufous-headed Parrotbill *Paradoxornis ruficeps* (flocks of
Thirteen species belonging to the Vulnerable (VU) category and 11 belonging to the Near Threatened category are found in Buxa, some with significant numbers.

**Methodology**

**Reconnaissance survey**

The survey was strategized into three consecutive phases; 1) First phase was questionnaire survey, 2) second phase sign survey and 3) third phase was camera trapping. The survey team initially has carried out the first phase, interview based survey in the villages present in and around Buxa Tiger reserve (BTR), on Forest staffs of BTR and daily field labourers to generate secondary presence absence data on lesser wild cats. It was an attempt to prioritize zones from where to start the pilot sign survey on the lesser felids.

Based on the interviews, sign survey (Second phase) was carried out with prime focus on leopard cat, jungle cat, marbled cat and fishing cat. Dart roads, animal trails, river and stream beds were searched for indirect signs of the target species. Multiple trails were walked to get signs of lesser cats in Jayanti, Hatipota and Kumargram range. Generating data points on indirect signs were carried out to
obtain the most possible camera trap locations where capture probability of the concerned species were high that was essential for third phase. In the month of January 2012 and December 2013 three Ranges of Buxa Tiger Reserve (BTR) were surveyed to record presence of lesser wild felids in the landscape with the help of indirect signs such as scats and pugmark. Based on the observed probability of obtained indirect signs, potential trap locations were identified and camera traps were installed accordingly (Fig.2). Lesser wild cat scats were collected during the sign survey to carry out DNA analysis for species level identification.

Few field instances during the sign survey on lesser wild cats of BTR

Camera trapping
Camera-trapping has long been used to survey for and monitor the occurrence of wildlife species around the world (Carbone et al. 2001; Jackson et al. 2006; Moruzzi et al. 2002). Much attention has been focused on using camera-trapping to detect otherwise elusive species. Over time, these efforts have been replaced by more systematic sampling approaches, often centered on identifying individual animals in a mark-recapture framework (Carbone et al. 2001; Jackson et al. 2006) to estimate their population abundance in the study areas. For species that cannot be individually identified from photographs, indices are often used to make inference about differences in abundance across time, space and species (O’Brien
et al. 2003; O’Brien, 2011). While Indices can rarely be used for inference about absolute population size under certain conditions they can provide information on relative differences in abundance or density (Williams et al. 2002; O’Brien, 2011). The pilot camera trap survey was carried out from December, 2013 to May, 2014 for all the sympatric lesser wild felids of the Buxa Tiger Reserve with very limited resources (Camera trap, n=11).

![Few field instances of camera trap installation in BTR](image)

The study area was divided into three Ranges named as Jayanti (5.96 sq. km, ETA), Hatipota (5.44 sq. km, ETA) and Kumargram (3.90 sq. km, ETA) (Fig.3), where in total ETA (Effective trapping area) covered 15.03 sq. km of the entire Buxa Tiger Reserve. Effective trapping area was calculated by joining the outer most camera traps of the trapping surface to form a polygon and the area of trapping polygon was considered as ETA. A total of 11 passive (Single unit) camera traps (Spypoint I6, Spypoint BF-6 and Spypoint FL-8) were deployed in the locations, identified as most probable capture points from the sign survey. Due to limitations of camera units (n=11), traps were deployed opportunistically in each range to record species and their occurrence in the area. Trapping was attempted to make systematic as per as possible by placing the cameras in 1x1 km grid system.
(Fig.2). All the camera trap units were functional for 160 days (5 months 10 days) consecutive occasions resulting into 1760 trap nights. Consecutive photo captures of same species were obtained by the same camera more than once within 1 hour were excluded (Bowkett et al. 2007) and declared as an event. Relative abundance index (RAI) was calculated for each species of lesser wild cats from captured photographs. The time and date printed on the photographs has been used to determine the daily activity pattern of individual species (Pei 1998). DAI (Daily activity index) formula was not used for this small data set. Here a simple representation was made up to indicate the activity pattern of lesser wild cats.
Fig. 2 Deployment of camera traps opportunistically in the study area for recording lesser wild felid presence and abundance
Fig. 3. Map showing synchronization among Indirect signs of lesser wild cats and deployed camera trap (n=11) points in Jayanti, Hatipota and Kumargram Ranges of Buxa Tiger Reserve (BTR), West Bengal, 2014
Fig.4. Map showing the effective camera trapping areas (ETA) covered by the camera traps in Jayanti (5.96 sq. km), Hatipota (5.44 sq. km) and Kumargram (3.90 sq. km) ranges respectively of Buxa Tiger Reserve (BTR), West Bengal

Result
Sign Survey

Total 42 signs of wild felids were found in different points during the pilot survey, of these 3 signs were of leopards. Two of those were scats and rest was a pugmark. 39 total signs were obtained of lesser wild cats, among those indirect signs, scat was 64.29%, pugmark, 26.19% and direct sighting contributed only 2.38% (Fig.5).

Fig.5. Sign abundance index for lesser wild cats in Jayanti, Hatipota and Kumargram Range of Buxa Tiger Reserve (BTR) during the pilot sign survey in January, 2013 and December, 2013

Results of sign survey indicated that among the study areas relative abundance of lesser wild felids were highest in Jayanti Range (57.14%) and followed by
Kumargram (30.95%) and Hatipota (11.90%) range. Only single sighting was recorded of a leopard cat from NRVK 13 compartment.

![Bar chart showing relative sign abundance (%) of lesser wild cats among Jayanti, Hatipota, and Kumargram ranges.]

**Fig.5.** Comparable Sign abundance of lesser wild cats among Jayanti, Hatipota and Kumargram Range of Buxa Tiger Reserve (BTR), West Bengal during the pilot sign survey in January, 2013 and December, 2013

**Camera Trapping**

Camera trap sampling has successfully photo captured lesser wild cats along with several other associated species in the study area. Definite evidence of 17 mammalian species from 10 different families was observed from the captured photographs. Felidae contributed 5 species, cervidae 3 species, viverridae 2 species and all other families contributed one species each. Among these 17 identified species, 4 species (Dhole, fishing cat, hog deer and elephant) belonged to IUCN endangered category (EN) (Table1).
Table 1. List of wild species, camera trapped in Buxa Tiger Reserve during the survey

<table>
<thead>
<tr>
<th>Common name</th>
<th>Scientific name</th>
<th>Family</th>
<th>IUCN Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leopard</td>
<td><em>Panthera pardus</em></td>
<td>Felidae</td>
<td>NT</td>
</tr>
<tr>
<td>Leopard cat</td>
<td><em>Prionailurus bengalensis</em></td>
<td>Felidae</td>
<td>LC</td>
</tr>
<tr>
<td>Fishing cat</td>
<td><em>Prionailurus viverrinus</em></td>
<td>Felidae</td>
<td>EN</td>
</tr>
<tr>
<td>Marbled cat</td>
<td><em>Pardofelis marmorata</em></td>
<td>Felidae</td>
<td>VU</td>
</tr>
<tr>
<td>Jungle cat</td>
<td><em>Felis chaus</em></td>
<td>Felidae</td>
<td>LC</td>
</tr>
<tr>
<td>Dhole</td>
<td><em>Cuon alpinus</em></td>
<td>Canidae</td>
<td>EN</td>
</tr>
<tr>
<td>Crab eating mongoose</td>
<td><em>Herpestes urva</em></td>
<td>Herpestidae</td>
<td>LC</td>
</tr>
<tr>
<td>Large Indian civet</td>
<td><em>Viverra zibetha</em></td>
<td>Viverridae</td>
<td>NT</td>
</tr>
<tr>
<td>Small Indian civet</td>
<td><em>Viverricula indica</em></td>
<td>Viverridae</td>
<td>LC</td>
</tr>
<tr>
<td>Gaur</td>
<td><em>Bos gaurus</em></td>
<td>Bovidae</td>
<td>VU</td>
</tr>
<tr>
<td>Yellow throated martin</td>
<td><em>Martes flavigula</em></td>
<td>Mustelidae</td>
<td>LC</td>
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<td>Barking deer</td>
<td><em>Muntiacus vaginalis</em></td>
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<td>LC</td>
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<tr>
<td>Hog deer</td>
<td><em>Axis porcinus</em></td>
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<td><em>Rusa unicolor</em></td>
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<td><em>Sus scrofa</em></td>
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<td>LC</td>
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<td>Asian elephant</td>
<td><em>Elephas maximus</em></td>
<td>Elephantidae</td>
<td>EN</td>
</tr>
<tr>
<td>Rhesus macaque</td>
<td><em>Macaca mulatta</em></td>
<td>Cercopithacidae</td>
<td>LC</td>
</tr>
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</table>

* EN* Endangered, VU* Vulnerable, NT* Near Threatened, LC* Least Concerned
Fig. 6. Capture of existing sympatric lesser wild cats of Buxa Tiger Reserve (BTR),
December 2013 to May 2014
Camera traps recorded 36 photographs of lesser wild felids. 18 individual events were counted for the entire occasion. For the entire trapping occasion leopard cats’ capture percentage was highest (83.33%) and followed by fishing cat (5.56%), marbled cat (5.56%) and jungle cat (5.56%). Capture data among the study areas showed measurable detection differences during trapping. The events were highest in Kumargram Range (0.51%) where all the captures of existing sympatric lesser wild felids were obtained and followed by Jayanti (0.45%) and Hatipota (0.06%) where only leopard cats were captured for the entire occasion (Fig.8).

Scat DNA analysis work is in progress at ZSI (Zoological Survey of India) Laboratory, whereby a MOU has been signed to this effect. So the result on species level identification from scat DNA is not explained yet.
Fig. 9. Relative abundance index (RAI) of lesser wild cats in the sampled area of Buxa Tiger Reserve (BTR), West Bengal during the pilot camera trap (n=11) survey from December, 2013 to May, 2014 (1760 trap nights).

Calculated RAI for lesser wild cats reflected that for the entire occasion leopard cats were found the most abundant species (0.85) among all the existing lesser wild cats and followed by other sympatric species like fishing cat (0.06), marbled cat (0.06) and jungle cat (0.06) (Fig. 9).
Fig.10. Combined activity pattern of lesser wild cats in Buxa Tiger Reserve (BTR), West Bengal during the pilot camera trapping from December, 2013 to May, 2014

All the species of lesser wild cats were observed active during the crepuscular time and during the night. The activity peaks were observed among 0-2 hours to 2-4 hours and again in 18-20 hours onward in the evening (Fig.10). Leopard cat showed 72.22% nocturnal and crepuscular activity.

**Discussion**

According to the present context demographic knowledge of lesser wild cats is insufficient and therefore implementing conservation plans with strong scientific methodologies, is the greatest challenge. Due to the limited resource constraints we are not in a situation to estimate lesser wild cat population rather result was generated to know population abundance index of the available species of lesser felids. Obtained abundance index indicated that except leopard cat other existing sympatric cats are least abundant in the area. In Kumargram range all the species of lesser wild cats were photo trapped and showed the best result in comparison to Jayanti and Hatipota in terms of trapping success. Photographic events were just n=18 in 160 days occasion with 11 camera traps, so in this session the data set is just to describe the simple observations from it. Information on the Activity pattern of the leopard cat (n=14) of our study synchronizes with the findings of Cheyne and Macdonald (2011) (camera trapping) Rajaratnam (2000) (radio telemetry) and (Bashir et al. 2013) reporting 65, 85% and 87% nocturnal activity, respectively. For further discussion more data set will be required on the matter and can be covered in the next session of camera trapping in BTR.
In the Protected Areas (PA) and outside the PA few studies were made in the recent times but more research needs to be undertaken to gain knowledge of current distribution pattern. All the observed lesser wild cats from the present study area are threatened with conflict and wildlife trade in different parts of India (Jungle cats in Rajasthan, Sharma et al. 1984; Marble cat in Arunachal Pradesh, Selvan et al. 2013; Fishing cat in Rajasthan, Sharma et al. 1984; Leopard cat in Sikkim, Bashir et al. 2013). Recorded evidences of killing or trading of marbled cats are rare; killing was recorded in Arunachal Pradesh by Apatini tribe for their rituals (Selvan et al. 2013). Ecological and behavioral studies indicated that lesser wild cats are well adapted in human dominated landscape, where chances of conflict are automatically high. They are known to be considered as conflict species when some farmers pointed the jungle cat as a pest which takes poultry (Abu-Baker et al.2003), for fishing cat the situation is also the same esp where the fishery industries or private fisheries exist in vicinity .Furthermore, the fishing cat is known to prey on poultry (Sunquist & Sunquist 2002, Cutter & Cutter 2009, IUCN 2010) and have the possibilities to face the same threat in BTR. Buxa is a Tiger Reserve which sustains several villages inside and around its premises (Table 2) with the human population over 3 lakh, which may act as potential threat to the study species referring to the accentuated conflict risks involved in other parts of India.
Table 2. Demographic and other data on forest villages, FD holdings, tea gardens and revenue villages in and around PA

<table>
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The ecology and population status of the lesser wild cats are poorly known in India. Specifically in Buxa landscape this study is not carried out before. In BTR studies using methodology like camera trapping will be beneficial for the purpose to develop improved species conservation and management plan. From this effort we have already obtained indications on population trends of lesser wild cats in BTR. Hence, from this comprehensive understanding of the pilot survey, it could be inferred that, further study on population monitoring and survival studies in Buxa Tiger reserve (BTR) will help in terms of conserving lesser wild cats with more definite strategies.
References


