CHAPTER 1
INTRODUCTION

1.1: General Introduction

It is being realized increasingly that the decline of large carnivores is a global conservation concern (Weber and Rabinowitz, 1996). Effective conservation of large predators requires the assessment of a complex mix of ecological, ethical and symbolic inter-relationships (Kellert et al., 1996). Although wolf packs once roamed from the Arctic tundra to Mexico, they were regarded as dangerous predators; gradual loss of habitat, human-animal conflict, lack of awareness and deliberate extermination programme in certain parts of their range led to their demise throughout their historical range. In the decades that followed the importance of the wolf as a part of naturally fluctuating ecosystem came to a better understanding, the gray wolf was eventually listed as an endangered species in all of its traditional range except Alaska (Mech and Boitani, 2003).

Originally, the wolf was the world's most widely distributed mammal, living throughout the northern hemisphere of 15°N latitude in North America and 12°N in India. It has become extinct in much of Western Europe (Boitani, 1995) in Mexico and much of the USA (Mech, 1970). Present distribution is more restricted; wolves occur primarily in wilderness and remote areas, especially in Canada, Alaska, and northern USA, Europe and Asia from about 75°N to 12°N ((Mech and Boitani, 2003). Indian Wolf is one of the smallest wolves of the world and represents southernmost limit of distribution of Grey Wolf in the world 12° 57' N and 76° 50' E (Kumar and Rahmani, 2000).

*Canis lupus* once had the largest natural range of any land mammal, besides *Homo sapiens* (Sheldon, 1992) and had successfully colonized much of the Northern hemisphere (Goldman, 1944). From being omnipresent and abundant, it has assumed endangered species
status in many countries. In most of the Southern, Western, Northern Europe and America major gray wolf populations are lost and their distribution is highly fragmented (Mech, 1970). In England and Japan, it has already become extinct while in many other areas it is on the verge of extinction (Ellegren et al., 1996). The wolves are now restricted to few large forested areas in Eastern Europe, a few isolated mountain ranges in the Mediterranean, mountains and semi-desert areas of middle east and the wilderness areas of North America, Russia and China, with largest concentrations in Russia followed by Canada and Alaska (Anon, 2001).

Three species of wolves are known today, Gray wolf Canis lupus (Nowak, 1995; Wayne et al., 1998), Red wolf Canis rufus (Nowak, 1995) and most recently classified Ethiopian wolf Canis simensis. However, the last two are not true wolves since both do not belong to the species lupus. A total of 32 sub-species of gray wolves (Canis lupus Linnaeus 1758) exist today that are widely distributed in diverse habitats in different ecosystems across the world (Mech, 1970). These sub-species have been described by wolf taxonomists, based on variation in their physical features, behavioural aspects and geographical distribution, many of which are believed to be extinct (Anon, 2001; Hall, 1981). Two recent proposals have been made for major taxonomic changes in the gray wolf in North America: Nowak (1995) presented data reducing the 24 North American subspecies to five; and Wilson et al. (2000), using molecular genetics data, proposed that wolves in eastern North America had evolved in North America contrary to wolves elsewhere that evolved in Eurasia and spread to North America. The seven Eurasian and five North American subspecies are:

- **C. l. albus** (Northern Russia)
- **C. l. communis** (Central Russia)
- **C. l. cubanensis** (East Central Asia)
- **C. l. hattai** (Hokkaido, Japan)
- **C. l. hodophilax** (Honshu, Japan)
- **C. l. lupus** (Europe, Asia)
- **C. l. pallipes** (Middle East, South-Western Asia)
There are two sub-species of Gray wolves found in the Indian Sub-continent. They are represented by geographically isolated broadly non-overlapping (allopatric) populations. One of these wolf populations is found only in the upper Trans-Himalayan region of India across the two northernmost states of Himachal Pradesh and Jammu and Kashmir, which as per the available census numbers about 350 individuals (Fox et al., 1992). This Himalayan wolf population, adapted to the cold environment, is better known as Tibetan wolf, *Canis lupus chanco*, which is found throughout central Asia with its range extending into Tibet, China, Manchuria and Mongolia. On the other hand, the second wolf population is found throughout the semi-arid plains of peninsular India. This species commonly called Indian gray wolf, is believed to represent the second sub-species in India, i.e., *C. lupus pallipes* and the same sub-species is believed to occur in Iran and Israel (Mendelssohn, 1982; Shahi, 1982).

Molecular genetics data from wolf and dog populations' world over suggest that they belong to closely related wolf-dog clade (Vila et al., 1997). Genetic analysis of mitochondrial DNA (control region and cytochrome b) of wolves from Indian subcontinent has shown that there are three extant lineages, two of them very different from the wolf-dog clade. Wolves from peninsular India i.e., *C. l. pallipes* may have diverged from the wolf-dog clad about 500,000 years ago and are different from the *pallipes* found in the Middle East. Wolves from the Himachal Pradesh to eastern Nepal (considered to be *C. l. chanco*) are basal to other wolf clades and may have separated from them about 800,000 years ago, while the wolves west of Kashmir belong to the widespread wolf-dog clade. Thus, the
peninsular and Himalayan wolf lineages of India are very ancient and unique to the Indian subcontinent (Aggarwal et al., 2003; Sharma et al., 2003). These results increase the biological significance of the Indian canid populations and warrants urgent and effective conservation measures for their protection and management.

Unlike the Grey Wolf of the North America, Grey wolf in peninsular India possess scantier coat. An adult weighs between 18 – 25 kg. Coat colour is sandy brown with black hair tips. Contrary to earlier reports, wolves in India too develop some under-fur in winter (Shahi, 1982). In winter coat C. l. pallipes resembles a German Shepard; whereas in summer most of the fur is shed and only sparse long hair remain on its body. This gives the wolf a thin long-legged appearance. In most of the wolf distribution range in India, the summer temperatures vary between 40-44°C or even higher and winter temperatures rarely approach 0°C. The marked variation in their summer and winter coats helps them to survive under such conditions.

Though the wolf is believed to have evolved as a temperate species, the Indian wolf is aptly adapted for living in semi-arid hot environments. The small body size reduces food demands, permitting it to sustain its populations on small to medium size ungulates, logomorphs and rodents; the shedding of the under fur and behavioural thermoregulation permits this canid to live in hot and arid regions. The Indian wolf still needs ample drinking water, and is not truly adapted to desert living like the chinkara (Gazella bennettii).

The Indian wolf has been accorded protection under the Wildlife (Protection) Act 1972. It is classified as an endangered species on Schedule I and also listed in the Appendix 1 of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Shahi (1982) estimated that no more than 800 wolves survive in the Indian
subcontinent. Sillero-Zubiri et al. (2004) estimated wolf population between 1000 – 2000 individuals where as according to Jhala (2000) a population estimate of 2000 – 3000 wolves for the Indian peninsula seems more realistic. Increasing human population pressure, land development and changing land use patterns have resulted in shrinkage of the former range of wolf and even its local extirpation. In any case the number of pallipes surviving presently in India is likely to be less than the current population of tigers (Panthera tigris). Their numbers are over-estimated because of their large home range. The surviving population of wolves is found in three biogeographic zones (a) desert, (b) semi-arid zone, and (c) the Deccan plateau of India (Rodgers and Panwar, 1988). However, Jhala and Giles (1991) have reported that the Indian wolf is continuously distributed in Gujarat, Rajasthan, Madhya Pradesh, Maharashtra, Karnataka and Andhra Pradesh.

The current estimated distribution of wolves covers much larger area than was reported earlier. This does not imply range extension by the wolf, but is a result of more intensive surveys and a better understanding of wolf distribution. The wolf is far from safe in most of its range and occurs at low densities of about 1 wolf per 100 – 200 sq. km (Jhala and Giles, 1991). High density wolf populations (up to 5 wolves per 100 sq. km) are found to occur in some habitat pockets and reserves. Breeding packs ranging from 4-14 wolves have been reported from the Bhal, Dwarka, Banni and Abdasa area in Gujarat and Kutch; Kumbhalgarh, Gudda-Bishnoi, and Pali-Barmer and Jodhpur areas in Rajasthan (Jhala, 1991); Nannaj, Rehukuri, Nasik, and Phaltan areas in Maharashtra; Neoradehi in Madhya Pradesh; Rollapadu in Andhra Pradesh; Melkote and Ranibennur in Karnataka; and Mahuadaur, Hazaribagh, Palamau areas in Bihar (Shahi, 1982). They have been reported in some of the districts in eastern Uttar Pradesh where human-animal conflict is intense (Kumar, 2003). Such high density areas are extremely important for wolf conservation,
since these pockets serve as successful breeding and recruitment areas from where wolves disperse to occupy marginal habitats (Kumar, 1998).

Since wolves are believed to have evolved in boreal forest systems as predators of large ungulates, it is rather unusual that the Indian wolf rarely lives in forests and prefers scrubland, grassland and semi-arid pastoral/agricultural landscapes. The Indian wolf probably evolved during the drier spells of the Pleistocene to exploit a relatively unoccupied niche as a top carnivore of the arid zones (Jhala, 2003)

The eastern population of C. l. pallipes, found in Orissa, Bihar and parts of West Bengal is an exception and occurs in moist forested habitats (Shahi, 1982), but even here wolves do not occur in thick forest. Wolves occur on the periphery of protected forest areas as seen in Kumbhhalgarh and Kailadevi Sanctuaries in Rajasthan; Panna, Kanha and Bandhavgarh National Parks in Madhya Pradesh; and Gir in Gujarat. These peripheral areas are under heavy biotic pressure from surrounding human populations and are reduced to scrub forests. It is these scrublands that wolves primarily use (Jhala, 2003)

Wolves do not seem to be restricted in their movements at night and even approach very close to human dwellings and villages (Jhala, 1991). However, during the day, wolves are extremely selective in their habitat use, limiting themselves to habitat pockets that offer visual cover and shade, away from human disturbance. Such habitat pockets are crucial for denning and rendezvous sites and could be in the form of broken terrain, rocky outcrops, rivulets, and grass or scrub patches (Kumar and Rahmani, 1995).

In Maharashtra, the Indian wolf is distributed in small pockets of semi-arid areas comprising Nasik, Aurangabad, Jalna, Buldana, Akola, Yevatmal, Ahmednagar, Beed,
Pune, Satara, Solapur, Jalgaon, Osmanabad, and Sangli (Kumar and Rahmani, 1997; Kumar, 1998; Habib and Kumar, 2002). The habitat of wolf in India is semi-arid dry grassland, scrubland, grazing land and rocky low hills. The grazing land lies mainly in the marginal agricultural areas. There is tremendous livestock pressure in these areas, which to some extent contributes to the decline of wolf prey. The majority of the wolf population in India occurs outside the protected areas. Wild ungulates are mostly limited to protected areas. Therefore, majority of wolf population subsist on the domestic livestock (Shahi, 1982; Jhala and Giles, 1991; Kumar, 1998; Habib and Kumar, 2003).

The wolf Canis lupus has been one of the most studied among wild species (Mech, 1995). The first study of the wolf was published in 1938, and since then several books and monographs and thousands of research articles have been published about the animal (Mech, 1995). Two major long-term studies that have ever been conducted on predator-prey relationships include that of wolf-moose system in Isle Royale National Park (Mech, 1966; Jordon et al., 1967; Peterson, 1977; Allen, 1979; Peterson and Page, 1988) and the wolf-deer system in the Superior National Forest of northeastern Minnesota (Mech and Frenzel, 1971; Mech and Karns, 1977; Nelson and Mech, 1981). Wolf preys mainly on large animals, because of its size and its habit of traveling in packs, and also its ability to consume and digest great quantities of food in short periods (Mech, 1970). There are not many studies conducted on the Indian wolf except for few in Velavadar National Park, Gujarat (Jhala 1991, 1993; Jethva and Jhala, 2003), the Great Indian Bustard Sanctuary, Maharashtra (Kumar and Rahmani, 1995; Kumar and Rahmani, 1997; Kumar, 1998; Kumar and Rahmani, 2000) and Uttar Pradesh (Kumar, 2003).

Preservation of wolf population in such circumstances need careful management efforts with an in depth knowledge of basic ecological parameters such as home range, dispersal,
denning behaviour and feeding ecology. The primary prey of the wolf in the Sanctuary is Blackbuck (*Antilope cervicapra*) and secondary prey consisting of Blacknapped Hare (*Lepus nigricollis*) and small domestic ungulates. However, the wolf is a regular predator of livestock, which brings it in direct conflict with humans. The main aim of this study was to investigate the ecology of Indian wolf viz-a-viz variation in its primary prey base in the Great Indian Bustard Sanctuary.

After the Drought Prone areas Programme (DPAP) initiated by the State Government of Maharashtra with the aid of the World Bank in 1976 there has been resurgence of wildlife in these areas. Breeding packs of wolves have also established their territories in these areas, which may help in repopulating their original range. The DPAP was aimed to mitigate the effects of drought. Under this programme, development of pastures and woodlots, construction of percolation tanks, genetic improvement of livestock and soil conservation was started with the aim of improving the socio-economic conditions of the people and also to restore ecological balance in the drought prone areas. Establishment of pasture and woodlot plots also resulted in improvement of water table. The programme also helped to protect wolves by providing them immediate cover.

To facilitate monitoring and research of few core-breeding packs, wolves were radio-collared. These radio-collared wolves were continuously monitored for population dynamics such as movement, dispersal, reproduction, mortality, predation on ungulates and depredation on livestock.

**1.2: Rationale**

With changing scenarios of land use pattern and urbanization, the habitat of wolves is under tremendous pressure especially in India where human population is increasing at
tremendous rate. Because of their large home ranges and sharing their habitats almost with humans it is impossible to create reserves, National Parks or Sanctuaries for wolves. This endangered canid in India is under tremendous threat and needs immediate attention. To save this dwindling species it is very important to keep a track of various changes, which are occurring in wolf range, and its capability of adaptation. In the light of this situation the present study would be important in developing future management plans for this magnificent canid.

The Department of Science and Technology, Govt. of India funded the project entitled, "Ecology and conservation of wolf (Canis lupus pallipes) in some selected habitats in Maharashtra" to Dr. Satish Kumar vide sanction order no SP/SO/C31/99 and I was appointed as JRF in this project. The project provided all facilities for carrying out this research.

The fascinating species to work in India are usually tigers and lions but to work on wolves is unique because they almost share their habitat with humans. All these things were enough to study Indian wolf in human dominated landscapes of Maharashtra India. The adaptability of the species to survive in spite of the changing circumstances is the challenge for the species and to reveal such secrets is the challenge for the researcher. An urge to investigate these aspects of wolf forced me to start my fieldwork for three years in Great Indian Bustard Sanctuary, Maharashtra, India.

1.3: Objectives of the study

The main aim of this study was to investigate the ecology of Indian wolf vis-à-vis variation in its primary prey base in the Great Indian Bustard Sanctuary. In order to investigate the ecology of the Indian Wolf (Canis lupus pallipes), I focused on the following objectives:
• To estimate density of primary prey species of the wolf on annual and seasonal bases
• To study food and feeding habits of wolves and their predation patterns
• To study home range of packs and individuals
• To study denning behaviour of wolves
• To develop, apply and validate a model of occurrence of wolf in response to varying ecological conditions using Remote Sensing and GIS