

Abundance of Indian Grey Mongoose *Herpestes edwardsii* (É. Geoffroy Saint-Hilaire, 1818) (Carnivora: Herpestidae) in the Bengaluru region

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Abstract

Indian Grey Mongoose, *Herpestes edwardsii* is common throughout the Indian subcontinent. To investigate the abundance of this species, a study was conducted in different urban locations of the Bengaluru, Karnataka State of South India. A significant difference was found among the relative percentage abundance of mongooses in various study locations. The highest abundance of mongoose was recorded from prohibited places, mostly in the rural and suburban regions, and the least in the urban region depending upon the availability of food and protected shelter in the reed beds and thickets of aquatic vegetation, particularly during the breeding season. They usually breed on the ground and need shelter from direct sunrays as well as potential predators during this period. This mongoose species also prefers shelter in the reed beds and thickets of aquatic vegetation and the suburban and rural region for diurnal activities.

Introduction

The Indian Grey Mongoose (Herpestidae: Carnivora: Mammalia) are the best known inhabitants of the urban ecosystem (Sinclair *et al.* 2006) and considered as a keystone species of inhabited areas (Simberloff 1998). Decreasing population of various mammalian species in most parts of the world nowadays, especially in urban areas, is of particular concern as many cities are developing rapidly both in area and population ignoring the conservation issues.

Indian Grey or Common Mongoose *Herpestes edwardsii* (É. Geoffroy Saint-Hilaire, 1818) belonging to the order Carnivora and family Herpestidae, is also of the acquainted species ubiquitously



Fig 1. Indian Grey Mongoose is alert and attentive towards their habitat disturbances in the Byadarahalli site of Bengaluru region

living in and around human habitations (Sharma 2009; Choudhury *et al.* 2011). They are active predators and constitute an important terminal link in the food chain and form natural population regulators of the invertebrate species that they feed on (Corbet & Hill 1992; Kalle *et al.* 2012).

The Indian Grey Mongoose are found in varying types of habitats, from cultivated lands, open lands, scrub jungles, mountain forests to the arid desert and the plains and even up to 2,135 m in the Himalayas (Prater 1971; Veron *et al.* 2004; 2007; Menon 2014). They have also been recorded from the disturbed areas, dry secondary forests, and thorn forests (Shekhar 2003). They live in hedgerows and thickets, among bushes lying up in a hollow in the base of a tree trunk or digging a hole for itself in the ground (Prater 1971; Kalle *et al.* 2012; Murali *et al.* 2012). The Indian Grey Mongoose is native to Afghanistan, Bahrain, Bhutan, India, Indonesia, Iran (Karami *et al.* 2008), Islamic Republic of Kuwait, Malaysia, Nepal (Dahal & Dahal 2011),

Pakistan (Roberts 1977; Sheikh & Molur 2004), Saudi Arabia and Sri Lanka, and has been introduced in Mauritius (main island) (Lever 1985, Wilson & Reeder 1993) and Japan (Nansei-shoto) (Corbet & Hill 1980, 1992; Wells 1989; Wozencraft 2005; Choudhury *et al.* 2011).

Literature Review

Although distributions of mongoose species in some locations of India have been recorded (Pocock 1939, 1941; Johnsingh 1986; Tehsin & Chawra 1994; Yoganand & Kumar 1995; Kumar & Umapathy 1999; Kumar & Yoganand 1999; Nameer *et al.* 2001; Sharma 2005; Kumara 2007; Kumara & Singh 2007;

Photos by S. Rajashekara

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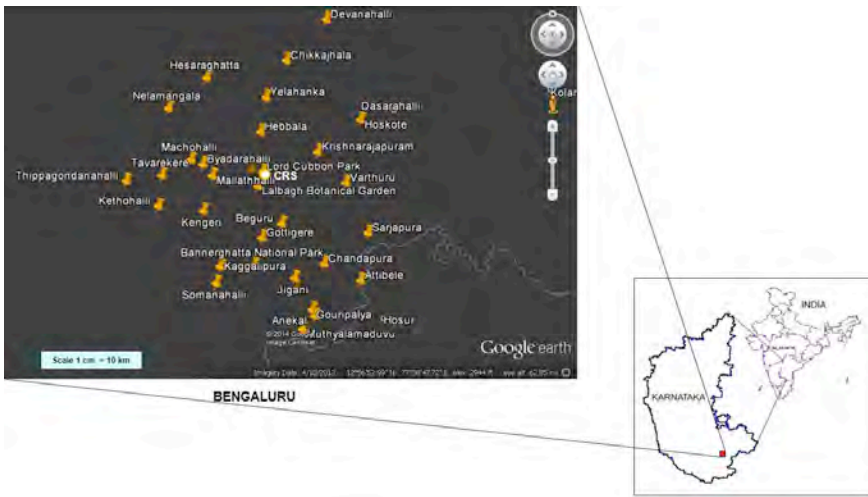


Fig 2. Map of Bengaluru region showing locations of the study sites. Courtesy: www.GoogleEarth.com

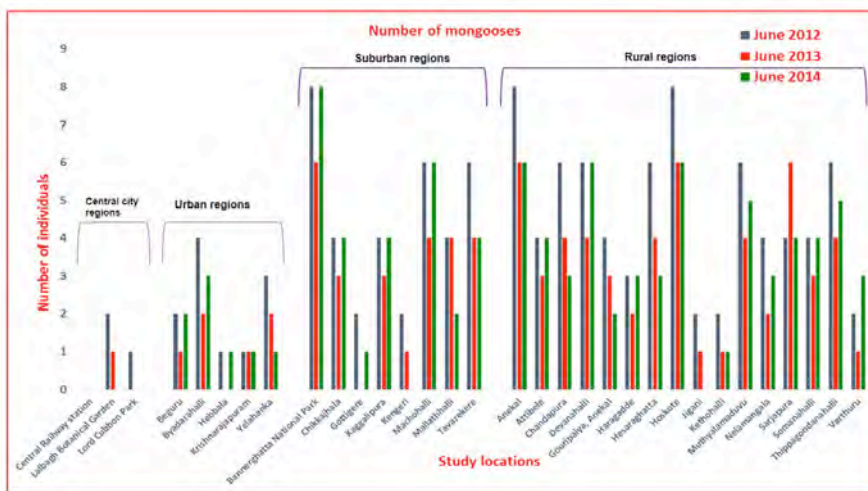


Fig 3. Number of *Herpestes edwardsii* in different study locations of the Bengaluru region

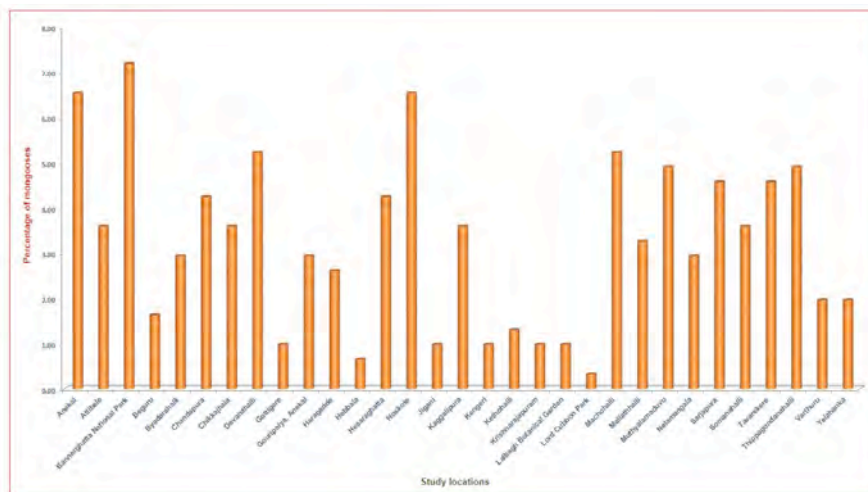


Fig 4. Percentage abundance of *Herpestes edwardsii* in different study locations of the Bengaluru region

Neginhal 2008; Pillay 2009; Sharma 2009; Sharma *et al.* 2009; Gupta 2011; Maurya *et al.* 2011; Rajpurohit *et al.* 2011;

Murali *et al.* 2012; Babu *et al.* 2013; Kalle *et al.* 2012, 2013; Srinivas *et al.* 2013; Kumara *et al.* 2014; David *et al.* 2015), their

distribution and abundance have not been thoroughly studied in the urban areas.

Significance of the study

The Indian Grey Mongoose are abundant in the Bengaluru region in the earlier decades. Of late, their population has been declining alarmingly in the region. As no valid documents are available, a study was piloted to know the abundance of this mongoose species in different locations in and around the Bengaluru region.

In order to develop efficient conservation and recovery strategies, wildlife and conservation biologists need to understand and evaluate various threats confronting mammalian populations. The estimation of Indian Grey Mongoose population can now be made for individually identified locations and relative abundance indices can be calculated.

Study area

Bengaluru, the capital city of Karnataka State which is located in the heart of South Deccan of Peninsular India. This region lies between latitudinal parallels 12° 39' - 13° 18' N and longitudinal parallels 77° 22' - 77° 52' E at elevation range of 839-962 m asl (<http://www.ces.iisc.ernet.in/energy/wetlands/sarea.html>). Over 9 million people occupy about 2,191 km² (<http://ces.iisc.ernet.in/energy/TR86/intro.html>) of the metropolitan area (Census of India 2011). An average maximum and minimum temperature is 36° and 14° C respectively, with rainfall an average of 800 mm and humidity range is 35-80% in Bengaluru city. Three main seasons are winter (December to February), summer (March to May) and monsoon (June to November). Dominant vegetation of the Bengaluru region is dry deciduous forests and thorny scrub, with patches of moist deciduous forests along the streams.

Table 1. Distance, number of trails laid and walking transects used for the sampling of *Herpestes edwardsii* mongooses in different locations of the Bengaluru region

Study locations	Distance (in km)	Coordinates of locations	No. of trails laid	Walking transects (km) length
Anekal*	40	12°42'36.54"N 77°41'16.62"E	12	14
Attibele*	35	12°46'27.29"N 77°46'19.76"E	10	12
Bannerghatta National Park♦	22	12°48'8.39"N 77°34'27.18"E	10	12
Beguru*	12	12°52'38.93"N 77°37'33.78"E	8	6
Byadarahalli*	14	12°59'7.40"N 77°28'43.99"E	2	4
Central Railway Station*	0	12°58'37.37"N 77°34'10.49"E	0	0
Chandapura*	28	12°48'16.26"N 77°42'16.51"E	10	12
Chikkajhala♦	18	13°10'25.41"N 77°38'4.35"E	8	14
Devanahalli*	39	13°14'53.59"N 77°42'32.14"E	12	10
Gottigere♦	17	12°51'6.77"N 77°35'20.47"E	7	10
Gouripalya, Anekal*	36	12°43'16.44"N 77°40'56.12"E	6	8
Haragadde*	32	12°45'39.05"N 77°39'12.22"E	9	12
Hebbala*	8	13°2'38.73"N 77°35'10.94"E	2	4
Hesaraghatta*	28	13°8'33.04"N 77°29'9.38"E	10	12
Hoskote*	27	13°3'57.29"N 77°46'20.73"E	11	15
Jigani*	28	12°46'44.04"N 77°39'0.31"E	11	15
Kaggalipura♦	23	12°47'58.26"N 77°30'38.37"E	8	14
Kengeri♦	18	12°54'3.26"N 77°28'47.58"E	6	12
Kethohalli*	28	12°54'33.36"N 77°23'45.63"E	9	12
Krishnarajapuram*	15	13° 0'27.56"N 77°41'34.42"E	5	10
Lalbagh Botanical Garden*	5	12°56'45.62"N 77°34'52.61"E	2	4
Lord Cubbon Park*	3	12°58'18.74"N 77°35'24.60"E	2	4
Machohalli♦	18	12°59'37.38"N 77°27'24.86"E	6	12
Mallathalli♦	18	12°57'52.57"N 77°29'47.50"E	6	12
Muthyalamaduvu*	45	12°41'9.71"N 77°39'52.16"E	12	12
Nelamangala*	28	13°5'13.22"N 77°24'53.35"E	6	10
Sarjapura*	40	12°51'38.53"N 77°47'10.56"E	10	12
Somanahalli*	28	12°46'9.56"N 77°30'12.08"E	8	8
Tavarekere♦	25	12°57'55.17"N 77°24'8.63"E	6	8
Thippagondanahalli*	40	12°57'17.60"N 77°20'9.43"E	8	10
Varthuru*	34	12°57'5.91"N 77°44'42.67"E	6	8
Yelahanka*	15	13°6'25.05"N 77°35'47.28"E	5	10

*Central city region, *Urban region, *Suburban region, *Rural region.

Study Locations

Study locations were selected on the basis of the various vehicular movement and human population (anthropogenic pressure) in the four principal directions of the Bengaluru region (Figure 2). There are three locations in the central part viz. Central Railway Station (CRS), Lalbagh Botanical Garden and Lord Cubbon Park with heavy vehicular traffic and densely populated city regions within a radius of 0-5 km from CRS; five urban locations with high vehicular traffic, densely populated areas and less greenery (Beguru, Byadarahalli, Hebbala, Krishnarajapuram and Yelahanka) within a radius of

5-15 km from the CRS; eight suburban locations (Bannerghatta National Park-outer region, Chikkajhala, Gottigere, Kaggalipura, Kengeri, Machohalli, Mallathalli and Tavarekere) with moderate vehicular traffic, populated areas and greenery within a radius of 15-25 km from the CRS, and sixteen rural locations (Anekal, Attibele, Chandapura, Devanahalli, Gouripalya, Haragadde, Hesaraghatta, Hoskote, Jigani, Kethohalli, Muthyalamaduvu, Nelamangala, Sarjapura, Somanahalli, Thippagondanahalli and Varthuru) comprising agricultural lands and scrub deciduous vegetation with less vehicular traffic, less populated



Fig 5. Indian Grey Mongoose caring their young ones and alerting him/her in its behavioral activities in the Byadarahalli site of Bengaluru region

and more greenery, within a radius of 25-45 km from the CRS (Table 1).

Materials and methods

The identified ecological niches were regularly monitored during daytime (the species being a diurnal forager from sunrise to sunset, i.e. 06.00 h to 18.00 h) in month of June for three years, spending 90 person-days (13 weeks and approximately 540 h). The species was recorded only by direct sighting or head counting method (Sharma 2005). The encounter rate is calculated on the basis of number of times the species encountered (number of individuals recorded divided by the total number of individuals). During the transect walk, for every sighting of the individuals, the number of trails laid for sampling and line transect sampling length (km) were collected (Table 1).

The study was conducted in June 2012, June 2013 and June 2014 consecutively in different locations in and around the Bengaluru region. Various types of vegetation were identified up to the species level at urban locations of the Bengaluru region exactly where survey of mongoose was made to understand their habitats (Ramaswamy & Razi 1973). Moreover, regular field observations were also made on the shelter habitats, feeding habitats and food sources. Behavioral observations such as foraging, communication between them, finding shelters, avoiding predators, parental care (guarding the young ones), conflict between them, and human interferences made by several workers (Sharma 2005; Shekhar 2008; Kumara *et al.* 2014). Moreover, the species was accurately identified by collation of a series of photographs taken by a digital camera (Olympus FEE-330 (Olympus Imaging Corporation, China)) from different angles, showing the animal in varied postures and behavior as proposed by Kumara *et al.* (2014). The total number of individuals recorded in a particular study site are estimated by the counting of individual mongoose in

an identified location and presented in the form of true number without the standard deviation or standard error of mean. Based on this, the percentage of individuals over all the individuals in a particular location has been estimated. Finally, data on the occurrence and percentage abundance of mongooses at different study locations were statistically analyzed using chi-square test using PAST version 1.60 software (Hammer *et al.* 2001). The difference in the number of mongooses in the different location wise and year wise was analyzed using one way analysis of variance (ANOVA) - Tukey's Honestly Significant Difference test (HSD) (SPSS Inc 2008).

Results and Discussion

Observations made on the number and percentage abundance of *Herpestes edwardsii* in different study locations of the Bengaluru region are given in Figures 3 and 4 respectively. During the study period, the highest number of mongooses was recorded in Anekal, Bannerghatta National Park (mainly outer region) and Hoskote (8 nos. each) and lowest at Lord Cubbon Park (1 no.). Similarly, the highest percentage abundance of *Herpestes edwardsii* was recorded in and around the Bannerghatta National Park (mainly outer region) (7.19%) (prohibited places), Anekal (rural region) and Hoskote (suburban region) (6.54% each), and the least at Lord Cubbon



Fig 6. Indian Grey Mongoose searching for food sources in the solid (burnt) waste in the Byadarahalli site of Bengaluru region

Park (0.33%) (urban region). *Herpestes edwardsii* preferred degraded forests and regions with high canopy cover as reported by Kalle *et al.* (2013). This species clearly indicated highly suitable sites in open scrub forests avoiding the dense regions of the National Park. They may indicate that it has a wider tolerance to disturbance than species occupying similar niches, and therefore can reach higher populations in degraded forest (Kalle *et al.* 2013). A significant difference was found among the percentage abundance of mongooses ($\chi^2=703.5139$, $df=30$, $\chi^2_{30}(0.01)=50.892$) in various urban locations of the Bengaluru region. Similarly, a

significant difference was observed in the three years (2012-2014) during the study period (Tukey HSD, $F_{2, 92}=3.287$, $P<0.05$). Also, a significant difference was recorded in the number of mongooses (Tukey HSD, $F_{30,62}=11.216$, $P<0.05$) of different landscapes in Bengaluru region during the study period.

The lowest percentage abundance of mongooses at Lord Cubbon Park could be owing to high disturbance as they are located within the city limit. These regions experience the high anthropogenic activities, more vehicular traffic, and less availability of food sources and shelter in the vicinity. Shekhar (2003) also reported migration of the mongooses from such disturbed regions (close to human inhabitants) to the undisturbed forests in the Bengaluru region.

On the contrary, in the suburban and rural region, the highest number of mongooses were found only in the fringe regions of Bannerghatta National Park (mainly outer region) and Hoskote (suburban region), and Anekal (rural region). The availability of plenty of food sources such as fruits and roots of some plants, insects, scorpions, crabs, centipedes, frogs, geckos, lizards, snakes, birds (especially small chickens), eggs of ground nesting bird species, rats, mice, rabbits, and carrion of some freshly dead animals in addition to suitable nesting sites could be important factors for the high abundance of mongoose in these regions.

Sixteen species of aquatic plants such as alligator weeds (*Alternanthera philoxeroides* and *A. sessilis*), water hyssop (*Bacopa monnieri*), colocasia (*Colocasia esculenta*), *Centella asiatica*, jointed flatsedge (*Cyperus articulatus*), grasses (*Cynodon dactylon*), dwarf morning-glory (*Evolvulus alsinoides*), water hyacinth (*Eichornia crassipes*), water lily (*Nymphaea nouchali*), castor (*Ricinus communis*), milk weed plant (*Calotropis gigantea* and *C. procera*), Swamp morning-glory (*Ipomoea aquatica*), reed-mace or cattail (*Typha angustata*), and tape grass (*Vallisneria spiralis*) were recorded in some wetlands (Anekal, Chandapura, Lalbagh Botanical Garden, Gottigere, Hebbala, Hesaraghatta, Hoskote, Nelamangala, Kaggalipura, Kengeri, Machohalli, Mallathhalli, Gouripalya, Somanahalli, Thippagondanahalli and Varthuru) of the Bengaluru region during the study period. Mallick (2012) recorded 19 species of vegetation in periurban and non-forest inland freshwater wetlands (Howrah, North 24-Parganas and South 24-Parganas districts) in southern West Bengal, Eastern India as reported for other species of mongoose (*H. auro-punctatus*) in which the presently recorded eight species (*Alternanthera philoxeroides*, *Bacopa monnieri*, *Centella asiatica*, *Colocasia esculenta*, *Cynodon dactylon*, *Eichornia crassipes*, *Ipomoea aquatica* and *Nymphaea nouchali*) were included. These plants serve as the habitat of *Herpestes edwardsii* populations and provide shelter

where they can easily hide and hunt for prey. Nonetheless, there is no canopy tree in and around the wetlands as reported for other species of mongoose (*H. auro-punctatus*) by earlier (Mallick 2012).

The number of individuals of Indian Grey Mongoose encountered is also more in the suburban and rural habitat for diurnal shelter in the reed beds and thickets of above mentioned aquatic plants, which are also their hunting grounds in urban region as reported for other species of mongoose (*H. auro-punctatus*) by earlier (Mallick 2012). It takes nighttime shelter in the separate burrow on the slope of slender mud-bank. It is a potential predator that forages inside a stable small range around the wetland in search of prey (primarily small fish, aquatic insects and secondarily amphibians, reptiles, birds and small mammals). Nevertheless, the Indian Grey Mongoose is a diurnal species, it is a very cautious animal, generally hiding in the aquatic vegetation and avoid the human interventions in urbanized region as reported for other species of mongoose (*H. auro-punctatus*) by Mallick (2012).

Mongoose was sighted, foraging near small bush vegetation of a particular location. Although they were observed in various locations within the suburban region, nests and resting sites were seen only in small thickets of shrub vegetation such as *Lantana camara* and *Ricinus communis* of Byadarahalli site in the Bengaluru region, kitchen wastes, unused vegetation near the garden houses, agricultural farms, in the tree holes of shrub vegetation and adjacent wetlands during monitoring as reported for other species of mongoose (*H. auro-punctatus*) by Mallick (2012). In the city region, solitary mongoose was usually found moving near the municipal wastes. It was noticed that most mongooses were sighted usually during their diurnal activities such as walking, foraging and searching for food sources, communication between them when they are in a pair and other human disturbances in different locations of Bengaluru region.

Conclusion

Mongooses have become more and more threatened due to increasing anthropogenic factors and it is listed in Schedule II part II of the Wildlife (Protection) Act 1972. The IUCN Red List status of the Indian Grey Mongooses *Herpestes edwardsii* is Least Concern (Choudhury *et al.* 2011).

To assess wildlife population trends of this mongoose species, scientifically based monitoring programs must be carried out. Thus, small mammals form an integral component of forest animal communities, contributing to energy flow and nutrient cycling. More extensive study on the time budget, seasonal

activities, ecology and ethology, as well as conservation strategies of *Herpestes edwardsii* recommended in the urban regions of Bengaluru city.

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