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Research Article

BIODIVERSITY ASSESSMENT OF BIRD SPECIES AS BIOINDICATORS AND THE IMPACT OF AIR POLLUTION ON THE ECOLOGICAL COMMUNITY

Sombuddha Roy Bhowmick*

Department of Biotechnology, St. Xavier's College, Kolkata, India

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ABSTRACT

Biodiversity or variation of species distribution of the biotic world, in the ecosystem is an important factor to device the fate of ecosystem functioning and the health of the biotic world, and their relation with the abiotic world, constituting a specific niche in the ecological community. Biodiversity forms a greater complex of various life forms and in turn regulates how the biotic world interacts with the abiotic world and vice versa. Biodiversity, impacts the quality of life of the living organisms. Changes in the biodiversity of an ecosystem show us the way to figure out the causes behind the ecological health degradation. Birds serve a wide range of environmental functions and services in an ecosystem. Though biodiversity cannot be defined by any single factor, as it is a complex of various factors, which cannot be segregated individually yet, we have tried to measure the biodiversity in a very elementary manner and hence, define and measure the biodiversity of the communities. The current study assesses the bird diversity in two green zones, in the city of Kolkata. They act as bioindicators of vehicular pollution, landscape changes through change in vegetation cover, urbanization and human activities. Human disturbance and high pollution rate was found to be the defining factor, to measure the biodiversity index in these two habitats. It was carried out in two sampling stations, one was at the Rabindra Sarobar and the other was at the Elliot Park. The bird diversity was assessed both qualitatively and quantitatively through various statistical indicators, of biodiversity such as-Species Richness, Species Evenness, Shannon-Weiner Diversity Index, Brillouin Index and Simpson's Index of Diversity. The paper is based on a very preliminary approach towards establishing the relation between biodiversity and air pollution, more precisely the AQI (Air Quality Index). It has been observed here, that with increasing levels of air pollutants, biodiversity within a local ecosystem or habitat decreases and the degree of correlation is highly significant. This high correlation coefficient become very significant, as birds are conspicuous, avian species and are more exposed to airborne particles. They also have a higher breathing rate. This study also focuses on loss of species from a local area (Local Extinction) and Functional Extinctions (the reduction of species, such that, it no longer plays a significant role in ecosystem functioning) which have received little attention compared to Global Extinctions (loss of all individuals of a species from its entire range). Further research and detailed experiments are needed in relation to biochemical and genetic damages in the bird species with respect to air pollution. Though it could be concluded that, bird diversity is impacted by pollution and air pollution has a very significant role in determining the diversity and count of the avian species in the respective niches. This study can be useful to check and keep track of the ecological functioning and proper biogeochemical cycle rolling, from time to time, as with change in biodiversity, these factors would tend to get impacted. The scope of the paper rotates around the idea and hypothesis about how significantly the biodiversity of one region is impacted by air pollution. It must be borne in mind, that no other factors including prey-predator interactions, competition or symbiosis have been considered while calculating the bird diversity. It must also be noted, here, that no physicochemical aspects of the pollutants or biodiversity has been considered within the scope of this study. The bird diversity acts as bio indicators for urban pollution, deforestation, habitat fragmentation as well as, human interference in the ecological community.

Keywords: Biodiversity, Air Pollution, Bio-monitoring, Bird species, Bio-indicators, Ecological community.

INTRODUCTION

Biodiversity can be defined as the variety and variability of life in the ecosystem or ecological complex, in which the living organisms are a part of. Biodiversity forms the foundation of the greater complex of life forms and the interactions. Biodiversity has many dimensions, and in order to characterize the multidimensional state and arrangement of the system, we need to characterize the biota into taxonomic, ecological, genetic diversity and so on. Changes in the biodiversity provide ways and means to study the ecosystem and the interaction of the ecosystem, the habitat with the biotic world, that is, to say, the niche. Biodiversity includes both managed and unmanaged ecosystems. Unmanaged ecosystems include forests, natural parks while the managed ones include urban parks, wetland sites and so on. Biodiversity in the unmanaged ecosystem is always greater than the managed ones, where deforestation, human interference and urbanization are provisional hindrances to the bio-diversity. But, yet if we can correlate our studies to

*Corresponding author e-mail:
sombuddharoybhowmick100@gmail.com

measure biodiversity in these managed ecosystems, we can clearly get an indication about how rapidly, our urban life and urban ecology and the habitat is changing. The pollution being one of the main causes behind this rapid decline in the biodiversity. The quality of air, water impacts the niche and changes the way, an organism interacts with the abiotic world. So, a change in the structure and functioning of the ecosystem surely finds a way, in changing biodiversity statistics in our ecosystem, here, urban ecosystem (scope of study is limited within urban ecosystem, to strengthen the focus of how pollution is a monstrous factor behind the degradation) (Köhler HR et al.2013).

Species composition as much or more than species richness, matters when it comes to ecosystem services. In a particular community, ecosystem functioning is governed by the ecological niche of the most abundant species, and not by the total number of the species (Muhammad NR et al.2011). The relative abundance of the species holds the key, in this respect. Conservation or restoration of biological communities is a critical aspect of maintaining the ecosystem services. Loss of species from a local area (Local Extinction) and Functional Extinctions (the reduction of species, such that,it no longer plays a significant role in ecosystem functioning) have received little attention compared to Global Extinctions (loss of all individuals of a species from its entire range).In this study, we try to highlight the loss of species or abundance of species or variation in the number of species,within a similar vegetation zone or habitat, and the reasons behind it. Ecosystems are impacted by air pollution, particularly sulphur and nitrogen emissions as well as ground level ozone (Colestock KL 2007). Ecosystem conversion and ecosystem degradation contribute to habitat fragmentation. Loss of habitat from exploitation of resources, agricultural conversion and urbanization is the single most important factor behind the constant loss of biodiversity. Birds are affected by the same respiratory problems as us, the humans, when exposed to air pollutants. So, the effects of air pollution extend to the bird habitats and their niches as well as, to the changing landscape and biodiversity of the community in subtle, but very significant ways (Eeva BE et al.2012).

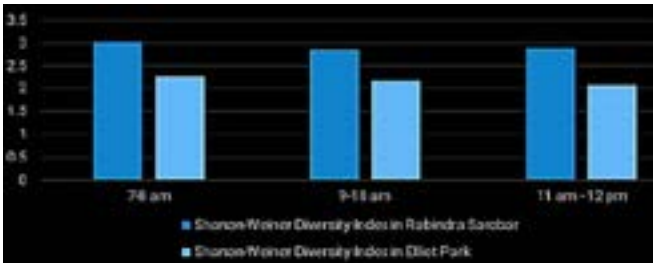
The biodiversity and the effect of pollution on the species composition in the habitat, has been studies and analyzed in this paper, on an elementary level. But it provides us with a clear hypothesis that, pollution does play a role in varying biodiversity and varying degree of species abundance even within regions of similar ecological communities. Two sampling stations have been selected, in the city of Kolkata, Rabindra Sarobar and the Elliot Park. Both are relatively greener zones and provide a better site of study for bird diversity.

These habitats are often more manageable areas of study as they are more condensed than the larger part of the mainland ecosystem. Robert MacArthur and E.O. Wilson (1967) in their 'The Theory of Island Biogeography' showed that the species richness in an area could be predicted in terms of factors, such as habitat area, where they have put focus on the role, the microhabitat plays. This theory is considered one of the fundamentals of ecological theory. The application of this theory, to habitat fragments and variation in the population of species in these fragments, suggest that some micro factors within a macro setup, is inevitable to cause this differentiation. And, disturbances in ecosystem functioning, due to pollution plays an integral part to create an imbalance between the diversity of species or varying degree of bird population in different habitats or microhabitats. Thus, Local Extinction or loss of species from the microhabitats is the primary aim and objective of the study

MATERIALS AND METHODS

Habitats under study

A. Rabindra Sarobar Region . B. Elliot Park Region (Table 1).



Figures 1. *Comparison of Index of Species Richness between two habitats, during the time intervals.*

Table 1: summarizes the description of the habitat,in a very compact manner.

Details	Rabindra Sarobar	Elliot Park
Area covered	300,000 sq m	8362 sq m
Average temperature (Summer)	Day 38°C	Hexane
Night 29°C	Day 38°C	Hexane
Night 29°C	Hexane	Hexane
Average temperature (Winter)	Day 27°C	Hexane
Night 13°C	Day 27°C	Hexane
Night 13°C	Hexane	Hexane
Humidity	96% (Max)	Hexane
69% (Min)	91% (Max)	
56% (Min)		
Rainfall	Moderate	Moderate
Wind	28 km/hr	23 km/hr
Latitude	22.51117° N	22.5480° N
Longitude	88.3591 ° E	88.3482° E

Bird Census Data: The line transects method has been followed for bird sampling and census data table. For both the habitats, stops were made for every 200 meters for bird survey count, and it was recorded for all contacts (species under study), on either side of the track traversed. The distance was kept in check throughout the study period and ample measures were taken to prevent miscounting of the bird species. Best of efforts were undertaken to reach a satisfactory sample number for the census data table (Gregory et al., 2005).

The different species of birds observed in this community

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House Crow (Corvus splendens), House Sparrow (Passer domesticus), Asian Pied Starling (Gracupica contra), Jungle babbler (Argya striata), Lineated barbet (Megalaima lineata), Common myna (Acridotheres tristis), Asian open bill stork (Anastomus oscitans), Black drongo (Dicrurus macrocercus), Pond heron (Ardeola grayii), White breasted water hen (Amaurornis phoenicurus), Orange headed thrush (Geokichla citrina), Purple rumped sunbird (Leptocoma zeylonica), Green bee eater (Merops orientalis), Common kingfisher (Alcedo atthis), Asian koyel (Eudynamys scolopaceus), Coppersmith barbet (Megalaima haemacephala), Oriental magpie robin (Copsychus saularis), Shikra (Alcipiter badius), Black naped oriole (Oriolus chinensin), Spotted Dove (Spilopelia chinensis), Rufous treepie (Dendrocitta vagabunda), Lesser flame back woodpecker (Dinopium benghalense), Common tailorbird (Orthotomus sutorius), Red vented bulbul (Pycnonotus cafer), Indian cormorant (Phalacrocorax fuscicollis) and White breasted kingfisher (Halcyon smyrnensis).

Table: 2

The different species of observed in the Elliot Park community (Carignan V et al., 2002)-

House crow (Corvus splendens), House sparrow (Passer domesticus), Common myna (Acridotheres tristis), White browed wagtail (Motacilla maderaspatensis), Black drongo (Dicrurus macrocercus), House pigeon (Columba livia domestica), White swan (Cygnus olor), White duck (Anas platyrhynchos), Red whiskered bulbul (Pycnonotus jocosus), Pond heron (Ardeola grayii), Asian pied starling (Gracupica contra), Red wattled lapwing (Vanellus indicus) and Large cormorant (Phalacrocorax carbo).

Table: 3

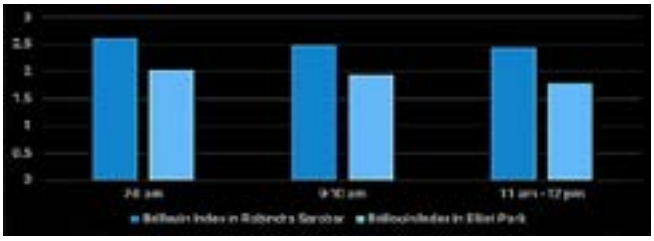

Figure 3: *Comparison of Shannon-Weiner Diversity Index between two habitats during the time interval.*

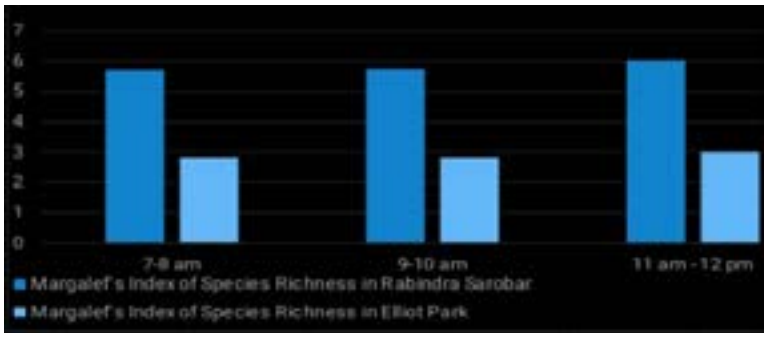

Figure 2: *Comparison of Species Even news Index between two habitats, during the time internal.*

Table 2: *The census data table,of the population of bird species recorded in the Rabindra Sarobar Region, Kolkata.*

Serial No	Bird Species (Common Name)	No of individual species between 7-8 am	No of individual species between 9-10 am	No of individual species between 11-12 pm	Serial No	Bird Species (Common Name)	No of individual species between 7-8 am	No of individual species between 9-10 am	No of individual species between 11-12 pm
1	House Crow	12	14	10	14	Common Kingfisher	2	1	0
2	House Sparrow	7	10	10	15	Asian Koyel	2	3	2
3	Asian Pied Starling	3	3	1	16	Coppersmith Barbet	4	2	1
4	Jungle Babbler	4	1	4	17	Oriental Magpie Robin	3	5	2
5	Lineated Barbet	1	2	2	18	Shikra	2	4	1
6	Common Myna	2	0	3	19	Black naped Oriole	3	1	2
7	Asian Open Bill Stork	4	4	1	20	Spotted Dove	1	2	3
8	Black Drongo	3	3	2	21	Rufous Treepie	1	0	3
9	Pond Heron	6	5	3	22	Lesser Flameback	1	1	2
10	White Breasted Water Hen	5	5	3	23	Common Tailorbird	4	3	1
11	Orange Headed Thrush	1	1	1	24	Redvented Bulbul	2	1	0
12	Purple Rumped Sunbird	1	2	2	25	Indian Cormorant	1	1	1
13	Green Bee-eater	2	2	2	26	White Breasted Kingfisher	3	2	1

Table 3: *The census data table ,of the population of the bird species recorded in the Elliot Park Region, Kolkata.*

Serial No	Bird Species (Common Name)	No of individual species between 7-8 am	No of individual species between 9-10 am	No of individual species between 11-12 pm	Serial No	Bird Species (Common Name)	No of individual species between 7-8 am	No of individual species between 9-10 am	No of individual species between 11-12 pm
1	House Crow	16	18	17	8	Duck	6	5	3
2	House Sparrow	14	16	14	9	Red Whiskered Bulbul	1	2	1
3	Common Myna	5	6	3	10	Pond Heron	2	3	0
4	White Browed Wagtail	4	2	2	11	Asian Pied Starling	2	2	3
5	Black Drongo	6	2	4	12	Red Wattled Lapwing	2	1	2
6	House Pigeon	3	3	3	13	Large Cormorant	4	4	1
7	Swan	4	5	3					

The data regarding the air pollution level and the air quality index has been noted down from the Air Quality Information System data from the website of West Bengal Pollution Control Board (WBPCB). The data is put up on the website for public use, and we have made use of the data, for the purpose of our study. WBPCB as well as the CPCB (Central Pollution Control Board) measures the air quality of the cities and various places in the cities, through the installed air quality monitoring stations, placed at different nook and corners of the city. Specific parameters like oxides of sulphur, oxides of nitrogen respirable particulate matters are monitored in the ambient air quality monitoring stations. Various pollutants are measured in these stations like Nitrogen dioxide, sulphur dioxide, carbon monoxide, carbon dioxide, ground level ozone, PM 2.5 (Particulate Matter) and PM 10(Chambers SA, 2008) The maximum and minimum concentration as well as the average concentration of each of these pollutants are provided in the website of the WBPCB. The summary of the individual pollutants, i.e., the AQI was also noted down from the website data. We took a note of the AQI report, of the stations, closest to our places of study, during the time intervals of our observation of the bird population.

Table: 4

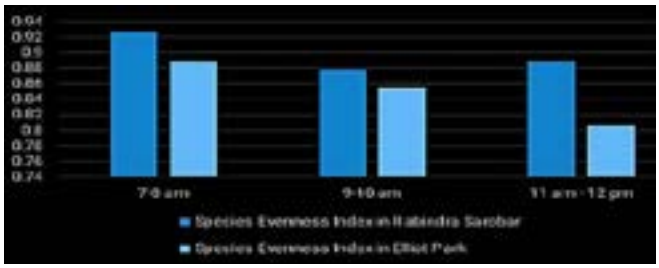

Figure 4: *Comparison of Brillouin's Index of Diversity between two habitats during the time interval.*

Table 4: *The detailed report of the AQI values ,that had been noted from the website, on the day of our bird census population study.*

Time Period	Air Quality Index at Rabindra Sarobar	Air Quality Index at Elliot Park
7-8 am	59	62
9-10 am	60	64
11-12 pm	62	67

THEORIES AND CALCULATION

A variety of processes have been devised to measure the biodiversity in an empirical manner. The idea of biodiversity index is a quantitative requirement to estimate the variability in time and space.

The various indices and measurements of biodiversity can only be understood and studied, while comparing between the diversity of habitats or communities. Individually they are not so significant, to denote the concept of diversity. While calculating biodiversity, through different biodiversity indices, the measurement has been based on certain assumptions (Hair, J. F,2014).

a. All species are equal- No distinction is made among species and little abundance is given to the species, that are exceptionally abundant, in the same way, those which are exceptionally rare.

b. All individuals are equal- No distinction is made between the largest and the smallest individual in that particular ecosystem.

Species richness: It can be defined as the measure of the total number of the species in a community. Although it is an unattainable goal to include the complete set of all the species of the community, yet, species richness provides us with a simple measure of the biodiversity and the count of the number of species in a given area. This measure is strongly

dependent on sampling size and effort. Species richness does not take into count, the relative abundance distributions. It remains strongly influenced by the sampling effort.

Species Evenness Index: Species Evenness Index describes how close the species in the community or habitat, are in their numerical figures. This index defined biodiversity which quantifies about the numerical equality of the two different ecological communities.

The ecologists describe the relative abundance of the species, as its evenness. It's described in such a way, that an even distribution of area among patch types results in maximum evenness. It's the complement of dominance. In simple words, this index gives us an idea about how evenly the species are distributed, in the two dataset of population of bird species, or in a community.

Species Diversity: The species diversity, consisting of three components-species richness, taxonomic or phylogenetic diversity and species evenness. In simple terms, species richness can be described as the simple count of species, taxonomic or phylogenetic diversity as the genetic or evolutionary relationship between the different groups of species in a given community (i.e. the dataset), and species evenness can be summed up as the abundance of the species.

Species diversity can be quantified as the effective number of species, in a given ecological habitat, where the effective number of species is, the number of equally abundant species, needed to obtain the same mean proportional species abundance, as that observed in the dataset (Hill, M.O. 1973).

While sampling all relevant individuals of the sampling area was obtained. Species diversity can be summed up as the number and frequency of the species, in the habitat.

Three species diversity indices have been used to compare the biodiversity of the two habitats,

A. Shannon-Weiner Diversity Index: It's a mathematical measure of species diversity in a community. Diversity indices provide more information about community composition than simply species richness. This index focuses on providing the answer about the rarity and commonness of the species. Shanon-Weiner Index along with the Brillouin Index are information statistic indices, that take into consideration the count of the rare species.

B. Brillouin Index: This index describes a known population. There is certainly no space for uncertainty, while using this index. Brillouin index places more emphasis on species richness and is moderately sensitive to sample size.

However, when the two indices are used to measure the diversity of a particular dataset, Brillouin index will always produce a lower value because it describes the collection of a known range of sample, having no uncertainty. The Shanon Weiner Diversity Index estimates the diversity of the unsampled as well as the sampled portion of the community, considered within the scope of the study.(Spellerberg, Ian F. et al.2003; Hurlbert et al.1971; Colinvaux et al.1973).

C. Simpson's Index of Diversity: The value of this index ranges between 0 and 1.The greater the value, the greater the sample diversity. This index represents the probability that, two individuals randomly selected from a sample will belong to different species. Simpson's Index puts more weight to the more abundant species in the sample.

It gauges the diversity differences in the population. The index gives us a clear idea, about which population is more diverse. The disadvantage is that, it is heavily weighted towards the most abundant species, as all are, in dominant indices. The addition of rare species with individual count, fails to change the index.

a. The following biodiversity indices were calculated using defined statistical measures (Egwumah FA, et al. 2015). Species Richness (d)

$= S - 1 / \ln N$ where, S=number of species, ln N=natural logarithm of the total number of individuals.

b. Index of Dominance (C)

$= \sum (ni/N)2$ where, ni=importance value for each species (number of individuals), N=total number of importance value.

c. Shannon-Wiener diversity index (H') H'

$= -[\sum Pi \ln Pi]$ where, Pi is proportion of species i relative to the total number of species, and ln Pi is natural logarithm of this proportion.

d. Evenness index Species Evenness

$= H'/ \ln (S)$ where, H' is Shannon Diversity Index; S is Species Richness (number of species), and ln (S) is natural logarithm of species Richness.

Tables: 5 and 6

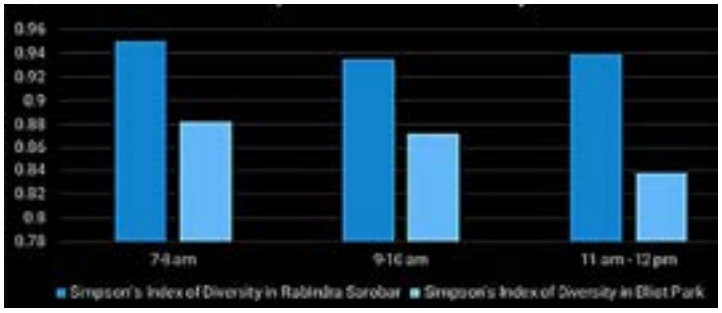

Figure 5: *The values of different biodiversity indices, calculated through statistical methods, with the help of the bird census data table of the population count.*

Table 5: *The values of different biodiversity indices, calculated through statistical methods, with the help of the bird census data table of the population count.*

Index Value	Rabindra Sarobar 7-8 am	Rabindra Sarobar 9-10 am	Rabindra Sarobar	Elliot Park 7-8 am	Elliot Park 9-10 am	Elliot Park 11-12 pm
Margalef's Index of Species Richness	5.705	5.738	6.034	2.834	2.834	2.981
Species Evenness Index	0.926	0.877	0.888	0.888	0.854	0.806
Shanon-Weiner Diversity Index	3.017	2.859	2.892	2.278	2.191	2.067
Brillouin Index	2.599	2.469	2.43	2.014	1.934	1.788
Simpson's Index Of Diversity	0.95	0.935	0.939	0.882	0.872	0.838

Table 6: *The degree of relation.*

Correlation Coefficient (only magnitude) between AQI values and	Rabindra Sarobar	Elliot Park
Species Richness	r=-0.97	r=-0.93
Species Evenness	r=-0.64	r=-0.99
Shannon-Weiner Index	r=-0.61	r=-0.99
Brillouin's Index	r=-0.87	r=-0.99
Simpson's Index	r=-0.54	r=-0.98

The negative value of the correlation coefficient, that is, the "r" indicates the fact that with increase in value of one parameter, there is a consequent decrease in the other dependent parameter as well, and vice versa. Here, it indicates that with increase in AQI of a particular habitat, the biodiversity indices of that habitat would decrease, and vice versa (Marzluff J.M et al., 2001). A high correlation coefficient denotes how strongly a change in one parameter, would affect the other parameter, dependent on it.The relation between two factors or entities can be established by correlation coefficient and thus, the air pollution and biodiversity are interdependent and inversely related to each other. The degree of relation is featured in the Table 6 above (Tanveer A et al., 2002).

RESULTS AND DISCUSSION

All forms of pollution pose a grave threat to the biodiversity of our ecosystem, but in particular nutrient loading, mainly of nitrogen and phosphorus, which is a major and increasing cause of biodiversity loss and ecosystem dysfunction. This in turn leads to the loss of species richness. Urbanization is the largest factor contributing to the loss of biodiversity. Pollution from burning of fossil fuels, automobiles, and factories remain in the air as particle pollutants (Yokohari M et al., 2000). It causes acidification of water resources, sensitive soil nature, slower growth of plants and tree damage at high elevations. It must be noted beforehand, that many species are vulnerable to the indirect effects of pollution due to the excess concentration of toxic chemicals in top predators of food chains and disruption of the prey-predator interactions. Nitrogen and Phosphorus deposits have harmful effects on birds, which lays eggs, with more fragile and porous shells. Plant diversity is also reduced (Newton I, 1995).

Accumulation, may also be associated with changes in species composition and altered functioning of the food web. Changes in biotic interaction among species-predation, parasitism, and competition can lead to disproportionately large, irreversible and often negative alterations of ecosystem processes (Dueñas A.H et al., 2014). In addition to direct interactions such as, predation, parasitism the maintenance of ecosystem process also depends upon indirect interactions such as, a predator preying on a dominant competitor, such that the dominant species is suppressed, which permits the subordinate species to co-exist (Soetaert, K et al., 2009).

Changes in biodiversity occurs due to high levels of AQI (Air Quality Index), greater variability in weather patterns and distribution of vegetation in the landscape. Deposition of oxides of sulphur and nitrogen, emitted from vehicles in urban regions affect the flora and fauna, as well as the efficiency of the nutrient cycling process (Sombuddha RB, 2019). The process of accumulation of nutrients, i.e. Eutrophication often results from air pollution. Overload of nutrients can cause algal blooms, and depletion in the levels of Dissolved Oxygen (D.O.), in the aquatic ecosystem, and ultimately biodiversity is impacted. Loss of plant cover due to urbanization affects biodiversity too, in both direct and indirect manner. Trees and vegetation cover absorb pollutants such as, ozone, oxides of nitrogen, particulate matters and helps improve the air quality. Affected vegetation has negative consequences on important ecosystem services like that are of capturing carbon and reducing impacts of climate change (Aiken, L. S et al., 1991).

Birds are exposed to more airborne particles, because birds have a higher breathing rate and spend more time in open air. Polycyclic Aromatic Hydrocarbons (PAHs), toxic chemicals may cause reduced egg production and hatching in the bird species, increased brood abandonment and reduced growth. Various studies have found that over time, increased ozone levels may reduce species diversity, alter water and

different other nutrient biogeochemical cycles (Aiken, L. S et al., 1991). Soil and water acidification may reduce the abundance or the nutritional value of the birds food sources. In some areas, this means lower calcium availability. Since, calcium is a necessary component of eggshells, less calcium means smaller clutch sizes and more fragile egg shells. Birds are affected by the same respiratory troubles as humans, and long term exposure to polluted air, having high AQI value may cause a change in the body structure, loss of body weight and lower RBC (Red Blood Corpuscle) count in their body(Steward, P. T. A. et al, 1985).

A highly significant relationship was observed between the different indices of biodiversity and the air pollution rate, the AQI. With increasing AQI or with increasing concentration of air pollutants, oxides of nitrogen, sulphur or ground level ozone or suspended particles, there is a marked decrease in the biodiversity indices. In the Rabindra Sarobar area, the biodiversity index was higher than the Elliot Park area, and in relation, the AQI values were lower in Rabindra Sarobar region than the Elliot Park.

Species composition is a contributing factor, to the ecosystem services. And, biodiversity is directly related to the ecological functioning and ecosystem services. The biodiversity indices were higher at Rabindra Sarobar, as with the species composition and species abundance. The better, a living organism can interact with the niche, without any external disturbance, the better the ecosystem functions, through the regulation of various biogeochemical cycles. Habitat fragmentation, loss of habitat from exploitation of resources, niche degradation due to habitat loss, urbanization all contributes to the ecosystem dysfunction and biodiversity loss. The noise of traffic and people disturbs avian species. The study supports with evidence that both the habitats experience human interactions and interventions.

Biotic interactions such as predation, parasitism, competition, symbiosis has not been considered within the scope of this study. A mismatch exists between dynamics in natural system and responses to those changes. The mismatch arises from the lags in ecological response, climate changes or dramatic changes in ecosystem responses. Biodiversity affects carbon sequestration primarily, through its effects on species characteristics and ecosystem services, and in turn, affects the diversity in a two way interrelated manner. The scope of the study is limited only to the correlation of the biodiversity and how it is impacted by air pollution. This study has been conducted on a preliminary scale and elementary concepts have been deployed to measure and compare the biodiversity at two sampling stations of Kolkata.

Some studies have been done on the physicochemical analysis of air pollution in Kolkata (CPCB 2009; Citizen's Report 2011), but screening of bird diversity bioindicity as bioindicators, to find out the impact of the pollution factor has not been tried before. No attempt has been made here, to study the physic I chemical properties of the air pollution and the genetic and evolutionary changes of the bird species on the biodiversity of the community.

CONCLUSION

The study is an elementary assessment of the bird diversity, to indicate how big a role, air pollutants play in determining them. Hence, in conclusion for better understanding the dimensions of biodiversity and the factors that impact the biotic world, which causes significant variation in local diversity, further studies in relation to biochemical and genetic changes in the bird species must be conducted and thoroughly analyzed, through different mechanistic models.

ACKNOWLEDGEMENT

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COMPETING INTERESTS

The author declare no competing interest, whatsoever.

DATA AVAILABILITY STATEMENT

All the data presented in this paper are to be allowed to be used by public, without any restrictions.

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