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Monitoring of Noise Levels at Various Sites during Winter Season at Bhindawas Wetland, Haryana, India

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ABSTRACT

Noise pollution has increased over the past century, especially the past few decades, disturbing the integrity of natural ecosystems. Higher noise level not only harms humans, but threatens the birds. It cause reduction of bird's species, reproductive failure and affect food availability. A comprehensive study on noise level of three pre-selected sites of Bhindawas wetland was carried out during the November 2010 and February 2011. At each site, noise level measurements were made at ten second interval for a period of 60 minutes. Equivalent continuous sound level (L_{eq}) ware ranged between 42.45 dB(A) to 55.66 dB(A) and 42.45 to 55.66 dB(A), respectively during the November 2010 and February 2011. It was observed that the road side site which is near to the canal water inlet to wetland has more noise level ($_{Leq}$) than the standard prescribed by the Central Pollution Control Board (CPCB) for a silence zone (50 dB). The higher values of the peak noise levels (L_1) was observed during the study period, which could be disturbed the birds and they fly away to the nearest water bodies.

Key words: Birds, noise level, ecosystem, Bhindawas wetland.

INTRODUCTION

Wetlands are found throughout the world landscape and covering nearly 6% of land area (i.e. 8.6 million km^2)[1]. Indian wetlands are home of the one fifth of country's biodiversity within less than 5% of the total geographical area of India[2]. A total of 4290 large lakes and uncountable small water bodies present in India[3,4]. Haryana is located between 27^0 29' to 30^0 56' N latitudes and 74^0 27' to 77^0 36' E longitudes, with total area of about 44, 212 sq. km. The state is a part of Indo- Gangetic Alluvial Plain. The state of Haryana consists of 1441 large wetlands and 10529 small wetlands. Approximately 42478 hectare area is occupied by these wetlands, which is 0.86 percent of the geographical area of Haryana[5]. Excessive developments in the state resulted in destructing of erstwhile balanced façade of environmental components. One visible effect is negatively influencing the age old rural wetlands[6].

Population of birds species are threatened due to various reasons viz., disturbance in habitat, agriculture activity, industrialization, urbanization, hunting, global warming and green house effect etc. The threatened birds are categories as near threatened (close to vulnerable), vulnerable (having risk of extinction), endangered (having high risk of extinction), critically endangered (likely to be extinct) and extinct (not found for at least 50 years) and data deficient (having no specific information)[7]. Many avian species have long been exposed to loud natural sounds such as streams, waterfalls, and wind. However, noise pollution due to the human activity is a relatively recent phenomenon that the birds now have to cope with throughout much of the

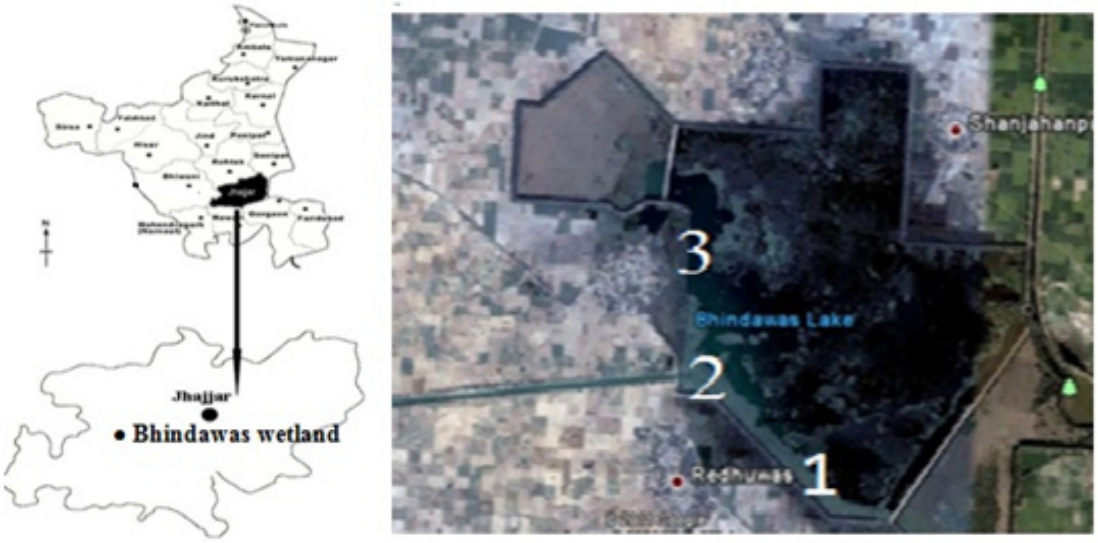
world. Birds communicate with each other through the songs. They call the other birds to attract the partner for mating, confinement to reside in their territories, to contact with groups for searching of food and warning of danger[8-10]. Bird responses to noise includes physical damage to ears, stress responses, flight or flushing responses, changes in foraging, and other behavioral reactions. Beside these some additional responses are also shown by birds. These are avoidance of noisy areas, changes in reproductive success, changes in vocal communication, shifts in vocal amplitude, song and call frequency, and song component redundancies as well as temporal shifts to avoid noisy environment. Sounds are the part of the environment but noise pollution has increased over the past century, especially the past few decades, disturbing the integrity of natural ecosystems[11].

Numerous investigators have documented the bird's community of wetlands[12-14]. There are few studies also estimated the effects of noise on bird's community[15-17]. The noise level monitoring in the wetlands is essential for selecting the management priority. In this study, an attempt has been made to determined the noise level aspects of Bhindawas wetland during the migratory season in order to assess the enhanced noise level due to development activity and vehicular movement.

MATERIALS AND METHODS

Study Area

Bhindawas bird sanctuary is a low-lying area of district Jhajjar (Haryana). It is located 15 Km away from Jhajjar district headquarters and 80 Km from Delhi located at 76^0 31' East and 28^0 32' West (Fig. 1). Mean minimum and maximum temperature were 7 C (January) and 40.5 C (May & June), whereas mean annual rainfall is 444 mm in the study area. Birds are the main attraction of the wetland complex. More than 30,000 varieties of migratory birds belonging to over 250 species and resident birds visit the wetland throughout the year. The total area of sanctuary is 1074 acres. The escaped water through the channel from the Jawaharlal Nehru Canal during the power failure on the Pump House made on the canal store in the wetland, man-made embankment periphery. Excess water of the wetland is siphoned off in the drain no. 8 through outlet channel. Drain no. 8 is a recipient of storm water as well as sewage, because some of the towns have a combined system of disposal for sewage and storm water.



Site 1= Near Redhuwas village Site 2= Near canal water inlet to wetland
Site 3= Near Chadwana village

Fig.1: Map of the study area

Noise monitoring

Monitoring of noise was done at three sites, namely; near a Redhuwas village (site 1), road side near the canal water inlet (site 2) and near the Chadwana village (site 3) in November 2010 and Febuary 2011, which is the season of migratory birds.

For the purpose of noise measurements Cesva 310 Sound Level Meter has been used. In the present study, the instantaneous sound pressure levels were recorded in Bhindawas wetland during the day time. Monitoring was done at a distance of 5 meters from the edge of the road and periphery of wetland and sound level meter was kept at the height of 1.2 meters from the ground. At each site, noise level measurements were made at 10 second intervals for a period of 60 minutes at each site. In other words a total of 360 data points of instantaneous sound pressure levels were obtained from each site. The instrument has the option to be attached to a data logger for making continuous measurements of noise levels. The data on instantaneous sound pressure levels, thus collected was fed and stored in a personal computer. Using this data various percentile indices (L_1, $L10$, L_{50}, L_{90}) were estimated with the help of a very popular computer software Excel. It is pertinent here to mention that the equipment used in the present study is not an integrating sound level meter. In other words, equipment does not have the inbuilt facility of calculating the L_{eq} noise levels from the data recorded for the specified interval of time. In view of this limitation the following expression is used for the estimation of L_{eq} levels in the present study.

$$L_{eq} = L_{50} + \frac{(d^2)}{60}$$

Where $d = L_{10} - L_{90}$

During the collection of data, numbers of vehicles passing by the observation point were also taken into account.

RESULTS AND DISCUSSION

Noise level

The measured noise level from 3 sites in the vicinity of wetland area have been depicted in figure 2 and figure 3. L_1 was the measurement of the peak noise level at a given site. L_{10} was considered intense noise, L_{50} was average noise level and L_{90} was back ground noise levels at a given site. It was observed that L_1, L_{10}, L_{50}, L_{90} ranged between 54.5 to **70**.4 dB(A), 47.2 to 58.2 dB(A), 42.1 to 46.8 dB(A) and 39.3 to 42.8 dB(A), respectively during the November 2010, whereas L_1, L_{10}, L_{50}, L_{90} were ranged from 52.6 to **72**.4 dB(A), 46.6 to 61.9 dB(A), 40.4 to 48.7 dB(A) and 37.1 to 40.8 dB(A), respectively

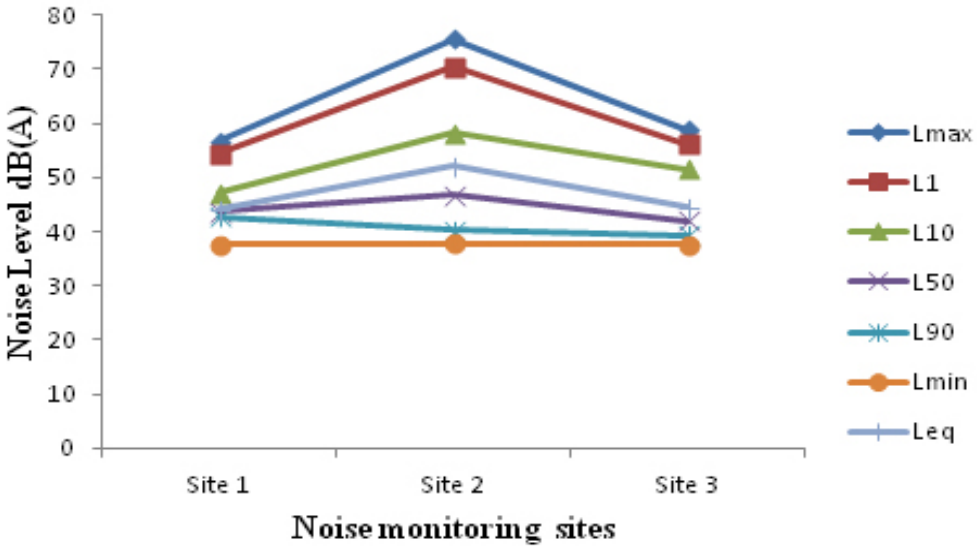


Fig.2: Noise level at different monitoring sites during month of November 2010

during the February 2011. One of the most widely used index of noise is equivalent continuous sound level (L_{eq}). This is the level of theoretical constant noise equivalent in energy contents to the actual fluctuating noise over a given period of time. L_{eq} was ranged between 42.45 to 55.66 dB(A) and 42.45 to 55.66 dB(A), respectively, during the November 2010 and February 2011. The maximum noise levels (L_{max}) were ranging between 56.8-75.6 dB(A) and 55.2-76.2 dB(A) respectively, during the November 2010 and February 2011 at studied sites. The noted levels were higher than the permissible limits for silence zone (50 dB) as prescribed by the Central Pollution Control Board (CPCB). The minimum noise level (L_{min}) values were ranging between 34.7-37.8 dB(A) during the Nov. 2010 and 37.1-40.8 during the Feb. 2011. L_{eq} was found maximum at road side near canal water inlet (52.14 dBA) and minimum (44.02 dBA) at near Redhuwas site during Nov. 2011. However during Feb. 2011 highest L_{eq} was observed on the same site with 55.6 dB (A), where as lowest L_{eq} 42.4 dB (A) was found at near the Chadwana village site. On comparing the L_{eq} noise results with the standards prescribed by the CPCB for silence Zone (50 dB) in day time, it was observed that the only road side site which was near to the canal water inlet to wetland has more noise ($_{Leq}$) than the standard mentioned for silence Zone. Higher values of the peak noise levels (L_1) as noted during the monitoring periods may disturbed the the migratory and local birds, mainly large size birds which preferred to live in shallow water on the banks. Highest noise was observed at the road side site, due to the movement of large, medium and

Table 1: Number of vehicles pass during the monitoring period

S.No	Type of Vehicle	November 2010			February 2011		
		Site 1	Site 2	Site 3	Site 1	Site 2	Site 3
1.	Bikes	7	29	6	4	36	6
2.	Auto	0	3	0	0	5	0
3.	Jeep	0	5	0	0	8	0
4.	Tractors	0	3	0	0	2	0
5.	Bus	0	1	0	0	1	0
6.	Car	0	6	0	0	6	0

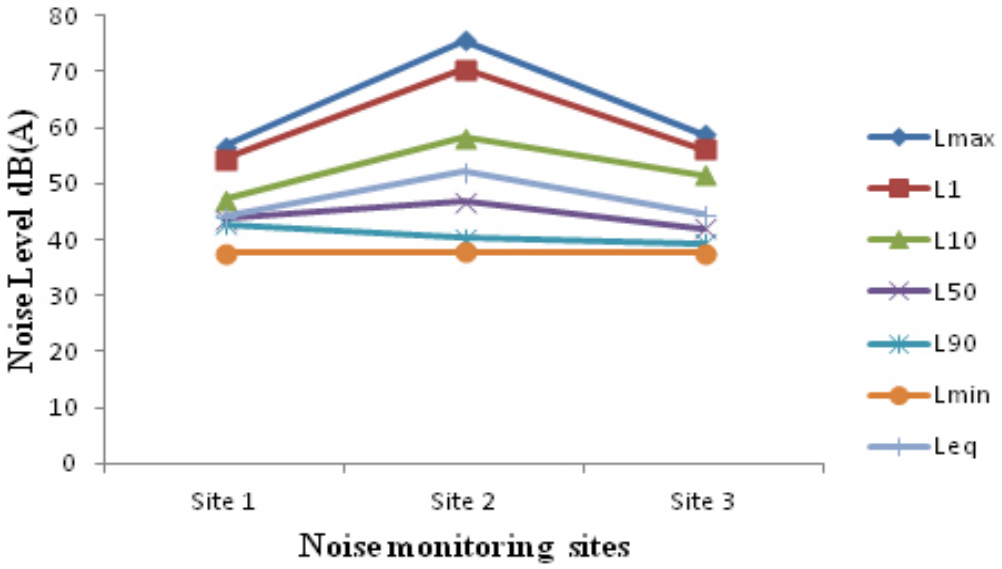


Fig.3: Noise level at different monitoring sites during month of February 2011

light vehicles. It was also observed that two sites showed the increase trend of noise levels from Nov. 2010 onward, whereas one site (near Redhuwas) showed the decreasing trend of noise during Feb. 2011. Temporal variation in noise level was very low, it could be due to the lacking of addition noise source during the monitoring period.

An attempt has been made to explain the observation behavior in the light of vehicles recorded at each site. Number of vehicle passed during the monitoring period of one hour at each site has been given in Table 1. It was found that light vehicles were dominated followed by car, jeep, tractor, auto and bus at road side near canal inlet. Only bikes were observed at other two sites during monitoring period.

Kumar[18] conducted the study of the avian faunal diversity of Bhindawas wetland in 2011. They reported the total of 66 species of wetland birds belonging to 30 families. Out of the total 66 species, 48 were resident and 18 (27.3%) were migrant species. Gupta et al.[19] studied the Khaparwas bird sanctuary, which is adjacent (2 km distance) to the Bhindawas bird sanctuary in Jhajjar district from 1997 to 2002. They recorded 16 Orders and 44 families with a total of 164 bird's species. From these 164 birds species, residents species were 104, winter migratory species were 45, local migratory species were 9, summer migratory species were 5 and one species was Straggler. The results of these studies suggest that significant reduction in the bird's diversity from 2002 to 2011. However, it is difficult to estimate that decline in bird's population could be due to the higher noise level on the some sites in Bhindawas wetland. Some studies indicate that birds are sensitive towards higher noise level. Saha and Padhy[7] reported the lower noise level in Ballavpur Wild Life Sanctuary (BWLS) forest and higher noise level in Lalpahari in the Birbhum forest division, West Bengal. They observed that in Ballavpur Wild Life Sanctuary (BWLS) resident birds species were 51, winter-visitors were 16, local migratory were 4, where 7 species come under the both resident/ local migratory. The total bird's species in BWLS were 78. The total numbers of avian species found in Lalpahari were only 25 species. Patón et al.[20] in cities and village of Spain and Portugal studied the urban noise effects on 91 bird's species in 27 parks. They demonstrated that noise is important factor in distribution of birds. However, other factor like characteristics of parks also correlated with abundance of number of species. They also suggested that reduction of noise level below 50 dB using acoustic barriers could be attracting the many of these bird's species to urban gardens. The thin distribution and reduced bird's population could be due to high volume of noise in urban gardens.

CONCLUSION

The noise level was measured at three sites during Nov. 2010 and Feb. 2011. L_{eq} was ranged between 42.45 dB(A) to 55.66 dB(A) during the month of November 2010 and 42.45 to 55.66 dB(A) during Feb. 2011. A road side site near to canal water inlet showed higher L_{eq} noise than standards prescribed by the CPCB for silence Zone (50 dB) in day time. It was observed that the bird's population decline with the time, it could be due to development activity in the surrounding area and noise created by vehicular moment on the periphery. The Govt. of India, Ministry of Environment and Forest declared the protected area upto 5 kilometers of Bhindawas Wild Life Sanctury as an Eco-sensitive Zone and directed the Department of Environment and State Forest Department, Haryana to draw guidelines and regulations for the control of noise in the Eco-sensitive Zone. The baseline information in the form of noise level may be highly useful for future for rehabilitation and conservation of Bhindawas wetland. Noise levels should be reduced below 50 dB by planting noise absorbing tree species on the road side and imposing restriction of vehicular movement on the peripheral embankment of the wetland.

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