

IMPACT OF ELECTROMAGNETIC POLLUTION FROM MOBILE PHONE TOWERS ON LOCAL BIRDS

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Abstract: Electromagnetic radiation from mobile phone base stations has become a global concern for its adverse effects on human health as well as on flora and faunas. Behaviour of avian community may be changed while exposed to the high level of power density. A study has been conducted at Kalyani (22°58'30"N, 88°26'04"E), Nadia, in vicinity of cell phone towers to draw a possible link among avian occurrences, nesting and electromagnetic radiation emitted from the towers. Birds and their nests have been counted using point count method at different distances in four cardinal directions from the masts, while recording the power density. It is observed that power density shows peak value within the distance 8m to 20m from the towers where the average percentage of occurrence is found lowest (1.59% and 1.81%). No avian nest has been detected near the towers. First natural nest is that of Jungle Babbler (*Turdoides striata*) at 80m away from a tower. More intensive studies are essential to evaluate the relation between avian behaviors and electromagnetic radiations.

Keywords: electromagnetic radiation, power density, avian community, point count method

I. INTRODUCTION

Telecommunication has become the indispensable part of the modern life in fast developing countries like India. Total number of mobile phone users in our country is 861.66 million till February, 2013. The wireless telephone subscribers in urban areas have been reported to be decreased by 7.59 million whereas, that of the rural areas have been increased by 6.64 million from January 2013 to February 2013. Tele density has also been decreased from 142.10 to 139.83 in urban areas and increased from 39.26 to 40.01 in case of rural areas hence indicating the rapid growth of telecommunications in rural India [1].

The communication of mobile phone takes place by transmission of radio wave through a network of base stations. A mobile phone transmits 1 to 2 watt of power in the frequency range of 824 to 849 MHz for CDMA, 890 to 915 MHz for GSM900, 1710 to 1780 MHz for GSM1800 and 1920 to 1980 MHz for 3G. Guidelines of International Commission on Non Ionizing Radiation Protection [2] have been adopted in India [3]. Besides its enormous utilities, it has some adverse effects on human health. Cell phone radiation possibly causes cancer, as per International Agency for Research on Cancer [4].

Changes in avian due to exposure of mobile phone radiation have been reported worldwide. Exposure in ground level is much less compared to one who is very close to the antenna [5]. Birds have been found more sensitive to EMF [6]. Birds are highly affected due to the presence of their thin skull, their high mobility, and their feathers as dielectric receptors [7]. More comprehensive studies are required to combat the potential risks of exposure to high power density radiations from mobile phone towers [8, 9]. Out of 919 research studies related to effects of cellular phone radiations, 30 are related to birds, having positive (77%), negative (10%) and neutral (13%) reports [10, 11]. Alteration in behavior of birds due to EMR exposure has been reported [12]. Electromagnetic radiation from cell phone base stations can affect the breeding as well as the eggs of birds [13]. Microwave radiation has thermal effect causing increased body temperature followed by physiological changes, besides it has some non thermal effects causing changes in cellular metabolisms in birds [14]. Microwave radiation also has potential impacts on the aviation of birds [15].

In the present study an attempt is made on regional basis, to note the change of nesting and occurrences of birds near the cell phone tower.

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II. MATERIALS AND METHODS

A. Study Area:

We have selected mobile towers near our University of Kalyani, West Bengal. Kalyani is a municipality area located at 22.9800°N and 88.4800°E, on the banks of River Hoogly in West Bengal. The city covers 29.14sq.km area. Two locations in vicinity of mobile phone towers have been taken for investigations as shown in Table I.

TABLE I Study sites

Tower	Location	Description of Site
I	Kalyani Picnic Garden	Located at 22°58'57" N and 88°25'27" E. Garden having number of plantations. Mobile phone Base station is located near the gate of the garden.
II	Kalyani Santal Para	The latitudinal location is 22°57'46" N and longitude is 88°26'51" E. Locality inhabited by Tribal Community. A Cell phone tower is located at the residential area. Active nests of common birds are abundant in this area.

B. Field Methodology

- Measurement of Power Density at different distances and counting of common birds:**
Two mobile phone base stations have been visited early in the morning when the maximum activities of birds are noticed on clear sunny days. Power Density of radiation from the mobile tower at different distances (as far as accessible) from the base of the tower has been recorded at regular intervals. Common birds seen at these equidistance points from mobile phone towers in four directions (North, East, West and South) have been noted in Point Count Method. Snaps of the unidentified birds have been taken and they are identified later with the help of the book entitled "The Book of Indian Birds" by Salim Ali [16].
- Active nest survey for all common birds and measurement of exposure to cell phone radiation:**
Both the sites have been surveyed for natural nests of birds. Nests are located and identified. Active nests are studied, their characteristics (*viz.*, status of the nest, number of chicks or eggs present within the nest, activities of the parent birds in and around the nest and so on) are noted and Power density has been recorded near each nest.

III. RESULT AND DISCUSSIONS

Total 19 species of birds have been seen near Tower I and 8 species in case of Tower II. Checklist of birds present at study areas is depicted in Table III.

From **Active Nest Survey** it is noted that there are only two natural nests at the surroundings of Tower I, though the occurrence of birds is plenty. In case of Tower II, two nests of House Sparrows are found in the holes of households near the vicinity of the tower. Table II shows the results of active nest survey.

In both the cases, nests are found at $\geq 80\text{m}$ away from the towers, *i.e.*, in the area having low radiation impacts. While measuring the power density along transects, in both the cases, higher values are obtained from 8m to 20m radius of the towers in four directions. The occurrences of birds are inversely linked with the changing power density as shown in Figure 1.

TABLE II Details of Natural Nest Survey

Site	Nest	Bird name	Eggs	Chicks	Birds	Distance From Tower(m)	Power Density ($\mu\text{W}/\text{m}^2$)
1	1	Jungle Babbler	0	0	2	80	1.2
	2	Tailor Bird	2	0	2	82	1.1
2	1	House Sparrow	4	0	0	96	0.01
	2	House Sparrow	2	0	1	160	0.2

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IV. CONCLUSIONS

Common bird population loss has become a considerable matter over the globe as a large portion of bird species are rapidly falling [17-22]. Electromagnetic pollution either by itself or by combination with other factors is responsible for decline of common birds like House Sparrow [23]. Exposure to electromagnetic radiation affects nest building, egg fertility, clutch size, hatching and survival of chickens [24]. Cell phone tower located near residential areas irradiate the organisms around it affecting them by deterioration of health, problems in reproduction and so on; it exerts an aversive behavioral response in birds like sparrows. Maximum occurrences of birds in both the cases are found at lowest radiation areas.

TABLE III List of Birds

Common Name	Scientific name	Identifying Characters
Tower I		
Bak / Intermediate Egret	<i>Mesophoyx intermedia</i>	White plumage, dark legs, thick yellow bills
Salikh / Indian Myna	<i>Acridotheres tristis</i>	Brown body, black head, yellow beak, yellow patches behind eyes.
Kak / Crow	<i>Corvus splendens</i>	Forehead, crown, throat and upper head glossy black, neck and breast are lighter grey in color; wings, tail and legs are black.
Pecha / Spotted Owlet	<i>Athene brama</i>	Upperparts grey, heavily spotted, white in color.
Kokil / Asian Koel	<i>Eudynamys scolopacea</i>	Long tailed, male are glossy bluish black, females are grey brown with white spots.
Ghughu / Spotted Dove	<i>Spilopelia chinensis</i>	Grey brown in color, spotted neck
Bulbuli / Bulbul	<i>Pycnonotus cafer</i>	Head with a squarish appearance, dark head, white rump and red vent.
BouKotha Kou / Black Hooded Oriole	<i>Oriolus xanthornus</i>	Bright yellow body with black hood and black parts of wings and tail
Tiya / Rose-ringed Parakeet	<i>Psittacula krameri</i>	Green in color with red ring on the neck.
Kubo / Greater Coucal	<i>Centropus sinensis</i>	Large in size, black in color with chest-nut brown wings.
HariChacha / Rufous Treepie	<i>Dendrocitta vagabunda</i>	Body is brown with black head and long grey tail with a black tip.
Chatare / Jungle Babbler	<i>Turdoides striata</i>	Body is brownish grey with yellow bill
Kath thokra / Black-rumped Flameback	<i>Dinopium benghalense</i>	Golden yellow wings, black rump, red crown.
ChatakPakhi / Ashy wood Swallow	<i>Artamus fuscus</i>	Grey upperparts with a dark head.
Finge / Black Drongo	<i>Dicrurus macrocercus</i>	Glossy black body with a long forked tail.
Doyel / Oriental Magpie Robin	<i>Copsychus saularis</i>	Small bird, with a long tail held cocked upright, black upperparts; white underparts and sides of wings and tail.
Tuntuni / Tailor Bird	<i>Orthotomus sutorius</i>	Small birds with green upperparts and whitish underparts.
Nil GolaBasantaBouri / Blue-throated Barbet	<i>Megalaima asiatica</i>	Green plumage, blue neck, red colored head
Moutushi / Purple Sunbird	<i>Cinnyris asiaticus</i>	Small bird with a down curved bill, male with glossy purplish upperparts, female with grey upperparts and yellowish lower parts.
Tower II		
Kak / Crow	<i>Corvus splendens</i>	Forehead, crown, throat and upper head glossy black, neck and breast are lighter grey in color; wings, tail and legs are black.
Chorai / House Sparrow	<i>Passer domesticus</i>	Males have dark grey crown, on the sides of the heads, under parts are pale grey to white, females are grey in color, without any black marks.
Salikh / Indian Myna	<i>Acridotheres tristis</i>	Brown body, black head, yellow beak, yellow patches behind eyes.
Bulbuli / Bulbul	<i>Pycnonotus cafer</i>	Head with a squarish appearance, dark head, white rump and red vent.
Chil / Kite	<i>Milvus migrans</i>	Upper plumage is brown, neck and head are paler, wings are black.
Finge / Black Drongo	<i>Dicrurus macrocercus</i>	Glossy black body with a long forked tail
Tuntuni / Tailor Bird	<i>Orthotomus sutorius</i>	Small birds with green upperparts and whitish underparts.
Moutushi / Purple Sunbird	<i>Cinnyris asiaticus</i>	Small bird with a down curved bill, male with glossy purplish upperparts, female with grey upperparts and yellowish lower parts.

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Microwave from cellular phone base stations possibly interfere the reproduction of birds like White Storks [25]. A very few number of natural nests of local birds have been found near the vicinity of the cell tower. Fall of sparrow population coincides with the emergence of cell phone [26]. In some cases radiation levels have been found higher than recommended values [27]. In spite of the presence of greenery at Site I, the occurrences of birds far away from the tower may

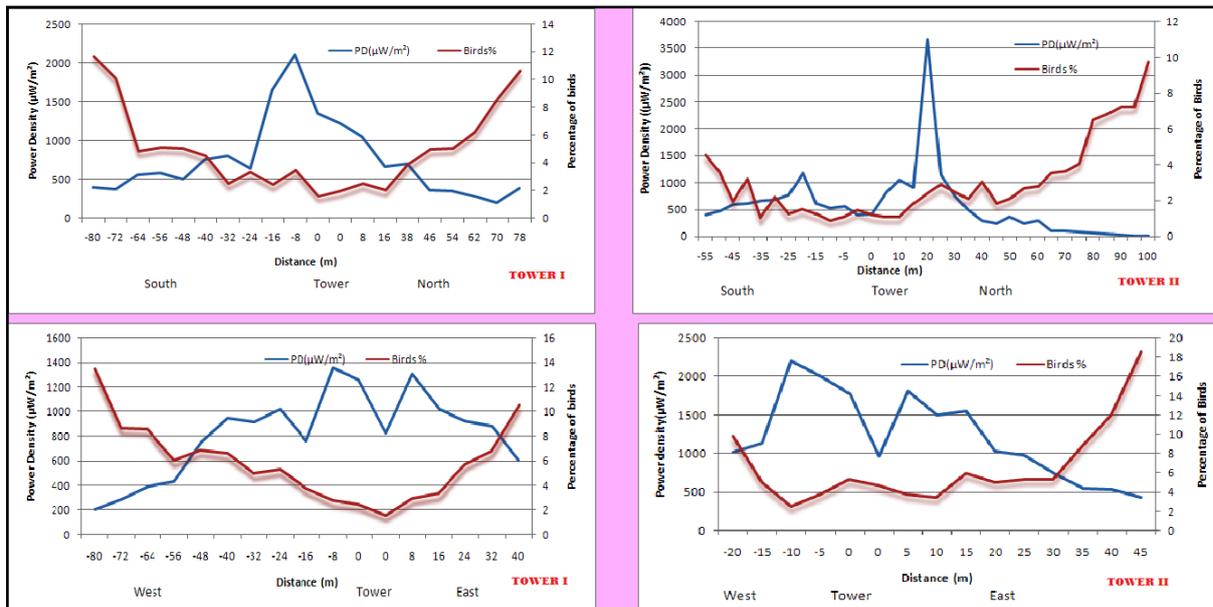


Fig. 1 Percentage of occurrence of birds and power density at different distances from the cell phone towers at four directions

be due to their tendency to avoid the impact of radiation. In case of Site II birds also avoid to come or build nests similarly ignoring the sufficient sources of food. However, more studies covering more cell phone towers at different locations will highlight more information regarding the potential impact of EMR on avians.

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