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Study of diversity of Macroinvertebrates from wetlands of Bhandup Pumping Station, Mumbai

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ABSTRACT
Bhandup Pumping Station (19°8'22"N - 72°57'38"E), located in Mumbai Suburban district of Maharashtra, India is an isolated area just out of the city limits. The study area is one of the biggest water filtration plants in the country. The chosen region consists of diverse habitats that include Mangroves interspersed with Salt Pans / marshland, forest patch, grassland and scrubland. The widespread wetland habitat is an indication of freshwater source and is likely to support variety of invertebrates. The present study will emphasize on the study of diversity of Macroinvertebrates as bioindicators and analyze the quality of water in the wetlands of the selected area. The proposed study may provide possible options for conservation of wetlands and planning the development activities. Aquatic Macroinvertebrates have different requirements to live. Some will need low temperatures, high dissolved oxygen levels, while others can survive where there are low dissolved oxygen levels where the water temperature is warmer. Macroinvertebrates act as Bio-indicator as a parameters of water quality indicator since they portray information over longer periods of time and acts as a good tool for the sustainable management of water resources. Water quality parameters such as pH, DO, temperature, turbidity, conductivity and flow velocity were recorded and water samples collected and analyzed for various other parameters.

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I. INTRODUCTION

Wetlands play an important role in the water cycle by capturing, holding rainfall and water from the melting snow; retaining sediments and purifying water in the process. In fact wastewater and urban runoff are received by wetlands, which are an effective filter, sink and transformation system for pollutants. Human intervention has adversely affected many natural ecosystems all over the world, the cumulative impact of which is now threatening the very existence of man through global warming and climate change.

Freshwater invertebrates can be classified in three groups

- **Pollution-sensitive organisms**: These organisms require good water quality to survive. They may require water with high dissolved oxygen levels. For example, water penny, mayfly, caddisfly and stonefly
- **Moderately pollution-sensitive organisms**: These organisms can survive in fair water quality. These include but limited to crane fly, crayfish, dragonfly, damselfly, sow bugs, clams and scuds
- **Pollution-tolerant organisms**: These organisms can survive in poor water quality. They can survive in water quality with low dissolved oxygen and their adaptations allow them to survive in turbid waters. For example, leeches, pouch nails, aquatic worms, midges, water striders, backswimmers, water bugs, and true bugs.

Pollution of aquatic environment caused by the anthropogenic activities, degradation and misuse of natural resources has been witnessed in the last few decades. This has led to stringent policy development globally and also need to highlight awareness on Water Conservation. Therefore understanding the ecology of freshwater is vital not only because of its biological implications, but also because the proper management and conservation of freshwater is necessary to any living organism including human being.

Most cities contain a number of fresh water bodies such as lakes and rivers together with a small network of streams. The freshwater ecosystems have been subjected to an increasing pollution load from contaminated urban run-off water coming from industrial, agricultural, residential, commercial and recreational areas and institutions such as schools and hospitals. Nature has its own way of indicating the health of the environment through Bio-indicator. Any deviation from the normal habitat conditions is reflected by bio-indicators can be in alteration of their health, population and distribution. Pollutants impacts organisms and exposure of organisms to pollutant over a period results in many changes in ecosystem and diversity. Initially these interactions may occur at the level of biochemical and cellular process and lead to physiological effects such as disruption of respiratory, excretory, feeding, circulatory, reproductive and neural phenomena in animals

and photosynthetic, respiratory, growth and reproductive processes in plants and microorganisms. The structure of the DNA and chromosomes in the organism may be affected leading to modification and eventual evolution of organ/isms which are capable of withstanding the stresses. This pattern of evolution of resistance or tolerance to the stress factors also occurs in entire communities.

Biological diversity or "biodiversity" refers to the variety of living organisms, found in a certain area. Biodiversity is important because it provides stability and balance in natural systems. Species diversity is a good indicator of the state of an ecosystem. In river systems, species diversity declines in severe cases of cultural eutrophication. Higher species diversity would be expected in aquatic systems that are relatively natural or undisturbed, as well as in those where there are a variety of different habitat types.

A bio indicator can be defined as "a species or group of species that readily reflects the abiotic or biotic state of an environment, represents the impact of environmental change. Such organisms are monitored for changes (biochemical, physiological or behavioral) that may indicate a problem within their ecosystem. Bio indicators can tell us about the cumulative effects of different pollutants in the ecosystem. Aquatic macro invertebrates are an integral part of the food chain in lotic environments and they are sensitive to changes in the environment though degrees of sensitivity differ among various groups. Communities of organisms integrate the impact of different stressors and thus provide a broad measure of their aggregate impact. Macro invertebrates have limited migration and their assemblages are made up of species that constitute a broad range of tropic levels and pollution tolerances and thus are particularly suited for assessing site specific impacts. They are most frequently used in bio monitoring since many of them are sensitive to pollution and integrate short term and long term effects of environmental stressors. Different species have different pollution tolerances and habitat preferences. Absence of sensitive species and presence of tolerant ones indicate water quality deterioration.

II. MATERIALS AND METHODS

Maharashtra, the third largest state is one of the most industrialized and urbanized states of India. The state is a home for 27%, 22% and 42%of mammals, reptiles and birds respectively (GoM, 2003). There are varying physiographical, geological features with forests ranging from the tropical wet semi evergreen to tropical dry deciduous forests and grasslands. Each season gives different perspective of the biodiversity of the state.

(i) *Study Area*

Bhandup Pumping Station(19°8'22"N - 72°57'38"E), located in Mumbai Suburban district of Maharashtra, India (Fig.1), is an isolated area situated right in the middle of the city limits. The area was selected for recording the diversity after preliminary surveys, as this site is home for many avain diversity as well other species. It consists of diverse habitats that include Mangroves, interspersed with salt pans / marshland and scrubland. In 2008, part of the area with mangroves was declared as protected forest (Fig.2). Recently Bhandup Pumping Station a part of thane creek has been identified as potential ramsar site. The site and its adjoining region has rich faunal diversity, making it a potential site for enthusiasts. This heterogeneity of habitat offer wide range of opportunities to various faunal componests to feed and breed.

Fig.1: Map of study site

Fig.2: Board displayed in BPS

(ii) Field observation

Bhandup Pumping Station and adjoining areas were surveyed from October 2017 to February 2018 at regular interval of seven days. Approximately twenty visits were made throughout the study period. Field observation was carried out by sight; sample collection, identification by using key chart and photography was done using digital cameras. Standard field guides were used for identification of different species.

(iii) Species composition

1. Macroinvertebrates

The study was conducted in lakes and streams consisted of three stations, the biodiversity in the macroinvertibrates from the three station are collected by a net sampler was used for sampling, because it reduces the amount of sediments in a sample and hence the time for sorting. The net is attached to circular metal frame. A square frame aquatic net was used to collect the specimen, by methods like gentle sweep under the vegetation from bottom to water surface. Snag methods can also be used. Samples collected from muddy and sandy sediments were washed thoroughly. The artificial substrate, stones, wood and other detritus was properly checked out. The macroinvertebrates were collected manually by brushes and forceps. Then the collected samples were transferred to specimen collection container, The macroinvertebrates so collected were sorted and identified to operational taxonomic level and the quality of water they can survive i.e pollutant sensitive, pollutant tolerate or moderately pollutant tolerant .

(iv) Water Sampling

Water samples were collected from the surface in clean and rinsed plastic bottles. Physico-chemical parameters viz , pH , temperature, turbidity DO, BOD, COD were measured at sampling sites by using standard method and study of the water quality of the respective lakes or streams was detected. The pH of the water sample was evaluated by using pH meter. DO and BOD was carried out by using Wrinkler's Method. Allthe water test was carried out by following standard protocol and the result was analysed to detect the quality of water

Species Account

(i) Macroinvertebrates

Sr no.	Common name	Scientific name	Family	Pollution sesitivity
1	Water strider	*Aquarius remigis*	Gerridae	Moderately tolerant
2	Rodong (cone snail)	*Telescopiumtelescopium*	Potamididae	Very tolerant
3	Freshwater limpet	*Lottiapustulosus*	Lepetodrilidae	Moderately tolerant
4	Pouch snail	*Physellaacuta*	Physidae	Very tolerant
5	Boring turret snail	*Turreitella*	Turritellidae	Very tolerant
6	Orb snail	*planobarius*	Planorbidae	Very tolerant
7	Predacious diving beetle	*Laccobiusminutus*	Hydrophilidae	Very tolerant
8	Segmented worm	*Namalycastisjaya*	Nereidae	Very tolerant
9	Creeping water bug	*Ilyocoriscimicoides*	Naucoridae	Very tolerant
10	Orange bluet(Damselfly)	*Enallagmasignatum*	Coenagrionidae	Moderately tolerant
11	Globe Skimmer (Dragonfly)	*Pantalaflavescens*	Libellulidae	Moderately tolerant
12	Drangonfly (nymph)	-	-	Moderately tolerant

WATER ASSESSMENT

TEST	Result
pH	6
Temperature	29oC
Turbidity	5 NTU
DO	15 mg/L
BOD	8 mg/L
COD	88mg /L

III. DISCUSSION:

The present study provides an array of macroinvertebrate diversity of Bhandup Pumping Station, a protected area in the city limits of Mumbai. The diversity of species also helped us to evaluate the quality of the water

1. The geographical location of an area, its climatic conditions and vegetative composition are essential requisites for supporting a rich diversity of the different faunal components.

2. The findings of the present study underline the importance of areas like Bhandup Pumping Station as a preferred habitat for various groups of fauna.

3. If the maintenance of such areas within the city limits are carefully planned, the diversity of flora and fauna may increase providing a rich ground for biodiversity conservation as well as for research. The study will also add to our future attempts in understanding the complex nature of mutuality interaction between different group of fauna and flowering plants that is essential for continuity of ecosystem services.

4. Eventually, further substantial refinement of such biogeography studies will greatly benefit from continued survey and collection work in Bhandup Pumping Station and from taxonomic revisions improving the knowledge of baseline distributional data.

RELEVANCE

Though not always easily captured by markets, biological diversity ('biodiversity') is a valuable asset for current and future generations (OECD, 1999).The biodiversity should be an integral part of Valuation should thus be an integral part of biodiversity policies, one of the key requirements in devising conservational plans, and a basis for conservation and sustainable use. Assessments of value can also help in raising public and political awareness of the importance of biodiversity. However there is a lack of available data to study the species diversity of Bhandup Pumping Station. The study of macro invertebrates gives a insight of water and quality and their diversity in an ecosystem. This is necessary to understand for developing policies for conservation and to protect the ecosystem as a whole.

However it is required to be protected from increasing anthropogenic interference. Present study can establish the data of diversity of species and the likely effect of anthropogenic activities on the species diversity of Bhandup Pumping Station. The present research will emphasize on the study of butterfly, spider and bird diversity of the area under study. The proposed study may provide possible options in charting the roadmap for future developmental projects and thus minimize the damage to the environment.

It is also true that we still have much to learn about the complex function of ecosystems in small pockets of Mumbai, and about which species perform critical roles. Much efforts are still needed to spread the awareness about ecosystem and the diversity of faunal components present it them.

IV. CONCLUSION

- The organisms are dependent on the environment for its needs and also dependent on each other. Due to anthropogenic activities this may disturb the delicate balance being maintained in th environment. Water pollution, in the study area, Bhandup Pumping Station will have impact in the ecosystem and its balance, as the area supports not only the diversity of the macroinvertebrates but also flora, amphibians and avian diversity. This study will help to understand the distribution of macro-invertebrate in the area under study and evaluate the health of the stream or water bodies (water quality) via macro-invertebrate and analyses which will enable conservation planning. This database will be useful to assess Impact of anthropogenic activities, industrial pollution and altered land use on natural habitat of Bhandup Pumping Station.

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