INTRODUCTION

Ecology is the science of determining how species within an environment relate to one another and also how species are distributed and abundant in a particular habitat. This is important in understanding the health of an ecosystem. With the high rate of urbanization globally and the rapid loss of wild habitats, cities are now viewed as challenging ecosystems for sustaining rich biotic communities. Over last few decades urban ecosystems have therefore become ecological challenges in conservation, restoration, and reconciliation of ecology (Miller and Hobbs, 2002; Rosenzweig, 2003). Designing sustainable urban ecosystems that support species rich bird communities also includes maintaining key ecosystem services, such as clean air and water, waste decomposition, and pest control. Cities consist of mixtures of built up habitats and green patches. Although urbanization increases total bird densities, it appears that only a few species contribute to this increase. Kark *et al.* (2007) describes these species as "Urban exploters". These are the species that can exploit urban resources and coexist and thrive and contribute to the biomass in the most

built parts of the city, such as business hubs and industrial zones where vegetation may almost be absent. In Vadodara species like Blue Rock Pigeons (*Columba livia*), House crow (*Corvus splendens*), Common Myna (*Acridotheres tristis*), House swifts (*Apus affinins*) and Black Kites (*Milvus migrans govinda*) are described as urban exploiters (Rathod, 2009). While food density is normally high in urban settings, the main source is of low quality anthropogenic refuge.

Birds, specifically raptors, are excellent indicators of environmental health. Their changing populations often provide clues to the overall health of their habitat (Estrella *et al.,* 1998). Raptors have fascinated humans for thousands of years due to their keen senses, hunting skills, power, behaviour, complex migration and occupation of key niches in ecosystem. Raptors play critical ecological roles often impacting ecosystems making them keystone and flagship species for conservation efforts (Palomino and Carrascal, 2007). Though found in low densities, using raptors as umbrella species in conservation can protect entire ecosystem and all the species that live within that community. They are

quite sensitive to changes in habitat structure and fragmentation and have a high susceptibility to local extinction (Simberloff, 1988). Population of raptors is declining worldwide and many species are threatened with extinction (IUCN, 2002). However, Black Kite -*Milvus migrnas govinda* is an urban exploiter found in huge number in many urban areas of northern and western India.

Black Kite (*Milvus migrnas govinda)* is classified in Order: Falconiformes and Family: Accipitridae with hawks, eagles, old world vultures, buzzards *etc*. In Latin Genus *Milvus* means 'Kite' while species *migrans* means 'migrating/ wandering'. Race *govinda* meaning 'cow finder' comes from Hindu mythology (Naoroji, 2007) as this race is common in Indian subcontinent.

There are 3 races of Black Kite, *M. m. migrans, M. m. lineatus, and M. m. govinda* in India (Ali, 1979; Navroji, 2007). The Black kite (*Milvus migrans govinda) is* a common resident bird of prey of urban environs in many parts of the world (Ali, 1979). It can be easily identified by its brown colour and long forked tail, brown eyes and yellowish legs and

feet. The adult is overall dark brown variably tinged with rufus colour. Adult *M. m. govinda* measures between 54-59 cm and has a wing span between 102- 107 cm. while, juvenile is overall dark brown with black spots but liberally mottled. *M. m. migrans* is larger species. Among the races *M. m. lineatus* is commonly known as Black eared Kite. It is also larger than *M. m. govinda*, more prominent and with extensive white patches at base of primaries, has extensively streaked head and neck and paler brown under parts lacking russet tone (Navroji, 2007).

Huge populations of *M. m. govinda* can be observed in many cities of western and northern India. They can be seen feeding at garbage dumps or soaring on thermals developed by urban concrete jungles. At sunset time they gather in large numbers at roosts and show Pre roosting behaviour in the form of soaring around the roost. The population of black kite is reported to fluctuate as well as shift their roosts seasonally (Mahabal and Bastawade, 1987). These authors have considered fluctuations in population of kites in Pune city central India in 3 phases of annual cycle: Pre breeding season – June to September, Breeding season

- October to February, Post breeding season – March to May. Based on this, as first step while studying ecology of Black kites *M. m. govinda* in western semi-arid subtropical zone of India, a study of annual fluctuations in their population is carried out.

For the survival of a bird species its successful nesting is important. As this species is adapted to urban habitats its nesting ecology with reference to nest site selection is also considered in the present study. An individual's fecundity and survival depends upon choice of nest site which may in turn determine the structure and growth rate of populations, and the evolution of species (Clark *et al.,* 2004). As selection of nesting site is equally important for the survival of a species, present study also deals with nest site selection, tree species used, its characteristics and whether nesting is successful or not.

Food is the most important factor influencing the abundance and distribution of birds in any ecosystem (Pimm, 1982; Polis, 1991; Begon *et al.,* 1996). A non-invasive method for the study of prey species of raptors is study of undigested food particles in regurgitated pallets.

Hence, investigations on regurgitated palates of Black Kites are also considered in the present study at Vadodara.

Pollution is one of the major problems of urban environment. Urban areas get polluted not only due to industries but also due to vehicular emissions. As a result of escalating generation of evidences that bird populations are particularly sensitive to the changes produced by human in the environment, potential use of birds as indicator for environmental pollution has been widely recognized. Environmental contamination caused due to men is a relatively novel concept, in ecological times. Stressors like pollutants negatively affect individuals and entire ecosystems via air and water around the world, even in the areas relatively free of contaminants (Iwata *et al.,* 1993). However, in the past few decades, many efforts have been made regarding monitoring of health of an ecosystem. Birds are one of the best indicators for bio-monitoring the environmental changes as they are on the pinnacle of the food chain. Among the birds raptors are the most intensively studied group of species which are at the apex position in the food chain and

show the spatial integration of contaminant levels in their extended home ranges (Altmeyer *et al.*, 1991; Esselink *et al.*, 1995; Pain *et al.*, 1995; Garcia- Fernandez *et al.*, 1997). However, being extremely mobile, they feeding over a wide geographical range making it complicated to determine the source and site for their toxic ingestion. However the present investigation also includes quantification of various toxic as well as trace elements from tissues like liver, kidney, muscles and feathers of Black Kite (*Milvus migrans govinda*) from the most polluted city of Gujarat, Ahmedabad.

Though the Black Kite is not under immediate threat of population decline it is exposed so several threats in urban environment. One has to learn from the example of vultures. The decline in the population of *Gyps species,* which was thriving till 1993, and declined by 95% in late 1990s (Prakash *et al.,* 2003, Green *et al.,* 2004) is now known fact. Before anything happens to Black Kite *M. m. govinda;* one of the "List Concerned" Species according to bird Life International and adapted very well to urban habitats; its status and ecology needs to be documents. This

study expected to provide information regarding its population size, breeding success, feeding ecology and different stressors encountered by them in cities in western India.