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Details of students of Environmental Science (Honours) of the College who completed Project Work on the following topic in 2022-2023

Total number of students = 05 (Five)

Semester: VI

SL NO.	NAME OF THE STUDENTS	PAPER	UNIVERSITY ROLL NO.	UNIVERSITY REGISTRATION NO.	TOPIC OF PROJECT WORK
1.	Sabana Khatun	CC 14 (Practical)	203056-11-0077	056-1215-0103-20	DOCUMENTATION OF NATURAL RESOURCES IN KOLKATA MUNICIPAL CORPORATION, WARD NUMBER 98
2.	Tanushri Middya	CC 14 (Practical)	203056-11-0022	056-1211-0119-20	DOCUMENTATION OF NATURAL RESOURCES IN KOLKATA MUNICIPAL CORPORATION, WARD NUMBER 98
3.	Kinnori Bhattacharjee	CC 14 (Practical)	203056-11-0035	056-1211-0138-20	DOCUMENTATION OF NATURAL RESOURCES IN KOLKATA MUNICIPAL CORPORATION, WARD NUMBER 98
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DOCUMENTATION OF NATURAL RESOURCES IN KOLKATA MUNICIPAL CORPORATION, WARD NUMBER 98



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SEMESTER : 6TH

SUBMITTED BY_

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1. INTRODUCTION:

1.1. Natural Resources:

The environment is everything which surrounds an organism and influences its life in many ways. It includes physical and biological components. The physical components of the environment are soil, water, air, light and temperature (abiotic components). The plants and animals are collectively referred to as biotic components. All these components work together, interact and modify the effect of another. The basic needs of life are fulfilled by minerals present in nature. These are referred to as natural resources.

1.2. Types of Natural Resources:

There are many ways of classifying natural resources. They can be biotic or abiotic (that is derived from organic materials or inorganic materials). Another way of classification of resources is by the amount of resources available for human consumption. Through this, resources can be classified into exhaustible and inexhaustible natural resources.

▲ Abiotic Natural Resources:

Abiotic resources refer to non-living components of the environment that are derived from the Earth's physical and chemical processes. These resources are usually found in the form of minerals, metals, water, air, and energy sources. Here are some examples:

a. Minerals and Metals: This category includes various elements and compounds found in the Earth's crust, such as iron ore, copper, gold, silver, coal, oil, natural gas, and uranium. These resources are typically extracted through mining and drilling operations.

b. Water: Water is a crucial abiotic resource necessary for all forms of life. It is used for drinking, agriculture, industrial processes, energy generation, and various other activities. Sources of water include rivers, lakes, groundwater, and glaciers.

c. Air: Although air is abundant and freely available, it is an important abiotic resource. It provides oxygen for respiration, carbon dioxide for photosynthesis, and plays a vital role in climate regulation.

d. Energy Sources: Abiotic resources also encompass energy sources such as fossil fuels (coal, oil, and natural gas) and nuclear energy (uranium). Renewable energy sources like solar, wind, hydro, and geothermal energy also fall under this category.

▲ **Biotic Natural Resources:**

Biotic resources are derived from living organisms or the products obtained from them. These resources include plants, animals, and their by products. Here are some examples:

a. Forest Resources: Forests are a significant biotic resource, providing timber, wood for fuel, and various non-timber forest products like fruits, nuts, medicinal plants, and latex. Forests also contribute to biodiversity conservation and play a crucial role in carbon sequestration.

b. Agricultural Resources: Agricultural resources comprise crops, livestock, and fisheries. Crops provide food, fibers (cotton, jute), oils (olive, soybean), and other materials. Livestock resources include cattle, poultry, sheep, and their products (meat, milk, eggs), while fisheries provide seafood and aquatic resources.

c. Wildlife Resources: Wildlife resources encompass various animal species, both terrestrial and aquatic. These resources are valuable for tourism, ecological balance, and scientific research. Examples include mammals, birds, reptiles, amphibians, and marine organisms.

d. Microorganisms: Biotic resources also include microorganisms such as bacteria, fungi, and algae. These organisms have significant roles in medicine, biotechnology, waste treatment, and environmental processes.

Both abiotic and biotic resources are essential for sustaining life and supporting human activities. It is crucial to manage and conserve these resources to ensure their sustainable use and prevent depletion or degradation.

▲ **Inexhaustible Natural Resources:**

Nature has blessed us with an unlimited supply of resources such as air, water and sunlight. These resources are called inexhaustible resources. They are also called renewable resources. Renewable natural resources refer to resources that can be replenished or naturally regenerated over time, either through natural processes or human intervention. These resources are typically derived from living organisms or natural ecosystems and can be utilized by humans for various purposes. Here are some examples of renewable natural resources:

a. Solar Energy: Solar power is derived from the sun's rays and can be harnessed using solar panels to generate electricity or heat water.

b. Wind Energy: Wind power is generated by harnessing the kinetic energy of wind using wind turbines, which can produce electricity.

- c. **Hydropower:** Hydropower is obtained from the energy of moving water, such as rivers or dams, which can be used to generate electricity.
- d. **Biomass:** Biomass refers to organic materials, such as wood, crop residues, and agricultural waste, which can be burned or converted into biofuels for heating or electricity generation.
- e. **Geothermal Energy:** Geothermal power is derived from the heat generated within the Earth's core, which can be harnessed to produce electricity or for direct heating and cooling purposes.
- f. **Tidal Energy:** Tidal power is generated by harnessing the energy of ocean tides using tidal turbines or barrages, which can generate electricity.
- g. **Forests:** Forests provide a renewable source of timber and wood products, and when managed sustainably, they can be regrown and replenished over time.
- h. **Fisheries:** Fish and other marine organisms are renewable natural resources in oceans, rivers, and lakes, but sustainable fishing practices are necessary to ensure their long-term viability.
- i. **Agricultural Crops:** Crops cultivated for food, fiber, or bio fuel production, such as grains, vegetables, fruits, and oilseeds, are renewable resources when managed properly.
- j. **Freshwater:** Water from rivers, lakes, and underground sources is a renewable resource, although careful management is required to ensure its sustainability.

▲ **Exhaustible Natural Resources:**

As the human population is increasing at an astounding rate, we have reached a number of 7.4 billion today. Naturally, this means that we are utilizing more and more natural resources. If we go at this rate, we will soon reach a day when nature will not be able to provide us with resources such as plants and trees, animals, mineral ores, and fossil fuels such as coal, petroleum and natural gas. Thus, these resources are exhaustible. These resources are called exhaustible or non-renewable resources.

If the use of these resources is not monitored carefully, there will be no food for our predecessors to eat, no energy for them to power their machines and no material for them to build a shelter with. This is why it is important to understand which resources are exhaustible and which are not, and to practice sustainable development. This is nothing but the development that meets the needs of the present generations without compromising the ability of future generations to meet their own needs.

1.3. Significance of Natural Resources:

Natural resources play a crucial role in the functioning of economies, the development of societies, and the overall well-being of individuals. The significance of natural resources can be understood from various perspectives:

- ▲ **Economic Importance:** Natural resources serve as the foundation of economic activities. They are used as raw materials in industries, providing inputs for manufacturing processes and the production of goods and services. Resources like minerals, fossil fuels, timber, water, and agricultural products contribute to economic growth, job creation, and trade. They generate revenue, create business opportunities, and support livelihoods.
- ▲ **Energy Production:** Natural resources, particularly fossil fuels such as coal, oil, and natural gas, are major sources of energy. They power industries, transportation systems, and households, providing heat, electricity, and fuel for various purposes. Renewable resources like sunlight, wind, water, and geothermal energy also contribute to sustainable energy production.
- ▲ **Environmental Balance:** Natural resources play a crucial role in maintaining ecological balance. Forests, wetlands, and other natural habitats provide habitats for diverse plant and animal species, support biodiversity, and contribute to the stability of ecosystems. They regulate climate, purify air and water, prevent soil erosion, and provide essential ecosystem services.
- ▲ **Food and Agriculture:** Natural resources, including fertile soil, water, and genetic diversity, are essential for food production and agriculture. They support crop cultivation, livestock rearing, and fisheries, ensuring food security and nutrition. Sustainable management of resources like land and water is critical for long-term agricultural productivity and food systems.
- ▲ **Cultural and Aesthetic Value:** Natural resources hold cultural and aesthetic significance. They are often linked to cultural identities, traditional practices, and spiritual beliefs. Natural landscapes, parks, and protected areas provide recreational opportunities, promote tourism, and contribute to human well-being and quality of life.
- ▲ **Climate Change Mitigation and Adaptation:** Natural resources play a vital role in addressing climate change. Forests act as carbon sinks, absorbing and storing greenhouse gases. Renewable energy sources offer alternatives to fossil fuels, reducing greenhouse gas emissions. Sustainable land and water management practices contribute to climate resilience and adaptation.
- ▲ **Geopolitical Considerations:** Natural resources can have geopolitical implications. Countries with abundant resources may have strategic advantages and influence in global politics and trade. Control over resources like oil, gas, and minerals can impact economic and political relationships between nations.

Given their significance, the sustainable management and conservation of natural resources are essential for long-term human well-being, environmental integrity, and the equitable distribution of benefits. Balancing resource use with conservation efforts, promoting renewable and efficient

technologies, and addressing environmental challenges are key considerations in ensuring the sustainable utilization of natural resources.

1.4. Consequences of depleting natural resources:

Depleting natural resources can have wide-ranging consequences that affect both the environment and human societies. Here are some of the major consequences associated with the depletion of natural resources:

- ▲ **Environmental degradation:** The overexploitation of natural resources can lead to severe environmental degradation. For example, deforestation can result in the loss of habitats for numerous plant and animal species, soil erosion, and disrupted water cycles. Similarly, overfishing can deplete fish populations, disrupt marine ecosystems, and negatively impact the food chain.
- ▲ **Climate change:** Depleting natural resources, particularly fossil fuels like coal, oil, and natural gas, contributes to the emission of greenhouse gases. These gases trap heat in the Earth's atmosphere, leading to global warming and climate change. Rising temperatures, melting ice caps, more frequent extreme weather events, and altered rainfall patterns are some of the consequences of climate change.
- ▲ **Water scarcity:** Overuse and mismanagement of water resources can result in water scarcity, particularly in arid and semi-arid regions. Depleting groundwater reserves and the pollution of water bodies can affect ecosystems, agricultural productivity, and human access to clean drinking water.
- ▲ **Loss of biodiversity:** The depletion of natural resources often leads to the loss of biodiversity, which refers to the variety of plant and animal species in an ecosystem. When habitats are destroyed or degraded, numerous species may become endangered or go extinct. The loss of biodiversity has ecological, economic, and cultural implications, as it disrupts ecosystem functions, affects food security, and erodes traditional knowledge and cultural practices.
- ▲ **Economic impact:** Depleting natural resources can have significant economic consequences. For example, the depletion of oil reserves can lead to increased energy costs and disruptions in transportation and manufacturing industries. Resource scarcity can also drive up prices and reduce availability, negatively affecting sectors such as agriculture, mining, and forestry, which rely on natural resources.
- ▲ **Social and political instability:** The depletion of natural resources can exacerbate social and political tensions, particularly in resource-rich regions. Conflicts may arise over control and

access to dwindling resources, leading to instability, displacement of communities, and even armed conflicts.

- ▲ **Health implications:** Depleted natural resources can have adverse health effects on both humans and ecosystems. For instance, air and water pollution resulting from resource extraction and consumption can contribute to respiratory problems, waterborne diseases, and other health issues. Additionally, the loss of ecosystems and biodiversity can disrupt natural disease control mechanisms and increase the risk of zoonotic diseases.

Flora and fauna represent the diversity of life on Earth. Urban areas often have limited natural spaces, so preserving and incorporating natural habitats into urban environments helps maintain biodiversity. A diverse ecosystem supports various plant and animal species, which are essential for ecological balance and resilience. Natural resources and their habitats provide vital ecosystem services that benefit urban areas. Trees and vegetation help purify the air, mitigate climate change by absorbing carbon dioxide, reduce urban heat island effect, and provide shade and cooling. Water bodies and green spaces help manage storm water, prevent flooding, and improve water quality. These services contribute to the overall well-being and quality of life for urban residents. Natural areas within urban environments provide spaces for recreation, relaxation, and enjoyment. Parks, gardens, and green spaces offer opportunities for outdoor activities, exercise, and social interaction. Access to nature has been shown to have numerous physical and mental health benefits, including stress reduction, improved mood, and enhanced cognitive function. Preserving natural habitats in urban areas supports wildlife populations. Birds, insects, small mammals, and other animals contribute to the urban ecosystem and add to the overall biodiversity. Observing and interacting with urban wildlife can foster a sense of connection to nature and promote environmental stewardship. Urban areas serve as living laboratories for studying the interaction between humans and the natural environment. Natural resources and habitats offer opportunities for scientific research, environmental education, and awareness-building. Studying urban ecology can lead to innovations in sustainable urban planning, resource management, and conservation practices. Natural areas and their associated habitats often hold cultural and historical importance. Preserving these spaces helps maintain connections to indigenous cultures, traditional practices, and historical heritage. Urban green spaces can also serve as symbols of community identity and pride. Flora and fauna, along with natural resources, contribute to the resilience of urban areas against climate change impacts. Green infrastructure, such as urban forests and green roofs, can mitigate the effects of extreme weather events, regulate temperatures, and reduce energy consumption. Preserving natural habitats helps maintain ecosystems ability to adapt to changing conditions and provide essential services.

2. OBJECTIVES OF THE STUDY:

The main objectives of the study are framed below:

- ❖ To document the existing natural resources i.e the floral and faunal species of KMC ward number 98 along with their habitat.
- ❖ To understand the role and importance of these natural resources of the area.
- ❖ To understand the threats pertaining to the natural resources of the study area.

3. STUDY AREA:

There is some information about KMC ward no. 98:-

- ▲ **Ward no. :** 98
- ▲ **Borough :** 10
- ▲ **City :** Kolkata
- ▲ **State :** West Bengal
- ▲ **Country:** India
- ▲ **Assembly Constituency:** Tollygunge
- ▲ **Parliamentary Constituency:** Jadavpur
- ▲ **Ward Description:** ward number 98 Kolkata municipal corporation is an administrative division of Kolkata municipal corporation in borough no. 10, covering parts of Ranikuthi Netaji Nagar (Gandhi Colony-Pallisri-Sangati Colony-Shahid Nagar Colony) in tollygunge and Barcelona (regent grove) neighbourhoods in south Kolkata, in the Indian state of West Bengal.
- ▲ **Agriculture:** Nil
- ▲ **Forest:** Nil
- ▲ **Climate:** Kolkata has a tropical wet and dry climate. The annual main temperature is 24.8 ° C (80°F), monthly main temperature range from 15⁰ C to 30⁰ C (59⁰ F to 86 °F). Summers are hot and humid with temperatures in the low 30 and during dry spells the maximum temperatures exceed 40⁰ C (104°F) during May and June. Winter tense lasts for only about to and a half months, with seasonal loss dipping 9⁰ C to 11 degree Celsius (48.2°F-51.8°F) between December and January.

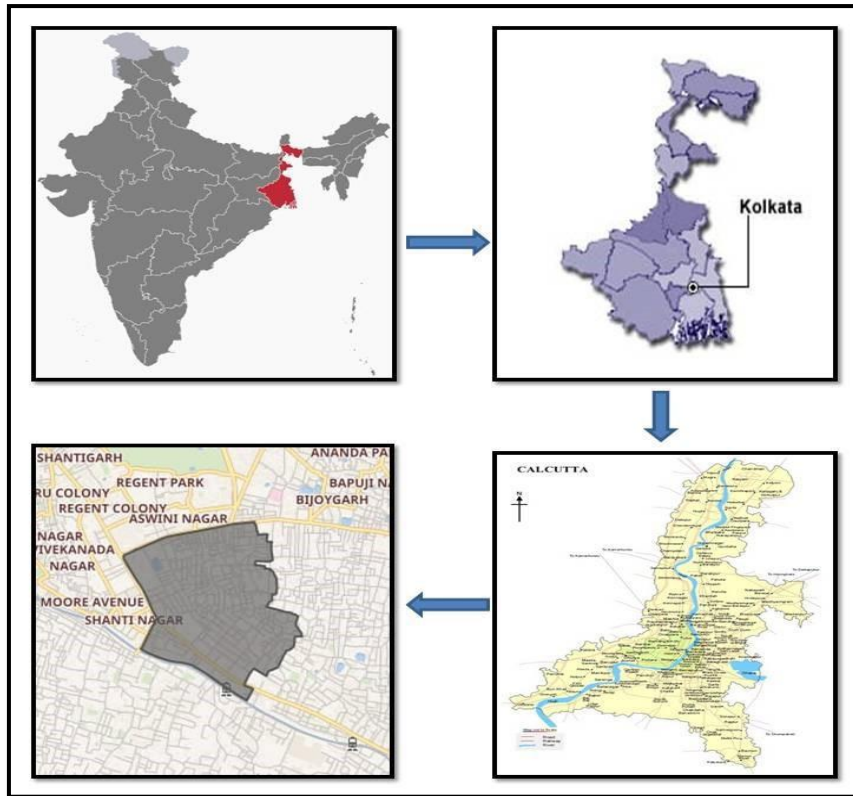


Figure 1.1: Location of Ward no. 98 (KMC) in India Map
 (Source:mapsofindia.com)



Figure 1.2: KMC Ward no. 98 (Source: KMC ward office)

4. METHODOLOGY:

The study of Natural resource documentation of KMC Ward No. 98 was carried on from May 2023 to 2nd week of June 2023. The following methods were done to study and document the natural resources present within ward no. 98-

- Reconnaissance survey was conducted extensively in different parts of KMC Ward number 98 to understand the natural resources present within the ward and also to identify the members of the community living in the area for the longest time as key informants about the surrounding natural resources.
- After the reconnaissance survey, a general survey was conducted within the ward and appropriate families were interviewed who would help us to document the natural resources present in KMC ward number 98. Free format discussions with local people at individual and group level were conducted to understand and document the natural resources present.
- Modified Pollard and Yates (1993) methods was followed. Plants, animals, natural resource habitats present within the KMC Ward No. 98 were documented while walking along fixed path (Transect method) i.e traversing the roads within the ward. Each road was taken as transects and natural resources encountered were documented. Specimens were not collected but field identification was done with help from local resource persons, field guides etc.
- The data so collected was categorized into plant, animal and natural resource habitat. The data was tabulated to obtain the natural resource inventory within the region.



5. RESULT:

The survey for natural resources present within KMC Ward No. 98 was divided into documenting the biodiversity present in the area along with its habitats.

In plant diversity a checklist of plant species along with their habitat, importance, local name etc. was listed (Table no.1). After that a table was prepared on the family wise plant species present within the study area (Table no. 2) and plotted a pie chart (Figure no.1.3) about number different plant species present in KMC ward no. 98. A table on plant species about their present status was listed (Table no. 3) and plotted a Graph (Figure no.1.4) about occurrence the plant species that present in KMC ward no.98. Animal diversity along with their local name, scientific name, family, importance etc. is also listed in a table form (Table 4). Then family wise animal species was listed (Table no. 5) and a pie chart was plotted (Figure no. 1.6) based on family wise distribution of animal species present within the study area. Natural Resources Diversity present in KMC ward no. 98 was divided into Plant, Mammal, Avian, Reptile, Amphibian, Fish and Invertebrate species (Table no. 6) and plotted a Graph (Figure no.1.8) about Natural Resources Diversity present in KMC ward no.98.Natural Resources Habitat in KMC ward no.98 was divided into Water Body, Ex-situ Biodiversity, Sacred Groves and sacred trees, Roads (Table no.7) and also plotted a graph (Figure no.1.9) about Natural Resource Habitat within KMC ward no. 98. During the survey period we also have identified the potential threats on the natural resources present within the ward no. 98 under Kolkata Municipal Corporation which were described in this report.

Table 1: Different Plant Species That Present in KMC Ward no. 98

SI No.	Local Name	Scientific Name	Family	Habitat	Importance of the Tree	Wild	Planted	No. of the tree	Present Status
1	Mango / Aam	<i>Mangifera indica</i>	Anacardiaceae	Grow mostly in the home garden, parks and few roads	Fruits consumed as Food, Leaves used in religious rituals		✓	46	Common
2	Jackfruit / Kathal	<i>Artocarpus heterophyllus</i>	Moraceae	Grow mostly in the home garden	Several parts used in traditional medicine. Termite proof wood used for furniture making		✓	37	Frequent
3	Neem	<i>Azadirachta indica</i>	Meliaceae	Grow mostly beside roads and in the home garden	In medicinal purpose, preservatives and insecticides	✓	✓	31	Frequent
4	Java Plum / Jaam	<i>Syzygium cumini</i>	Myrtaceae	Mostly in the home garden	Fruits consumed as Food, Effective in Preventing common infections		✓	19	Rare
5	Bougainvillea	<i>Bougainvillea</i> sp.	Nyctaginaceae	Mostly in the home garden, parks	The plant as an ornamental purpose		✓	66	Abundant

6	Longan / Ashfol	<i>Dimocarpus longan</i>	Sapindaceae	Grow mostly beside roads and in the home garden	Fruits consumed as Food, helps the immune system in fighting infections	✓	✓	13	Rare
7	Guava	<i>Psidium guajava</i>	Myrtales	Grow mostly in the home garden	Fruits consumed as Food; The leaf and the fruits used as medicinal purpose		✓	45	Common
8	Pomelo / Batabi Lebu	<i>Citrus maxima</i>	Rutaceae	Grow mostly in the home garden	Fruits consumed as Food, helps the immune system in fighting infections		✓	22	Frequent
9	Papaya	<i>Carica papaya</i>	Caricaceae	Grow mostly in the home garden	Fruits consumed as food; Eating papaya may help reduce the risk of heart disease, diabetes		✓	31	Frequent
10	Coconut	<i>Cocos nucifera</i>	Arecaceae	Grow mostly beside roads and in the home garden	Fruits consumed as Food, helps control blood sugar levels in our bodies	✓	✓	46	Common
11	Date Palm / Khejur	<i>Diospyros lotus</i>	Arecaceae	Grow mostly beside the roads	Fruits consumed as food, people use juice from	✓	✓	14	Rare

					date palm for coughs and breathing problem				
12	Orange Jessamine / Kamini	<i>Murraya paniculata</i>	Rutaceae	Grow mostly beside roads and in the home garden	The plant as an ornamental, The leaves as a stimulant and decongestant	✓	✓	22	Rare
13	Hibiscus / Joba	<i>Hibiscus</i> sp.	Malvaceae	Grow mostly in the home garden	The plant as an ornamental, and medicinal purpose		✓	44	Common
14	Asian palmyra palm / Taal	<i>Borassus flabellifer</i>	Arecaceae	Grows on the edge of the pond and beside the roads	Fruits consumed as Food, shelter and even as the source of toddy	✓		3	Rare
15	Oleander Leaf	<i>Nerium oleander</i>	Apocynaceae	Grow mostly beside roads and in the home garden	The plant as an ornamental, Treatment of cardiac illness, asthma, diabetes mellitus		✓	11	Rare
16	Garden Croton / Pata Bahar	<i>Codiaeum variegatum</i>	Euphorbiaceae	Grow mostly beside roads and in the garden	The plant as an ornamental purpose	✓	✓	46	Common
17	Areca Nut / Supari	<i>Areca catechu</i>	Arecaceae	Grow mostly beside the roads	A masticator for chewing purposes, vegetable, fuel wood,	✓		26	Frequent

					medicine				
18	Giant Taro / Man kochu	<i>Alocasia macrorrhizos</i>	Araceae	Grow mostly beside roads and in garden	The Giant Taro leaves and stems are also eaten as a vegetable rich in vitamins	✓	✓	12	Rare
19	Tamarind	<i>Tamarindus indica</i>	Fabaceae	Grow mostly beside the roads and in the garden	Fruits consumed as food, decrease LDL cholesterol and increase HDL cholesterol,	✓	✓	6	Rare
20	Bael	<i>Aegle marmelos</i>	Rutaceae	Grow mostly in the home garden	Fruits consumed as Food, helps the immune system in fighting infections		✓	14	Rare
21	Monoon Longifolium / Debdaru	<i>Polyalthia longifolia</i>	Annonaceae	Grow mostly beside roads and in garden, parks	The leaves are used for ornamental decoration during festivals	✓	✓	89	Abundant
22	Royal Poinciana / Krishna chura	<i>Delonix regia</i>	Fabaceae	Grow mostly beside the roads, parks	The tree is value for leaves, shades, ornamental. The wood is handled for carpentry tool	✓		31	Frequent
23	Peacock Flower / Radha chura	<i>Caesalpinia pulcherrima</i>	Fabaceae	Grow mostly beside the	The tree is value for leaves, shades, ornamental.	✓		28	Frequent

				roads, parks	The flowers are effective against intestinal worms				
24	Fig Trees / Dumur	<i>Ficus carica</i>	Moraceae	Grow mostly beside roads and in garden	Producing fruits that are important food source for human and thousand animal species	✓	ü	68	Abundant
25	Peepal Tree / Ashwath ha	<i>Ficus religiosa</i>	Moraceae	Grow mostly beside the roads	The tree is value for shades. leaves the tree attracts fruits lot of birds and bats it also dust absorbent	✓		65	Abundant
26	Burflowe r-Tree / kodom	<i>Neolamarckia cadamba</i>	Rubiaceae	Grow mostly beside roads and parks	The plant as an ornamental, Burflower used for timber and manufacturing paper	✓	✓	20	Rare
27	Banana Tree / kola gach	<i>Musa balbisiana</i>	Verbenaceae	Grow mostly in the home garden	Fruits consumed as Food, helps the immune system in fighting infections		✓	26	Frequent
28	Night- Bloomin g Jasmine / Shiuli	<i>Cestrum nocturnum</i>	Solanaceae	Grow mostly in the home garden	The plant as an ornamental, Night jasmine oil used in aromatherapy to relive stress		✓	20	Rare

					and anxiety				
29	Giant Cerepe-myrtle / Jarul	<i>Lagerstroemia speciosa</i>	Lythraceae	Grow mostly beside the roads	The plant as an ornamental, the flower attract to provide nectar and pollen to many pollinating bees	✓		21	Rare
30	Jungle geranium / Rangan	<i>Ixora coccinea</i>	Rubiaceae	Grow mostly in the home garden, parks	The plant as an ornamental, Treatment heart disease asthma, diabetes	✓		46	Common
31	Barleria Cristata / Jhinti	<i>Barleria cristata</i>	Acanthaceae	Grow mostly beside the roads, parks	The plant as an ornamental, Attracts pollinators; India claimed for the treatment toothache, anaemia	✓		15	Rare
32	Aloe vera	<i>Aloe vera</i>	Asphodelaceae	Grow mostly in the home garden, college premises	This medicinal plant treat skin problem , antioxidant, antidiabetic and antihyperlipidemic	✓		71	Abundant
33	Madagascar Periwinckle / Nayantara	<i>Catharanthus roseus</i>	Apocynaceae	Grow mostly in the home garden, parks	The plant as an ornamental, the flower attract to provide nectar and pollen to many	✓		28	Common

					pollinating bees				
34	Rangpur Lime / Gondhoraj Lebu	<i>Citrus limonia</i>	Rutaceae	Grow mostly in the home garden	It can also enhance the flavour of cooking dishes	✓		7	Rare
35	Bamboo Plant	<i>Bambusa vulgaris</i>	Poaceae	Grow mostly beside the roads, edge of the pond	Bamboo shoots used for foods, it is used to make roofing, decors, paper	✓		7	Rare
36	Water Spinach / kalmi	<i>Ipomoea aquatica</i>	Convolvulaceae	Grows on the edge of the pond and beside the roads	The leaves are used for eating, used in salads	✓	✓	Could not be counted	Common
37	Bitter Gourd / Korola	<i>Mamordica charantia</i>	Cucurbitaceae	Grow mostly in the home garden	Fruits consumed as Food, It juice reduces ageing and fight acne and skin blemishes		✓	12	Rare
38	Bottle Gourd / Laau	<i>Lagenaria siceraria</i>	Cucurbitaceae	Grow mostly in the home garden	Fruits and leaves consumed as Food, boost your immunity		✓	15	Rare
39	Pumpkin / Kumro	<i>Cucurbita moschata</i>	Cucurbitaceae	Grow mostly in the home garden	Fruits and leaves consumed as Food, boost your immunity		✓	8	Rare
40	Sponge Gourd / Dhudul	<i>Luffa aegyptiaca</i>	Cucurbitaceae	Grow mostly in the home	Fruits and leaves consumed as		✓	3	Rare

				garden	Food, helps treating anemia				
41	Thevetia peruviana	<i>Cascabela thevetia</i>	Apocynaceae	Grow mostly beside roads and in garden, parks	The plant as an ornamental, Treatment of external wounds, infected area	✓	✓	23	Frequent
42	Water Lettuce / Pistia	<i>Pistia stratiotes</i>	Araceae	Grow mostly above the surface of the water	Grown as an ornamental in lakes, ponds. Reduce harmful algal blooms	✓		Could not be counted	Frequent
43	Parthenium	<i>Parthenium</i> sp.	Asteraceae	Grow mostly beside the roads	Pharmacologically active against neuralgia and certain types of rheumatism			5	Rare
44	Rose	<i>Rosa</i> sp.	Rosaceae	Grow mostly in the garden, parks	The plant as an ornamental, the flower attract to provide nectar and pollen to many pollinating bees		✓	48	Common
45	Basil / Tulsi	<i>Ocimum basilicum</i>	Lamiaceae	Grow mostly in the home garden	The plant used as an medicinal purpose, Leaves used in religious rituals		✓	44	Common
46	Shirish	<i>Albizia lebbek</i>	Fabaceae	Grow mostly	The decoction of its leaves is	✓		23	Frequent

				beside the roads	used as eye drops in case of night-blindness, neutralize toxins in the body				
47	Scutch grass / Durba ghas	<i>Cynodon dactylon</i>	Poaceae	Grow mostly beside roads and in home garden, parks	Durba grass is one of the best fooder and is a good soil binder	✓	✓	Could not be counted	Abundant
48	Rudra Palash	<i>Spathodea campanulata</i>	Bignoniaceae	Grow mostly beside the roads, parks	Leaves of palash are used to manage skin problems like acne and pimples, Astringent, diuretic	✓		18	Rare
49	Jimsonweed	<i>Datura metel</i>	Solanaceae	Grow mostly in the home garden	Used as an medicinal purpose, alleviating pain, treating fever		✓	15	Rare
50	Bay Leaf / Tejpata	<i>Laurus nobilis</i>	Lauraceae	Grow mostly in the home garden	Bay leaf is used to cooking dishes, it can also enhance the flavour of cooking dishes		✓	2	Rare
51	Java Apple / Jamrul	<i>Syzygium cumini</i>	Myrtaceae	Grow mostly in the home garden	Fruits consumed as food; These Java Apple		✓	8	Rare

					can help with prostate and breast cancer				
52	Firecracker flower	<i>Crossandra infundibuliformis</i>	Acanthaceae	Grow mostly in the home garden, College premises	The plant as an ornamental, Flower extract used in fever, headache, pain etc		✓	5	Rare
53	Lychee Plant / Lichu	<i>Litchi chinensis</i>	Sapindaceae	Grow mostly in the home garden	Fruits consumed as Food, Effective in Preventing common infections		✓	4	Rare
54	Randram boay	<i>Euphorbia lophogona</i>	Euphorbiaceae	Grow mostly in the home garden, parks, College premises	This medicinal plant used for Ayurvedic treatment. Worm infestations in children, pimple		✓	22	Frequent
55	Gout Plant	<i>Jatropha podagrica</i>	Euphorbiaceae	Grow mostly in the home garden, College premises	J.Podagrica in folk medicine including as an analgesic, purgative, intestinal worms		✓	3	Rare
56	Fiddle Leaf Plumeria	<i>plumeria pudica</i>	Apocynaceae	Grow mostly in the home garden	The plant as an ornamental, Treatment diabetes mellitus, skin disease		✓	2	Rare
57	Golden Shower Tree	<i>Cassia fistula</i>	Fabaceae	Grow mostly beside	The plant as an ornamental, and herbal	✓	✓	19	Rare

				roads and in the garden	medicinal purpose				
58	Frangipani / Chompa	<i>plumeria</i> sp.	Apocynaceae	Grow mostly in the home garden, parks	The plant as an ornamental, These flowers primarily symbolize beauty, charm, and grace		✓	10	Rare
59	Cannonball Tree	<i>Couroupita guianensis</i>	Lecythidaceae	Grow mostly in the home garden	It is the tree of sacred scriptures.		✓	2	Rare
60	Curry leaf	<i>Murraya koenigii</i>	Rutaceae	Grow mostly in the home garden	It helps in the treatment of dysentery, morning sickness and nausea		✓	4	Rare
61	Water hyacinth/ Kochuripana	<i>Eichhornia crassipes</i>	Pontederiaceae	Grow mostly above the surface of the water	Used for making textiles, paper and for camouflaging fish traps	✓		Could not be counted	Frequent
62	Sago Palm	<i>Cycas revoluta</i>	Cycadaceae	Grow mostly in the home garden, College premises	Sago is produced sago pearls, sago pearls boiled, mixed with other foods		✓	7	Rare

Table 2: Family wise plant species in KMC ward no. 98

SI No.	Local Name	Scientific Name	Family
1	Mango / Aam	<i>Magnifera indica</i>	Anacardiaceae
2	Jackfruit / Kathal	<i>Artocarpus heterophyllus</i>	Moraceae
3	Neem	<i>Azadirachta indica</i>	Meliaceae
4	Java Plum / Jaam	<i>Syzygium cumini</i>	Myrtaceae
5	Bougainvillea	<i>Bougainvillea</i> sp.	Nyctaginaceae
6	Longan / Ashfol	<i>Dimocarpus longan</i>	Sapindaceae
7	Guava	<i>Psidium guajava</i>	Myrtales
8	Pomelo / Batabi Lebu	<i>Citrus maxima</i>	Rutaceae
9	Papaya	<i>Carica papaya</i>	Caricaceae
10	Coconut	<i>Cocos nucifera</i>	Arecaceae
11	Date Palm / Khejur	<i>Diospyros lotus</i>	Arecaceae
12	Orange Jessamine / Kamini	<i>Murraya paniculata</i>	Rutaceae
13	Hibiscus / Joba	<i>Hibiscus</i> sp.	Malvaceae
14	Asian palmyra palm / Taal	<i>Borassus flabellifer</i>	Arecaceae
15	Oleander Leaf	<i>Nerium oleander</i>	Apocynaceae
16	Garden Croton / Pata Bahar	<i>Codiaeum variegatum</i>	Euphorbiaceae
17	Areca Nut / Supari	<i>Areca catechu</i>	Arecaceae
18	Giant Taro / Man kochu	<i>Alocasia macrorrhizos</i>	Araceae
19	Tamarind	<i>Tamarindus indcia</i>	Fabaceae
20	Bael	<i>Aegle marmelos</i>	Rutaceae
21	Monoon Longifolium / Debbaru	<i>Polyalthia longifolia</i>	Annonaceae
22	Royal Poinciana / Krishna chura	<i>Delonix regia</i>	Fabaceae
23	Peacock Flower / Radha chura	<i>Caesalpinia pulcherrima</i>	Fabaceae
24	Fig Trees / Dumur	<i>Ficus carica</i>	Moraceae
25	Peepal Tree / Ashwaththa	<i>Ficus religiosa</i>	Moraceae
26	Burflower-Tree / kodom	<i>Neolamarckia cadamba</i>	Rubiaceae
27	Banana Tree / kola gach	<i>Musa balbisiana</i>	Verbenaceae
28	Night-Blooming Jasmine / Shiuli	<i>Cestrum nocturnum</i>	Solanaceae
29	Giant Cerepe-myrtle / Jarul	<i>Lagerstroemia speciosa</i>	Lythraceae
30	Jungle geranium / Rangan	<i>Ixora coccinea</i>	Rubiaceae
31	Barleria Cristata / Jhinti	<i>Barleria cristata</i>	Acanthaceae
32	Aloe vera	<i>Aloe vera</i>	Asphodelaceae
33	Madagascar Periwinkle / Nayantara	<i>Catharanthus roseus</i>	Apocynaceae
34	Rangpur Lime / Gondhoraj Lebu	<i>Citrus limonia</i>	Rutaceae
35	Bamboo Plant	<i>Bambusa vulgaris</i>	Poaceae
36	Water Spinach / kalmi	<i>Ipomoea aquatica</i>	Convolvulaceae
37	Bitter Gourd / Korola	<i>Mamordica charantia</i>	Cucurbitaceae
38	Bottle Gourd / Laau	<i>Lagenaria siceraria</i>	Cucurbitaceae
39	Pumpkin / Kumro	<i>Cucurbita moschata</i>	Cucurbitaceae
40	Sponge Gourd / Dhudul	<i>Luffa aegyptiaca</i>	Cucurbitaceae
41	Thevetia peruviana	<i>Cascabela thevetia</i>	Apocynaceae
42	Water Lettuce / Pistia	<i>Pistia stratiotes</i>	Araceae
43	Parthenium	<i>Parthenium</i> sp.	Asteraceae

44	Rose	<i>Rosa sp.</i>	Rosaceae
45	Basil / Tulsi	<i>Ocimum basilicum</i>	Lamiaceae
46	Shirish	<i>Albizia lebeck</i>	Fabaceae
47	Scutch grass / Durba ghas	<i>Cynodon dactylon</i>	Poaceae
48	Rudra Palash	<i>Spathodea campanulata</i>	Bignoniaceae
49	Jimsonweed	<i>Datura metel</i>	Solanaceae
50	Bay Leaf / Tejpata	<i>Laurus nobilis</i>	Lauraceae
51	Java Apple / Jamrul	<i>Syzygium cumini</i>	Myrtaceae
5	Firecracker flower	<i>Crossandra infundibuliformis</i>	Acanthaceae
53	Lychee Plant / Lichu	<i>Litchi chinensis</i>	Sapindaceae
54	Randramboay	<i>Euphorbia lophogona</i>	Euphorbiaceae
55	Gout Plant	<i>Jatropha podagrica</i>	Euphorbiaceae
56	Fiddle Leaf Plumeria	<i>plumeria pudica</i>	Apocynaceae
57	Golden Shower Tree	<i>Cassia fistula</i>	Fabaceae
58	Frangipani / Chompa	<i>plumeria sp.</i>	Apocynaceae
59	Cannonball Tree	<i>Couroupita guianensis</i>	Lecythidaceae
60	Curry leaf	<i>Murraya koenigii</i>	Rutaceae
61	Water hyacinth/ Kochuri pana	<i>Eichhornia crassipes</i>	Pontederiaceae
62	Sago Palm	<i>Cycas revoluta</i>	Cycadaceae

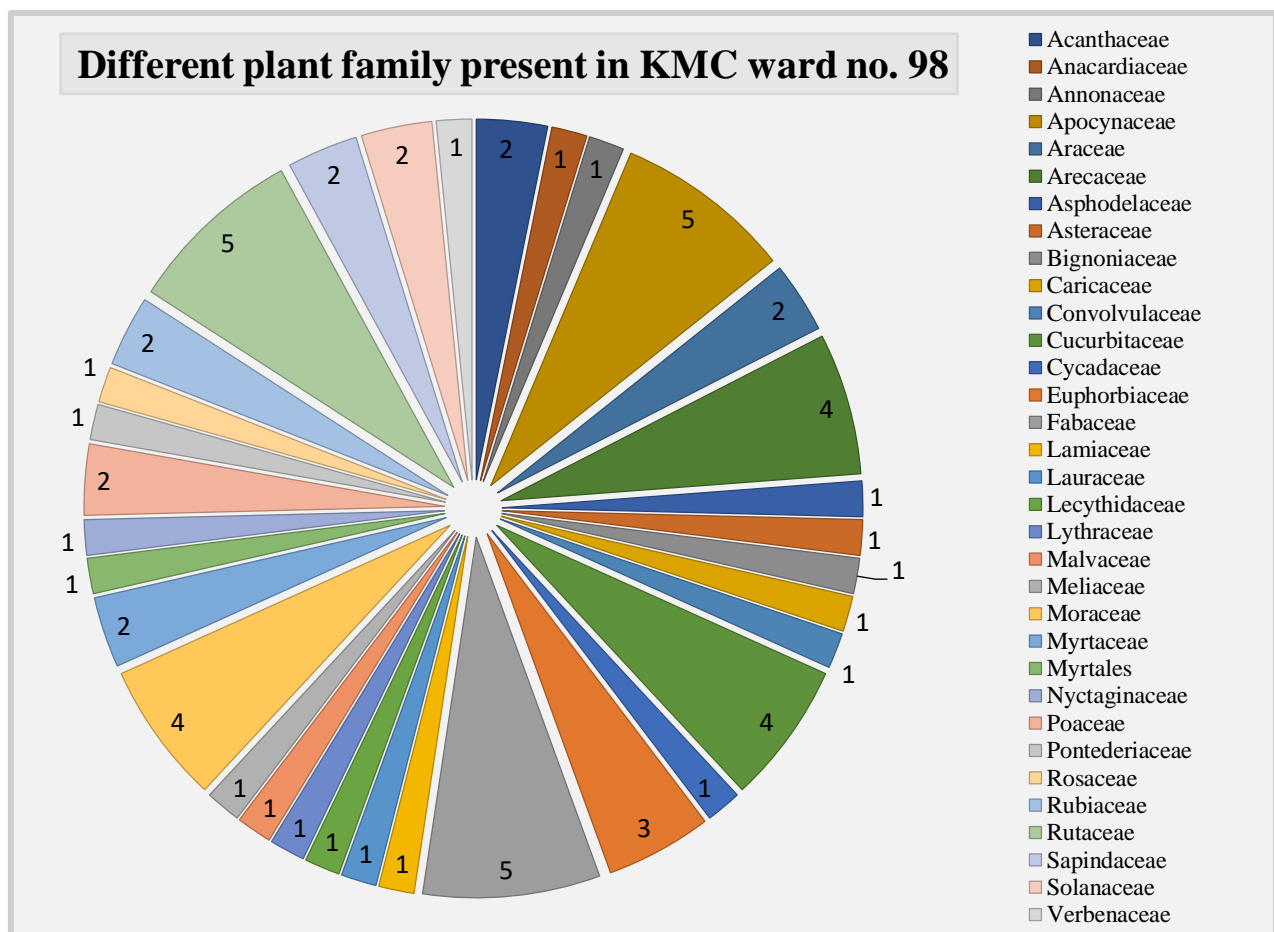


Figure 1.3: Different plant family present within KMC ward no. 98

Table 3: Present status of the plant species present in the study area

Sl No.	Local Name	Scientific Name	Present Status
1	Mango / Aam	<i>Magnifera indica</i>	Common
2	Jackfruit / Kathal	<i>Artocarpus heterophyllus</i>	Frequent
3	Neem	<i>Azadirachta indica</i>	Frequent
4	Java Plum / Jaam	<i>Syzygium cumini</i>	Rare
5	Bougainvillea	<i>Bougainvillea</i> sp.	Abundant
6	Longan / Ashfol	<i>Dimocarpus longan</i>	Rare
7	Guava	<i>Psidium guajava</i>	Common
8	Pomelo / BatabiLebu	<i>Citrus maxima</i>	Frequent
9	Papaya	<i>Carica papaya</i>	Frequent
10	Coconut	<i>Cocos nucifera</i>	Common
11	Date Palm / Khejur	<i>Diospyros lotus</i>	Rare
12	Orange Jessamine / Kamini	<i>Murraya paniculata</i>	Rare
13	Hibiscus / Joba	<i>Hibiscus</i> sp.	Common
14	Asian palmyra palm / Taal	<i>Borassusflabellifer</i>	Rare
15	Oleander Leaf	<i>Nerium oleander</i>	Rare
16	Garden Croton / PataBahar	<i>Codiaeum variegatum</i>	Common
17	Areca Nut / Supari	<i>Areca catechu</i>	Frequent
18	Giant Taro / Man kochu	<i>Alocasia macrorrhizos</i>	Rare
19	Tamarind	<i>Tamarindus indcia</i>	Rare
20	Bael	<i>Aegle marmelos</i>	Rare
21	Monoon Longifolium / Debdaru	<i>Polyalthia longifolia</i>	Abundant
22	Royal Poinciana / Krishna chura	<i>Delonix regia</i>	Frequent
23	Peacock Flower / Radhachura	<i>Caesalpinia pulcherrima</i>	Frequent
24	Fig Trees / Dumur	<i>Ficus carica</i>	Abundant
25	Peepal Tree / Ashwaththa	<i>Ficus religiosa</i>	Abundant
26	Burflower-Tree / kodom	<i>Neolamarckia cadamba</i>	Rare
27	Banana Tree / kola gach	<i>Musa balbisiana</i>	Frequent
28	Night-Blooming Jasmine / Shiuli	<i>Cestrum nocturnum</i>	Rare
29	Giant Cerepe-myrtle / Jarul	<i>Lagerstroemia speciosa</i>	Rare
30	Jungle geranium / Rangan	<i>Ixora coccinea</i>	Common
31	BarleriaCristata / Jhinti	<i>Barleria cristata</i>	Rare
32	Aloe vera	<i>Aloe vera</i>	Abundant

33	Madagascar Periwinkle / Nayantara	<i>Catharanthus roseus</i>	Common
34	Rangpur Lime / GondhorajLebu	<i>Citrus limonia</i>	Rare
35	Bamboo Plant	<i>Bambusa vulgaris</i>	Rare
36	Water Spinach / kalmi	<i>Ipomoea aquatica</i>	Common
37	Bitter Gourd / Korola	<i>Mamordica charantia</i>	Rare
38	Bottle Gourd / Laau	<i>Lagenaria siceraria</i>	Rare
39	Pumpkin / Kumro	<i>Cucurbita moschata</i>	Rare
40	Sponge Gourd / Dhudul	<i>Luffa aegyptiaca</i>	Rare
41	Thevetiaperuviana	<i>Cascabela thevetia</i>	Frequent
42	Water Lettuce / Pistia	<i>Pistia stratiotes</i>	Frequent
43	Parthenium	<i>Parthenium</i> sp.	Rare
44	Rose	<i>Rosa</i> sp.	Common
45	Basil / Tulsi	<i>Ocimum basilicum</i>	Common
46	Shirish	<i>Albizia lebbek</i>	Frequent
47	Scutch grass / Durbaghas	<i>Cynodon dactylon</i>	Abundant
48	RudraPalash	<i>Spathodea campanulata</i>	Rare
49	Jimsonweed	<i>Datura metel</i>	Rare
50	Bay Leaf / Tejpata	<i>Laurus nobilis</i>	Rare
51	Java Apple / Jamrul	<i>Syzygium cumini</i>	Rare
52	Firecracker flower	<i>Crossandra infundibuliformis</i>	Rare
53	Lychee Plant / Lichu	<i>Litchi chinensis</i>	Rare
54	Randramboay	<i>Euphorbia lophogona</i>	Frequent
55	Gout Plant	<i>Jatropha podagrica</i>	Rare
56	Fiddle Leaf Plumeria	<i>Plumeria pudica</i>	Rare
57	Golden Shower Tree	<i>Cassia fistula</i>	Rare
58	Frangipani / Chompa	<i>Plumeria</i> sp.	Rare
59	Cannonball Tree	<i>Couropita guianensis</i>	Rare
60	Curry leaf	<i>Murraya koenigii</i>	Rare
61	Water hyacinth/ Kochuripana	<i>Eichhornia crassipes</i>	Frequent
62	Sago Palm	<i>Cycas revoluta</i>	Rare

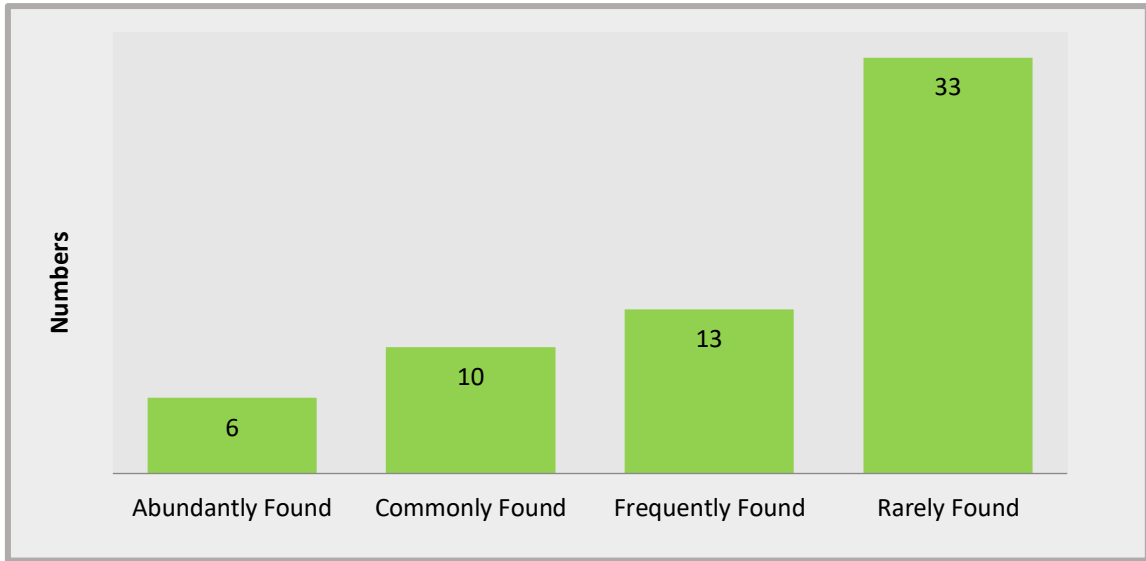


Figure 1.4 : Occurrence of the Plant species that present in ward no. 98



Figure 1.5 : Pictures of some plant species present within KMC ward no. 98

[A. Krishnachura B. Debdaru C. Togor D. Joba E. Patabahar F. Ucche]

Table 4: Different animal species present in KMC ward no.98

Sl No.	Local Name	Scientific Name	Family	Importance of the Animal	Domestic	Wild	Present Status
1	Kathberali/ Five Striped Palm Squirrel	<i>Funambulus pennantii</i>	Sciuridae	They probably play an important role in the spread of seeds, they provide food for birds of prey, they may pollinate some plants		✓	Common
2	Beji/ Small Indian Mongoose	<i>Herpestes javanicus</i>	Herpestidae	Important for terrestrial ecosystems as part of food chains often kept as a pet to keep dwellings free from rats and other pests		✓	Rare
3	Endur/ Brown Rat	<i>Rattus norvegicus</i>	Muridae	Rats are major source of food for many predators and scavengers		✓	Abundant
4	Badur/ Indian fulvous fruit bat	<i>Rousettus leschenaultii</i>	Pteropodidae	They are important pollinators and seed dispersers for many plant species and provide food for other animals		✓	Common
5	Biral/Cat	<i>Felis catus</i>	Felidae	Cat can bring unconditional love and companionship to your life	✓	✓	Abundant
6	Kukur/Dog	<i>Canis familiaris</i>	Canidae	Dogs make us feel less alone, Dogs make us more social	✓	✓	Abundant

7	Goru/Cow	<i>Bos taurus</i>	Bovidae	Milk, dairy products cow dung increase the quality and yield of crops	✓		Rare
8	Kath-thokkra / Black Rumped Flameback	<i>Dinopium benghalense</i>	Picidae	They play important role in the ecosystem by helping to control the population of insects and small animals		✓	Common
9	White-throated kingfisher	<i>Halcyon smyrnenis</i>	Cerylidae	Important member of ecosystems and good indicators of freshwater community health		✓	Rare
10	Bulbuli	<i>Pycnonotus barbatus</i>	Pycnonotidae	bulbuls are important for dispering the seeds of forest plants and as pollinators		✓	Abundant
11	Crow	<i>Corvus splendens</i>	Corvidae	Crows helps control pest insects and clean up dead animals and garbage that has been scattered by other animal		✓	Abundant
12	Chorai/ House Sparrow	<i>Passer domesticus</i>	Passeridae	Maintaing the food web and an ecological balance. Feeding on seeds, grains the bird has proven to be an ecological balance		✓	Rare

13	Shalik/ Myna	<i>Acridotheres tristis</i>	Sturnidae	Myna is called the Farmer Friend because it eats insects that destroy crop plants	✓	Abundant
14	Tiya / Rose-ringed parakeet	<i>Psittacula krameri</i>	Psittaculidae	Parakeet is a very beautiful bird as well as a popular pet and can become an excellent companion for the entire family	✓	Common
15	Payra/Pigeon	<i>Columba livia</i>	Columbidae	Importance to humans as food, pets, holy animals, and messengers	✓	Abundant
16	Jol dhora / Checkered Keelback	<i>Xenochrophis piscator</i>	Colubridae	It helps control the population of other animals, such as rodents and fish	✓	Rare
17	Daras sap / Indian rat snake	<i>Ptyas mucosa</i>	Colubridae	It helps rid fields of rodents and does the same in urban settlements as well	✓	Rare
18	Tiktiki/House Gecko	<i>Hemidactylus</i> sp.	Gekkonidae	House gecko are important because they help control the population of insects and other small animals in and around homes	✓	Abundant
19	Sona Byang / Indian Bull Frog	<i>Hoplobatrachus tigerinus</i>	Ranidae	Help to control insect pests, importance in food chain	✓	Rare
20	Kuno Byang / Asian Common Toad	<i>Duttaphrynus melanostictus</i>	Ranidae	Important in food chains, being significant predators of insect and other invertebrates	✓	Rare

21	Rohu	<i>Labeo rohita</i>	Cyprinidae	Most generally esteemed for eating purpose	✓		Abundant
22	Silver Carp	<i>Hypophthalmichthys molitrix</i>	Cyprinidae	It is herbivorous and low in the food chain; feeds and fertilizers are therefore easily available at low cost	✓		Abundant
23	Catla	<i>Catla catla</i>	Cyprinidae	Great food value, reduce the risk of arthritis and help strengthen the joint bones	✓		Abundant
24	Moumachi/ Honey Bee	<i>Apis</i> sp.	Apidae	They provide high-quality food honey, royal jelly, pollen and beeswax, propolis		✓	Abundant
25	Lime Butterfly	<i>Papilio demoleus</i>	Papilionidae	They pollinate plants in your garden, butterflies show the health of an ecosystem		✓	Abundant
26	Common Rose Butterfly	<i>Pachliopta aristolochiae</i>	Papilionidae	They pollinate plants in your garden, butterflies show the health of an ecosystem		✓	Abundant
27	Striped Tiger Butterfly	<i>Danaus genutia</i>	Nymphalidae	They are attracted to bright flowers and need to feed on nectat		✓	Abundant
28	Peacock Pansy	<i>Junonia almana</i>	Nymphalidae	They pollinate plants in your garden, butterflies show the health of an ecosystem		✓	Abundant

29	Common Mormon	<i>Papilio polytes</i>	Papilionidae	Common Mormon butterflies are pollinators, herbivores and prey.	✓	Abundant
30	Common emigrant	<i>Catopsilia</i> sp.	Pieridae	They play in the food chain of a forest ecosystem. They also greatly affect biodiversity, also they are pollinators of flowering plants.	✓	Abundant
31	Psyche butterfly	<i>Leptosia</i> sp.	Pieridae	Psyche Butterfly is important to the ecosystem because it helps with pollination	✓	Abundant
32	Dragonfly		Dipterocarpaceae	As predators and as prey to birds and fish	✓	Abundant
33	House Fly	<i>Musca domestica</i>	Muscidae	Pollinating plants, breaking down organic material and serving as food for other bugs and animals	✓	Abundant
34	American Cockroach	<i>Periplaneta americana</i>	Blattidae	American cockroaches are important decomposers in the ecosystem because they help break down dead and decaying organic matter	✓	Abundant
35	Apple Snail	<i>Pila globosa</i>	Ampullariidea	It is an ecological element that actively contributes to preserving a healthy aquatic habitat	✓	Abundant
36	Common house Spider	<i>Parasteatoda tepidariorum</i>	Theridiidae	Spider like to feast on pesky insects, like roaches, moths, and	✓	Abundant

				earwigs, which keep their population in check			
37	Common Malaria Mosquito	<i>Anopheles stephensi</i>	Culicidae	it is a primary mosquito vector of malaria in urban India, serving as food for fish as larvae and for birds		✓	Abundant
38	Lal Pipre	<i>Monomorium</i> sp.	Formicidae	Ants turn and aerate the soil, allowing water and oxygen to reach plant roots		✓	Abundant
39	Kalo Pipre	<i>Camponotus</i> sp.	Formicidae	They play an important role in the ecosystem by helping to break down organic matter and aerating soil.		✓	Abundant

Table 5: Family Wise Animal Species Present in KMC ward no. 98

SI No.	Scientific Name	Family
1	<i>Pila globosa</i>	Ampullariidea
2	<i>Apis</i> sp.	Apidae
3	<i>Periplaneta americana</i>	Blattidae
4	<i>Bos taurus</i>	Bovidae
5	<i>Canis familiars</i>	Canidae
6	<i>Halcyon smyrnensis</i>	Cerylidae
7	<i>Xenochrophis piscator</i>	Colubridae
8	<i>Ptyas mucosa</i>	Colubridae
9	<i>Columba livia</i>	Columbidae
10	<i>Corvus splendens</i>	Corvidae

11	<i>Anopheles stephensi</i>	Culicidae
12	<i>Labeo rohita</i>	Cyprinidae
13	<i>Hypophthalmichthys molitrix</i>	Cyprinidae
14	<i>Catla catla</i>	Cyprinidae
15	<i>Anisoptera</i> sp.	Dipterocarpaceae
16	<i>Felis catus</i>	Felidae
17	<i>Monomorium</i> sp.	Formicidae
18	<i>Camponotus</i> sp.	Formicidae
19	<i>Hemidactylus</i> sp.	Gekkonidae
20	<i>Herpestes javanicus</i>	Herpestidae
21	<i>Rattus norvegicus</i>	Muridae
22	<i>Musca domestica</i>	Muscidae
23	<i>Danaus genutia</i>	Nymphalidae
24	<i>Junonia almana</i>	Nymphalidae
25	<i>Papilio demoleus</i>	Papilionidae
26	<i>Pachliopta aristolochiae</i>	Papilionidae
27	<i>Papilio polytes</i>	Papilionidae
28	<i>Passer domesticus</i>	Passeridae
29	<i>Dinopium benghalense</i>	Picidae
30	<i>Catopsilia</i> sp.	Pieridae
31	<i>Leptosia</i> sp.	Pieridae
32	<i>Psittacula krameri</i>	Psittaculidae
33	<i>Rousettus leschenaultii</i>	Pteropodidae
34	<i>Pycnonotus barbatus</i>	Pycnonotidae
35	<i>Hoplobatrachus tigerinus</i>	Ranidae
36	<i>Duttaphrynus melanostictus</i>	Ranidae
37	<i>Funambulus pennantii</i>	Sciuridae

38	<i>Acridotheres tristis</i>	Sturnidae
39	<i>Parasteatoda tepidariorum</i>	Theridiidae

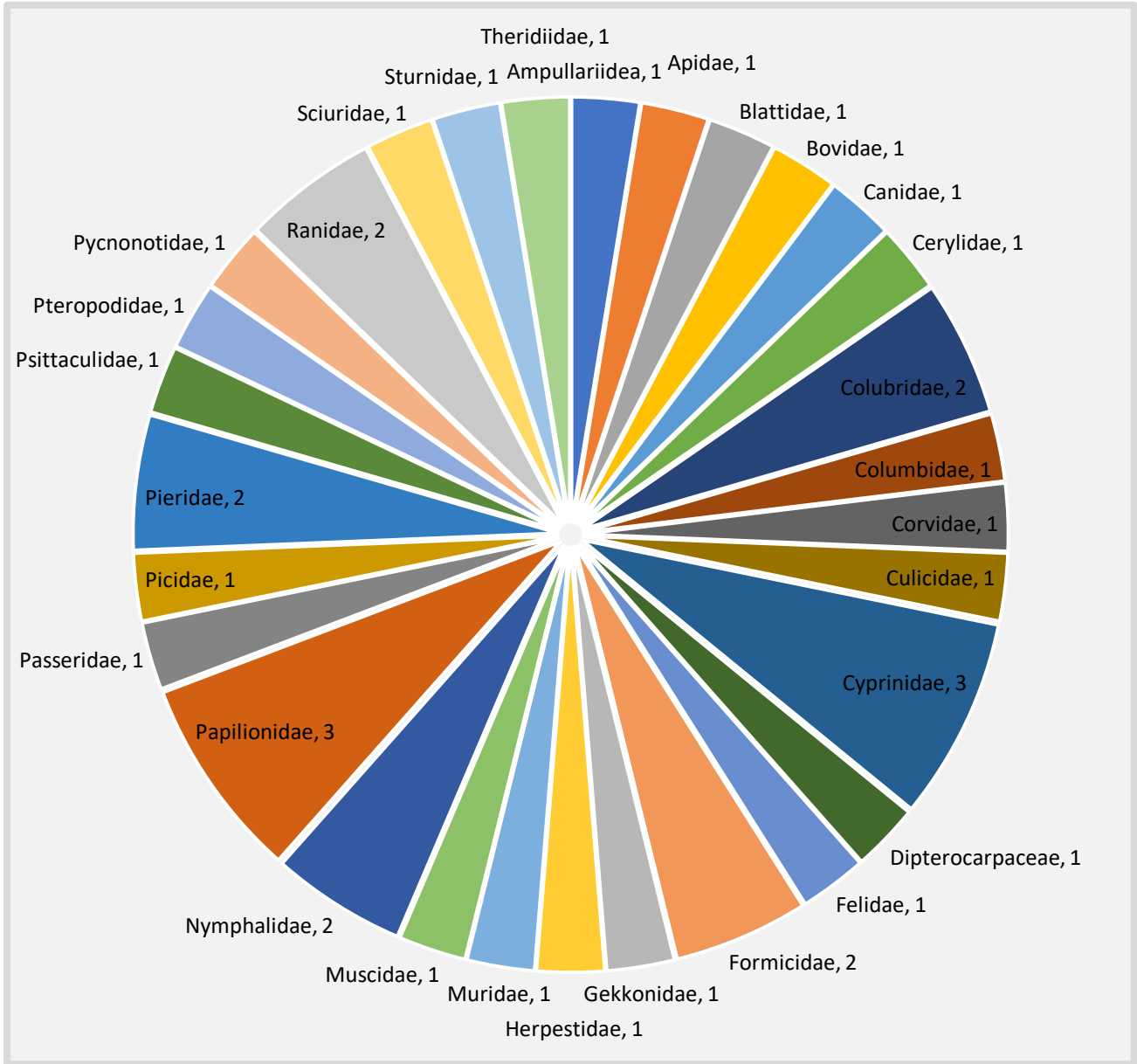
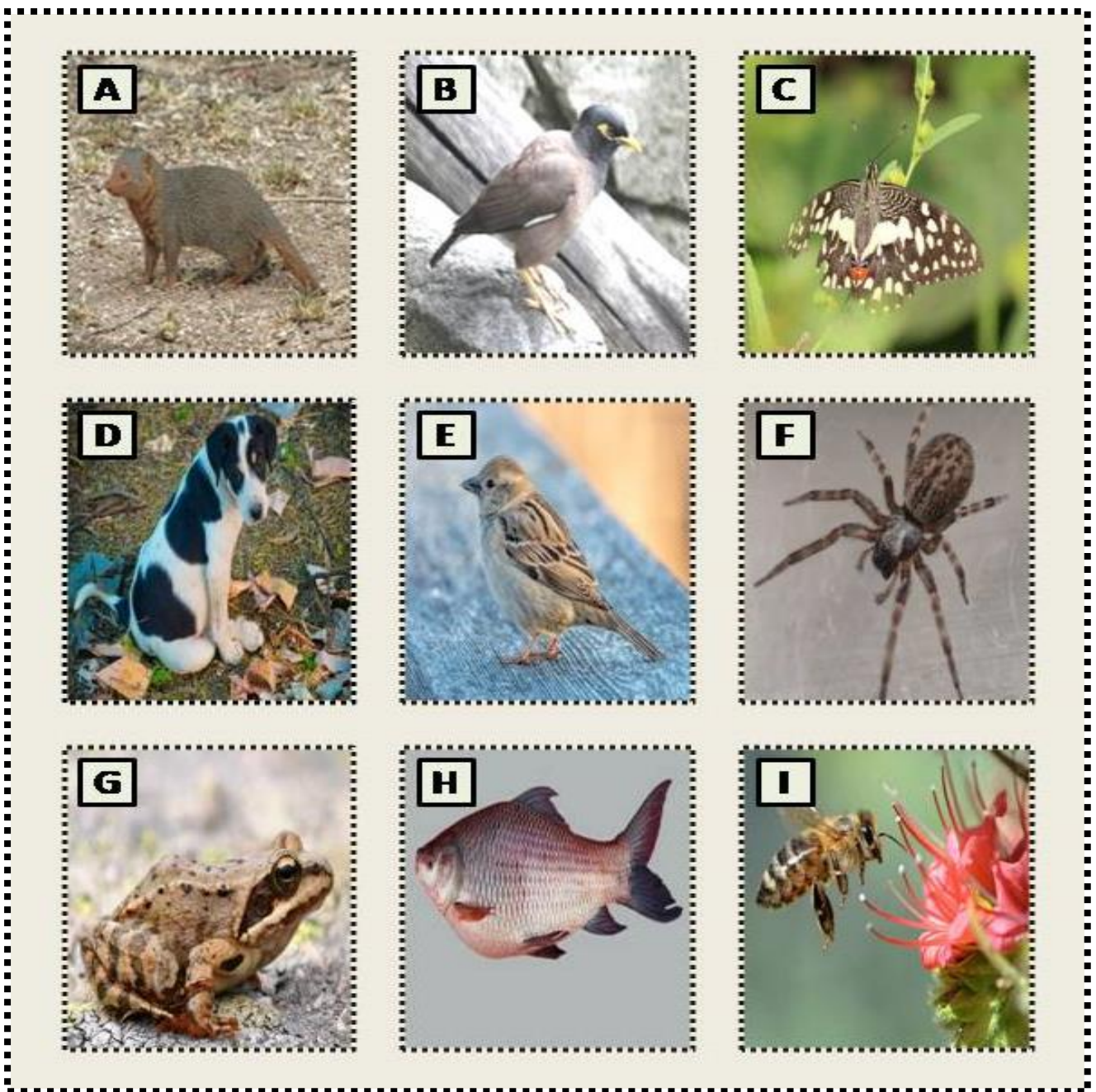


Figure 1.6 : Family wise distribution of different animal species that present within ward no. 98



(Source of the pictures: Internet)

Figure 1.7 : Pictures of some animal species in present within KMC ward no. 98

[A. Indian Grey Mongoose B. Myna C. Lime butterfly D. Dog E. Sparrow F. Spider G. Frog
H. Rohu fish I. Honey Bee]

Table 6 : Natural Resource Diversity in KMC ward no. 98

Sl No.	Natural resource diversity	Number of species
1	Plants	62
2	Mammals	7
3	Avian	8
4	Reptile	3
5	Invertebrate	16
6	Fish	3
7	Amphibian	2

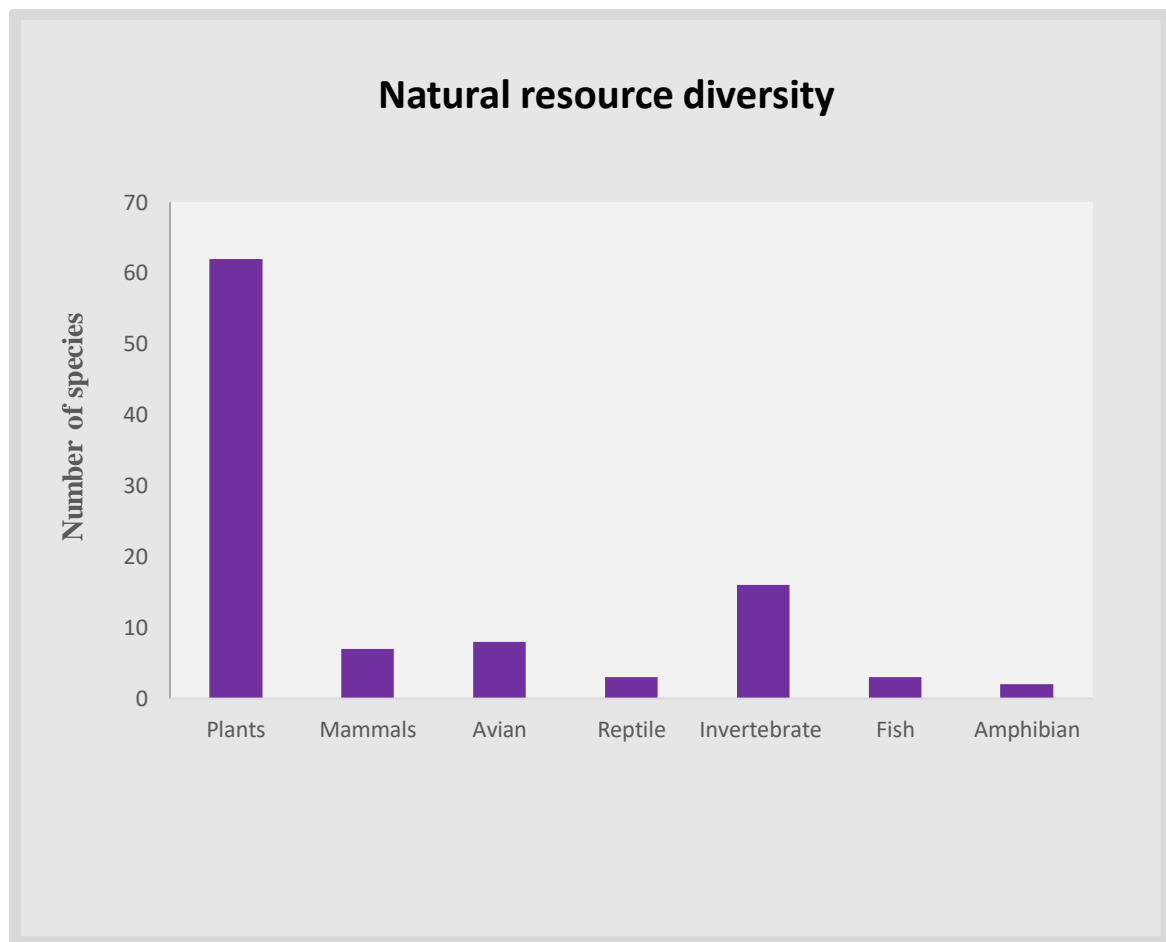


Figure 1.8 : Natural Resource Diversity in ward no. 98

Table no. 7 : Natural Resource habitat in KMC ward no. 98

SI No.	Types of Habitat	Name of the habitat area	Number of different habitats	Ownership	Features	Use pattern
1.	Water body	a) Ranidighi b) Bansdronipukur c) Netaji nagar 8 no. pukur d) Sanghati colony pukur e) Sanghati colony 1no. goyalpukur f) Battala 15 no. padmapukur g) Pallyshree 3 no. pukur h) Netaji nagar 9 no. pukur	8	Kolkata municipal corporation (KMC)	Cemented bank / mud	Fisheries , Idol immersion, Religious ritual perform
2.	Ex-situ Biodiversity	Park: a) Netaji nagar 5 no. children park b) 7/23 Aprahu children park c) Prasanta children park d) Netaji nagar 10 no. children park e) Netaji nagar 11 no. children park f) Bijoygarh 5 no. children park	9	Kolkata municipal corporation (KMC)	Cemented/ mud	Recreational activities such as walking, exercising, cycling, playing etc.

		<p>g) Pallyshree 3 no. children park</p> <p>h) Babudutta children park</p> <p>i) Netaji subhas park</p> <p>j) Sanghati 1 no. children park</p> <p>k) Sanghati 2 no. children park</p>				
		<p>Roadside Garden:</p> <p>a) Raipur sishu garden</p> <p>b) NSC roadside garden</p> <p>c) Annapurna roadside garden</p> <p>d) Suryanagar side garden</p>	4		Greenary	Scenic beauty
3.	Sacred groves and sacred trees	Ranidighi sacred grove	9	Kolkata municipal corporation (KMC)	The repositories of rich medicinal plants, wild relatives of crops and many important species, which act as a valuable gene pool	

4.	Road	Concrete Asphalt		Kolkata municipal corporation (KMC)	Connecting the all different street as well as all people to travel from one place to another places	Road make a crucial contribution to economic development and growth and bring important social benefits.
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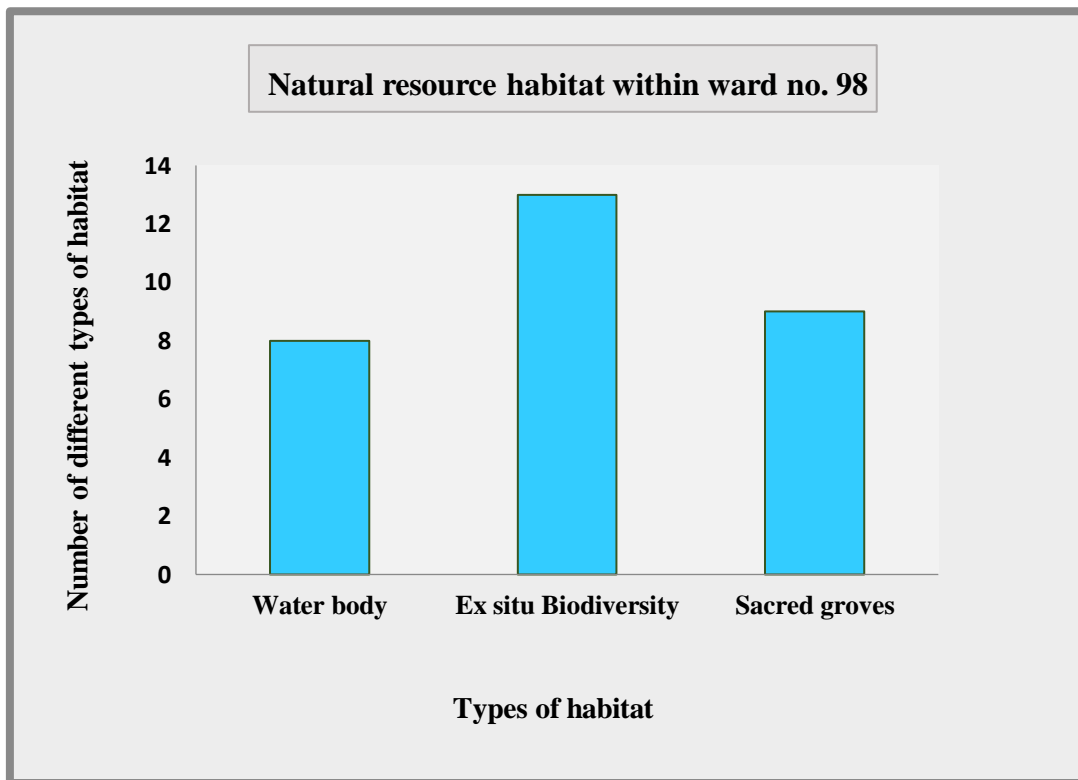


Figure 1.9 : Natural resource habitat present within ward no. 98

The road was not included in the plotted graph as it was not possible to follow every roads and cover the total ward area within the short time period.

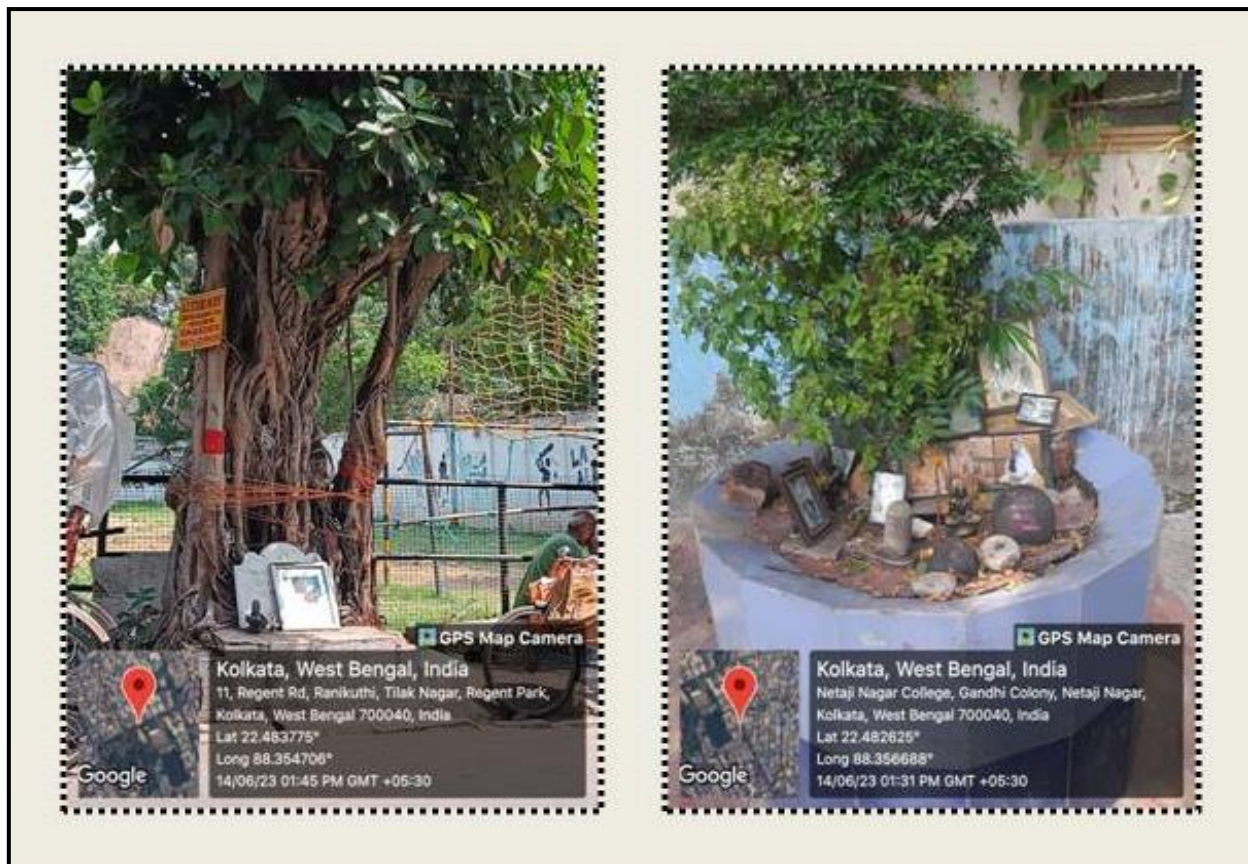


Figure 1.10: Pictures of some sacred trees located in the study area

▲ **Threats to natural resources encountered within the study area:**

In urban areas, there are several threats to natural resources that can have significant environmental and socio-economic impacts. Here are some common threats to natural resources that were identified in KMC ward no. 98:

- This ward may face challenges related to water scarcity in future due to high demand from the growing population, developmental activities, and inefficient water management and conservation activities. The water bodies of the area are being polluted by dumping of residential and constructional waste materials. This is result is increasing the process of eutrphication of the water bodies. Urbanization of the KMC ward no. 98 led to conversion of the natural resources (water bodies) into impervious surfaces like urban areas, roads etc. as some residents have the notion that water bodies act as nuisance and breeding ground for mosquitoes.
- Construction of new building in the study area without proper planning resulted in the loss of biodiversity and its habitat, several water bodies declined and loss in green spaces such as parks, playground etc. Trees are often cut down and other natural habitats are altered to make way for buildings, roads, and development infrastructure.

- Urban areas generate significant amounts of waste, including solid waste, hazardous waste, and electronic waste. Adequate waste management practices are not done properly in ward no. 98 leading to pollution of remaining water bodies and biodiversity habitats of the area. Rarely the houses in KMC ward no. 98 have rain water harvesting systems involved. Although some houses still have plenty of flora but they are mainly ornamental exotic flora that are preferred over indigenous species.

Addressing these threats requires sustainable urban planning and management practices, including promoting green infrastructure, implementing efficient waste management systems, adopting renewable energy sources, and implementing water conservation measures. Public awareness and active participation of residents of KMC ward no. 98 are essential in fostering a more sustainable approach to natural resource management in the area.



Figure 1.11: Pictures about the identified threats for the natural resources present within ward no. 98

A. A tree was uprooted due to construction purpose

B. A tree was cut down for development infrastructure

CONCLUSION:

KMC Ward No. 98, is an administrative division of Kolkata Municipal Corporation in Borough No. 10 in South Kolkata, West Bengal. From the above study we can conclude that Kolkata municipal corporation Ward No. 98 has a wide range of local resources i.e a great diversity of plant and animal species still present in the area. The documentation of natural resources within KMC ward no. 98 concludes that 62 species of plants, 7 species of mammals, 3 species of reptiles, 8 species of birds, 16 species of invertebrates, 3 species of fishes and 2 species of amphibian are present within the area. According to the survey the plant family that have higher species richness are Apocynaceae, Fabaceae and Rutaceae followed by Arecaceae, Cucurbitaceae and Moraceae . While surveying habitats for biodiversity, 8 water bodies and 15 parks and gardens were found to be present within KMC Ward No. 98. The ward also harboured few sacred trees and one sacred grove which act as the valuable wild biodiversity gene pool. Integrating and protecting flora, fauna, natural resources, and their habitats in urban areas is crucial for biodiversity conservation, ecosystem services, recreation, education, cultural significance, and climate change resilience. It enhances the livability and sustainability of cities and promotes a harmonious relationship between humans and the natural environment.

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DEPARTMENT OF ENVIRONMENTAL SCIENCE

The following students of Environmental Science (Honours) Semester, III completed **their EDUCATIONAL FIELD VISIT TO BAKKHALI, WEST BENGAL WEST BENGAL** from 2nd November – 5th of November 2022 in Session 2022-2023

Total No. of students: 04 (Four)

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FIELD VISIT TO BAKKHALI ,WEST BENGAL (ECOLOGICAL STUDY)



CC5(3rd SEMESTER) ENVA – CC3-5-P

YEAR – 2022 -2023

SUBMITTED BY –

UNIVERSITY ROLL NO. – 213056-11-0047

UNIVERSITY REGISTRATION NO.- 056-1211-0145-21

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Dr. Moumit Roy Goswami

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OUR PEAR TEAM –

Sweety Nandy

Sunita Rani Pal

Anwasha Ray

Adrita Das



OUR TEAM WITH OUR TEACHER

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INTRODUCTION

Ecosystem :

An Ecosystem can be visualised as Functional unit of nature, where living organisms interact among themselves and also with the surrounding physical environment. Ecosystem varies greatly in size from a small pond to a large forest or a sea. Many ecologists regard the entire biosphere as a global ecosystem, as a composite of all local ecosystems on Earth. Since this system is too much big and complex to be studied at one time, it is convenient to divide it into two basic categories, namely the terrestrial and the aquatic. Forest, grassland and desert are some examples of terrestrial ecosystems; pond, lake, wetland, river and estuary are some examples of aquatic ecosystems. Crop fields and an aquarium may also be considered as man-made ecosystems.

We will first look at the structure of the ecosystem, in order to appreciate the input (productivity), transfer of energy (food chain/web, nutrient cycling) and the output (degradation and energy loss). We will also look at the relationships – cycles, chains, webs – that are created as a result of these energy flows within the system and their inter- relationship.

Structure and Function of the Ecosystem :

The various components of the environment- abiotic and biotic. How the individual biotic and abiotic factors affected each other and their surrounding. Let us look at these components in a more integrated manner and see how the flow of energy takes place within these components of the ecosystem.

Interaction of biotic and abiotic components result in a physical structure that is characteristic for each type of ecosystem. Identification and enumeration of plant and animal species of an ecosystem gives its species composition. Vertical distribution of different species occupying different levels is called stratification. For example, trees occupy top vertical strata or layer of a forest, shrubs the second and herbs and grasses occupy the bottom layers.

The components of the ecosystem are seen to function as a unit when you consider the following aspects:

- (i) Productivity;
- (ii) Decomposition;
- (iii) Energy flow; and
- (iv) Nutrient cycling.

To understand the ethos of an aquatic ecosystem let us take a small pond as an example. This is fairly a self-sustainable unit and rather simple example that explain even the complex interactions that exist in an aquatic ecosystem. A pond is a shallow water body in which all the above mentioned four basic components of an ecosystem are well exhibited. The abiotic component is the water with all the dissolved inorganic and organic substances and the rich soil deposit at the bottom of the pond. The solar input, the cycle of temperature, day-length and other climatic conditions regulate the rate of function of the entire pond. The autotrophic components include the phytoplankton, some algae and the floating, submerged and marginal plants found at the edges. The consumers are represented by the zooplankton, the free swimming and bottom dwelling forms. The decomposers are the fungi, bacteria and flagellates especially abundant in the bottom of the pond. This system performs all the functions of any ecosystem and of the biosphere as a whole, i.e., conversion of inorganic into organic material with the help of the radiant energy of the sun by the autotrophs; consumption of the autotrophs by heterotrophs; decomposition and mineralisation of the dead matter to release them back for reuse by the autotrophs, these event are repeated over and over again. There is unidirectional movement of energy towards the higher trophic levels and its dissipation and loss as heat to the environment.

TYPES of ECOSYSTEM :

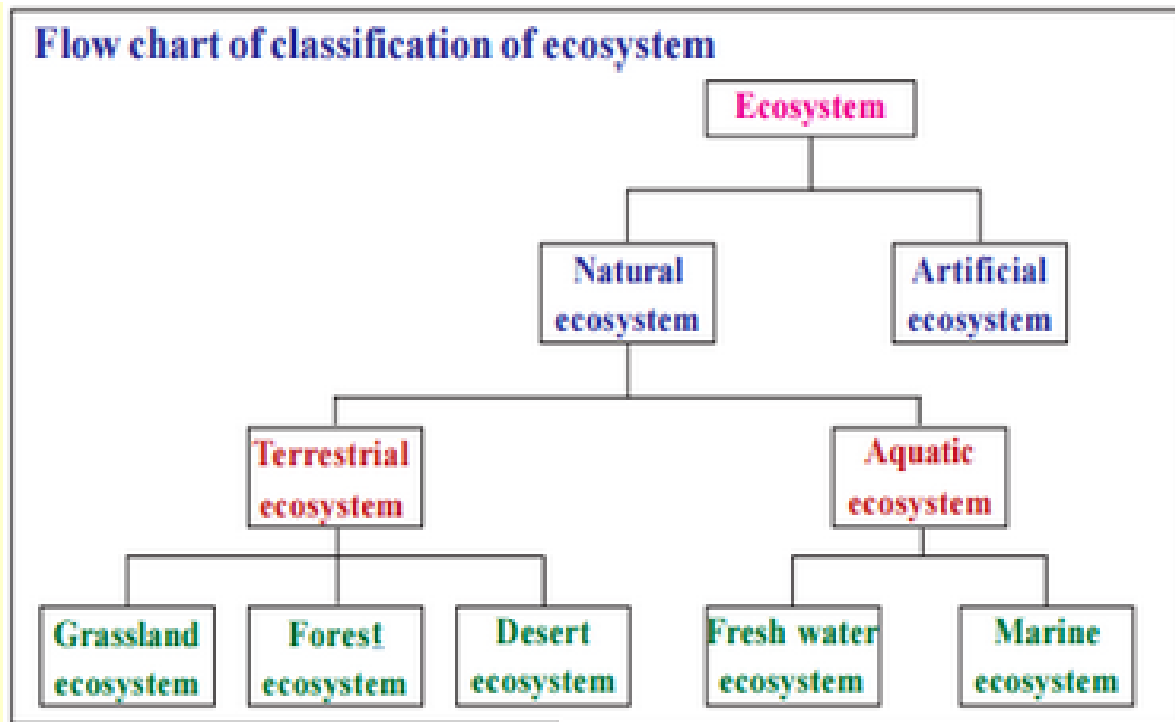


Fig. 1- TYPES OF ECOSYSTEM

BIO - GEOGRAPHICAL AREAS :

Biogeographic regions are geographical areas that are defined based on the species found in them, which provides invaluable information to ecologists and natural resources managers for understanding large scale processes that affect species and ecosystems.

Famously, Alfred Russell Wallace's delineation of the first biogeographic regions identified similar species living oceans away from each other, provided inspiration for the discovery of [continental drift](#). Historically, these regions were defined based on the occurrence of similar species or the same species using clustering techniques that do not consider physical geographic boundaries or other environmental variables in their sample site .

These researchers studied the spatial distribution of four mammal species in Angola and performed a spatial (REDCAP) and a non-spatial (Ward's Clustering) clustering analyses on records of observations of those species to see which analysis defined biogeographic regions that more closely correlated with different climatic conditions, existing ecoregions, and groupings of species within those regions.

STUDY AREA

About Bakkhali :

Bakkhali beach is located on the east of the river Hugli along the vast stretch of coastal tract of West Bengal extending for a length of 350 km . This sea beach represents a wide range of diversity in terms of coastal processes , geomorphology ,environment etc .West Bengal coast of India is characterized by the presence of the largest tide dominated Hugli estuary with numerous channels , creeks and impressive digitize architecture ,surrounded by the extensive mangroves . Bakkhali sea beach along the West Bengal coast stand on the lower (tidal) delta plain of the Ganges-Brahmaputra delta . This coastal stretch was lying beyond the paleo-shoreline during Holocene time in terms of available evidences indicating that maximum sea level transgression occurred at about 6500 BP when the shoreline was 300 Brahmaputra rivers subsequent to this time accounts for ~ 30000 km of growth comprises 30% of the modern delta plain .

Climate :

The climate in the West Bengal coast is characterized by the southwest monsoon system . seasonal low pressure areas over the Persian Gulf initiate the southwest monsoon in summer (May- September)with high precipitation rates . Seasonal high -pressure areas over Tibet create the northeast monsoon in winter (December-February) , which is calm and dry . Changing monsoonal winds strongly affect the surface water flow in the Bay of Bengal . In Spring , northeast monsoon to the southwest monsoon surface water movement is characterized by a clockwise rotation . In Autumn , during transition from southwest to southeast monsoon , surface water mainly flows counter clockwise . Strong tides govern the channel regime and influence the upstream sediment movement and there is almost no headwater discharge during the summer in mouth of Hugli . On the contrary , the channel regime is governed by the combined effect of both the headwater discharge and tides and influence the seaward drift of the sediments during the monsoon .

Beach Environment of Bakkhali :

Bakkhali,nature's heaven with sea shore changing every day is perfect quiet camouflaged shelter far away from the loud outcry. It leads its lonely existence as a seabeach of exotic charms.The Bay of Bengal holds this solitary beach, a geographical marvel in its bosom.A century : old sea beach known for recovering for health & spending leasuire at the vacation is a part quit peaceful sandy shore of enormous mystery with stands casurina trees bodering post line amidst the vibrant bio diversity upon the beach where the molluscan shells are scattered. With a coastal length of only about 1.2km, Bakkhali (latitude 22° 35' N, longitude 88° , E) is situated in the lower reaches of the South 24 Parganas along the coastal tract of West Bengal where land meet the sea at the end of the world like an unpredictable woman,who quickly changes her mind, the Bakkhali sea beach keeps changing its character after every monsoon.The sandy bed of Bakkhali sea beach is a product of the interaction of both waves and tides. The beach is seen extended up to the limit of the swashmark in the supratidal zone.This swash mark is zigzag in pattern and comprised of the accumulated drifted materials like leaves,rootes,branches.molluscan shells,straw,mangrove fruits, propagules and even the skeletal remains of marine animals . Entire beach with considerable variability as a result of waves and tides of current dynamics associated flows consist of the dopositional faces from low water spring tides to the upper limit of wave action.

Sternward tree lines along the coastal stretches are the most spectacular view of BakkhaliFrasergunj, a well-known spot for tourism in the lap of the Bay of Bengal. The coastal tourist spot Bakkhali is famous for its natural sandy beach, and it stretches far beyond the other tourist spot Frasergunj where gentle breakers of the Bay of Bengal cuddle the coastlines of Bakkhali and Frasergunj. The spilling breakers proceed towards the shore and lash until they turn into the surf at Bakkhali-Frasergunj seashore - the natural sandy beach along the coastal stretches of West Bengal. The gentle breakers are not rough at all, and the tourists move easily for their bath as

there is no existence of rip currents. Swatting casuarina trees separate the sea from the land. A lush green low height sand dune border in between the beach and casuarina trees exists parallel to the sea beach (Figure 1). The 1.2 km-long metal road runs from west to east parallel to the beach and extends up to the bus terminus of Bakkhali, a spot along the stretch of the beach that is admired most by the visitors. Tourists can travel in auto-rickshaws or private cars along this metal road. The BakkhaliFrasergunj beach is enchanting when anybody looks through the casuarina tree lines, stands on the coast, and sees the fishing boats take a nap on the beach after sailing from the sea. The harmonious blending of beach, breakers, and casuarina in the same place is spell bounding.

Bakkhali-Frasergunj is under the coverage of Coastal Regulation Zone (CRZ), monitored by the Government of India since 1991 along the coastal stretches of India, influenced by wave action and tidal flow, which is characterized by the sand dunes vegetation, casuarina tree lines, mangroves along with many other floral assemblages rich in genetic diversity [4]. Rich coastal vegetation along the coastal region is considered as an ecologically sensitive area. Coastal areas of Bakkhali- Frasergunj is covered with Casuarina equisetifolia, Tamarix gallica, and mangroves like Avicennia marina and Excoecaria agallocha in an area of about 3.7 sq km . Among them, Casuarina equisetifolia is the dominant species, whereas mangroves grow along the bank of Bakkhali creek particularly in the muddy substratum inundated twice daily with the flood tide, and Tamarix gallica exists mainly in the sandy substrate soils . Coexistence of Casuarina equisetifolia, mangroves, and Tamarix gallica compose the floral assemblages in the Bakkhali-Frasergunj coastal areas Determination of correlation among these plant species of coastal origin is the objective of the present study.

LOCATION :

Location Details –

- AREA- 1621.34 sq.mt
- COUNTRY- INDIA
- STATE & DISTRICT- WEST BENGAL, SOUTH 24 PARGANAS
- LATITUDE - **22° 35'N**
- LONGITUDE - **88° 15, E**
- CLIMATE- VERY WARM & BREEZY
- TEMPERATURE -31° (HIGHEST) 21° (LOWEST)
- RAIN FALL- AVERAGE ANNUAL RAINFALL 9.028mm
- NEAREST CITY- KOLKATA



FIG. 2- MAP OF INDIA

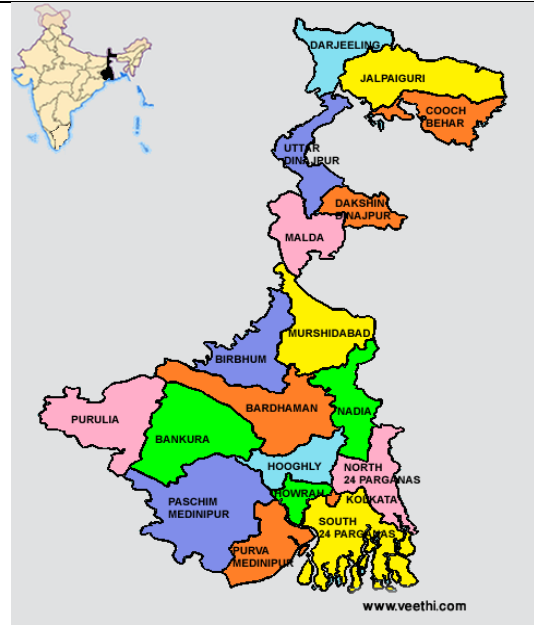
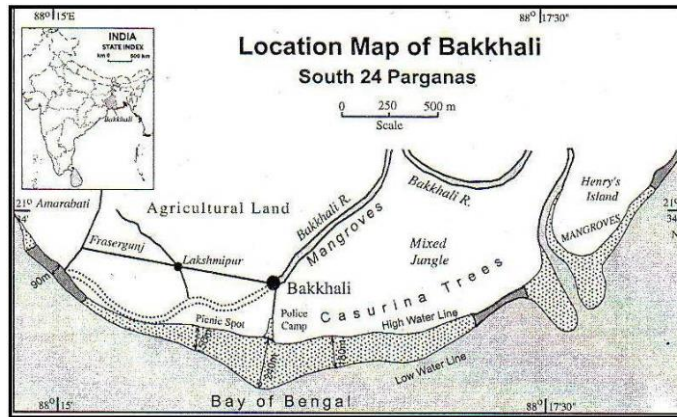


FIG. 3- MAP OF WEST BENGAL



Source : Das, 2010

FIG. 4- MAP OF BAKKHALI

ECOLOGICAL STUDY IN BAKKHALI

METHODOLOGY OF ECOLOGICAL STUDY

In our field visit we've performed the following ecological studies:-

- ✓ Study of Diversity of herbaceous plant community in Bakkhali by Quadrat method.
- ✓ Study of DBH and Height of certain plants of Bakkhali.
- ✓ Study of macro invertebrate in Bakkhali by pitfall method
- ✓ Study of fish diversity at Benfish, Bakkhali
- ✓ Study of Crab diversity in Bakkhali
- ✓ Study of Crab holes in Bakkhali and Henry's Island Beach
- ✓ Study of avian diversity of Bakkhali, Frasergunj and Henry's island.
- ✓ Vegetation study at Bakkhali Beach.
- ✓ Mangrove study at Henry's island

STUDY OF DIVERSITY OF HERBACEOUS PLANT COMMUNITY IN BAKKHALI BY QUADRAT METHOD

A representative patch containing herbaceous plants at Bakkhali was selected and community analysis was studied using quadrat method .

QUADRAT METHOD

PRINCIPLE: Random sampling deletes the chances of biasness regarding species and hence a uniform collection of specimen can be made from any place. Thus total species diversity of a community can be studied along with the abundance ,frequency, density of each species which help us to study the community pattern of an area at any specific timeof year, where:

FREQUENCY= (No. of sampling unit in which the species has occurred) / (TotalNo. of sampling units) X 100

DENSITY = (Total No. of individuals of a species in all sampling units) / (Total No. of sampling units studied)

ABUNDANCE= (Total No. of individual of species in all sampling units) / (No. of sampling units in which species occurred)

In this process, a definite area is taken in the form of square which is the quadrate of definite size and shape. This method for sampling and studying community pattern consists of the following steps:

- Determination of least quadrate size.
- Analysis of quadrate.
- Determination of frequency, density and abundance.

Materials Required:

- Nail
- Hammer
- Thread
- Measuring tape

Determination of minimum size of quadrat

Methodology:

- ✓ The site was selected randomly in a specific habitat (land)
- ✓ At first, an 'L' shaped line was formed with the help of nails, and hammer. Then a rectangular structure was made with nails and thread forming 10 X 10 cm area.
- ✓ The plant species of the area were counted and recorded.
- ✓ The same process was repeated increasing the area of quadrat (e.g. 10x10 cm, 25x 25 cm etc.), till the number of species in the bigger quadrat reach almost a plateau in the graph. This is achieved when no more different species is observed.
- ✓ The size of quadrat which firstly reaches the quadrat plateau in the graph is then recorded as least quadrat size.

RESULTS:-

DETERMINATION OF MINIMUM SIZE OF QUADRAT

SERIAL NO.	NAME OF SPECIES	SIZE OF QUADRAT (In cm)				
		20 x 20	40 x 40	60X 60	80X80	100x100
1	<i>Ageratum</i> sp.			✓	✓	✓
2	<i>Eclipta alba</i>	✓	✓	✓	✓	✓
3	OTU 1			✓	✓	✓
4	OTU 2	✓	✓	✓	✓	✓
5	OTU 3			✓	✓	✓
TOTAL		2	2	5	5	5

Table 1 : Analysis of Least size of Quadrat

COMMENT

From this experiment we can conclude that in 60 X 60 cm area we got maximum number of species which is continued till 100 X 100 cm area. Hence we can take the area 100 X 100 cm as the least size of quadrat that can be used for suitable quadrat analysis of the habitat.

B. STUDY OF HERBACEOUS PLANT COMMUNITY BY QUADRAT METHOD

METHODOLOGY:

- Sites were selected randomly to omit the chance of biasness regarding species.
- Quadrat of required number of definite size as determined in earlier step was laid down in the selected area.
- Various species of herbs and total number of individuals of each species were noted down in each quadrat.
- Percent frequency, density, abundance of each species was calculated from the data obtained.

SL. NO.	NAME OF SPECIES	NO. OF SPECIES IN FIVE DIFFERENT QUADRAT OF 100 X 100 CM					PERCENT FREQUENCY (%)	DENSITY	ABUNDANCE
		In Spot 1	In Spot 2	In Spot 3	In Spot 4	In Spot 5			
1	<i>Ageratum sp.</i>	1	0	0	1	0	40	0.4	1
2	<i>Eclipta alba</i>	3	1	0	5	0	40	1.8	3
3	OTU* 1	4	9	5	5	6	100	5.8	5.8
4	OTU 2	1	0	1	0	2	60	0.8	1.3
5	OTU 3	1	0	0	0	0	25	0.2	1

Table 2 : Percent Frequency, Density, Abundance of different species

*OTU OPERATIONAL TAXONOMIC UNIT

INTERPRETATION

Among the five herbaceous species in different spots percent frequency, abundance and density was found to maximum in case of OTU1



Fig . 5,6 – STUDY OF HERBACEOUS PLANT COMMUNITY BY QUADRAT METHOD

MEASUREMENT OF TREE HEIGHT

We evaluated the height of a Coconut trees (*Cocos nucifera*) in Bakkhali through comparison of height as seen through a glass scale. The materials required are as follows-

- Measuring tape
- Measuring scale (Glass)

A person stood beside the tree. Another person viewed the tree from a certain distance in such a way that the whole view of the tree could be obtained in the divisions of the measuring scale. Both the height of the tree and the person in the scale are noted down as divisions in the scale and height of the tree was calculated with the help of the following formula-

$$\frac{\text{Person's height (division in scale)}}{\text{Tree's height (divisions in scale)}} = \frac{\text{Person's actual height}}{\text{Tree's actual height}}$$

$$\frac{\text{Person's height (scale)}}{\text{Tree's height (scale)}} = \frac{\text{Person's actual height}}{\text{Tree's actual height}}$$

Plant Name : Coconut tree (*Cocos nucifera*)

Person's height (scale) – 4

Tree's height (scale) - 14

Person's actual height – 5 ft

Tree's actual height - x ft

Therefore; $4/14 = 5 / x$

Thus, height of the coconut tree = **17.5 ft**

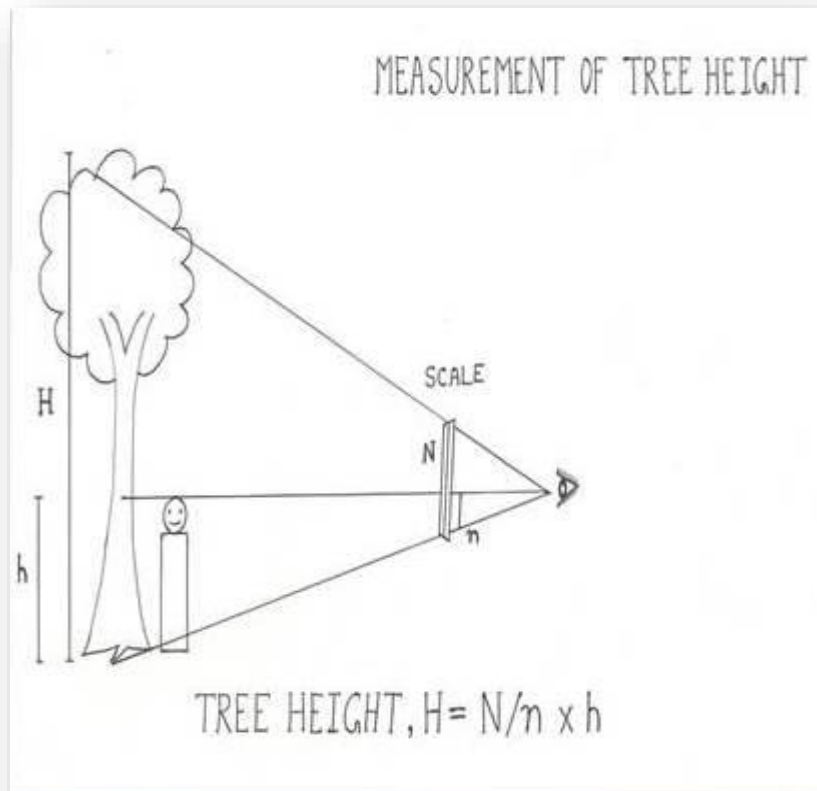
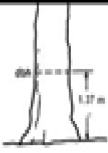




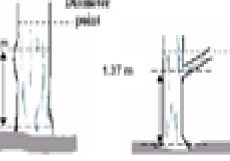




Fig . 7.8- MEASUREMENT OF COCONUT TREE HEIGHT

STUDY OF GBH (Girth at Breast Height) OF TERRESTRIAL TREE SPECIES

Methodology

Tree diameter has been traditionally measured at 1.37 meters above the ground or root of the crown if the root crown is exposed, a point defined as Girth at breast height (DBH). The exact position of GBH is also dependent of individual tree form and topography. For measurement of diameter calipers or tapes are used. The following situations may be encountered in measurement of tree diameter.

<p>Diameter on flat ground: Measure DBH at 1.37 m above the ground.</p>		<p>Forked tree:</p> <p>Trees forked below 1.37 m. Trees forked in this region are treated as distinctly separate trees. Distances and azimuths are measured individually to the center of each stem where it splits from the stump. DBH is measured for each stem at 1.37 m above the ground.</p> <p>Trees forked at or above 1.37 m. Trees forked in this region count as one single tree. If a fork occurs at or immediately above 1.37 m, measure diameter below the fork just beneath any swelling that would inflate DBH.</p>	
<p>Leaning tree: Measure diameter at 1.37 m from the ground along the bole.</p>			
<p>Tree on slope: Measure diameter at 1.37 m from the ground along the bole on the uphill side of the tree.</p>		<p>Live wind thrown tree: Measure from the top of the root collar along the length to 4.5 feet.</p>	
<p>Tree with irregularities at DBH: On trees with swellings, bumps, depressions, and branches at DBH, diameter will be measured immediately above the irregularity at the place it ceases to affect normal stem form.</p>			
<p>Missing wood or bark. Do not reconstruct the DBH of a tree that is missing wood or bark at the point of measurement. Record the Diameter of the wood and bark that is still attached to the tree.</p>			
<p>Tree with butt-swell or bottleneck: Measure these trees 45 cm above the end of the swell or bottleneck if the swell or bottleneck extends 1.0 m or more above the ground.</p>			

RESULTS

NAME OF THE TREE	GBH (cm)
Coconut tree (<i>Cocos nucifera</i>)	25
OTU 1	18



Fig. 9,10,11 - STUDY OF GBH OF TERRESTRIAL TREE SPECIES.

STUDY OF MACRO INVERTEBRATE (TERRESTRIAL) DIVERSITY IN BAKKHALI BY PITFALL METHOD

A pitfall trap is a trapping pit to study terrestrial macro invertebrates. A pitfall trap consists of some type of cup or other container that is inserted in the soil and partially filled with a preservative particularly soap water or alcohol. Macro invertebrate species crawling on the ground are trapped in pit fall.

METHODOLOGY:

1. Pit falls were placed in five randomly selected spots for 12 hours. Soap water was placed in each pitfall to required level.
2. After 12 hours the trap was collected for further observation. The total number of individuals of different species in pitfall trap from five spots was recorded and identified with help of our teachers, field guide books etc.
3. Percent frequency, density, abundance of each species was then calculated from the data obtained.

RESULTS

SL N O.	NAME OF SPECIES	NO. OF INDIVIDUAL OF SPECIES IN FIVE SPOTS					PERCENT FREQUENCY	DENSITY	ABUNDANCE
		Spot 1	Spot 2	Spot 3	Spot 4	Spot 5			
1	Very Small size ant (Hymenoptera)	2	3	10	8	4	100	5.4	5.4
2	Big Size red ant (Hymenoptera)	0	1	0	2	4	60	1.4	2.3
3	OTU 1	0	1	0	0	0	20	0.2	1
4	OTU 2	0	0	2	0	0	40	0.4	2
5	Spider	1	0	1	0	0	40	0.4	1

Table 3: Percent Frequency, Density, Abundance of different species

INTERPRETATION:

Among the five species trapped in pit fall in different spots percent frequency, abundance and density was found to maximum in case of very small sized ant (Hymenoptera).



Fig . 12,13,14 - STUDY OF MACRO INVERTEBRATE DIVERSITY BY PITFALL METHOD

STUDY OF CRAB DIVERSITY IN HENRY'S ISLAND BEACH (BAKKHALI)

The process used by us is solely watching based. For crab watching and recording the various species of birds for further identification we took help of:

- ✓ Naked eyes
- ✓ Binocular and DSLR
- ✓ Crab Identification Manuals/ Books/Research papers

Modified Pollard and Yates (1993) methods was followed and documenting the crab species while walking along fixed paths (Transect method). Specimens were not collected but field identification was done with the help of our teachers, field guide books.

A checklist with different crab species observed in Bakkhali was prepared and is given below-.

Sl No.	Common Name	Scientific Name
1	Red fiddler crab	<i>Uca sp.</i>
2	Yellow fiddler crab	<i>Uca sp.</i>
3	Hermit crab	<i>Paguroidea sp.</i>
4	Ghost Crab	<i>Ocypodinae sp.</i>
5		<i>Dotilla sp.</i>



Fig . 15,16,17 – STUDY OF CRAB DIVERSITY IN HENRY’S ISLAND

A. Red fiddler crab

B . Yellow fiddler crab

C. Hermit crab

D. *Dotilla* sp.

STUDY OF CRAB HOLES IN HENRY'S ISLAND BEACH (BAKKHALI)

METHODOLOGY:

Quadrats of size 2 X 2 m were laid down in between low tide line (LTL) and High tide line(HTL) along a fixed path and numbers of crab holes were observed.

RESULTS:

Meters	Number of crab holes observed
Low Tide Mark (0)	0
5	0
10	5
15	12
20	19
25	23
High tide Mark (30)	15

Table 4 : Number of crab holes (HTL to LTL)

INTERPRETATION:

The number of crab holes increased while moving from low tide mark to high tide mark showing the burrowing habit of most crabs in the high tide line zone. Burrowing of crab is an essential procedure as it directly or indirectly affects the activity of crab. The pattern of burrows varies on the type of crab.

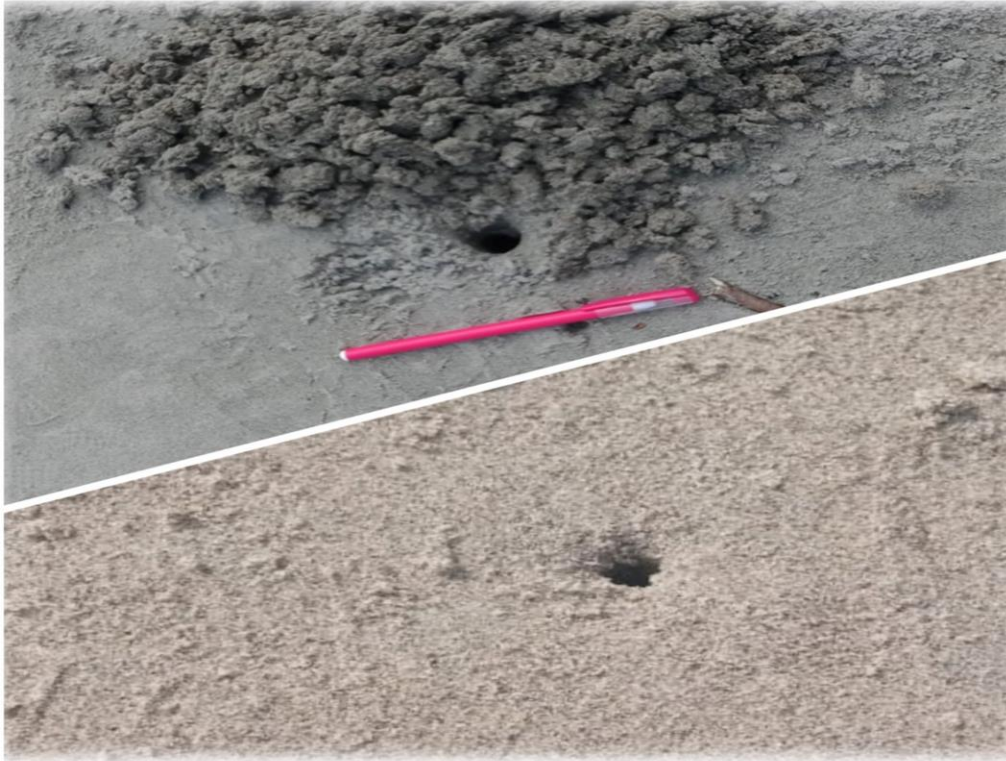


Fig . 18 – STUDY OF CRAB HOLES DIVERSITY IN HENRY’S ISLAND

STUDY OF FAUNA OF BAKKHALI BEACH BY **TRANSECT METHOD**

The Beach characteristic feature of Bakkhali beach is both Sandy

1. Five 15 m transect was laid down with one end at the high tide mark and another end towards the sea at different spots of the beach.
2. Species touching the tape in alternate segments of convenient length (here 20 cm) were noted down.
3. Percent frequency, density, abundance of each species was calculated from the data obtained.



Fig . 19 - STUDY OF FAUNA BY TRANSECT METHOD

RESULTS

SL. NO	NAME OF SPECIES	NO. OF SPECIES IN THREE DIFFERENT TRANSECT 15 M					PERCENT FREQUENCY (%)	DENSITY	ABUNDANCE
		In Spot 1	In Spot 2	In Spot 3	In Spot 4	In Spot 5			
1	Crabs	0	5	1	1	1	80	1.6	2
2	Star fish (<i>Asterias sp.</i>)	0	1	0	1	0	40	0.4	1
3	<i>Gari fervensis</i>	3	3	3	1	1	100	2.2	2.2
4	<i>Paphia malabarica</i>	2	1	2	1	1	100	1.4	1.4
5	<i>Acrilla acuminata</i>	3	1	1	1	1	100	1.4	1.4
6	<i>Natica tigrina</i>	1	1	0	0	1	60	0.6	1

Table 5 : Percent Frequency, Density, Abundance of different species

INTERPRETATION:

Percent frequency was found to be maximum in case of *Gari fervensis*, *Paphia malabarica* and *Acrilla acuminata*. Maximum density and abundance was observed for *Gari fervensis* in Bakkhali beach. Least Percent frequency, density and abundance were observed for Star fish (*Asterias sp.*).

STUDY OF FISH DIVERSITY AT BENFISH HARBOR, BAKKHALI

The Benfish harbor was visited to observe particularly the fish diversity. Dried fish were also observed.

The following species were observed mainly -

1. Pompret fish (*Pampus chinensis*)
2. Topse fish (*Polynemus paradiseus*)
3. Ilish Fish (*Tenualosa ilisha*)
4. Shark
5. Prawns/Shrimp
6. Giant Crabs.
7. Lobsters
8. Pale-edged stingray (*Dasyatis zugei*)
9. Pointed tail anchovy fish (*Stolephorus indicus*)
10. Bombay duck fish (*Harpadon nehereus*)
11. Ribbon fish (*Lepturacanthus saval*)
12. Corica fish (*Corica soborna*)



Fig . 20,21– STUDY OF FISH DIVERSITY AT BENFISH HARBOUR

STUDY OF AVIAN DIVERSITY IN BAKKHALI

The process used by us is solely watching based. For bird watching and recording the various species of birds for further identification we took help of:

- ✓ Naked eyes
- ✓ Binocular and DSLR
- ✓ Bird Identification Manuals/ Books

Modified Pollard and Yates (1993) methods was followed and documenting the birds while walking along fixed paths (Transect method). Specimens were not collected but field identification was done with the help of our teachers, field guide books.

A checklist with different bird species observed in Bakkhali was prepared and is given below-.

RESULTS

Sl. No.	Common Name	Scientific Name	Food Habit
1.	Common Myna	<i>Acridotheres tristis</i>	Frugivorous
2.	Spotted Dove	<i>Spilopelia chinensis</i>	Granivorous
3.	Cattle Egret	<i>Bubulcus ibis</i>	Carnivorous Insectivorous
4.	Little cormorant	<i>Microcarbo niger</i>	Carnivorous Insectivorous
5.	Indian Pond Heron	<i>Ardeola grayii</i>	Carnivorous
6.	Black Drongo	<i>Dicrurus macrocercus</i>	Insectivorous
7.	Red-wattled Lapwing	<i>Vanellus indicus</i>	Frugivorous Insectivorous
8.	White-throated Kingfisher	<i>Halcyon smyrnensis</i>	Carnivorous
9.	Common Crow	<i>Corvus splendens</i>	Carnivorous
10.	Long Tailed Shrike	<i>Lanius schach</i>	Carnivorous
11.	Brown-headed Gull	<i>Chroicocephalus brunnicephalus</i>	Carnivorous Insectivorous
12.	Pied Starling	<i>Gracupica contra</i>	Granivorous Frugivorous Insectivorous
13.	Jungle Babbler	<i>Argya striata</i>	Insectivorous Granivorous
14.	Bronze-winged jacana	<i>Metopidius indicus</i>	Insectivorous

Table 6 : Checklist of Avian species found in Bakkhali

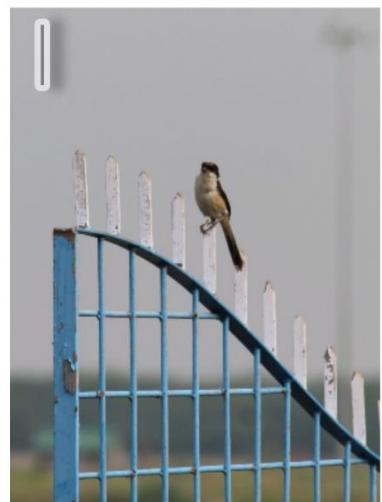
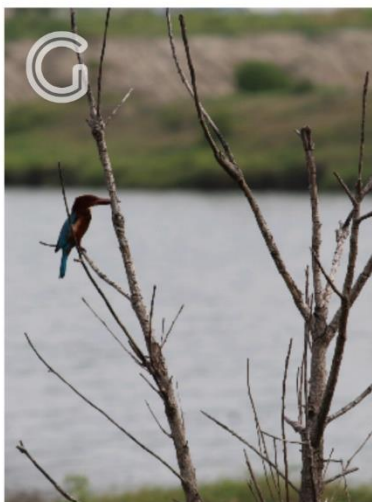
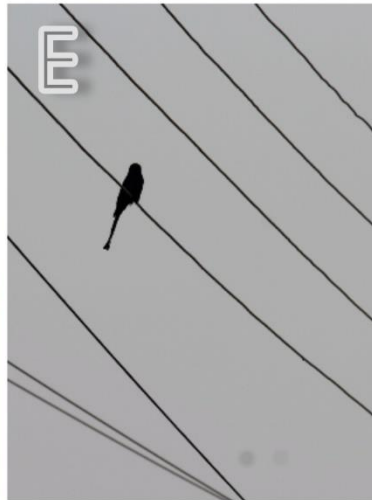
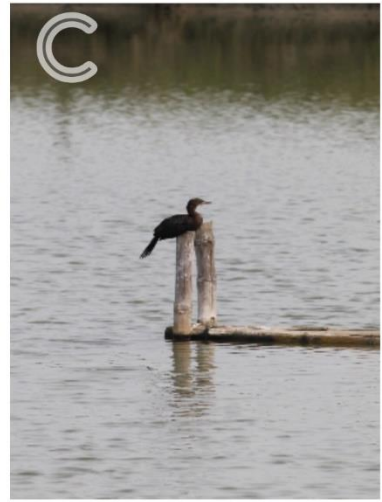
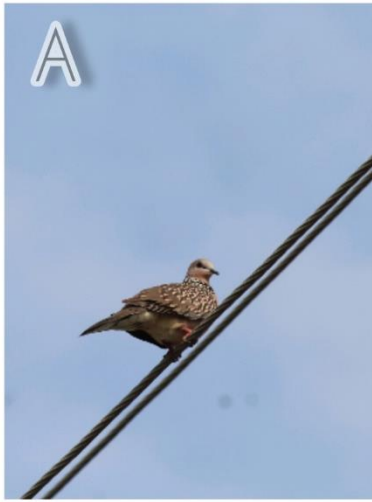
CALCULATION OF ENCOUNTER RATE OF BIRD

Total number of birds observed	41	
Total minutes of bird watching	120	
Encounter Rate of the Bird	0.3416	Birds/min
Total Species of birds observed	14	
Species encounter rate	0.116	Species/min

INTERPRETATION

Species Richness of birds found in the studied area is 14 with different food habits. Most of the birds were carnivorous specially insectivorous followed by Granivorous and Frugivorous.

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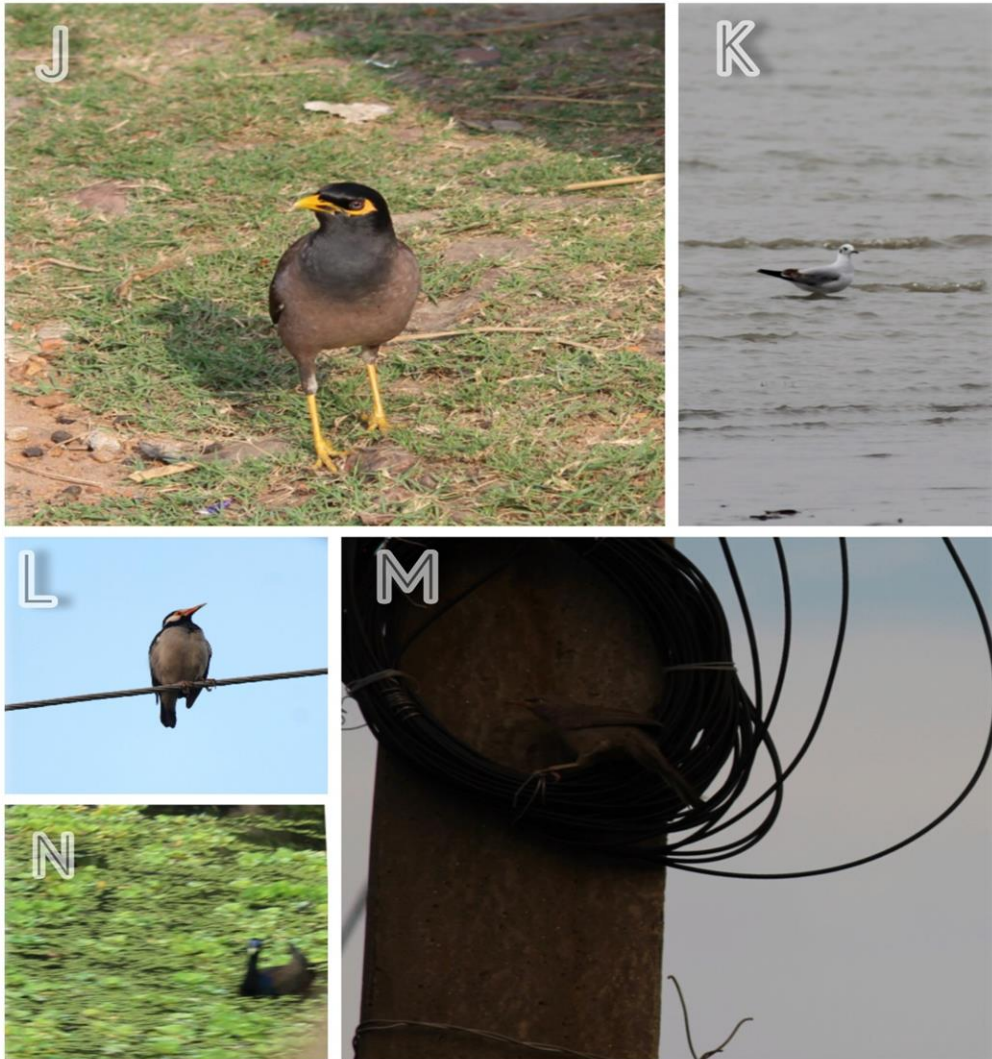


Fig . 22,23 – Study of Avian Diversity

A . Spotted Dove

B . Cattle Egret

C . Little Cormorant

D . Indian Pond Heron

E . Black Drongo

F . Red- wattled Lapwing

G . White- throated Kingfisher

H . Common Crow

I . Long Tailed Shrike

J . Common Myna

K . Brown – headed Gull

L. Pied Starling

M . Jungle Babbler

N . Bronze – winged Jacana

VEGETATION STUDY AT BAKKHALI BEACH

Vegetation study was performed at Bakkhali beach and Henry's island beach at different terrain unit and the following vegetation pattern type was mostly observed

Terrain unit	Types of plant	Name of plant
Dune base	Creepers	<i>Ipomoea pescaprae</i>
Dune crest	Shurbs Tree	<i>Pandanus sp.</i> <i>Opuntia.sp.</i> <i>Phoenix sp.</i>
Dune Back	Shurbs	<i>Pandanus</i> <i>Opuntia Lantana</i> <i>camara</i> <i>Calotropis gigantean</i>
Dune tail	Large tree	<i>Acacia moniliformis</i> <i>Casurinas equistifolia</i>

Table 7 : Vegetation at different terrain unit of Bakkhali and Henry's island Beach



Fig. 24,25 – VEGETATION STUDY AT BAKKHALI

MANGROVE DIVERSITY OF HENRY'S ISLAND (BAKKHALI)

Modified Pollard and Yates (1993) methods was followed and documenting the mangrove species found in the Henry's island while walking along fixed paths (Transect method). Specimens were not collected but field identification was done with the help of our teachers, field guide books, local people. A checklist with different mangrove species observed in Henry's Island was prepared and is given below-

Sl No.	Common Name	Scientific Name	Family
1	Kalobaine	<i>Avicennia alba</i>	Avicenniaceae
2	Shadabaine	<i>Avicennia officinalas</i>	Avicenniaceae
3	Pyrabaine	<i>Avicennia marina</i>	Avicenniaceae
4	Tora	<i>Aegialitis rotundifolia</i>	Plumbaginaceae
5	Kankra	<i>Brugiera gymnorhiza</i>	Rhizophoraceae
6	Goran	<i>Ceriops decandra</i>	Rhizophoraceae
7	Mat Goran	<i>Ceriops tagal</i>	Rhizophoraceae
8	Genwa	<i>Excoecaria agallocha</i>	Euphorbiaceae
9	Sundari	<i>Heiteria fomes</i>	Stericuliaceae
10	Golpata	<i>Nypa fruticans</i>	Palmae
11	Hetal	<i>Phoenix paludosa</i>	Palmae
12	Dhundul	<i>Luffa aegyptiaca</i>	Cucurbits
13	Kalilata	<i>Derris trifoliata</i>	Leguminosae
14	Horgoja	<i>Acanthus ilicifolius</i>	Acanthaceae
15	Dhani ghas	<i>Porteresia coarctata</i>	Poaceae



Fig . 26,27 – STUDY OF MANGROVE DIVERSITY AT BAKKHALI

CONCLUSION

From our study we came to know the basic requirement of a field tour, the method of studying of an eco-system (Mangrove and Coastal). A detailed knowledge was gained by this field study at Bakkhali which is inhabited by different flora and fauna. During our study we have encountered 15 species of mangroves, 14 species of birds, 5 species of crabs, and 5 species of marine fauna respectively. We observed and recorded beach vegetation structure in dune base, dune crest, dune back and dune tail. We performed pitfall trap study to analyse macro-invertebrates community in Bakkhali island. Overall we learned and performed various ecological techniques and observe and recorded various flora and fauna at this rich ecosystem.

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