

# Status of Physical Environment and Land use Pattern in Rabindra Sarobar Lake Area of Kolkata

Debabrata Mistry<sup>1</sup> and Ranjan Basu<sup>2</sup>

Research Scholar<sup>1</sup> and Professor<sup>2</sup>, Department of Geography, University of Calcutta  
West Bengal, India

Corresponding author. D. Mistry: debabrata.geog@gmail.com

## Abstract

The Rabindra Sarobar lake ecosystem is playing a key role in maintaining the oxygen balance of the Kolkata metropolis by generating fresh oxygen. The Physical environment is considered as an essential part of a lacustrine system. Degradation of environment largely affects the physical component. If the physical components are spoiled, then the entire system of the lake will get degraded. Water, air, soil, sound level etc. have been taken as the physical components of the study. Due to cultural activities and improper monitoring system practised by the lake authority, the physico-chemical properties of Rabindra Sarobar Lake are degrading over time. The total land and water area of Rabindra Sarobar is about 192 acres which is being used for sports, recreational and cultural activities. Holistic measures need to be followed for improvement of the ambient air and the water quality of the lake area.

**Keywords:** BOD, COD, lacustrine system, biomass, zooplankton, tree count

## Introduction

Rabindra Sarobar lake is used mostly for rowing and swimming purposes. It was created as a part of recreational complex and was earlier known as '*Dhakuria Lake*'. Today it stands as a green and blue landmark at the heart of southern Kolkata. At present the Kolkata Improvement Trust (K.I.T.) maintains this recreational complex. Rabindra Sarobar Lake is situated in South Kolkata covering an area of 192 acres, where the actual water area consisting of three water bodies is about 73 acres.

## Study Area

It is surrounded by Southern Avenue to the North, Russa Road to the West, Dhakuria to the east, and the Kolkata Sub urban Railway track to the south. It is situated in part of ward no. - 87 as well as occupying a part of ward no. - 90 under Kolkata Municipal Area. The lake area is situated between and 22p 30t03tt to 22p 30t05tt north longitude 88p 21t02tt to 88p 22t03tt east.

### **Historical Background**

In the early 1920s, the Calcutta Improvement Trust (C.I.T.), a body responsible for development work in the Kolkata Metropolitan area, acquired about 192 acres of marshy jungles which was transformed into Dhakuria Lake in May 1958, (C.I.T.) later renamed as Rabindra Sarobar Lake, as a tribute to the great Bengali writer Nobel Laureate, Rabindra Nath Tagore (Annual report 2007, KMDA). Today the lake and its surrounding areas are one of the most popular recreational sites in Kolkata. 73 acres of land are covered by water, while shrubs and trees, some of which are more than 100 years old, occupy the rest of the area. In the winter, one can spot some migratory birds around the lake, though the numbers are dwindling because of the rise in pollution level.

### **Objectives**

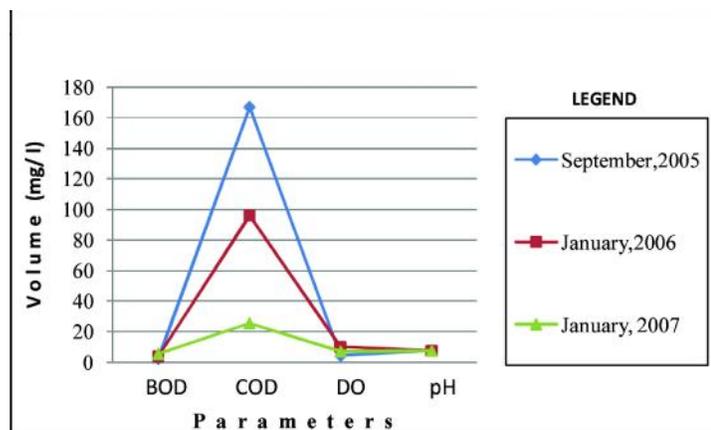
The objectives of this paper include;

1. Assessment of the current lake ecology involving water quality and aquatic vegetation etc.
2. Recording people's perception on lake ecology and willingness to pay for preservation of the abiotic and biotic resources
3. Development of monitoring plans for improvement of the lake ecology to desired levels and standards
4. Study of the ambient environment in terms of air and water quality and noise level
5. Estimation of the magnitude of environmental degradation around the lake area
6. Taking note of the land use pattern of the lake area

**Water Quality:** Water is one of the most important constituents of life support system. It is indeed a wonderful chemical medium which has unique properties of dissolving and carrying in suspension along with huge varieties of soluble chemicals.

### **Data Base and Methodology**

Primary data have been gathered through pre-designed questionnaire based interaction with the different target groups following random sampling technique. Diurnal and nocturnal sound levels had been recorded by sound meter in front of Nazrul Manch. Secondary data and information have been collected from various Government and Non Government sources. It includes Kolkata Improvement Trust, Kolkata Metropolitan Development Authority and West Bengal Pollution Control Board. Data on water and ambient air quality also have been collected from the lake authorities. All these data have been computed for tabulation, cartographic presentation as well as for their interpretation



**Fig. 1:** Water Quality In Rabindra Sarobar Main Lake Area  
 Data source: K.I.T., 2009

**Water Quality:** Water is one of the most important constituents of life support system. It is indeed a wonderful chemical medium which has unique properties of dissolving and carrying in suspension along with huge varieties of soluble chemicals.

Water quality of the Rabindra Sarobar main lake area is degrading. From 2005 to 2007 the pH values of water has increased. The BOD and COD levels of the water from 2005 to 2007 have also decreased. It is evident that the water quality of the lake area has degraded through time. Waste disposal, sewage disposal, vehicular waste, land cleaning, and misuse of water for domestic purposes by the dwellers of the adjacent squatter settlements are the major causes of water quality degradation in lake area.

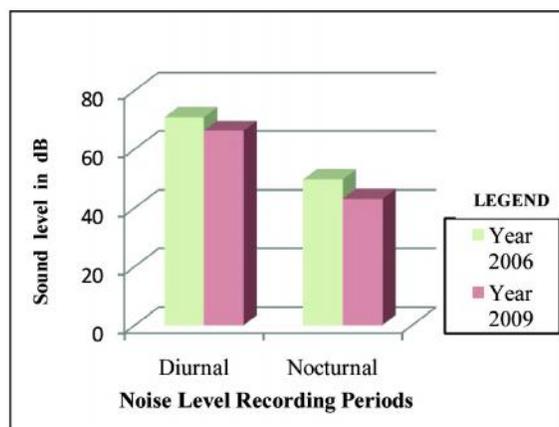
**Ambient Noise Standard and Noise Level around Lake Area:** Noise is an unwanted, unpleasant sound. Attitude and annoyance threshold are determining factors for consideration whether a sound is a noise (Uberoi, 2010). Central Pollution Control Board recommended the permissible limit of noise at various places in the country (Santra, 2004).

**Table 1:** Diurnal and Nocturnal Noise Level Standard in Different Zones of Kolkata

Area	Noise level (dB)	
	Diurnal	Nocturnal
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40

Source: Central Pollution Control Board, Govt. of India, New Delhi

Ambient noise level surrounding lake area has decreased in comparison to that of earlier period. In 2006, the noise level surrounding the lake area was as follows: during day maximum sound level was 70.9dB and during night maximum sound

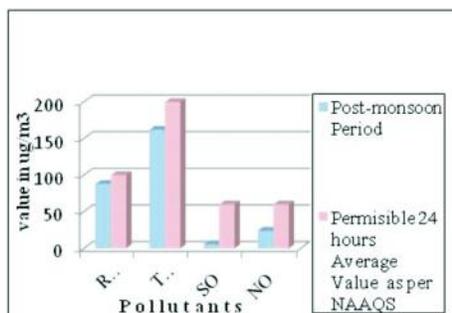


**Fig. 2:** Ambient Noise Level in Front of Nazrul Manch  
 Data sources: i) K.I.T, 2007 ii) Primary data, 2009

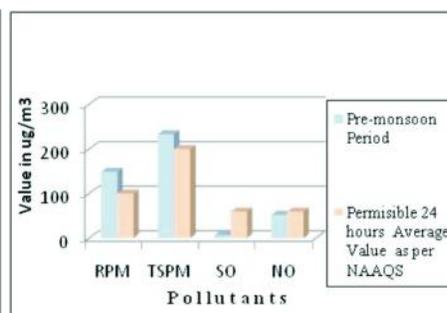
level was 49.7dB. In 2009, the noise level surrounding lake area as during day was recorded 66.3dB which during night maximum sound level was 43.1dB. Noise in Rabindra Sarobar area is generated from various sources like transport, construction work and loud music.

**Ambient Air Quality:** Air quality in any area depends on environmental cycle especially greenary system. If the contaminants of air are not absorbed by natural environmental cycle, then the quality of air of that area will tend to degrade. Major pollutants of air in the lake area are SPM, RPM, CO, NO and SO. The air quality surrounding lake area has revealed that the air quality is much better during post-monsoon period.

In Rabindra Sarobar Lake area, air pollution is widespread because of vehicular emission. Seasonal Variation of Different Groups of Phytoplanktons and



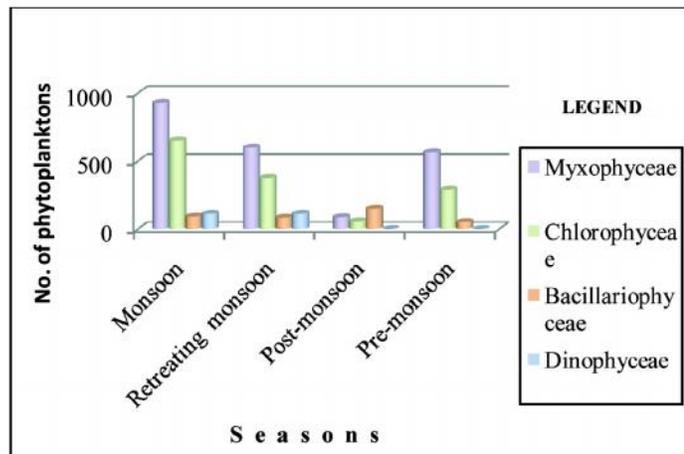
**Fig. 3:** Ambient Air Quality Monitoring in front of Nazrul Manch  
 During Post-monsoon Period, 2006  
 Data source: K.I.T. 2007



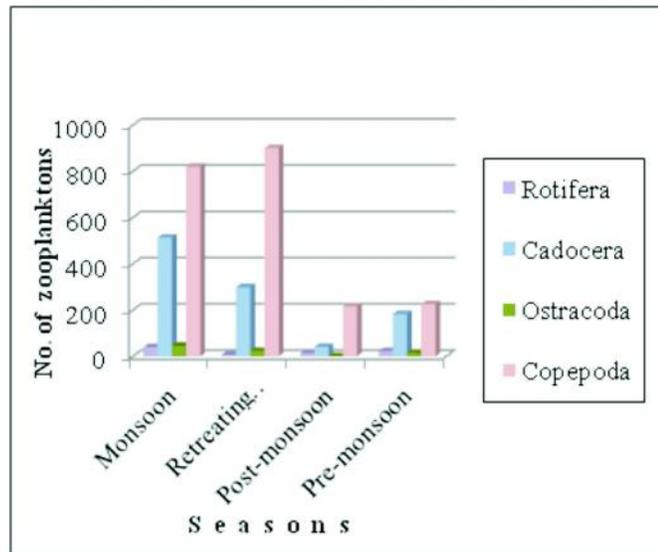
**Fig. 4:** Ambient air Quality Monitoring in front of Nazrul Manch  
 During Pre-Monsoon Period, 2006

Zooplanktons: Planktons<sup>1</sup> are the floating organisms whose movements are more or less dependent on currents (Odum, 1996). Planktons are of two types, one is phytoplankton and another is zooplankton. Among the four major groups of phytoplanktons, *chlorophyceans* or green algae showed maximum diversity and *dinophyceae* had the minimum.

In spite of maximum diversity of *chlorophyceae*, *myxophyceae* depicted its highest population throughout the year due to abundance of certain macrophytes that



**Fig. 5:** Seasonal Variation Of Different Groups Of Phytoplanktons  
Data source: KMDA, 2011



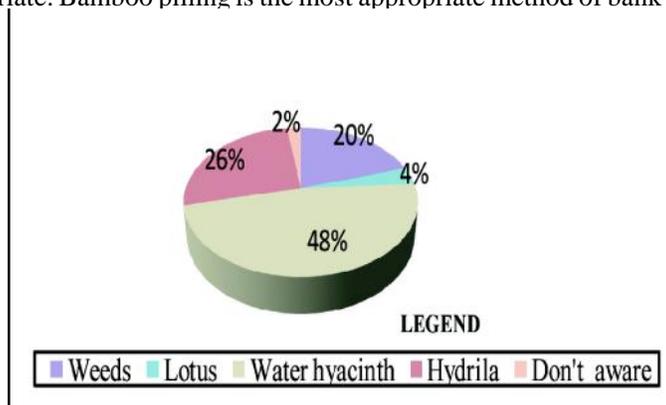
**Fig. 6:** Seasonal Variation Of Various Zooplanktons  
Data source: KMDA, 2011

favours the dominance of some *myxophycean* members. Maximum number of *myxophyceae* and *chlorophyceae* groups of phytoplankton<sup>1</sup> is found during monsoon season. *Bacillario phyceae* group of phytoplankton is found in maximum number during winter season. Zooplankton<sup>2</sup> being a major link in energy transfer at secondary level plays a significant role in transformation of food to the higher trophic level especially to fishes. Four major groups of zooplankton had been identified in Rabindra Sarobar.

These four groups of zooplankton are *rotifera*, *cladocera*, *ostracoda* and *copepoda*. Out of these four groups of *Copepoda* group is found in maximum number throughout the year while *Rotifera* group of zooplanktons is observed in minimum number throughout the year.

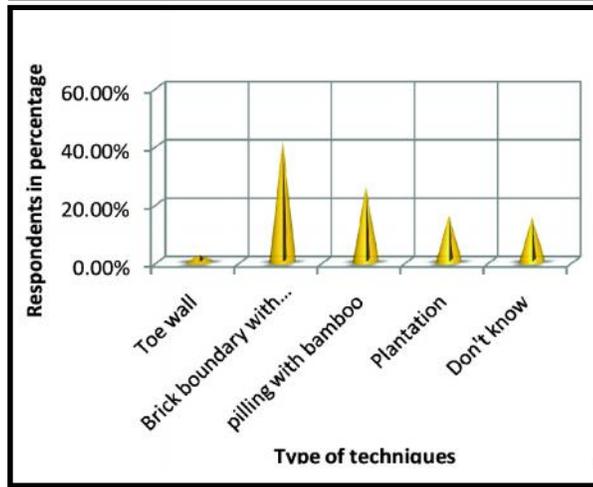
Out of survey with predesigned questionnaire and feedback from the respondents, it has been revealed that water hyacinth are the dominant hydrophytes in this lake water body. Lotus shows the minimum quantity in the main lake area. But in the water body of Padma pukur area lotus has recorded the maximum frequency.

Feed back from the respondents has revealed that the techniques of bank protection are appropriate. Bamboo piling is the most appropriate method of bank protection.

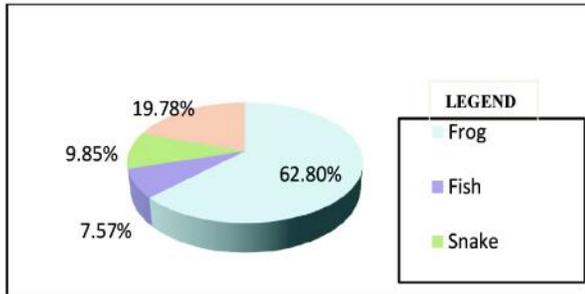


**Fig. 7:** Dominant Hydrophytes in the Lake Area  
 Source: Primary data, 2009

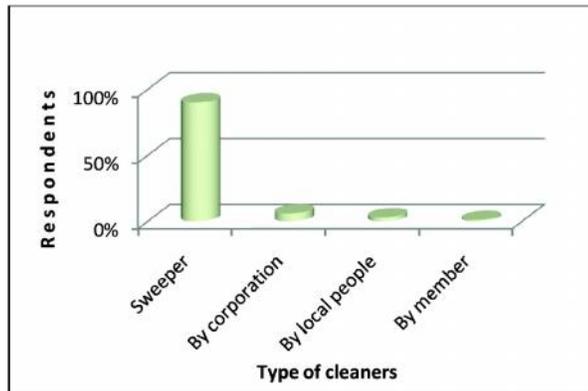
This measure is indeed cheap and causes minimum environmental degradation. Near about 16 percent respondents are not aware about the importance of bank protection. Another technique of bank protection is cementing. This technique is more durable and lasting longer than bamboo piling but on the contrary affects the aquatic and amphibian species because of the negative impact of the built environment on their survival and diversity; aquatic ecosystem is destroyed thereby. Frog is the most adversely affected species. Cementing on the bank of the Sweepers who are recruited by the Kolkata Improvement Trust are engaged to clean this lake area every day. It is also cleaned by the municipal workers but they are very



**Fig. 8:** Choice of Techniques for Bank Protection  
*Source:* Primary data, 2009



**Fig 9:** Species Affected by Cementing the Bank of the Lake  
*Source:* Primary data, 2009

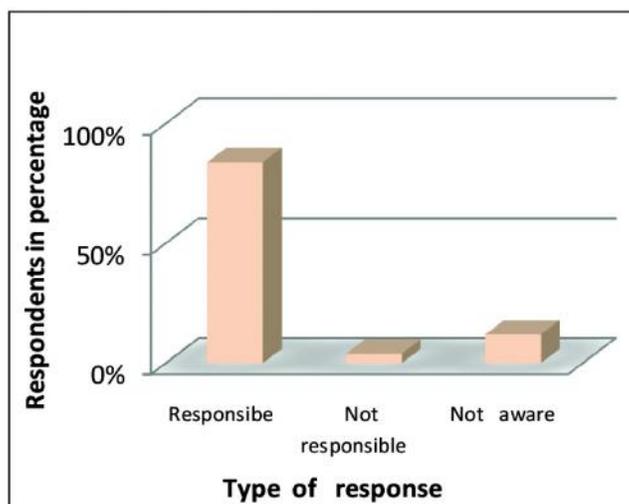


**Fig 10:** Different Types of Cleaners in and around Lake Area

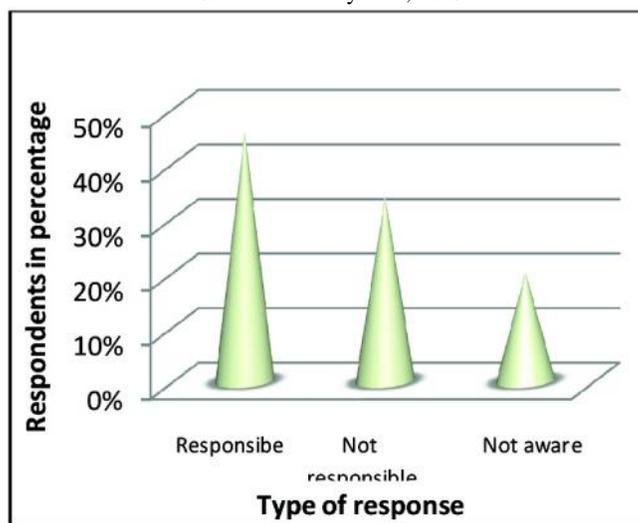
few in number. Sometimes local people clean the lake area to collect dry leaf and wood to because as domestic fuel.

From the questionnaire survey and feedback from the respondents, it has been revealed that visitors are mostly responsible pollution of the lake area. They throw waste materials here and there in the lake.

The different club authorities are regularly holding various receptions, parties and social functions. This is one of the reasons for pollution, because they prefer to



**Fig 11:** Pollution by the Visitors  
*Source:* Primary data, 2009

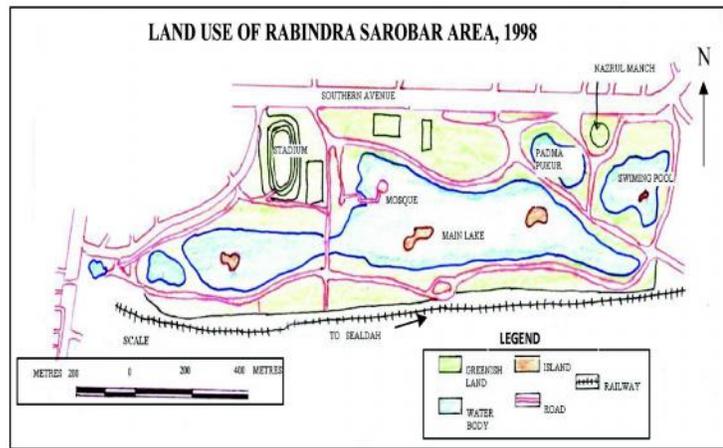


**Fig. 12:** Pollution by the clubs

cook in earthen kitchen. At the end of the ceremony they dump kitchen waste in the lake water. Decomposition of such waste food is one the man causes for increasing phenol in lake water. Only very few respondents have said that visitors do not pollute the lake area.

**Land Use Pattern of Rabindra Sarobar Lake Area:** Land use is conditioned by the association of two sets of factors- one, physical factors such as relief features, climate, soil and vegetation which limit the use capabilities of land and secondly, cultural factors which include both economic and institutional factors (Mandal, 1990)

During 1998, the total area under Rabindra Sarobar Lake was 192 acres among which the proportion of water area was much more. Within this lake area there is



**Fig.13:** Land Use of Rabindra Sarobar Area, 1998.

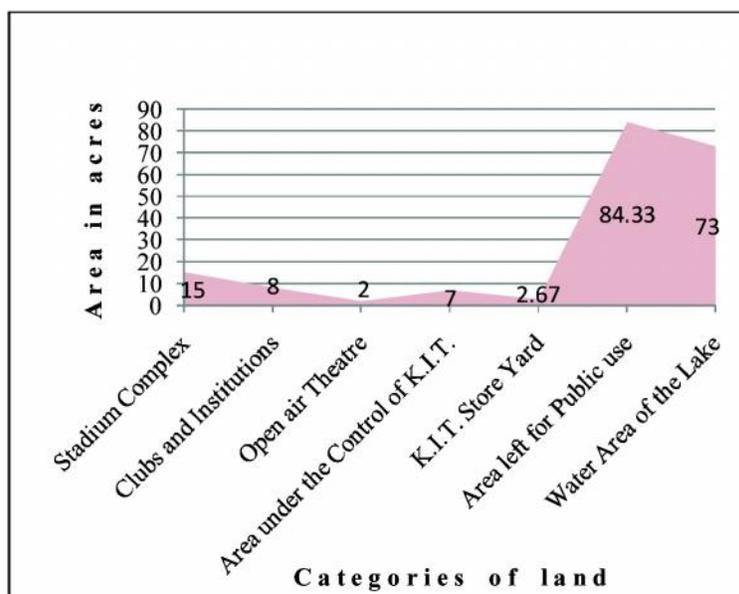
*Source:* K.I.T

a stadium, C.I.T store yard, open air theatre, clubs etc. An overall observation of the Rabindra Sarobar lake area would reveal that the commercial land use area is 46.59 acres and non commercial land use area is 65.41 acres while the water area occupies 73 acres only.

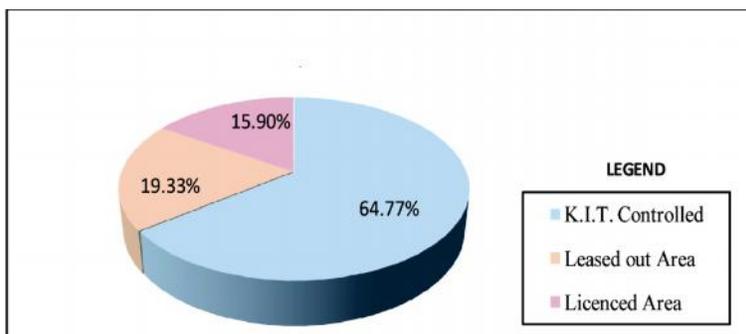
The total land and water areas of Rabindra Sarobar are 192 acres which are being used for sports, recreational and cultural activities. Out of 192 acres of land, 84.33 acres area is left for public use. Total water area of Rabindra Sarobar Lake is 73 acres. It is used mainly for rowing and fishing.

The total water area of this lake is controlled by Kolkata Improvement Trust (K.I.T.), Indian Life Saving Society, Kolkata Sports Association and Lake Friends. Near about 10 acres of area is used for Recreational and Cultural activities.

The land use pattern of the lake area according Kolkata Improvement Trust (K.I.T.)



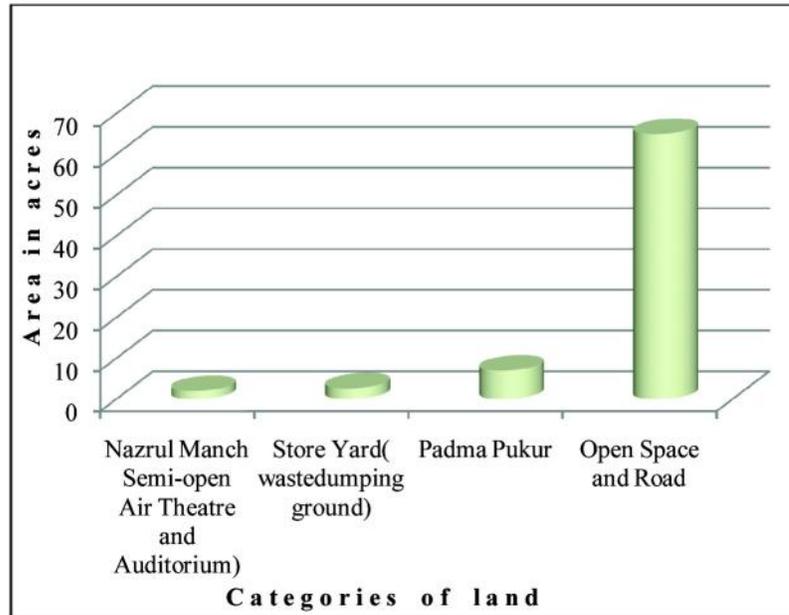
**Fig. 14:** Land Use Pattern Of Rabindra Sarobar Area, 1998  
*Data source: KMDA, 1998*



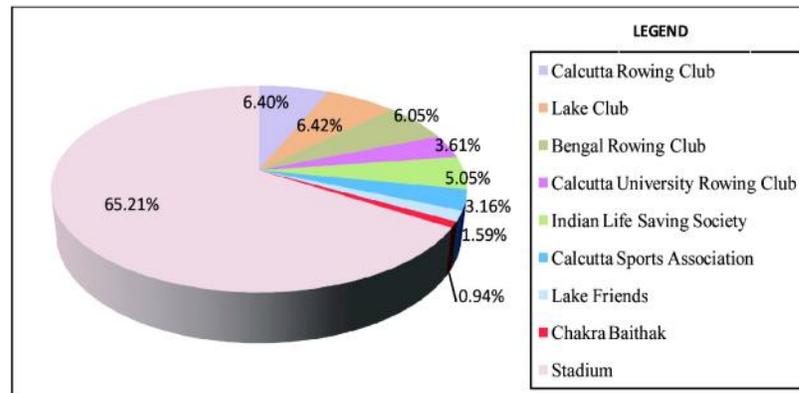
**Fig. 15:** Ownership-wise Current Land use Pattern of Rabindra Sarobar Area , 2007  
*Data source: K.I.T, 2007*

is that maximum proportion of land in Rabindra Sarobar lake area is devoted for public use. Near

about 19 percent of the total area land is allotted to private institutions and 16 percent area has been leased out to the State Government. Out of the total area under Kolkata Improvement Trust, open space for public use and road around the lake area occupy maximum proportion of land (about 65 percent), followed by Padma Pukur (seven percent) and Nazrul Manch (two percent) and store yard occupies (2.63 percent).

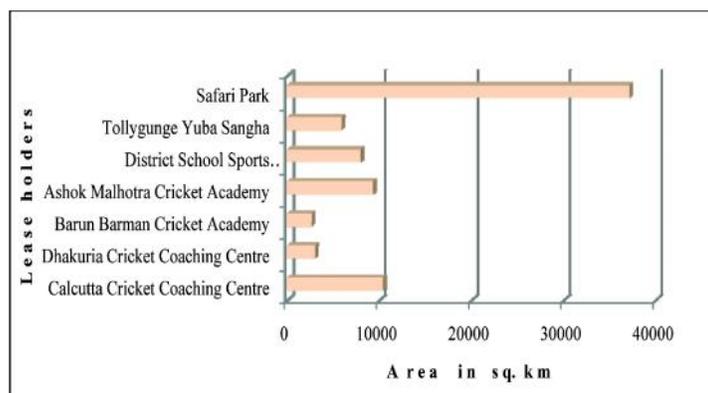


**Fig. 16:** Land use Pattern of K.I.T. Owned Land, 2007  
*Data source: K.I.T., 2007*



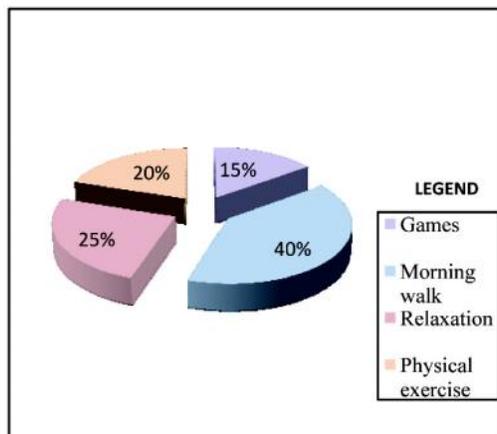
**Fig. 17:** Distribution of Land Among Lease Holders  
*Data source: K.I.T., 2007*

Total leased out area of Rabindra Sarobar is about 23 acres. Both land and water areas of Rabindra Sarobar have been leased out. Different Clubs, Sports Associations and Recreational Institutes share this area with lease. Among the lease holders, the land for stadium holds maximum proportion up to 65 percent. These lease holders organize various types of sports and cultural programmes in and around lake area throughout the year. Through these types of activities, the lacustrine system has been spoiled and the process is still going on.



**Fig. 18:** Distribution of Licenced Area Among Lease Holders  
*Data source: K.I.T, 2007*

In Rabindra Sarobar lake area total licensed area is 18.92 acres. Different cricket coaching clubs and safari park occupy this area. Safari Park consists near about half of the total licensed area. Different types of trees are grown here. So many gardens can be found in this park. Different Cricket Coaching Centres and Clubs organize various types of sports throughout the year.



**Fig. 19:** Proposed Land use by Kolkata Improvement Trust  
*Data source: K.I.T, 2007*

The Lake reflects many expressions of nature to different people at different time of day; both young and old persons assemble within the complex for various recreational purposes. So, Kolkata Improvement Trust has suggested a new land use pattern in and around Rabindra Sarobar Lake.

The proposed land use pattern by Kolkata Improvement Trust is 15 percent land for games, 40 percent for morning walk and 25 percent for relaxation leaving the rest 20 percent area for physical exercise.

**Major findings and Suggestions:** After completion of the entire study some findings have been recorded. The ambient environment around lake area has degraded over time. Due to improper monitoring system executed by the lake authority along with non-implementation of certain rules and regulations for the visitors, the water quality of the lake area is gradually deteriorating. The water body inside the lake area has to be monitored regularly (at least four times in a year). The weeds in and around the lake water body will have to be cleaned. Ambient noise level during diurnal and nocturnal periods is decreasing. Ambient air quality has to be monitored during pre-monsoon and post-monsoon periods. In the study area, air pollution is widespread because of vehicular emission. Pollution check system of the vehicles will have to be generated. The lake area has to be cleaned every day. Number of dustbins for degradable and non degradable waste disposal inside the lake area must be increased to ensure cleanliness of the surroundings. Some dustbins have been arranged in the lake area by the Kolkata Improvement Trust (K.I.T.) authorities for waste disposal. Fencing is must for the area surrounding the water body to prohibit common people from throwing garbage in the lake water. Illumination arrangements must be made around the lake area. The clubs inside the lake area must be given some guidelines regarding waste disposal and noise control. Security system around the lake area will have to be improved especially for ladies and children. Maximum pollution around the lake area is induced by the visitors. It can be noticed that different clubs in Rabindra Sarobar Lake area are also responsible for pollution of the area. Certain restriction upon visitors, clubs and institutions must be imposed like that of plastic bag prohibition. In recent times, K.I.T is taking necessary steps to restore the environmental balance around the lake area. Maximum portion of land in the lake area is left for public use. Kolkata Metropolitan Development Authority has prepared a framework for development and upkeepment of the lake area. They also implemented some greenary projects around the area.

### **Conclusion**

The land and water bodies forming open space of Rabindra Sarobar play a very important role in the metropolitan city of Kolkata. The environmental imbalance that has occurred in the Rabindra Sarobar lake , therefore, deserves special consideration and steps have to be taken by the lake authority to control the situation and to restore the original ambience as well as aquatic and terrestrial biodiversity of the lake area. Water quality no doubt, exerts an influence on the aquatic biodiversity. However, the water pollution control measures implemented, so far energized the recovery system of the lake. It is a very effective measure to restore its original floral and faunal species.

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