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Research article

MITIGATING ROLE OF ANTHROPOGENIC AND HABITAT VARIABLES ON DISTRIBUTION OF BLACK KITE *(MILVUS MIGRANS GOVINDA)* IN AN URBAN SCENARIO

Sandhya Godshe, Bhavna Bharucha and Geeta Padate*

Division of Avian Biology, Department of Zoology, Faculty of Science, The M. S. University Of Baroda, Vadodara-390002, Gujarat, India.

ABSTRACT: The urban landscape asses a broad spectrum of variable environments ranging from remnant patches to highly modified streetscapes. Population growth and human intervention results in loss of biodiversity. Compare to other vertebrates, Raptors are easily monitored for changes at an ecosystem scale. Biodiversity is being lost at an increased rate as a result of human activities. One of the major threats to biodiversity is infrastructural development. Despite the expansion of urban environments, few studies have examined the influence of urbanization on faunal diversity. In this study we observed that distribution of black kite was fluctuating seasonally and less in disturbed area while high in undisturbed area. Number of Black kites was high in the monsoon while low in summer because of migration of birds from neighboring cities. Our findings show the importance of minimizing human intervention and disturbance for wildlife conservation in relatively undisturbed areas.

Key words: Black kite, Anthropogenic activities, Distribution, Urban city, Vadodara.

INTRODUCTION

Urban areas house a large proportion (~50%) of the world's population (Brown et al., 1998) and this proportion is increasing rapidly, particularly in the developing world (World Resources Institute, 1996). Urbanization promotes extensive changes in the landscape especially when urban sprawl produces large scale extensions of once continuous natural habitats, causing its intense fragmentation (Clergeau & Quenot 2007). As urban settlements encroach on natural habitats, it is clear that their impacts need to be mitigated, and their potential for conservation better understood and exploited. Numerous studies of avifauna have been carried out in urban landscapes. Some of these studies focused on birds in remnant forests, urban reserves or parks (Tomialojc, 1998; Natuhara and Imai, 1999; Park and Lee, 2000). While, other studies focused on the change in bird communities across gradients of urbanization. Many of these studies found that the amount and structures of vegetation cover (both native and exotic), and the availability of anthropogenic food influenced bird communities (Mills et al., 1989; Munyenyembe et al., 1989; Jokimäki and Suhonen, 1998; Maeda, 1998). The increased urbanization usually leads to an increase in avian biomass with reduction in species richness. This successive increase is reflected as increase in population of certain species in the urban habitat because urban settings are free from persecution and provide adequate food supplies (Chalse & Walse 2006) leading to their positive population responses.

Even though patterns of avian responses to urbanization are emerging, most of the studies have been carried out in the temperate regions. Little is known about the effects of urbanization on avifauna in the tropics, despite the fact that the rich tropical biota is under immense pressure from a burgeoning human population (Marzluff et al., 2001). With the relatively high bird and habitat diversity, studies from tropical urban areas may yield yet unknown patterns and processes, and this may contribute substantially to the ecological knowledge of urban avifauna that has largely been derived from temperate studies.

These processes have substantial and lasting effects on bird communities (Marzluff and Ewing 2001) by altering the amount, composition, and arrangement of vegetation (Hostetler 2001, Melles et al. 2003), creating barriers to movement (Fernaindez-Juricic 2000) and changing local temperature, food supply, predators, and parasites (Bowman and Woolfenden 2001, Crooks et al. 2001, Marzluff 2001, Chance et al. 2003, Thorington and Bow-man 2003, Sinclair et al. 2005, White et al. 2005). In the present study, we investigated the response of raptors especially Black Kites to urbanization in the tropical city Vadodara - State of Gujarat.

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The Black Kite (*Milvus migrans govinda*) is a locally common diurnal wide scavenger species. Though, it is migratory breeder in the Paleartic region (Bijlsma 1997) however, in Indian subcontinent it is a resident species showing local movement (Mahabal & Bastawade 1987). This species is abundant in the area and now has been classified as least concerned (Bird Life International 2009). In last few years, the Black Kites have become very common species in urban skies and their soaring and roosting behaviour in these built up areas have become a common scene. As, there is a lack of information about the distribution of Black kite in urban area, an attempt is made to document adaptability of these umbrella species in different seasons viz. summer, monsoon and winter in relation to anthropogenic and habitat variables in urban landscape.

MATERIALS AND METHODS

Study area

Distribution of Black Kites was investigated in Vadodara city (22^{o} 18'42 13" N, 73^{o} 10' 49 59" E), Gujarat, India from May 2008 to December 2010. Of the three roosting sites, a major roosting congregation was observed in an undisturbed area of Sayaji Baug (commonly known as Kamati Baug) (22 ^{o} 18'44 94"N, 73 ^{o} 12'22 20" E). The second roosting is located near Vadodara railway station (22 ^{o} 18'26 58"N, 73 ^{o} 12'22 20" E). This roost in the vicinity of Vadodara Railway station is highly disturbed because of vehicular and rail traffic as well as continuous human intervention. The third study site at Bhutdizapa (22"18'26 58" N, 73"12'22 20" E), is located right in the middle of the city. It is also a highly disturbed area composed of concrete jungle.

The number of kites using the roost was estimated by direct counting with naked eyes as well as with the help of field binoculars (10X magnification). These sites were surveyed about 6 times in a month from May 2008 to December 2010 to note down the distribution in their population. We recorded number of vehicles passing in 1 hour at the time of roosting by point count method.

Statistical analysis

To find out the distribution of Black kites months were divided into three seasons Summer (February to May), Monsoon (June to September) and Winter (October to January). Statistical evaluation of the data was carried out using Statistical software package Graph Pad Prism 5.00. To find out correlation among three different roosts One way Analysis of Variance (ANOVA) was applied. Data value are expressed as mean ± SE and test statistics were considered significant at $P< 0.05$

RESULTS

Distribution of Black kites in relation to anthropogenic activities:

Numbers of Black kites were noted more in undisturbed area (Sayajibaug) and low in disturbed areas (Railway Station and Bhutdizapa). At Sayajibaug disturbance was very low therefore distribution of black kites were highly significant (F- 53.94, R^2- 0.8999) and the number was high. While, high disturbance level at Railway station and Bhutdizapa (F- 6.419, R^2 – 0.5169 and F- 7.129, R^2 -0.532 respectively) number of black kites were low. We also find out the correlation between roosting site and vehicular traffic at different study sites. We documented number of vehicles passing in 1 hour at the time of roosting. Of the three sites we observed that, at Sayajibaug which has very low human and vehicular intervention an assemblage of trees on Eastern side of the park is used by kites for communal roosting. The Second study site Railway station we observed very large number of vehicular traffic 600 ± 0.05 vehicles/ hour and noise of Railways affected distribution and roost at that site. Similarly at third site Bhutdizapa again very large number of vehicular traffic- 800 ± 0.08 vehicles/ hour was recordedand also because this site is present in the centre of the city with concrete jungle and very less number of trees for roost.

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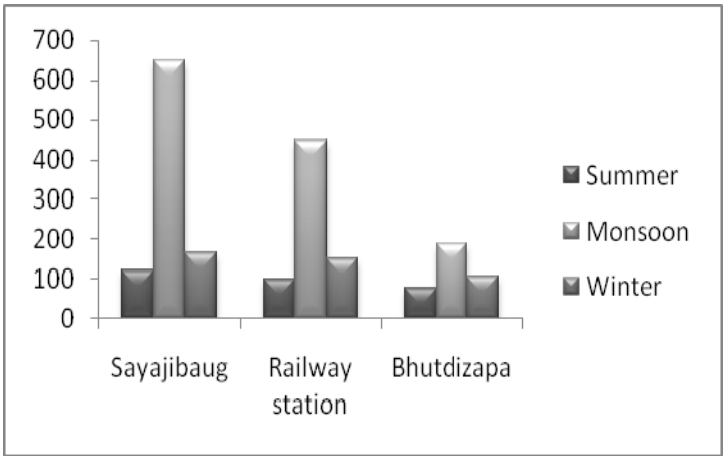
Distribution of Black kites in relation with seasons:

During study period, an increase in the number of kites, 650 at Sayajibaug, 450 at Railway station and 190 at Bhutdizapa were noticed during the months of July to September coinciding with the monsoon season while very less number of kites, 120, 100 and 78 in the months of March to May (Summer) at Sayajibaug, Railway station and Bhutdizapa respectively. The monthly and seasonal fluctuations in the population of black kites is influenced by one or more factors like the immigration of kites into city area, the emigration of kites from city area, addition of newly born young to the population (Mahabal and Bastawade, 1984).



Graph: 1 Number of Black kites in different sites in three seasons.

Habitat Variable

In present study, we were divided three sites with its habitat variable like Natural vegetation (Sayajibaug) and commercial buildings with residential area (Railway Station) and Residential area (Bhutdizapa). Sayajibaug harbours a varied tree assemblage with diverse types of vegetation no vehicular traffic as the distance to nearest road is 490 meter. While at Railway station and Bhutdizapa area both have very less vegetation with no tree diversity and the distance to nearest road is 0 meter and 70 meter respectively.

Table:-1 Anthropogenic activities at three sites

Variable	Sayajibaug	Railway station	Bhutdizapa
Vehicular traffic per hour	0	600 ± 0.05	800 ± 0.08
Distance to the nearest road	490 m	0 m	70 m

DISCUSSION

Urbanization is increasing worldwide and affecting local and global ecological systems (Marzluff 2001, Pickett et al. 2001, Alberti et al. 2003, Imhoff et al. 2004).The expansion of cities often perforates, isolates, and degrades natural land (Meyer and Turner 1992, Matlack 1993, Marzluff and Hamel 2001, Faulkner 2004). Urban ecosystems have usually been examined in terms of their impact on biodiversity (Middleton, 1994; Wackernagel and Rees, 1996). In urban ecosystems bird species also vary in terms of how they are perceived by people (Brown et al, 1979; Penland, 1987).

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Carnivores and raptors are often used as reliable sentinel or indicator species owing to their position at the top of the food web and to a number of life history traits (low density or low fecundity) that make them particularly vulnerable to human-induced alterations of their supporting ecosystems (Sergio et al.,2008).Besides fragment size, isolation, and habitat structure, urban bird species may also be affected by human disturbance (Blair 1996; Sauvajot et al. 1998; Fernández-Juricic and Tellería 2000; Fernández-Juricic 2000b).
Avian population fluctuations have been shown to arise primarily from random demographic processes (Karr 1982, Boag and Grant1984, DeSante and Geupel 1987) and movement of individuals within and among habitats (Greenberg 1981, Karr and Freemark 1983,Wheelwright 1983). In the present study distribution of Black kites were negatively correlated with disturbance of human and vehicular traffic.

Roads contribute greatly to habitat loss and fragmentation, which are major causes of biodiversity reduction (Pimm and Gilpin, 1989; Kruess and Tscharntke, 1994). Most studies dealing with the relationships between roads and raptors have attempted to estimate mortality related to traffic, particularly for owls (Bourquin, 1983; Hernandez, 1988; Illner, 1992) while in this study such results like mortality were not observed. Because of the large roads, disturbance of vehicular traffic and very less vegetation or habitat loss because of roads they may be interrupt in the roosting. Individuals move in response to seasonal climatic changes (Root 1988), breeding (Robinson 1992), or the temporal and spatial variation in food resources (Wheel-wright 1983, Levey 1988, Blake and Loiselle 1991,Powell and Bjork 1994). In monsoon black kite which are locally migrate from one place to another their population arise because of migratory species coming and roost with resident species as in winter its population became low.
Adaptation to urban ecological niches requires changes in the behavior and ecology of synurbic
population, in comparison with non-urban (rural) ones. Despite their architectural values (e.g. provision of shade; Corlett, 1992b), urban greenery appears to have little impact on the make-up of avian communities. Sodhi et al. (1999) also found that the presence of adjoining natural habitats was probably the most important determinant of bird fauna in corridor parks in Singapore. There may be a number of reasons why urban parks and managed vegetation do not become a refuge for the more sensitive species. However, equipped with ecological knowledge, planners and managers can still make the urban environment a suitable habitat for some of the more adaptable species, thus simultaneously achieving the objectives of conserving elements of the avifauna and improving the quality of life of human residents through increased positive encounters with wildlife. There is a need to study urban biodiversity and to include ecological knowledge in urban planning (Niemelä 1999a; Savard et al. 2000).

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