Ambient Science, 2018: Vol. 05(2); 13-19
DOI:10.21276/ambi.2018.05.2.ra02

Published by: National Cave Research and Protection Organization, India

ambient SCIENCE
Vol. 05(2):13-19
Year 2018

RESEARCH ARTICLE

Conservation and Management of the National Bird, Indian Peafowl *Pavo cristatus*, in Urban Green Areas of Delhi, India

Mohammad Shah Hussain, Aisha Sultana*, Yasser Arafat

Biodiversity Parks Programme, Centre for Environmental Management of Degraded Ecosystems, University of Delhi, Delhi-110007, India

Study Area: Delhi, India
Coordinates: 28°37'N 77°14'E; 28.61°N 77.23°E

Key words: Dietary spectrum; Avifauna management; Urban ecosystems

Abstract

Pavo cristatus (Peafowl) is widely distributed bird but its status is unknown in urban parks in the National Capital Delhi. We surveyed four parks and city forest to determine the status and threats to peafowl. We undertook 245 surveys in these parks and observed significant differences in the sighting of individuals. Maximum density was in Deer park while no peafowl was found in Nehru Park. Peafowl perching height was negatively correlated with human disturbance and positively correlated with ground cover and canopy cover in every park. Peafowl predominately roosted in *Azadiracta indica, Prosopis juliflora,* and *Dalbergia sissoo.* A total of 173 observations were made on feeding items (62.5% plant items and 37.5% animal matter). The niche breadth of peafowl varied from 0.36 in January to 0.85 in June. This study was important from the management point of view by keeping harmony with humans and prevailing conditions of urban parks. We observed variability in independent parameters in different parks and made recommendations to conserve the peafowl and to mitigate the threats upon them in different urban parks of Delhi.

Introduction:

Delhi, the national capital of India has 12.12% forest area, which is much larger than other Indian cities (Forest Survey of India, 2013). Urban parks of Delhi have a great contribution in increasing the green area of Delhi apart from forest areas. Each park has its own importance (as a cultural site, historical site, and natural heritage site) and some of them are rich in biodiversity (in particular biodiversity parks and city forests). Delhi had a good peafowl population in the past (Tak & Sati, 1997), but recent developmental activities have encroached and fragmented the habitats of this bird. Presently, it is confined to the remaining portion of Delhi Aravallis (The Ridge forest). The IUCN Red Data Book has listed over one-third of pheasant species as endangered. Pheasants (Family Phasianidae) are generally sedentary and terrestrially adapted birds (Johnsgard, 1999). Possibly, due to this reason, they are unable to cope with the alarming rate of destruction of forest habitats. Peafowl is an exception, it has adapted well to the human-altered landscapes. Several studies have been conducted on different aspects of peafowl ecology, such as status at different places (Easa, 1990; Yasmin, 1995), ecological needs (Johnsingh & Murali, 1978; Basavarajappa, 2002), behavioural aspects (Hillgarth, 1984; Ganguli, 1995), management practices (Chakaravathy, 2002) and its effects on agricultural crops if considered a pest (Sathyanarayana, 2004). Most of the existing urban parks of Delhi are the remnants of contiguous forest. At present, they do not provide favourable habitat conditions for the long-term survival of peafowl, and if this situation continues, the entire population may become locally extinct from these parks. Therefore, an initiative was taken to assess the status, ecology and possible threats to the species in some selected parks of Delhi in order to make suitable recommendations for its long-term survival.

Methodology:

Study area: Delhi is located on the banks of the River Yamuna and spreads over an area of 1,484 km^2. The terrain of Delhi changes from plains in the north to dry arid hills (an offshoot of the Aravalli hill range) in the south. Delhi features an atypical version of a humid subtropical climate (Pidwirny, 2006) with long and hot summers (early April to September) and brief winters (mid-October and peaks in

*Corresponding Author: aishasultana28@yahoo.com

ISSN- 2348 5191 (Print) & 2348 8980 (Electronic)

Ambient Science, 2018: Vol. 05(2); 13-19
DOI:10.21276/ambi.2018.05.2.ra02

January). Extreme temperatures range from -0.2°C to 46.7°C. The average annual rainfall is approximately 714 mm (National Data Centre, Pune). Delhi and its neighbouring hilly tract represent tropical thorny and secondary forest. The indigenous trees of the Delhi Aravallis are *Acacia nilotica, Anogeissus pendula, Butea monosperma, Prosopis cineraria, Tecomella undulata,* etc. Four urban parks and city forest of Delhi; Lodi Park, Hauz Khas Deer Park, Jahanpanah city forest and Nehru Park were selected (Fig.-1) (further they are mentioned as urban parks only).

Survey design and sampling techniques: the study period was divided into the Summer season (Apr.-Sep.) and Winter season (Oct.-Mar.) in the selected parks. Existing trails were utilized and two transects of 500 m were established in each park for data collection. The method was designed to be simple and allowed analysis on a number of levels. The selection of existing park trails and areas for establishing transects was done in such a way that the entire park's habitat was covered. Monitoring was conducted in the early morning and evening hours to obtain maximum information. Habitat variables (Table-1) were recorded for each peafowl sighting, and main roads used for regular vehicle movement surrounding these parks. Peafowl were counted on roosts in the early morning between 05:00 and 09:00 and late evening hours between 17:30 and 19:30. Vegetation was sampled on trails and transects used for peafowl monitoring for each park using plot sampling method (Mueller-Dombois & Ellenberg, 2002) to know the available vegetation for breeding, feeding and roosting ecology of the bird. Each sampling plot was 50 m apart; trees were quantified in 10 m radius circular plot, shrubs in 3 m radius circular plot and ground cover (herbs and grass) in four 1 m^2 quadrates were laid in four directions at a distance of 5 m from the sampling point. Percent ground cover was estimated following the line interception method (Canfield, 1941) within the vegetation sampling plot.

Table 1: Description of different habitat variables recorded for each peafowl sighting in the parks, Delhi, India.

Habitat variables	Description
Tree height / Pearch height	The overall tree height recorded on which peafowl perched. Perching height was recorded to know the approximate tree height a Peafowl used for safe roosting and for other activities.
Shrub cover	Estimation of shrub cover was made at each sighting point (planted or wild).
Ground cover	The dominance of ground cover (grasses and herbs) was assessed at the sighting location on percentage scale (an indicator habitat parameter Peafowl presence).
Canopy cover	Percentage canopy cover was estimated at each sighting point location.
Distance from human	The distance of human from peafowl were recorded because it may be an important factor to decide the status of Peafowl in the urban parks.
Distance from road	The distance to surrounding roads from the sighting place of Peafowl was recorded which is considered as an indicator of disturbance.

Statistical analysis : statistical analysis was conducted using SPSS version 10.0 (Norusis, 2000). Paired sample t-test was conducted to see the difference in peafowl abundance during morning and evening hours. One-way ANOVA (Zar, 1984) was carried out to test if peafowl abundance in different parks as well as during the morning and evening hours was significantly different. The same test was also conducted to detect differences in winter and summer seasons.

To assess the effect of different habitat variables on the number of Peafowl present in different parks, Kendall's tau b correlation analysis (Zar, 1984) was performed. Habitat variables used in the analysis were tree density, tree diversity, tree richness, tree cover, shrub density, shrub diversity, shrub richness, shrub cover, mean shrub height, percent herb cover, percent grass cover, percent bare ground, percent litter, percent withered stone and percent rock. Stepwise multiple regression analysis was also performed to find out the abundance predictors for Peafowl. This analysis was also performed on the perching height of Peafowl. The variables used were tree height used, percent shrub cover, percent canopy cover, distance from human and distance from the road. Actual significance levels for all tests are given. Densities were calculated using the DISTANCE 6.0 Release 1 software (Buckland *et al.*, 2004).

Niche breadth: it was measured by Levin's (1968) measure, which measures how uniformly resources are being utilized by each species. It was calculated by-

$$BA = B - 1 / n - 1$$

where BA = Levin's standardized niche breadth, B = Levin's measure of niche breadth and n = Number of possible resource states, which tells how specialized or generalist a peafowl was within a given environment. All observations were recorded through visual encounters using binoculars at the feeding sites. A specialist that feeds on only one or two food resources will have a value closer to '0' while a generalist that feeds on a number of food items will have a value closer to '1' (Sultana & Hussain, 2010).

Results :

Status, distribution and abundance: A total of 245 surveys which includes 263 hours and 33 minutes man hours were accomplished (Table-2). Nehru Park was excluded from the analysis due to no peafowl sighting. One-way ANOVA showed significant difference in sighting of individuals in different parks ($F_{2,403} = 25.41, p < 0.001$).

Ambient Science, 2018: Vol. 05(2); 13-19
DOI:10.21276/ambi.2018.05.2.ra02

Paired sample t-test showed a significant difference in overall peafowl abundance during morning and evening hours ($t = 4.57$, $p < 0.001$). More peafowl were observed during evening hours. ANOVA confirmed this significant difference in abundance during morning ($F_{2, 314} = 56.68$, $p < 0.001$) and evening hours ($F_{2, 314} = 17.41$, $p < 0.001$). Sighting of adult male and female differed significantly in all parks during the winter ($F_{2, 260} = 47.08$, $p = 0.00$ & $F_{2, 260} = 7.61$, $p = 0.00$) and summer seasons ($F_{2, 271} = 34.01$, $p = 0.00$) & $F_{2, 271} = 18.42$, $p = 0.00$). Juveniles were sighted only during the late summer season.

Population dispersal: Fig.-2 shows monthly fluctuations in different age and sex groups of peafowl in parks. There was a greater fluctuation in the numbers of the females and juveniles than the adult males, sub-adult males and sub-adult females in all parks. There was a marked increase in the number of females during the summer season (Apr. to Jun.) but declined during the egg-laying period. There is a possibility of peafowl population dispersion between Khelgaon and Deer Park due to their close proximity whereas the peafowl population of Lodi Park and Jahanpanah Park were stagnant because they were isolated.

Habitat preference

Lodi Park: grass cover was significantly negatively correlated with peafowl number ($\tau = -0.381$, $p < 0.01$). Tree species density and diversity (Table-3) were positively correlated with the peafowl presence ($\tau = 0.317$, $p < 0.04$ and $\tau = 0.366$, $p < 0.02$ respectively). They preferred areas where tree density and diversity was more.

Regression analysis extracted grass cover, which accounted for 44% of variance correlated with abundance. Peafowl preferred less grass cover area in Lodi Park. Perching height of peafowl was also negatively correlated with distance from human presence and accounted 59% variance (Table-4).

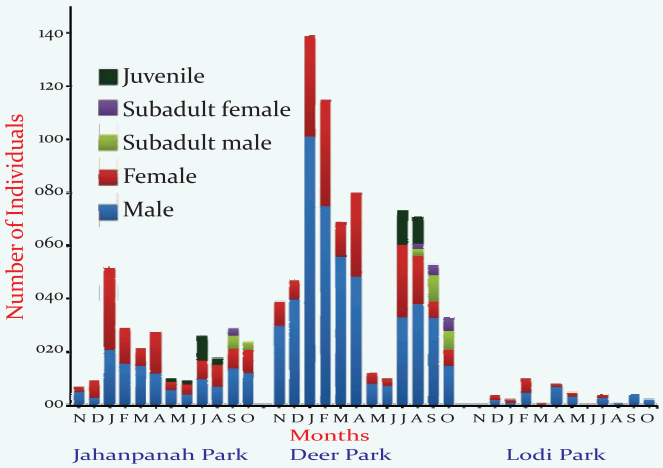

Figure-1: Fluctuation in Peafowl population in Jahanpanah Park, Deer Park and Lodi Park, Delhi

Deer Park: the peafowl abundance was positively correlated with tree diversity and tree richness ($\tau = 0.255$, $p < 0.05$ & $\tau = 0.163$, $p < 0.001$). Litter was also significantly positively correlated with peafowl population ($\tau = 0.197$, $p < 0.01$). The regression analysis extracted distance from human presence as the main abundance predictor. It accounted for 37% variance and it was positively correlated with abundance. Other predictors were canopy cover (positively correlated), distance from road (negatively correlated) and tree height (negatively correlated). The peafowl preferred less disturbed habitats having a medium height closed canopy tree species. Peafowl used more canopy cover and low shrub diversity areas for perching in this park (total variance accounted for 96%) (Table-4).

Jahanpanah Park: the Peafowl abundance was positively correlated with shrub diversity ($\tau = 0.155$, $p < 0.029$) and shrub height ($\tau = 0.163$, $p < 0.02$). Litter was also significantly positively correlated with the peafowl presence ($\tau = 0.294$, $p < 0.01$). The ground cover was positively correlated with peafowl abundance and emerged as the main abundance predictor which accounted for 34% of the variance. The peafowl perching height was negatively correlated with distance from the human presence in Jahanpanah Park and accounted for 28% of the variance (Table-4).

Table 2: Peafowl density (individuals/ha±C.I.calculated by Distance 6.0 programme, time spent (min.), and demographic data (individuals) in the urban parks of Delhi. Nehru Park was excluded as no peafowl encountered there.

Parameters	Lodi Park	Deer Park	Jahanpanah Park
Area	0.36 km²	1.74 km²	1.76 km²
Monitoring	50	75	89
Time spent	3510	5115	5535
Mean no. of individuals	0.37 ± 0.66	2.73 ± 1.85	1.67 ± 1.43
Density	3.31 ± 2.37 - 4.63	10.48 ± 4.36 -15.02	6.36 ± 2.92 -13.86
Adult male	28	212	125
Adult female	13	97	112
Sub adult male	-	15	8
Sub adult female	-	7	3
Juvenile	-	19	14

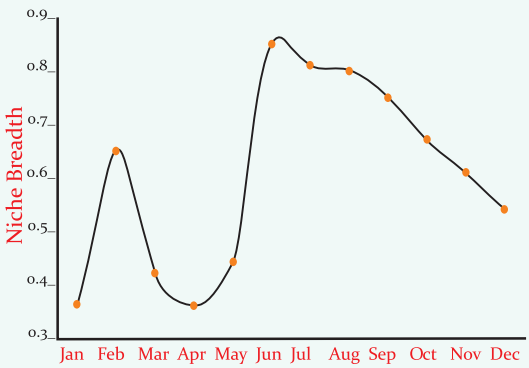

Figure-2: Niche Breadth of Peafowl in urban parks of Delhi.

Ambient Science, 2018: Vol. 05(2); 13-19
DOI:10.21276/ambi.2018.05.2.ra02

Table 3: Different vegetation attributes (Mean±C.I.; Trees, shrubs, ground cover) of surveyed urban parks of Delhi (Fig.-1). C.I. = Confidence Interval, ha = hectare

Vegetation attributes	Lodi Park	Deer Park	Jahanpanah Park	Nehru Park
Tree density*	233.54±191	877.9±453	536.4±345	145.5±63.9
Tree diversity	0.71±0.52	1.65±0.5	1.21±0.4	0.67±0.45
Tree richness	2.57±1.68	8.06±2.9	4.84±1.95	1.23±0.93
Tree cover (%)	24.08±16.1	32.93±10.4	29.02±11.8	20.1±6.36
Tree height (m)	8.16±3.91	9.5±3.75	9.1±3.5	7.15±2.91
Shrub density*	-	1273.9± 2172.6	3389.16± 3635.74	-
Shrub diversity	-	0.13 ± 0.31	0.46 ± 0.47	-
Shrub richness	-	0.87 ± 0.86	1.89 ± 1.35	-
Shrub cover (%)	-	11.67 ± 12.34	21.67 ± 16.85	-
Herb cover**	7.0±13	2.0±1.5	14.0±11	34.0±12
Grass cover**	46.0±36	6.0±5	26.0±19	49.8±34
Litter cover**	19.0±16	32.0±12	26.0±13	14.0±5
Withered stone cover**	6.8±7.0	10.0±6	8.0±7	2.0±0.9
Rock cover**	0.02±0.9	21.0± 9	9.0±10.0	0.1±0.7
Bare ground cover**	21.0±23	29.0±11	17.0±12	0.1±0.6

*individuals/ha; **Mean

Table-4: Summary of predicted models selected by Stepwise regression analysis, considering abundance and perching height of Peafowl as dependent variables in different parks. (ANOVA)

Parks	Variables	Sum of Squares	F value	p value
Lodi	Abundance/Grass cover	5.62	6.65	(-) 0.016
	Perching h.t/Human distance	9.71	14.34	(-)0.001
Deer	Abundance/Human distance	33.91	39.04	(+) 0.00
	Abundance/Canopy cover	47.67	29.21	(+) 0.00
	Abundance/Road distance	56.74	24.17	(-) 0.00
	Abundance/Tree height	59.90	19.38	(-) 0.00
	Perching ht./Canopy cover	146.97	269.5	(+) 0.00
	Perching ht./Shrub diversity	149.82	162.8	(-) 0.00
Jahan-panah	Abundance/Ground cover	3.95	5.56	(-) 0.02
	Perching ht./Human distance	10.46	11.07	(-) 0.001

Table 5: Details of the tree species used by Peafowl in surveyed urban parks of Delhi (Fig 1) for perching. Mean ± C.I. (Confidence Interval) of tree height and perching height was recorded in meter.

Park name	Tree species	Tree height	Perching height
Lodi	*Azadiracta indica*	9.33 ± 1.15	5.0 ± 1
Deer	*Azadiracta indica*	12.4 ± 3.27	7.0 ± 2.39
	Prosopis juliflora	5.02 ± 2.14	2.89 ± 1.61
	Albizia lebbeck	13.71 ± 6.76	10.71 ± 7.5
	Dalbergia sissoo	9.85 ± 4.91	5.86 ± 5.55
	Delonix regia	9.0 ± 6.32	6.0 ± 2.19
	Mimosops elangi	6.2 ± 1.79	3.6 ± 1.82
Jahanpanah	*Azadiracta indica*	8.0 ± 2.83	4.5 ± 1.15
	Prosopis juliflora	7.0 ± 3.6	4.5 ± 0.75
	Albizia lebbeck	8.0 ± 2.83	4.5 ± 2.12
	Cassia fistula	8.5 ± 2.12	5.5 ± 0.71
	Dalbergia sissoo	7.0 ± 1.41	4.0 ± 1.41

Roosting tree characteristics: different roosting trees were identified in the selected parks. *Azadiracta indica* was used for roosting in Lodi Park. The mean tree height and mean perching height was 9.33±1.15 m and 5±1 m respectively. Again, *Azadiracta indica* was the most used in Deer Park followed by *Prosopis juliflora*. Other trees such as *Albizia lebbeck, Dalbergia sissoo, Mimosops elangii* were also preferred for roosting. Different tree heights were used by peafowl in this park, roosting tree characteristics are given in Table-5.

Niche breadth: a total of 173 observations were taken on peafowl feeding items for all parks, out of which 62.5% of feeding was on plant items whereas 37.5% was on the animal matter. The animal matter contained ants, termites, skink (Scincidae) and beetles. The niche breadth of peafowl was found to vary from 0.36 in January to 0.85 in June (Fig.-3). The niche breadth was comparatively higher during monsoon than summer and it was least during winter. A look at the wide dietary spectrum suggests that peafowl is a generalist.

Discussion:

Peafowl is a promiscuous species and can increase rapidly when the sex ratio is biased towards the female (Spillet, 1966). However, the peafowl population in Delhi parks was biased towards males except in Khelgaon. Similar results were also obtained by Sharma (1978) in Jodhpur where the sex ratio was 1.7-1.2: 1 (male: female), Yasmin (1995) showed a ratio of 1.5: 1 in Aligarh district whereas Johnsingh & Murali (1978) reported an inverse relationship in a rural landscape in South India with 0.47: 1. A relatively small percentage of young usually indicates a sluggish rate of population increase, which was the case in the parks.

Variation in local population between parks might be due to the movement of individuals between the populations. The monthly age structure and sex ratio of the population in all parks suggested that breeding dispersal occurs in peafowl and was definitely sex-biased towards females. The sub-adult male also shows the wandering movement (Yasmin, 1995). Adult peacocks tend to establish display sites, most probably at the same place every year and therefore dispersal may be carried out by young males. Females of lek-breeding species tend to visit several leks before mating and so also may disperse. Yearling males may be moving among leks more frequently because they are inexperienced at breeding and may need to investigate several leks before establishing a territory. Female-biased dispersal has been documented in sage-grouse (Dunn & Braun, 1985), spruce grouse (Keppie & Towers, 1992) and ruffed grouse (Small & Rusch, 1989). It is postulated that adult females, which are more experienced than young females select a nest site that provides better shelter to eggs. If site selection occurred, females might respond mostly to vegetation at the immediate location of

Ambient Science, 2018: Vol. 05(2); 13-19
DOI:10.21276/ambi.2018.05.2.ra02

the nest. Unfortunately, due to disturbance, no nest was sighted but personal observations (unpublished) on peafowl at the Aravalli Biodiversity Park in Delhi indicated that peahen preferred undisturbed and camouflaged habitat for nesting. Lack of adequate nesting habitat was a major limiting factor for future survival of peafowl in these parks. The nesting of peafowl on the ledges of building in Delhi (Singh, 2007) also indicates the extreme alteration in the landscape (Svardson, 1949). It might also be due to the protection provided by human beings, so they could nest on roofs of houses (Singh, 2007) and in agricultural fields. Peafowl is predominantly a primary consumer (Johnsingh & Murali, 1978; Trivedi, 1993). Niche breadth was comparatively higher during monsoon season due to the abundance and variety of food in the form of wild herbs and insects. Peafowl had shown broader niche range of 0.36 to 0.85 and a species with a broader niche are called generalists (Kaur & Kler, 2017). Peafowl appears to adjust requirements according to the availability of food resources in the habitat. Preference and avoidance of any habitat can be attributed to the vegetation structure and composition of a habitat but other factors also govern the distribution of a species (Hussain, 2002). Nehru Park was totally avoided by the peafowl perhaps because of a lack of understorey vegetation (shrub layer and ground cover) and large human presence with their related activities in this park (Sukumal *et al.*, 2015). Human encroachment into their natural territories have brought peafowl and humans into increasing contact, but peafowl always maintains a threshold distance from them. Parks are regularly used for walks, jogging and other activities. Avenue plantation has been done at the boundaries of parks as a natural barrier and this area of the park is becoming favourable roosting places for peafowl.

Azadiracta indica and *Prosopis juliflora* were preferred trees over others because of overall greater height and more availability of these tree species in the parks (Kaur & Kler, 2017). *Azadiracta indica* and *Dalbergia sissoo* also had a greater height of the first branch. This might be offering greater protection from the ground predators, particularly from stray dogs and from humans. Peafowl needs to watch the approaching predators as a safety measure because they are too big to hide behind the foliage and these parks do not have thick foliage except at some places in Jahanpanah Park. Other large birds such as turkeys (Hoffman, 1968) and vultures (Thompson *et al.*, 1990) also prefer old and over-mature trees with greater height as a safe venue. According to Ward & Zahavi (1973), the bird's main defense lies in the selection of inaccessible sites for roosting. The preference for tall trees with the first branch at a greater height from the ground suggests that peafowl adopt an anti-predator strategy for selecting roosting tree species.

Peafowl does not seem to select a particular tree species over their distributional range. In Aligarh, they have been seen roosting on *Ficus religiosa, Mangifera indica* and *Dalbergia sissoo* near a village (Yasmin, 1995). In Keoladeo National Park, they were seen roosting on *Acacia nilotica*, *Prosopis juliflora* and dead trees (personal observation M.S.H.). This suggests that phenotypical characteristics of the trees are of primary consideration during roost tree selection. In most of the horticulture maintained parks, trees are trimmed from time to time, which doesn't show their natural growth and canopy as they occur in the natural forest. Peafowl prefers the transition zone between human settlements and natural areas (Johnsgard, 1999). Open habitats with low tree density and short grass height tend to be associated with human dwellings (Yasmin & Yahya 1996). Moreover, human habitations ensured the availability of water too. In the parks of Delhi, the tree density and diversity was low as compared to ecotone (between human settlements and forest), consequently, the peafowl tends to use the optimum trees of the parks.

Conclusion:

Peafowl gets special protection in the Indian subcontinent because of importance in mythology and religious sentiments from the community. Being the largest pheasant, reluctant to fly long distances, averse to humans and fragmentation of habitat is likely to have a detrimental effect on its survival. The selected parks of Delhi are very much disturbed in terms of human presence (Doody, 2010). The early morning and late evening hours should bedisturbance free in the parks so that the peafowl can roam and feed freely. Conservation of any species means the conservation of its habitat. Research on habitat use by peafowl highlighted the importance of ground cover and canopy cover a prerequisite for its long-term stay in any particular area. These parks are horticulturally managed and do not provide any of the basic ecological needs of the species. Some fruit yielding native shrubs such as *Capparis decidua, Carrisa carandas, Grewia tenax* can be planted in these parks which will provide wild food, shelter as well as an escape to the peafowl. Peafowl maintain a threshold distance from humans when breeding. Portions of park areas should be left free from human presence and developed as a peafowl habitat. Suitable habitat can be developed in Nehru Park also; if some portion is left only for the peafowl as flagship species then some pairs of peafowl can also be released here.

The Jahanpanah Park area is accorded with the Indian Forest Act (1927) so strict jurisdiction should be implemented here through enforced forest management regulations to provide better ecological settings to peafowl. Bamboo thickets should be planted in Lodi Park at scattered locations for nesting and shelter. Tree species *Albizia lebbeck, Dalbergia sissoo, Azadiracta indica* will provide preferred roosting sites for peafowl, and also it will act as a natural barrier from disturbance. Although peafowl preferred *Prosopis juliflora* (an exotic species from Mexico) for roosting in the Deer and Jahanpanah Parks due to its

dominance over other tree species but its future propagation should be restricted through planting native vegetation to avoid entire biodiversity loss (Kathiresan, 2006). The availability of clean water will ensure a permanent stay of peafowl in these parks because peafowl were effectively confined to undisturbed water sources during the dry months.

Gardeners can use natural manure such as cow dung and vermicompost (compost prepared by earthworms which convert organic waste into manure) instead of chemical fertilizers and pesticides to maintain flower beds and plants that mostly kill insects and seasonal weeds (food of peafowl) which limit peafowl food supply. Insects are an important prey-item for peafowl during the incubation period and for juvenile's growth. Litter burning practices destruct peafowl habitat and destroy feeding material, and removes the cover and nesting materials necessary for shelter and protection from predators. The broken boundary wall of all the parks should be repaired to keep away the stray dogs. Personal observation revealed that dogs have a detrimental effect on peafowl's nesting and roaming behaviour. Dogs also lead to hardening the soil by decreasing the vegetation of the area through continuous roaming and sitting at the same place, thereby making a search for food more difficult for peafowl. They were sighted chasing peafowl also (Gurjar *et al*., 2013). People should not be allowed to feed peafowl which infects them and starts a competition with other urban birds such as feral pigeons, *Columba livia*, and common myna, *Acroditheres tristis*. Awareness should spread on a large scale to the people of Delhi by putting hoardings and posters to promote peafowl conservation. It should also include the information on legal action against the person selling feathers. Many conservation measures advocated in this paper regarding the conservation of peafowl will also be a direct benefit to many of the other bird and mammal species in general and biodiversity of the city parks in particular.

Acknowledgements:

The present work obliged to Department of Environment, Government of NCT of Delhi, India, for providing funds to the World Pheasant Association (WPA)-India. Thanks to the entire staff of different parks for providing help at all levels after knowing that it is a first study on the National Bird in their area. We thank Narendra Singh Bisht for assistance in vegetation assessment of parks. Last but not the least; we are thankful to Samar Singh, Ex President, WPA-India for valuable suggestions.

References:

Basavarajappa, S. (2002): A preliminary report on the Indian crested Peafowl in Channagiri area, Karnataka. *Newslett. Birdwatchers*. 42(2); 20-21.

Buckland, S.T., Anderson, D.R., Burnham, K.P., Laake, J.L., Borchers, D.L., & Thomas, L. (2004): **Advanced Distance Sampling.**, Estimating abundance of biological populations Pub. by: London: Oxford University Press. pp. 440.

Canfield, R. (1941): Application of the line interception method in sampling range vegetation. *J.Forest.*, 39; 388-394.

Mueller-Dombois D, Ellenberg H (2002) **Aims and methods of vegetation ecology.** Pub. by: The Blackburn Press, Caldwell, NJ, USA. pp. 547.

Doody, B.J., Sulliven, J.J,. Meurk, C.D., Stewart, G.H., & Perkins, H.C. (2010): Urban realities: the contribution of residential gardens to the conservation of urban forest remnants. *Biodivers. Conserv.*, 19(5):1385-1400.

Dunn, P.O., & Braun, C.E. (1985): Natal dispersal and lek fidelity of Sage Grouse. *The Auk*, 102(3):621-627.

Easa, P.S. (1990): Reappearance of common Peafowl (*Pavo cristatus*) Linn. in Parambikulum Wildlife Sanctuary, Kerala. *J.Bom. Nat. His. Soc.*, 87(2); 292-293.

Forest Survey of India. (2013): **India State of forest report.** Pub. by: Forest survey of India, Min. Environ. For., Dehradun.

Ganguli-lachungpa, U. (1995): A peahen nests on a roof. *Newslett.Birdwatchers*., 5(4):46.

Gurjar, R.L., Singh, R.P., & Mishra, A. (2013): Density of the Indian Peafowl *Pavo cristatus* in Satpura Tiger Reserve. *Podoces*. 8(1): 12-18.

Hillgarth, T.W. (1984): Social organization of wild Peafowl in India. *J. Wor. Pheasant Asso.*, 9(2): 47-56.

Hussain, M.S. (2002): **Aspects of Ecology and Conservation of pheasants in Kumaun Himalaya, Uttaranchal, India**. Ph.D. Thesis, Aligarh Muslim University, Aligarh, India.

Johnsgard, P.A. (1999): **Pheasants of the World: Biology and Natural History**. Pub. by: Smithsonian Inst. Press. pp 432

Johnsingh, A.J.T., & Murali, S. (1978): The ecology and behavior of the Indian peafowl (*Pavo cristatus*) Linn. of Injar, Tamilnadu. *J. Bom. Nat. His. Soc.*, 75:1069-1079.

Kathiresan, R.M. (2006): Invasion of *Prosopis juliflora* in India. In: **Problems posed by the introduction of *Prosopis* spp. in selected countries** (ed. Labrada R.), FAO, pp. 310, Pub. by: Plant Protection Service, Rome.

Kaur, S., & Kler, T.K. (2017): Feeding habits and roosting preferences of Indian Peafowl (*Pavo cristatus*) in Ludhiana district (Punjab). *J. Entom. Zool. Stud.*, 5(4):1693-1696.

Keppie, D.M., & Towers, J. (1992): A test on social behaviour as a cause of dispersal of spruce grouse. *Behav. Ecol. Sociobiol*., 30: 343-346.

Levins, R. (1968): **Evolution in Changing Environments: Some Theoretical Explorations**. Princeton, NJ: Pub. by: Princeton University Press

Norusis, M.J. (2000): **SPSS/PC+10.0 Guide to Data Analysis. SPSS Inc., Englewood Cliffs. Pub. by:** NJ Prentice Hall.

Pidwirny, M. (2006) **Climate Classification and Climatic Regions of the World. Fundamentals of Physical Geography, 2nd Edition**. Online Physical Geography, http://www.physicalgeography.net/fundamentals/7v.html, accessed 22 October 2015.

Sathyanarayana, M.C. (2004): Bird pest management with special reference to Indian Peafowl *Pavo cristatus* in Tamilnadu, India. In: **Proceedings of the 3rd International Galliformes Symposium** (eds. Fuller, R.A. and S.J. Browne). World Pheasant Association, Fordingbridge, UK.

Ambient Science, 2018: Vol. 05(2); 13-19
DOI:10.21276/ambi.2018.05.2.ra02

Sharma I.K. (1978): Social and sexual behaviours of the Peafowl (*Pavo cristatus*). *Environ.Awareness.*, 1:169-171.

Singh, S. (2007): Unusual nesting behaviour of the Indian Peafowl Pavo cristatus. Paper presented in **4th International Symposium on Galliformes**, World Pheasant Association, Chengdu, China.

Small, R.J., & Rusch, D.H. (1989): The natal dispersal and lek fidelity of ruffed grouse. *The Auk*. 106:72-79.

Spillet, J.J. (1966): A report on wildlife surveys in North India and Southern Nepal. *J. Bom. Nat. His. Soc.*, 63: 494-528.

Sukumal, N., McGowan, P.J.K., & Savini, T. (2015): Change in status of green peafowl *Pavo muticus* (Family Phasianidae) in Southcentral Vietnam: A comparison over 15 years. *Global Ecol. Conserv.*, 3: 11-19.

Sultana, A., & Hussain, M.S. (2010): Avian Foraging Pattern in the Oak Forest of in Central Himalaya: An Ecological Conservation Approach. *Int. J. Ecolog. Econ. Stat.*, 19(10): 83-102.

Svardson, G. (1949): Competition and habitat selection in birds. *Oikos*. 1: 157-174.

Tak, P.C., & Sati, J.P. (1997): Aves. In: **Fauna of Delhi** (ed. Director), pp. 699-821, Pub. by: Zoological Survey of India, Calcutta, India.

Thompson, W.L., Yahner, R.H., & Storm, G.L. (1990): Winter use and habitat characteristics of vulture communal roosts. *J. Wildlife Manag.*, 54:77-83.

Trivedi, P. (1993): **Habitat selection of Indian Peafowl, *Pavo cristatus*** in Gir National Park. M.Sc. Thesis, Saurashtra University, Gujarat, India.

Ward, P., & Zahavi, A. (1973): The importance of certain assemblages of birds as "information centres" for food finding. *Ibis*. 115: 517-533.

Yasmin, S. (1995): **Ecology and biology of the Indian Peafowl *Pavo cristatus* in the Aligarh region**. Ph.D. Thesis, Aligarh Muslim University, Aligarh, India.

Yasmin, S., & Yahya, H.S. (1996): Correlates of mating success in Indian Peafowl. *The Auk*, 113(2): 490-492.

Zar, J.H. (1984): **Biostatistical Analysis**. Pub. by: Pearson, - Pearson modern classic. pp. 944.