1.1 Background

Of four Asiatic large predators two Asiatic Lion (*Panthera leo persica*) and Common Leopard (*Panthera pardus fuska*), are existing in Gir Lion Sanctuary, Western Gujarat, India (henceforth Gir WLS). Both predators have been the source of attraction globally. Leopard is often considered to epitomize the features and behaviour of the large carnivores. It can surely be considered as the most perfect large carnivore, beautiful in appearance and graceful in its movements, most ferocious, cunning and 3rd fastest (45-50m/min) member of the family felidae (Guggisberg 1975). Considerable variations in recorded subspecies currently exist, viz-a-viz. fluctuation in coat pattern and spot or rosette size only due the regional variations (Prater 1993).

The lion is a flagship species among large carnivores. Based on genetic analysis two sub-species are recognized and Asiatic lion is one of them. Due to recent investigations six African sub species are recognized (Haas et al. 2005) and Asiatic lion is found more close to the west and central African lions than to the southern and east African lions due to regional differences (Bertola et al. 2011, Flow chart 1.1).

1.2 Historical distribution and status of Leopard & Lion

Fossil evidence, some as old as 1.5 to 2.0 million years (Hemmer 1976), suggests that leopards were once more widely distributed than today’s (Hayward et al. 2006, Nowell & Jackson 1996) while the Asiatic lions are now restricted to a single wild population in the dry deciduous forest patch in Gir WLS (Kumar & Meena 2012, Caro et al. 2006) where the species has been rescued from near-extinction. Geographical distributions of these two predators have declined drastically due to primarily a combination of human-related causes (Cardillo et al. 2004). Leopard’s distribution extends throughout Africa, Central Asia, south-east Asia and north Amur valley in Russia. They have very broad latitudinal range encompassing a diverse array of habitats from tropical rainforest to arid savanna, and from alpine mountains to the edges of urban area, but have reached their highest densities in riparian zone (Nowell & Jackson 1996, Sunquist & Sunquist 2002, Henschel et al. 2005, Hayward et al. 2006).
Leopards are found throughout the Indian sub-continent with the exception of deserts, the Sundarban mangroves, and densely settled areas (Bailey 2005). The lion occurred in Africa, Europe, the Middle-East and Southwest Asia, in all habitats except very dry deserts and very moist forest. They disappeared from Europe during the first century AD and from North Africa, the Middle East and Asia between 1800 and 1950, except remaining population of the subspecies Panthera leo persica in western India. Currently, lions are found in savannah habitats across sub-Saharan Africa (Nowell & Jackson 1996). According to the latest assessment of International Union for the Conservation of Nature (IUCN)-Red List, the Leopard has been classified as “endangered” carnivore species under the category of least concern and lion has shifted from critically endangered (CR) to endangered (CE) carnivore species. In view of the world-wide down-ward trend in leopard numbers, the IUCN urged intensive research on leopard likely remained in Appendix 1 of CITES because of its extensive hunting. In spite of being most widely distributed member of the family felidae, the leopard remained essentially unstudied in the wild. In India leopard figures in Schedule I of the Indian Wildlife Protection Act, 1972 (Anon.1993). According to the Global Cat species Vulnerability Ranking, it has been categorized as 5(a), while regionally placed in category 4(a).

Large predators pose enormous challenges as far as their long term conservation is concerned. Large cat species require extensive wild areas with substantial prey base and relatively less disturbed habitats for long term viability. Such extensive areas go beyond the boundaries of protected areas and put survival of these species in jeopardy. The first on leopard-lion ecological study was conducted in Serengeti National Park, Tanzania during 1972-73 using radio-tracking methodology (Bertram 1982). The leopards are generally considered nocturnal. However radio-tracking studies in Gir WLS have found them more diurnal and crepuscular. They have been found in all types of habitats and vegetation including cultivated areas. Similarly it has been observed to occupy varying topography from hilly to undulating or flat (Vijayan & Pati 2002). The present study was conducted to investigate ecology of large predators of Gir as lion and leopard have been hypothesized to compete for resources (Khan et al. 2007, Meena et al. 2011). The possibilities of competition have risen due to simultaneous increase in lion and leopard numbers (Vijayan & Pati 2002). Viability of both predators survival depend on availability of large to medium sized
ungulates biomass, availability of quality habitat and less disturbance. Their co-existence is facilitated by leopard's ability to adapt and spatio-temporal variation in activity pattern. Leopards and lions usually live very close to each other and their home ranges overlap. The leopards are extremely varied of lion's presence. The lions on contrary react instantly by overtaking the kill. The climatic condition of Gir WLS is distinguished by summer, monsoon and winter seasons with great variation in canopy cover, water availability, and ungulate biomass availability. Leopards are generally solitary and social interaction can be observed only during mating or cub rearing activity whereas lions are social and live in groups.

1.3 Major threats

Major threats to large cats have been shaped by three extrinsic factors such as (i) fluctuations in prey population during the past has contributed towards declining population of large predators (Burnham et al. 1980, Karanth & Stith 1999). Wildlife ecologists have emphasized on important role that large mammalian prey species play for large predators through forming bulk of prey base along with advance understanding for ecological processes at landscape and ecosystem level (Jathanna et al. 2003). (ii) Rapid transformation of natural habitats in agriculture land, contraction of forest area are another key threats for survival of large predators which frequently turn to conflict and result in awful incidents (Loc 2002). Basic requirement of extensive large home ranges and large prey populations have become scarce commodities (Woodroffe 2000) to draw them at outskirt of protected areas where they come in contact of human beings so often and due to fear they gain persecution worldwide. Sometime this problem occurs due to co-existence of two sympatric predators (Khan et al. 2007, Nazneen Zebra et al. 2012) around many PAs. Major threats to their survival also include (iii) hunting for trade. Till date thousands of leopards have been relentlessly hunted for sport, killed for its body parts assumed to have medicinal properties.

1.4 Conservation

Hence, conservation of large cats has become a symbol of the status of wildlife conservation in the country and similarly represents the conservation of whole ecosystems (Treves & Karanth 2003). Besides escalating large predator-human
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conflict (henceforth LPHC) has become multifarious challenge in protected area management all over the world. The important milestones in independent India were taken with provisions under National Forest Policy, 1952 for setting up of Sanctuaries and National Parks, enactment of the Wild Life (Protection) Act 1972, launching of Project Tiger and Project Lion in 1973 followed by the Biological Diversity Act (2002) to protect and conserve endangered fauna. The National Forest Policy 1988 has conservation as its basic objective: “Conserving the natural heritage of the country by preserving the remaining natural forest with vast variety of flora and fauna” represents a milestone in conservation of biological diversity and genetic resources of the country. 4.8 percent of the geographical area of the country has been set aside for exclusive conservation of its biodiversity in the form of protected areas (PAs). Currently, about 659 Protected Areas include 100 National Parks, 514 Sanctuaries, 41 Conservation Reserves and 4 Community Reserves exist to protect and conserve remaining biodiversity. In case of Gir WLS, both leopard and lion exist in healthy population in and around the protected area (PA) and a sizeable population of lion and leopard exist in agriculture areas (Vijayan & Pail 2002). The local people who live in these areas co-exist with large cats in complete harmony.

1.5 Rationale for study

Gir WLS being home to sole wild population of Asiatic lion (*Panthera leo persica*) and a large population of leopard (*Panthera pardus fuska*) makes it an ideal site for carrying out ecological study on both species with emphasis on understanding the co-existence mechanism. Leopard was a least studied species until recently. The movement of lions outside Gir WLS around 1990 led to establishment of lion subpopulations around Gir WLS in a mixture of agro ecosystem and degraded scrub forest habitat. This was followed by rising incidences in leopard-human conflict from the same areas towards late 90’s. Existence of large leopard population inside Gir WLS has been thought to be responsible for movement of lions from Gir as it is hypothesized that there is sever competition between lion and leopard for food resources. This necessitated a careful ecological investigation on aspects of ecology of both species.
Map 1.1 Historical ranges and distribution of leopard (*Panthera pardus*). (Map source: http://www.pictures-of-cats.org/Leopard-Habitat.html).
1.6 Study period

The field work for the present study was carried out from December 2007 to August 2012 during following different seasons: summer (March-June), monsoon (July-October) and winter (November-February).

1.7 Objectives

The study was carried out with following objectives:

1. To study distribution, abundance and habitat use of large mammalian predators of Gir with special reference to leopard.

2. To estimate current wild and domestic prey densities and availability of prey biomass for large mammalian predators of Gir with special reference to leopard.
3. To investigate spatio-temporal utilization of prey biomass by large mammalian predators of Gir with special reference to leopard.

4. To study movement pattern, territoriality and co-existence mechanism of large mammalian predators of Gir with special reference to leopard.

5. To study past and current patterns of human-large predator conflict in and around Gir with special reference to leopard.
Flow chart 1.1 Tree of sub-species of large predators.
Table 1.1 Facts profiles of leopard (*Panthera pardus fuska*) and Asiatic lion (*Panthers leo persica*).

<table>
<thead>
<tr>
<th>S.Nu.</th>
<th>Facts</th>
<th>Leopard</th>
<th>Lion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Reproductive system</td>
<td>Year-round, but based on sightings of cubs there is a birth peak from late winter to early summer (pers. Obs.).</td>
<td>Year-round, but based on sightings of cubs there is a birth peak from late winter to early summer (Ravi Chellam &amp; Johnsingh, 1993, P.Obs.)</td>
</tr>
<tr>
<td>2</td>
<td>Litter size (LS)</td>
<td>In wild: mean of LS, 1.92, range 1-4 (observed only after young cubs are fully mobile (Hemmer 1976). In captivity: 2-5 (P. Obs.).</td>
<td>In wild: mean, 2.5, range 1-5 (observed only after young cubs are fully mobile. In captivity: 2-6 (Chavan 1993, P.Obs.).</td>
</tr>
<tr>
<td>3</td>
<td>Age at first reproduction</td>
<td>In wild: ?-2.5 to 3Years, ?-2.5 to 4Years (Bailey1993). In captivity: avg. 2.5-3 years (? &amp; ?) (P.Obs.).</td>
<td>In wild: ?- 4 Years, ?-5 to 6 Years In captivity: 3 years (?&amp;?) (P.Obs.).</td>
</tr>
<tr>
<td>4</td>
<td>Age at last reproduction</td>
<td>In wild: ?-13 to 14 years, ?-14 to 16 (P.Obs.) In captivity: both sexes (? &amp; ?) on an avg. 13-14 years (P.Obs.)</td>
<td>In wild: ? 15 to 16 years, ?-14 to 15years (Chavan 1993) In captivity: both sexes (? &amp; ?) 15 years (P.Obs.).</td>
</tr>
<tr>
<td>6</td>
<td>Longevity</td>
<td>In wild: ?: avg. 14-15 years; ?: 16-17 years In captivity: avg. 16-17 years (P. Obs.)</td>
<td>In wild: ?: 17-18 years ?: 16-17 years (Chavan 1993) In captivity: both sexes (? &amp; ?) on an avg.17-18 years (P.Obs.).</td>
</tr>
<tr>
<td>7</td>
<td>Respiration</td>
<td>13.87 beats/minute (P.Obs., Sabapara et al. 2008)</td>
<td>11-12 beats/minute (P.Obs.)</td>
</tr>
</tbody>
</table>

Note: Personal observations are based on observations and captivity records at rescue center of Wildlife Division, Sasan Gir and monitoring of adult radio-collared leopards in the wild (2009-2012).
1.8 Literature review


Population size estimation of large cats has been a globally challenging task. The methods used for population estimation have been marred because of various reasons such as limitations to apply such advanced techniques due to high cost of equipments, possibility of theft and vandalism, low numbers and poor sighting probability etc. which make it extremely difficult to arrive at reliable estimates across large geographical area (Smallwood & Fitzhugh 1995). In regard of requiring scientific data on population sizes a diverse array of methods have been used answer the single question as to how many individuals of targeted species exist? Some methods have been used excessively in research contexts to estimate population size within a pre fixed study area. The count of indirect signs (spoor, scat, scrap and scratch etc.) were used to create inventory of relative abundance index (here forth referred as RAI) particularly for large predators as they often leave evidences of their presence (Macdonald et al. 1998a, Wilson & Delahay 2001, Gese 2001) and consequently received much attention from wildlife biologists due to being inexpensive means of monitoring of population trends. However the probability to find indirect evidences may differ between different locations and habitats as well (Kumar et al. 2002). Foot prints or spoor count of large predators have been used widely (tiger and snow leopard; Karanth et al. 2003, Jennelle et al. 2002, Singh 2000, Sharma et al. 2005, Waseem & Khan etc.), but possibility to find sufficient sets of spoors has been found to be poor (Stander 1998). Among indirect evidences, scat count is often
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underestimated because of the assumption of long term survey. But it can provide
RAI over time or between locations, and in some cases estimates of absolute density
have been calculated fairly accurately (Putman 1984, Cavallini 1994, Wilson &
Defecation surveys were also used to explore distribution information of Otters (L.
lutra) (Conroy & French 1987, Kruuk et al. 1986) and vigorously defended by
and seats were used to identify distribution and movement pattern of Jaguars
(Panthera onca) in Brazil (Schaller & Crawshaw 1980). Rau et al. (1985a & b)
modified method of Taylor and Williams (1956) to permanent plots in order to
compute the absolute density of foxes from their faces (Linhart & Knowlton 1975)
and the same was applied on Iberian lynx by Palomares et al. (1991). Population
estimation by unaided opportunistic sightings or counts is not as reliable as added
with indirect evidences. This strategy (combination of direct and indirect methods)
was first used by Rabinowitz (1989) to estimate population size of leopards and tigers
together with their behavioural studies. Caughley (1977) & Burnham et al. (1980)
reviewed the assumptions of direct counts and the estimators used to determine
population size with low cost and suggested correlating results of indirect evidences
with absolute abundance to find accuracy. This method is basically used for ungulate
population estimation (Hahn 1949) but can be used for cryptic carnivores (Donovan &
Hines 2007). Counts may involve total counts of the area, or a subsample of the area
and extrapolation to the rest of the area of concern. Stratification of subsamples to
different habitat types or land classes may increase the validity, usefulness, and
precision of the surveys (Macdonald et al. 1998a). Solitary opportunistic actual count
has been used rarely (Crete & Messier 1987, Vandel & Stahl 2005) while indirect
methods have been used extensively even with assumption of long term monitoring
positive relation between true density and RAI of indirect evidences was detected in
2002). Recently it was implemented by Wilting et al. (2006) on clouded leopard
(Neofelis nebulosa) in Sabah, Malaysia and supported by Waltert et al. (2008) on
large mammals of western Tanzania. But few recent studies have turned this difficult
aspect in an easy track by using occupancy rates of a focused species at site in relation
to their abundance (Stanley & Royle 2005, Riley & Malecki 2001, Mackenzie et al. 2005, Khorozyan et al. 2008) where the key factors including habitat values influence site occupancy were also investigated. Count studies have been carried out in southern Asia until recently however less attention has been given to estimate leopard population (e.g. Chauhan 2005, Goyal 2000, Balme et al. 2009, Edgaonkar 2008 etc.).

Since survival of large predators is based on availability of prey species, the study also included assessment of status of prey populations. Studies by Schaller (1967), Berwick (1974), and Johnsingh (1983) in India, Eisenberg and Lockhart (1972) in Sri Lanka and Dinerstein (1980), Tamang (1982) & Seidensticker (1976) in Nepal were some of the early studies to estimate herbivores assemblages in the regions. Some later studies have relied on line transect method due to robustness of this method in estimating ungulate population size estimates (Caughley 1977, Burnham et al. 1980, Focardi et al. 2002). Karanth & Sunquist (1992), Sankar (1994), Varman & Sukumar (1995), Jathanna et al. (2003) used distance sampling method for estimating densities of large mammals in a tropical deciduous forest of southern India, Sankar (1994), Karanth & Sunquist (1995), Khan et al., (1996) estimated large herbivores population using line transect method in southern and western India respectively while variation in group sizes of ungulates due to seasonal and monthly changes was investigated using line transect method by Khan et al. (1995) and Raman (1997) together with the factors such as habitat types, topography and disturbance parameters which may contribute to maintenance of high ungulate biomass in any forest ecosystem (Khan 1996, Ndibalema et al., 2007, Mason et al. 2006).

A number of studies have been carried out to assess diet profiles of large predators either of a single predator species (Ramakrishinan et al. 1999, Biswas & Sankar 2002) or comparative studies on feeding ecology worldwide (Karanth & Sunquist 2000, 1995, Bodendorfer et al. 2006, Emmons 1986). The standard work on prey utilization has been done by Mukherjee et al. (1994), Sankar & Johnsingh (2002) in India and Bothma et al. (1984) on Kalahari leopards. Seasonal influence on diet was also investigated under several studies (Andelt & Kie 1987, Dharaiya et al. 1998). The correction factor was developed to correct the over representation of smaller prey species in the diet of a carnivore by Ackerman et al. (1984). The long term existence
of large predators particularly in case of co-existence could be possible if preferred
prey species are available in ample abundance at a particular protected site (Schaller
1967, Emmons 1986, Biswas & Sankar 2002). If two or more similar competitors co-
exist together then some level of avoidance by inferior competitor or niche overlap
was also observed (Seidensticker 1976, Ramakrishnan et al. 1999, Scognamillo et al.
2003). Radio-telemetry was used to study home range pattern. It has been used widely
now to assess home range (Mohr 1947) using predators movement pattern, habitat
selection (Brown & Orians 1970), social organization (Rubenstein & Wrangham
1986), mating system (Bailey 1993) and use of topographical features (Dickson &
Beier 2005). It has proved to be quite helpful to understand main causes of human-
large carnivore conflict and also to develop mitigation measures (Bertram 1982,
Dickson & Beier 2003, Gehrt et al. 2009). Home range estimation has been used to
predict fitness of focused species (Mitchell & Powell 2003). Studies have also been
carried out using radio telemetry specifically in case of endangered species all over
the world for conservation and management purpose (Norton & Lawson 1985, Kotwal
mandate of protection (e.g. Endangered Species Act of 1973, USA) to understand the
spatial requirements of a particular species (Hansteen & Andreasen 1997) and to
assess minimum viable population at a particular site (Gehrt et al. 2009). Home
ranges of large predators have been traditionally computed using a variety of
statistical models (Macdonald et al. 1980, Worton 1987) but 100% and 95 % MCPs
(Jennirich & Turner 1969) were used widely to assess land use by a particular species
(Grassman 1999, Stander et al. 1997, Bailey 2005, Maan & Chaudhry 2000, and
Broomhall et al. 2006), and to ascertain ecological, biological and social requirements
(Karanth & Sunquist 2000, Marker & Dickson 2005). Estimation models i.e. Bivariate
normal (Jennirich & Turner 1969), Harmonic mean (Dixon & Chapman 1980), and
Kernel method (Worton 1989) provided more detailed information, characterizing the
relative intensity of space use in the form of a probability density function (PDF),
sometimes referred to as a utilization distribution (UD). Several studies assessed
habitat use using radio-telemetry relocation points where locations taken in each
habitat were considered as animal presence (Otis & White 1999, Dickson & Beier
range area and body size of terrestrial mammals was studied by Lindstedt et al. (1986) followed by Marker & Dickson (2005) in a study of leopard at Namibian Farmland. Evidences were presented by linear relationship between home range sizes and body mass of a particular species by Grant et al. (1992). This scaling supports the hypothesis that animals select their home range areas to meet metabolic demands integrated over biologically critical periods. Social organization and behavior may also influence the relationship of home range area to metabolic needs for different sex and age categories within a species. The advantage of radio telemetry was taken by predicting movement corridors, linkage areas in habitats influenced by rapid urbanization (Schaller & Crawshaw 1980, Dickson & Beier 2002, 2005, Mizutani & Jewell 1998, Burdett et al. 2007, Ngoprasert et al. 2007) and other natural disturbances (Crawshaw 1991, McCarthy et al. 2005). The critically endangered population of cheetah (Acinonyx jubatus) numbering between 60-100 restricted to the arid central Iranian Plateau has also been studied using radio telemetry for gathering scientific ecological data. The hypothesis of small home ranges of females than males has also been the topic of debate in many studies (Schaller 1980, Mizutani & Jewell 1998, Dickson & Beier 2002, Pittman et al. 2000) as it helps to predict the area for existing population at a particular protected site (Odden & Wegge 2005). Coexistence of two sympatric species has been studied and debated for many decades regarding key factors promoting i.e. ecological and behavioural separation (Seognamillo et al. 2003, Gordon 2000, Seidensticker 1976).

The large predator human conflict (LPHC) is a worldwide problem and has been reported extensively in case of lions (Saberwal et al. 1994, Macdonald & Sillero-Zubiri 2002 etc.), tigers (Madhusudan 2003, Miquelle et al. 2005 etc.), leopards (Goyal 2001, Athreya et al. 2004, Khorozyan 2005, Rahalkar 2008 etc.), snow leopards (Rao et al. 2002, Hussain 2003 etc.), wolves, wild dogs, and bear (Jackson & Novel 1996, Rajpurohit & Crausman 2000, Jhala & Sharma 1997, Podruzny et al. 2002, Woodroffe et al. 2005, Musiani et al. 2003 etc.). A bulky literature is available on conflict relating to either livestock depredation or direct attacks on human beings. Main causes of LPHC have been investigated but lack of prey, habitat degradation, and immense availability of non-wild prey species at peripheral areas have been identified as major key conflict drivers (Ogada et al. 2003, Athreya et al. 2004, Dar et al. 2009). Lions are well known to kill large cattle or livestock while leopards prefer
to kill small to medium sized animals or calf (Jackson & Nowell 1996, Hayward et al. 2006, Bommel et al. 2007). Livestock movement has been found to contribute to draw lions towards peripheral areas of Gir protected area (Kumar & Meena) and predators may follow livestock from the periphery and attempt killing on finding suitable opportunity (Bommel et al. 2007). Few studies have documented seasonal influence on conflict problem as higher depredation or conflict cases have been recorded during monsoon season at large distances from periphery while the attacks occur in proximity to periphery throughout the year (Saberwal et al. 1994, Vijayan & Pati 2002, Michalski et al. 2006). In monsoon forest becomes flooded and large predators shift their home ranges at periphery of PA’s where extensive movements of livestock lure them for easy hunting (Patterson et al. 2004). Conflict grows rapidly if predators are scared away which in turn increases depredation risk and possibilities of even human fatalities (Bommel et al. 2007). Sometimes livestock husbandry practices may also be linked for converting normal individuals to livestock killers (Ogada et al. 2003). If livestock guarding is not well planned, the predator may develop habits for killing livestock (Patterson et al. 2004, Ogada et al. 2003). Most of the studies showed that old, sick and injured animals turn to livestock killing due to their inability to hunt wild prey species (Hoogesteijn et al. 1993, Linnell et al. 1999). However the notion that the old and infirm individual’s only turn to livestock killing or man—eating has been questioned as other factors may also be responsible for conflict. These factors may include severe depletion of wild prey biomass in the area (Patterson et al. 2003), healthy individuals could be livestock killer (Schaller & Crawshaw 1980, Riley et al. 1994), versus large predators can reside close to livestock without causing problem and shift to forest area when neighboring dominating individuals vacate their ranges and also the age and sex posing serious challenge for managers (Rabinowitz 1986, Linnell et al. 1999). There is however almost a universal trend for males to be involved more rather than females and adult & sub-adults than old adults in conflict (Saberwal et al. 1994, Patterson et al. 2004). Few studies examined incidents of large predators (lion, tiger and leopard) attacks on humans which were results of sudden clashes with human beings and predators reactions for defense (Jackson & Nowell 1986, Patterson et al. 2003, Goyal 2001). Certain regions like Russian Far East, Malaysia, Nepal, Bangladesh, Sumatra (Indonesia) and southern Asia have had serious and persistent problem of LPHC. tigers, lions, leopards, and
bears accounted for killing of hundreds of people per year worldwide (Linnell et al. 1999, 2001) and leopard alone accounted for death of 99 individuals/year in Indian subcontinent (Marker & Sivamani 2009). There have been some exceptional events in the past for man eating predator such as eight man-eating tigers and one leopard shot by Jim Corbett in the early 1900’s had killed and eaten nearly 1,100 people (Corbett 1991). There have been over a hundred human deaths from grizzlies and black bears in the 20th century in the USA (Herrero 1985). Western India has serious problem of LPHC and particularly Leopard-Human Conflict (Ravi Chellam & Johnsingh 1993, Athreya et al. 2004, Goyal 2001). The leopard is a secretive lifter, which is able to live surprisingly in close proximity to humans and problem individuals which turned to “man-eating” have been proved extremely difficult to identify for their removal. India is at the top to report more leopard’s attacks on humans during night when people were thought to be in full sleep (Corbett 1954). While, lions are responsible for high economic losses (livestock depredation) of peripheral villagers (Vijayan & Pati 2002). Lions attacks on were reported to be high during prolonged drought linked to the decline of the local cattle population by Ravi Chellam & Johnsingh (1993). Although, lions have been thought to be less dangerous in comparison to other large carnivores (Dickman 2008). A renowned exception was that of the man-eaters of Tsavo, which killed 130 workers on a railway line in Kenya at the turn of last century (Patterson 1907). Lion attacks have been attributed to diverse triggers including the defense of their kills from thieves etc. (Treves & Naughton 1999). These incidents have been found to develop negative attitudes in local people towards large predators and sometimes have led to retaliatory killings (Treves et al. 2006, Zimmermann et al. 2005, Waseem & Khan 2008, Kissui 2008). Translocation of large predators is one of the potential conservation tools to reduce some level of risen conflict and re-establishment of problem individuals (Griffith et al. 1989, Wolf et al. 1997). However the effectiveness of translocation is not fully documented. Few studies have reported in favour of this strategy (Nowell & Jackson 1996, Breitenmoser et al. 2001, Goodrich & Miquelle 2005) while others have not (Belden & Hagedorn 1993, Ruth et al. 1998, Athreya et al., 2004). At the same time several entities and social constituencies are working to promote large predator protection and conservation as a part of broader social mobilizations in support of nature and animal welfare (Breitenmoser 1998, Forbes et al. 1996, Fox 2001) because retaliation for livestock’s
Depredation and for human deaths makes the survival of large predators vulnerable (Marker & Sivamani 2009, Treves et al. 2006, Hussain 2003, Kalaivanan et al. 2010). The African lion (Panthera leo), spotted hyena (Crocuta crocuta) and leopard (Panthera pardus) were killed in retaliation for livestock predation in the Maasai steppe landscape in Northern Tanzania, (Kissui, 2008). In order to manage LPHC, efforts have been made to reduce economic losses by way of compensation, and through environmental education and awareness programs to make public aware of conservation of large canivores (Saberwal et al. 1994, Mishra 1997, Mishra & Fitzherbert 2004, Waseem & Khan 2008, Bagchi & Mishra 2006). As LPHC has become a global problem, understanding of 'human dimensions' in wildlife management has become central to any management strategy which aims to realize harmonious long term conservation goal of a protected area.