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ABSTRACT

Kannur District in Kerala State of India was well known for enormous number of perennial ponds. The present study was aim at comparison of phytoplankton diversity in connection with physico-chemical parameters of perennial ponds in urban and rural areas of Kannur. Water samples will be taken from a few urban and rural habitats in Kannur. Periodic sampling will take place in the mornings between 9.00 and 11:00. The sampling stations are situated over random places in Kannur district.4 out of 7 ponds are situated near urban areas and are associated with religious institutions and the rest of the sampling sites are situated in rural areas with low human activity. The study give total of 30 algal genus belong to Chlorophyceae, Dinophyceae, Cyanophyceae and Bacillariophyceae. pH, temperature, dissolved oxygen and biological oxygen demand of each sample was studied.BOD and DO of pond water from 7 different regions of Kannur using a random selection method, it was found that out of these 7 ponds, the Irikkoor pond had the lowest DO. Among all ponds irikkoor pond had most variety and abundant number of algal genera. This indicates the relation between physiochemical parameters and phytoplankton diversity in pond. Pond diversity is more in pond having less BOD and having less human activities. The study emphasis the importance of pond ecosystem , how the human activities effect the diversity of pond and importance of conservation activities should done to protect remaining diversity.

1. INTRODUCTION

Water supports life on earth and around which the entire fabric of life is woven. Ponds, as sources of water, are of fundamental importance to man. However, ponds may have been naturally occurring water sources that humans have exploited over time to meet various needs, or they may have been artificially created for a wide range of purposes, including domestic or agricultural use, transportation, defense, ritual or industrial use, social advancement, swimming, fish farming, or the creation of picturesque areas (Ress, 1997; Narayan et al., 2007; Bishnoi and Malik, 2008).

The main issues affecting standing water bodies have been known for at least 20 years, but it has been difficult to quantify and categorize them for environmental managers. The condition of India's freshwater resources and their management have recently been cited by environmental managers and researchers as a major concern.

Environmental problem with nutrition enrichment, acidification, and domestic waste, sewage, agricultural and industrial effluents contamination by toxic substances identified as major impacts (Sachidananda Murthy and Yajurvedi, 2006; Parashar et al., 2008; Shekhar et al., 2008; Senthilkumar and Sivakumar, 2008; Laskar and Gupta, 2009). Today, it is extremely difficult to meet the needs of all living things, from microorganisms to humans, because unplanned urbanization and industrialization have polluted all water resources.

Natural ponds are thought to cover an area of 0.72 million ha in India, with the majority of them being situated close to communities, places of worship, and other human habitations (Isaiarasu and Mohandoss,1998; Kamat and Sima, 2000; Shiddamallayya and Pratima, 2008). This leaves them extremely subject to human influence and daily fluctuations, whose measurement would likely provide a clear picture. Imagine the stress of the pollution on them (Isaiarsu and Mohandoss, 1998;Raja et al., 2008).

Water quality has been evaluated through phytoplankton investigations, both qualitative and quantitative (Adoni et al., 1985; Chakravedi et al., 1999; Ponmanickam et al.Shekhar et al., 2008; et al., 2007). The first trophic level in the food chain is formed by phytoplankton, which are the main producers. Quite a few different types of planktonic creatures can be found in fertile standing water.

According to Eggs and Aksnes (1992) and Chellappa et al. (2008), phytoplankton diversity reacts quickly to changes in the aquatic environment, especially in relation to silica and other nutrients. In investigations of water pollution, a variety of phytoplankton species have been used as bio-indicators (Vareethiah and Haniffa, 1998; Bianchi et al., 2003; Tiwari and Chauhan, 2006; Hoch et al., 2008). (Ahmad, 1996).

Despite the fact that several studies on the biological state of freshwater bodies have been conducted across India Information on the relationship between physio-chemical parameters and plankton indicators of water pollution is scarce (Rana, 1991; Sinha and Islami, 2002; Singh et al., 2002; Tiwari and Chauhan, 2006); Ahmad and Siddiqui, 1995; Rana, 1996; Dadhich and Saxena, 1999; Rajagopal et al., 2006; Bhuiyan and Gupta, 2007; etc.

It is vital to do research on the planktonic composition and morphometric, physical, and chemical characterization of water bodies to learn the fundamentals of the biodiversity in a particular area. Consequently, the goal of the current research is to examine the physicochemical properties and phytoplankton species diversity of perennial ponds in urban and rural areas of Kannur district, Kerala, in order to assess their pollution status.

2. REVIEW OF LITERATURE

A brief review of the pertinent literature for the study on "COMPARISON OF PHYTOPLANKTON SPECIES DIVERSITY IN CONNECTION WITH PHYSICO-CHEMICAL PARAMETERS OF PERENNIAL PONDS IN URBAN AND RURAL AREAS OF KANNUR" is provided here under.

2.1 Pond Ecosystem

Water play important role in human life. Pond ecosystem act as a important source of water, are of fundamental to human. They have key role in water filtration, flood control, irrigation, animal watering, fish production and climate change mitigation. Phytoplankton distribution in ponds varies according to the nature of water and other physio-chemical parameters such as temperature, PH, alkalinity, salinity, biological oxygen demand etc. Degradation of water quality brought on by the discharge of various contaminants into pond make them unfit for using. To gain a better knowledge of the biological integrity of the ecosystem, synchronous investigation of the physical, chemical, and biological aspects of the freshwater environment is crucial. Most of the ponds in India have become polluted mainly due to anthropogenic activities and it may adversely affect human health.

Many studies are carried out in India about phytoplankton diversity, physio-chemical parameters and ecosystem of ponds. AR Zafar in 1964 studied the ecology of algae in certain fish ponds in India. Here he conduct study by considering various factors like pH, temperature, Oxidizable organic matter, magnesium, Sodium and chloride. In 1974 Mohiuddin Munawar studied about seasonal abundance of phytoplankton in three tropical ponds of Hyderabad. He looked at trends over a two-year period, and they have been classified as seasonal maxima and minima throughout the summer, monsoon, and winter. The majority of maxima and minima were recorded during the winter and monsoon or rainy season, respectively. In all seasons, diatomeae dominated the phytoplankton in all the ponds. Diatomeae and Cyanophyta and Diatomeae and Euglenineae were found to have an antagonistic connection. The phytoplankton has been divided into species that are perennial, summer, monsoon, and winter. Substantial contributions have been made to the understanding of phytoplankton ecology in Indian rivers (K Thirugnanamoorthy, and M Selvaraju, 2009;Sayeswara et al., 2011 ;PP Baruah and BhaswatiKakati, 2012)At the Central

Inland Fisheries Research Institute in Karnal, an examination of the physical and chemical characteristics of the water and substrate of nursery-cum-research-cum-rearing-cum-stocking ponds was conducted(R N Singhal et al., 1986). In 2016 Arpita Dalal, and Susmita Gupta studied about the diversity of aquatic insects in two separate ponds—one in an urban environment (urban pond, UP) and another in a rural area—was compared (Jalinga pond, JP).Therefore, it may be claimed that urban ponds are crucial to the preservation of biodiversity.

In kerala limnological features of Thirumullavaram temple pond was carried out in 2006 by V Sulabha and VR Prakasam.In 2013 KV Vijayan and co works studied about phytoplankton diversity and population in Ananthapura temple pond of Kasargod district. Algal diversity of Guruvayoor temple pond was studied. Throughout the course of the investigation, 15 pollution-tolerant algae species were discovered in this pond. This study was conducted to analyze pollution status of pond (P Tessy Paul and PK Anu, 2016). A study was conducted to assess the organic pollution levels in six ponds within KulathupuzhaGramaPanchayat.Herephysio-chemical parameters are considered for study(MV Vincy et al., 2018).

2.2 Phytoplankton Diversity

Phytoplankton are auto trophic components in the community of planktons. They are free floating algae seen in the upper side of the water and primary producer of aquatic food web. The qualitative and quantitative studies of phytoplankton have been utilized to assess the quality of water (Adoni et al., 1985; Chaturvedi et al., 1999; Ponmanickam et.al., 2007; Shekhar et al.,2008). Evaluation of water quality generally benefits by monitoring phytoplankton development. Freshwater management and ecosystem functioning will have a successful, long-lasting foundation thanks to biodiversity conservation. These are essential for the conservation of pond biodiversity. For the purpose of evaluating water quality, knowledge of the biodiversity of algae and associated factors in water bodies is crucial. Throughout the past three decades, limnological research focusing primarily on algae have significantly decreased, whereas studies encompassing other aquatic groups in addition to algae have gradually increased in recent years(Irfanullah, 2006). India's algal flora has been documented since 1959. There are 6500 kinds of algae in India, and they live in both freshwater and marine environments (Rao and Gupta, 1977).

2.2.1 Phytoplankton Diversity in India

A case study based on 'Phytoplankton diversity in relation to physio-chemical parameters of Gnanaprekasam temple pond of Chidambaram in Tamilnadu, India conducted by K.Thirugnanamoorthy and M.Selvaraju in 2009. Between September 2007 and August 2008, researchers examined twelve physical and chemical characteristics, as well as the variety and number of phytoplankton in a freshwater pond near Chidambaram. The overall number of phytoplankton genera was 14, with 4 each from the cyanophyceae, chlorophyceae, Bacilariophyceae, and Euglenophyceae. Physico-chemical and biological characteristics of the pond water have been measured in order to understand the fluctuations in phytoplankton distribution and periodicity. The research pond appears to be mesotrophic based on its TDS, BOD, phosphate, and nitrate readings as well as its current phytoplankton population state.Cyanophyceae made up 48.47% of the total phytoplankton population over the course of the study. Euglenophyceae, which made up 19.86% of the population, came in second, followed by bacillariophyceae (16.15%) and chlorophyceae (15.49%) during the study period.

In 2010 NafeesaBegum, JNarayana, HASayeswara reported that the variety, density, and dispersion of phytoplankton in different seasons, as well as their relationships to the physio-chemical characteristics of water, were examined at Bathi Pond, which is close to Davangere, Karnataka. There was a total of 67 phytoplankton species present, including members of the Chlorococcales, Blue-greens, Desmids, Diatoms, and Euglenoids families. In terms of relative phytoplankton abundance, blue-green algae had the highest concentration (45.61%), followed by chlorococcales (40.11), diatoms (13.97), desmids (0.17%), and euglenoids (0.13%). The factors BOD, Chloride, COD, Conductivity, Potassium, and Sodium all influence phytoplankton development. When total phytoplankton density was taken into account, BOD was positively connected with diatoms and air temperature was favorably correlated with euglenoids. Desmids and diatoms had a positive correlation with chloride. COD and blue-green algae, chlorococcales, and euglenoids exhibited a favorable association. Desmids and potassium have a favorable correlation. Scenedesmus quadricauda, Coelastrum sp., Tetraedonmuticum, Closterium sp., Euglena sp., Phacus sp., Trachelomonas sp., and Microcystis sp. were among the species identified as pollution-tolerant.

A case study based on 'Water quality and phytoplankton diversity of Gopeswar temple freshwater pond in Assam'(PP Baruah,Bhaswati Kakati,2012).45 phytoplankton species were recorded Phytoplankton species from the Chlorophyceae (16), Cyanophyceae (10), Bacillariophyceae (14), Euglenophyceae (3), Chrysophyceae (1), and Dinophyceae (1)families totaled 45. Peak phytoplankton levels have been seen throughout the summer and monsoon seasons. When the density of phytoplankton was compared to other indicators of water quality, the water body was found to be moderately contaminated. The study took place at the Gopeswar Temple Pond in the Kamrup District of Assam (India), which is located between 26°30' N and 91°71' E, from January to December 2009. Since it was dug by monarch Ahom Kingdom, the pond, a 600-year-old water feature connected to an ancient Hindu shrine to Lord Shiva, has been used frequently for the temple's daily operations.DebjyotiDas,ArabindaPathak,Sidin Pal (2018) conducted studies on to investigate the interactions between seven fish ponds on the Chota Nagpur Plateau that are supplied by urban effluent and five significant physicochemical variables. Four classes of phytoplankton, including Cyanophyceae (7 taxa), Chlorophyceae (29 taxa), Bacillariophyceae (5), and Euglenophyceae (2), total 43 phytoplankton taxa, and they are all thriving in these ponds, which may indicate that various nutrient-rich wastewater supports the diversity and abundance of the phytoplankton.

The water quality of seven sites is investigated using the Algal Genus Pollution Index (AGPI). According to the AGPI score, Site 4 is likely to have high organic pollution, whereas Sites 2 and 3 have moderate organic pollution. Because these ponds serve as a protection for livelihoods as well as significantly contributing to local food and water security as well as economic success, long-term intense studies and effective management are required to protect these ponds against eutrophication and degradation.

A case study based on Diversity of phytoplankton in a waste stabilization pond at Shimoga Town, Karnataka State, India (Shankar P Hosmani, Basaling B Hosetti,2009)The current investigation is being conducted to comprehend the diversity of phytoplankton in waste stabilization pond effluents. Phyto planktons were subjected to Shannon-Wiener and Simpson's species diversity indices.A total of 71 species of algae from the families Cyanophyceae, Chlorophyceae, Euglenophyceae, Bacillariophyceae, and Desmidaceae were identified. For the course of the investigation, Chlorella and Scenedesmus dominated the algae genera. In waste stabilization ponds, phytoplankton are crucial for enhancing the water quality of wastewater. The diversity indices of every species revealed that the water was somewhat polluted, with the least amount of diversity and the greatest number of equally distributed phytoplankton species. Lesser phytoplankton diversity is caused by greater pollution impact.

In 2013 The current study examines the limnobiotic state of three chosen lakes in Himachal Pradesh over a two-year period utilizing physical-chemical and biological indicator, particularly phytoplankton and zooplankton. One hundred forty-eight phytoplankton species from nine groups and 79 zooplankton species from five groups were found in the lakes. The size of the plankton population was connected with both biotic and abiotic factors (pH, alkalinity, temperature, dissolved oxygen, transparency, phosphate, chloride, and nitrate). The results of the current study showed that the physicochemical characteristics of the environment influenced how plankton species were distributed. According to the study's findings, planktons have a very high potential for use as trophic state bio-indicators. According to the study's findings, planktons have a very high potential for use as trophic state bio-indicators

2.2.2 Phytoplankton Diversity in Kerala

Kerala, one of the biodiversity hotspots and located in the southern portion of the Western Ghats, is rich in flora and fauna, including many endemic species. There is still much to be done in the systematic study of the algal flora on Indian algae, particularly in Kerala (Essa, 2004).He claims that among lower plants, algae are one of the least well-known and least well-documented categories, with only 834 species identified in Kerala.

From 1988 onwards, MVN Panicker made a significant contribution to the ecology and variety of freshwater algae in Kerala. Spirogyra*, Oedogonium, Trentenpohlia*, and *Chara* are among the filamentous green algae on which he has focused most of his *Chlorophyceae*researching. Depth studies on blue green algae from rice fields in kerala were done by Anand and Hopper in 1987. Depth studies on blue green algae from rice fields in Kerala were done by Anand and Hopper in 1987.108 species of algae identified from temple ponds of Kerala which are Thiruvananthapuram, Alappuzha, Ernakulam and Kollam (Maya et al., 2000). In 2005 CC Harilal conducted study on phytoplankton diversity of Karamana river and Neyyar rivers of kerala, with particular emphasis on nutrition. He identified 23 genera of phytoplankton from Neyyar river and 20 from Karamanariver.Here species diversity arefound more in upstream. In 2013 KV Vijayan and co works studied about phytoplankton diversity and population in Ananthapura temple lake of Kasaragod district. Assessments of phytoplankton variety, composition, and abundance were made in the fresh water ponds of the Parassala and Athiyanoor blocks. Seven classes and a total of 69 genera were identified throughout this study period. Of these, the class Cholorophyceae has the most genera (38), followed by Bacillariophyceae (23), Cyanophyceae (14) and the class with the fewest genera, Xanthophyceae (1). There were also other classes found, including Pyrophyceae (4), Rhodophyceae (3), and Euglinophyceae (2) (V Dinesh and Rajesh Reghunath, 2013).

In 2014 Sushanth Vishwanath Rai and MadaiahRajashekhar made a systematic studies on seasonal variations in the hydrographic factors and phytoplankton species diversity of the Arabian sea off the coast of kerala. Here they considered variables such as pH, turbidity, salinity and chlorophyll a contents of water. Total of 53 species of phytoplankton are identified from there. Major phytoplankton seen here are *Biddulphiamobiliensis, Chaetoceroscurvisetus, Licmophoraabbreviata, Skeletonemacostatum, Prorocentrummicans* and *Oscillatoria sp.* They observed that the diversity of phytoplankton are more in post monsoon period.The pH, salinity and temperature shows positive correlations but turbidit and dissolved oxygen negative correlation.

Algal diversity of guruvayoor temple pond was studied.Throughout the course of the investigation, 15 pollution-tolerant algae species were discovered in this pond. This study was conducted to analyze pollution status of pond. Chlorophyceae (48%), eight Euglenophyceae (19.5%), six each of Bacillariophyceae (14.6%) and Cyanophyceae (14.6%), and one Dinophyceae (2.5%). The Chlorophycean members in the Guruvayur temple pond were the most diverse, followed by the Euglenophycean members. (P Tessy Paul and PK Anu, 2016). Over a full year, the variety of phytoplankton and physio-chemical parameters were investigated. In the current study, three seasons were used to quantify 20 phytoplankton genera from 4 classes, including Chlorophyceae (11 species), Cyanophyceae (3 species), Bacillariophyceae (3 species), and Euglenophyceae (3 species) (G Geethu and RS Balamurali, 2018). In 66 representative locations of seven different eutrophic waters system dynamics of phytoplankton was studied. In this study 297 algal species were identified which belongs to 8 phyla, 11 classes and 26 order.

2.3 Algal Bloom

An algal bloom, also known as an algae bloom, is a sudden rise in the number of algae in freshwater or marine water systems. The pigments in the algae's cells cause the water to turn discolored. The majority of aquatic photosynthetic organisms fall under the umbrella word "algae," including large, multicellular animals like seaweed and tiny, single-celled ones like cyanobacteria. One example of a macroscopic blooming algal community is a kelp forest. Algal blooms are brought on by nutrients that enter the water environment and encourage excessive algae development, such as nitrogen or phosphorus from fertilizer runoff. An algal bloom has an impact on the entire ecosystem; depending on the individual, it can produce positive results such as simply feeding higher tropical levels to more negative effects, blocking sunlight from reaching other species, causing oxygen loss in the atmosphere, and secreting toxins into the environment.

Eutrophication is the process of nutrient overstock that results in the development of algae and the reduction of oxygen. Causes if algal blooms are excess of nutrient, Presence dead organic matter, High temperature and seen more jn slow moving water. Harmful algal blooms, or HABs, are those that produce toxins and have an adverse effect on other organisms. Occasionally they can only result in dangerously low oxygen levels, which kills organisms. Nutrient pollution, or an excess of the vital plant nutrients phosphorous and nitrogen, is what can cause blooms. Many algal indicators have been employed to evaluate the state of the environment. Algae can act as an indicator of the level of water quality degradation. In 1908 Kolkwitz and Marsson who were pioneer classified algal species based on their tolerance to different types of pollution.

2.3.1 Algal Bloom Studies in India

James Hornell made the first observations of the large fish mortality caused by algal blooms in Indian waters in 1908 while sailing from the Malabar coast to the Laccadive Islands (Hornell 1908).A study is conducted in west and east coast of India. In India's east and west shores, there have been reports of algae outbreaks. 101 incidences of blooms have been observed in Indian waters between 1908 and 2009, according to an assessment of the phenomenon. There has been an increase in the number of recorded bloom instances during the 1950s, according to a comparison of cases reported before and after that time. According to studies, there are frequent algal blooms throughout India's west coast, particularly in the southern region. While diatom blooms predominate in the east coast, dinoflagellate blooms account for the majority of those documented near India's west coast. There have been 39 species that have caused blooms, the most frequent of which being *Noctiluca scintillans and Trichodesmiumerythraeum. The blooming of Cochlodiniumpolykrikoides, Karenia brevis, Kareniamikimotoi, N. scintillans, T. erythraeum, Trichodesmiumthiebautii,* and*Chattonella marina* has been linked to reports of significant fish mortality in Indian waters.

The majority of the blooms happened before and during the south-west monsoon's retreat. This mechanism is primarily impacted by seasonal upwelling and monsoonal forcing in Indian waters, which result in high riverine flow and nutrient-enriched waters, giving phytoplankton species a competitive advantage(Maria ShaminaD'Silva et al., 2012). In 2012 a study was conducted by KB Padmakumar, NR Menon and VN Sanjeevan in the Exclusive Economic Zones of India. In this study intensity and spatial coverage of harmful algal blooms and frequency increases in algal blooms are documented. They conduct study during the period of 1998-2010. Eighty algal blooms are reported during this period. Among the eighty 31 formed by dinoflagellates, cyanobacteria form 27 algal bloom and 18 blooms are formed by diatoms.In the South Eastern Ocean, Red*Noctiluca scintillans* was the most prevalent and frequent blooming dinoflagellate (without endosymbiont *Pedinomonasnoctilucae).*Green *Noctiluca scintillans* (with endosymbiont *Pedinomonasnoc- tilucae*) were found in the North Eastern Arabian Sea (NEAS) during the winter cooling and in the Arabian Sea (SEAS) during the summer monsoon. The dinoflagellates *Cochlodinium sp., Gymnodinium sp., Gonyaulax sp., and Ceratium spp*. were also frequently found bloom-forming dinoflagellates. The research shows that whereas the *Noctiluca* bloom came at random intervals, the *Trichodesmium* bloom happened annually.

About 422 species of microalgae were reported. The data from this study indicates the increasing of harmful algal blooms in the Indian EEZ.A study was conducted in hotspots of Marginal Productive Seas. The algal blooms in the Marginal Productive seas of India become more prevalent nowadays. They reach from lower latitude up to North Indian cost. Therefore, study was mainly conducted to identify the key marine and atmospheric processes that cause them and impact major monsoons on algal blooms. The analysis is based on the comprehensive data set which was collected from many focusing on the Indian ocean. In this study first Identify the main factors supporting algal blooms in ten hotspots for algal blooms. Growth is discovered to be dependent on nutrients delivered by dust, river runoff, upwelling, mixing, and advection, as well as the presence of light, all of which are influenced by the monsoon's phase. Also discover that sunlight and dust deposition are crucial for comprehending marine biodiversity because they are reliable indicators of algal bloom species. (Maryam R Al-Shehhi et al., 2022).

In 2022 Chintan B Maniyar, Abhishek Kumar and Deepak R Mishra in Indian inland water for harmful algal bloom. This study's primary objectives were to highlight CyanoKhoj's usefulness for quick monitoring and to talk about the pervasive CyanoHABs issues in India.Here they Selected case studies of lakes and reservoirs from five different states—Bargi and Gandhisagar Dams in Madhya Pradesh, Hirakud Reservoir in Odisha, Ukai Dam in Gujarat, Linganamakki Reservoir in Karnataka, and Pulicat Lake in Tamil Nadu—are used to illustrate the usefulness of Cyanokhoj. CyanoKhoj, a tool for monitoring CyanoHABs in close to real-time and evaluating them across the nation, was used to conduct research at these locations from September to November 2018.They studied the local spread of the CyanoHABs and their phenology in these waterbodies using CyanoKhoj to prepare spatiotemporal maps of Chlorophyll-a (Chl-a) concentration and Cyanobacterial Cell Density (CCD).CyanoKhojcapable of near-real-time monitoring and country-wide assessment of CyanoHABs.According to the findings of this CyanoHABs are more common in nutrient-rich waterbodies that are exposed to discharges from industry and other nutrient-rich sources. The blooms' distinct temporal history revealed that they are most prevalent during the post-monsoon season (September to October), when nutrient concentrations in the waterbodies are at their highest, and that they start to wane as winter approaches (November-December)

2.3.2 Algal Bloom in Kerala

`In 2006 R Jugnu of Cochin University of Science and Technology conduct studies on the prevalence of algal blooms along Kerala coast. SitesChombala in North Kerala and Vizhinjamim in South Kerala. Algal diversity of this placewere identified. North Kerala's Chombala was home to 61 species of marine phytoplankton from 32 genera between October 2001 and September 2002 (the first year), and 76 species from 33 genera between October 2002 and September 2003. (second year). In the first and second years, respectively, 91 species from 30 genera and 90 species from 35 genera were documented in the sea off the coast of Vizhinjam in south Kerala, while 88 and 95 species from 28 genera were recorded in the nearby bay. This analysis are used to algal bloom in this two place.

In2011 R K Sarangi and Gulshad Mohamed studied about seasonal algal bloom and water quality around the coastal part of Kerala. It was during Southwest monsoon. Data on the chlorophyll, productivity, nutrients, dissolved oxygen, salinity, temperature, and other in situ water quality indicators have been gathered by CMFRI, Cochin. In situ observations and IRS-P4 (Oceansat-1) OCM data were used to detect an algal bloom in the area of Kerala's coastal and shelf waters around Calicut in September 2002 and 2003. Images of diffuse attenuation coefficient, chlorophyll, total radiance, and remote sensing reflectance have all shown signs of an algae bloom. In-situ observations show that in the first, second, and third weeks of September 2002, the dinoflagellate *Noctilucascintillensis* predominated. Fish have been found to be dying in large numbers around the southern coast of Calicut. Seasonal algal blooms and their changes are analyzed. A study was conducted to survey the algal bloom of ponds in pallippiram district in Kerala.

In this study 873 ponds were analyzed and surveyed. Amongthese 873 ponds 66 % are unused, while 33% are used for domestic purpose other than drinking and irrigation such as washing and bathing. Study was conducted in each of the 17 wards of pallipurampanchayat .First a preliminary survey is conducted to analyze the total number of ponds then algal blooms were selected from the ponds and surveyed. Algal bloom was observed in 48 ponds The blooms appeared as green or blue green turbidity, floating scum,or as thick blue-green floating mats. Submerged Aquatic Vegetation (SAV) occurred in 19 ponds. The SAV comprised of *Vallisneria sp., Hydrilla verticillata* and *Ceratophyllumsubmersum*. Floating hydrophytes were *Lemna minor, Pistia stratiotes, Eichhorniacrassipes, Salvinia molesta and Azollapinnata*.Six of the thirty two ponds that were sampled for algal blooms contained charophyta blooms, and the remaining ponds had cyanophyta blooms. The majority of the blooms were filamentous algae, which produced thick surface scum or mats that floatedSix of the thirty two ponds that were sampled for algal blooms contained charophyta blooms, and the remaining ponds had cyanophyta blooms. The majority of the blooms were filamentous algae, which produced thick surface scum or mat that floated. Six of the thirty two ponds that were sampled for algal blooms contained charophyta blooms, and the remaining ponds had cyanophyta blooms. The majority of the blooms were filamentous algae, which produced thick surface scum or mats that floated. Six of the thirty-two ponds that were sampled for algal blooms contained charophyta blooms, and the remaining ponds had cyanophyta blooms. The majority of the blooms were filamentous algae, which produced thick surface scum or mat that floated.*Spirogyra sp., Klebsormidium sp.,* and*Mougeotiascalaris all represented* the *Charophyta.* While*Klebsormidium and Mougeotia*were each found in one pond, Spirogyra bloomed in four of them. The remaining 26 ponds under examination all experienced blue-green algal blooms. Oscillatoria were found in 19 ponds, with 2 species in each. Three ponds experienced Microcystis aeruginosa blooms. In several ponds, hydrophytes and algal blooms were seen coexisting (S Dhanya et al.,2012).

A study was conducted to study about fish mortality due to cyanobacterial algal bloom. It was in fresh water pond, cochin. The results of the current study explain why fish populations in the freshwater pond of the UdayathumvathilSreekrishna Swami Temple in Cochin, Kerala, were decimated, as well as the color variations of the microalgal bloom. During the study period, monitoring of water quality and phytoplankton quantity was done from specific stations. Nitrate, phosphate, and ammonia concentrations were found to be greater than normal, which points to the production of phytoplankton blooms. Oxygenlevel was observed here. Among the phytoplankton species Cyanobacterial were dominated. Fish mortality was likely brought on by either a lack of oxygen, cyanobacterial toxins, or a combination of both (GeethuMocham et al., 2020)

2.4 Water Quality Parameters

Water is major abiotic factor in the environment. Water is a life supporting system. Every living thing are depend on water in their daily life. Quality of water is the condition of water including physical, chemical and biological characteristics of water. Physical quality parameters include Electrical conductivity, salinity, solids turbidity, temperature etc. pH, acidity, alkalinity, Hardness, chlorine, dissolved oxygen and Biological oxygen demand are belong to chemical parameters. Biological parameters include bacteria, algae and virus. An ecosystem's quality is influenced by both natural and human activities. For the examination of aquatic ecosystem quality, systematic and scientific water quality monitoring is necessary. pH One of the most crucial aspects of water quality is ph. It is described as the hydrogen ion concentration's negative logarithm. . It is an arbitrary integer that expresses how strong an acidic or basic solution is.

Essentially, water's pH is a gauge of how acidic or basic it is. A pH of greater than 7 denotes a base solution, whereas one of less than 7 implies acidity [2, 24]. The pH of pure water is neutral, hovering about 7.0. pH of rain water is about 5.6.For home usage and the requirements of living things, the safe pH levels for drinking water are between 6.5 and 8.5. Electrometric and colorimetric techniques are both available for determining.pH levels that are too high or too low might be harmful to the use of water. The taste becomes harsh at high pH levels, and chlorine disinfection is less effective, necessitating the use of more chlorine. As the pH rises, so does the amount of oxygen in the water. Metals and other materials will corrode or dissolve in low-pH water. Certain compounds in water can take on different forms depending on the ph. Thus, aquatic plants and animals may be impacted.

2.4.1 Dissolved Oxygen

Dissolved Oxygen is a critical water quality parameter which helps to determine the pollution in lake, pond, river etc. The greater the water quality, the higher the dissolved oxygen concentration. The solubility of oxygen causes dissolved oxygen to exist. Oxygen is particularly temperature-sensitive and only mildly soluble in water. The actual concentration of dissolved oxygen changes with water salinity, pressure, and temperature. There are three primary techniques for determining the concentrations of dissolved oxygen: the colorimetric approach, which is quick and affordable; the Winkler titration method, which is more conventional; and the electrometric method. Biological oxygen demand Organic materials are the food source for bacteria and other microbes. They use oxygen to digest organic matter .The microorganisms utilize the energy provided when the organic materials are broken down into simpler chemicals like CO_2 and H_2O for growth and reproduction. The oxygen consumed during this process in water determines the water's DO. The concentration of DO will decrease as the bacteria break down the organic components if oxygen is not continuously replenished by natural or artificial ways in the water. The biological oxygen demand refers to this need for oxygen (BOD). The BOD that the microorganisms use will increase as there is more organic material in the water. The dilution method can be used to calculate the biological oxygen requirement. The water is contaminated if the BOD concentrations are high

2.4.2 Water Quality Parameter Studies in India

In 2008 a study was conducted in Bhopal, India. Study was about Multivariate analysis of drinking water quality parameters. The study area are Upper Lake and Kolar reservoir located in Bhopal. On the eastern end of Upper Lake's catchment, there is a little amount of urbanization, although the most of the area is rural. Since the western end of the lake has flat contours and is used as agricultural land, the topography of the lake suggests that the basin is natural. The lake's northern and southern sides are hilly. The land surrounding the reservoir at Koolar is heavily forested. As a result, runoff from the forest provides the reservoir's water. Many trees are drowned in the reservoir since the submerged area was also a part of the forest before the reservoir was built.

To determine the drinking water quality, the physio-chemical parameters such as temperature, pH, turbidity, total hardness, alkalinity, BOD, COD, chloride, nitrate, and phosphate were examined. According to the investigation, Water of Kolar reservoir is more significant than Upper Lake since it is transparent, low in BOD and COD, relatively soft, and has a moderate alkalinity. Since Kolar Reservoir is surrounded by a dense forest and is less likely to see human influence than Upper Lake, its overall water quality is significantly better.(Charu Parashar et al., 2008).

In 2008 C Gajendran and P Thamarai conducted a study in Nambiyar River basin, Tamil Nadu, India. Study was about statistical relationship between ground water quality parameters. All of the water quality characteristic's correlation coefficients have been calculated in the current study. The statistical analysis for the years 1988, 1999, 2002, and 2003 utilises data from the Tamil Nadu Public Work Department. All parameters are reasonably associated with one another, according to the investigation of correlation between water quality parameters. Correlation coefficient is used to analyse the quality of the ground water. Total Dissolved Solids and Chlorine exhibit strong association with other parameters, according to the results of the correlation analysis.

As sodium, chloride, calcium, and sulphate have substantial correlations with total dissolved solids (TDS), a regression equation linking TDS and these parameters has been developed. So, by measuring TDS, it is possible to estimate the concentration of better linked factors like sodium, calcium, sulphate, and chloride. So, this approach offers a better alternative. This method is effective for identifying changes in the system's water quality. This paper's indirect method of ground water quality assessment offers a superior alternative to traditional methods for a comprehensive investigation. Both the time and the amount of analysis are reduced. Thus, this could be thought of as a quick procedure. As a result, this might be considered a quick way to check the water quality in the Nambiyar Basin. A study was conducted about Water Quality Index Assessment of Groundwater in Todaraisingh Tehsil of Rajasthan State, India. Here 20 water samples were collected from tube well, open well and hand pump. The primary goal of this study is to characterize and assess the water hardness of the rural Todaraisingh area of Tonk district. Therefore, this study examines the statistical analysis and study of the water quality index to determine the hardness of the groundwater in the Tonk district of Rajasthan state's Todaraisingh tehsil. Its usefulness for drinking, irrigation, and industrial purposes is the subject of the investigation. Due to local contaminants, there are problematic salts present in groundwater that have a negative impact on the quality of the water. The predicted values were compared to B.I.S.-mandated criteria for drinking water quality. It was discovered that salts that cause hardness have seriously contaminated drinking water. This study demonstrates how vulnerable those who depend on the study area's water resources are. This study also concern with use of indigenous technologies to make water fit for drinking. (Ashok Kumar Yadav et al., 2010).

In 2011 Chadetrik Rout and Arabinda Sharma studied about Ambala cantonment area, Haryana, India. Study was conducted for assessment drinking water quality. The physicochemical properties of the groundwater in the Ambala Cantonment area were evaluated in the current study to determine whether it is suitable for drinking. 26 water samples total were taken from deep aquifer-based tube wells located throughout the Ambala Cantonment area. The water samples were examined for a variety of physicochemical characteristics, such as pH, electrical conductivity (EC), total dissolved solids, calcium, magnesium, total harness, sodium, potassium, carbonate, bicarbonate, total alkalinity , chloride, fluoride, and sulphate concentrations, in order to determine the quality of the ground water. The outcomes were contrasted with those required by the Bureau of Indian Standards (BIS) and the World Health Organization (WHO) (BIS). It was discovered that every physiochemical parameter was within the permitted range. Also, the correlation matrix was generated for several drinking water parameters. The deep aquifer's water is moderately hard, according to the pH values, which show that the ground water in the study area is alkaline by nature. Total hardness ranges between 116.6 and 129.4 mg/l. So the water is not fully good for drinking purposes. The cantonment areas are advised to soften the tube well water before using it.

In 2011 K Saravanakumar and R Ranjith Kumar conducted a study in groundwater near Ambattur industrial area, Tamil Nadu, India. Here they focused their study in analysing water quality parameters. The only supply of water for Ambattur's industrial zones is underground. Due to industrial activity, Ambattur's groundwater quality is continuously declining, and neighbouring fields' soils are also being impacted.So they conduct studies in underground water so remedial measures can be carried out there. They collect water from the 10 different locations during post rainy season that is November in 2010. The parameters under investigation included conductivity, total dissolved solids, total alkalinity, total hardness, turbidity, chloride, sulphate, and fluoride, as well as pH. Overall study revealed that the physico-chemical properties of the investigated water samples varied somewhat from one another. When the water sample's physico-chemical properties were compared to the WHO and ICMR's recommended limits, it became clear that the groundwater was seriously contaminated and posed a risk to human health. A study was conducted in Ghataprabha river, India. RuverGhataprabha is a tributary of River Krishna flow through Karnataka state of India. Several physicochemical and biological water quality indicators were measured in order to evaluate the water quality of a 30 km length of the river Ghataprabha. River Ghataprabha gets untreated domestic sewage from Gokak town and three villages located on the river's bank downstream of Gokak town as it flows through Belgaum district in north Karnataka state. Here water is collected from seven sampling station. Every month for two years 2006-07 and 2007-08, several factors including temperature, pH, dissolved oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD), hardness, alkalinity, etc., were examined.

The two years average values during pre-monsoon and post - monsoon seasons were analysedFrom the findings of their study, it was discovered that all of the physico-chemical parameters from the downstream of Gokak town had significantly increased, especially during the pre-monsoon season. All of the indicators were, however, within the boundaries of the drinking water requirements. According to the CPCB stream classification, the river stretch up to 3 2222.2.1km from the upstream boundary (upstream of Gokak town) can be defined as class of stream "C," while the stretch between 3 and 30 km can be categorised as class of stream "D." At all locations throughout both seasons, the river met the requirements for class of stream "C" (> 4 mg/l) in terms of DO.(CB Shivayogimath et al., 2012).

A study was conducted in groundwater of Valsad district of south Gujarat, India. From August 2008 to July 2009, groundwater samples were taken from five talukas in the Valsad district. Five talukas are Valsad, Pardi, Umargam, Kaprada and Dharampur. Their physicochemical properties were examined. The current study focuses on measuring parameters such as pH, colour, electrical conductivity (EC), total hardness , calcium , magnesium , total alkalinity , total dissolved solids , silica, chloride, sulphate, sodium, chemical oxygen demand , and metals such as copper and manganese . To find the highly associated and related water quality measures, correlation coefficients were calculated. According to the Valsad district's correlation matrix, eight out of the seventeen analysed water quality metrics and groundwater EC were shown to be strongly associated.It might be advisable to check the Valsad district's quality.EC has a high and positive link with Total Hardness, Magnesium, Total Alkalinity, TDS, Chloride, Sulphate, Sodium, and SAR, according to the results of the correlation analysis. As the EC of water substantially connected with eight out of the seventeen factors in the research area, it can be inferred from the discussion above that EC of water is an important drinking water parameter.(P Shroff et al., 2015).

2.4.3 Water Quality Parameters Studies in Kerala

Ajith Verghese George and Mathew Koshy(2008) case studies on Water quality studies of sasthamkotta lake of kerala. The largest freshwater lake in Kerala is Sasthamkotta Lake. Due to anthropogenic activities like the disposal of human waste, soil erosion brought on by the removal of vegetation, and the dumping of refuse from hotels and slaughterhouses, the lake is degrading. The entire Kollam Dist receives water from this lake. From March 2006 to August 2006, water samples from various locations were analysed to look into the water quality parameters. Using industry-standard techniques, the samples were examined for physical, chemical, and biological factors such as pH, electrical conductivity, free CO_2, total alkalinity, dissolved oxygen, hardness, chloride, phosphate, and total coliform count (MPN).The bacterial population of Sasthamkotta Lake is almost within the limit in the current research. In light of this, even though the MPN of coliform bacteria barely exceeds the upper permissible limit, the water is not significantly contaminated with them. Since coliform bacteria tend to pollute water bodies, constant surveillance of this water body is actually required. The goal of the current research is to examine the Sasthamkotta Lake's water quality parameters. The results of the analysis indicate that all of the lake's stations' quality parameters—aside from the bacterial count, which exhibits a slightly higher value in some stations—are within acceptable ranges.

These water samples exhibit a low likelihood of pollution and can be used without remediation for routine tasks. For drinking reasons, coliform bacteria should be treated. The results of the analysis indicate that all of the lake's stations' quality parameters, with the exception of the bacterial count, which exhibits a slightly higher value in some stations, are well within acceptable ranges. However, despite the fact that this water has little potential for pollution and can be used for routine tasks without any special preparation, coliform bacteria should be remedied before consuming.

In Tripunithura, a suburb of Kerala's Ernakulam district, physical, chemical, and microbiological features of various sources of surface and groundwaters were identified in February 2011. The study's goal was to determine whether water was suitable for drinking and other household uses. Three separate highly populated locations' water samples were taken, and standard analytical techniques were used to determine various parameters. Home well water and pond water all had acceptable physico-chemical parameters, with the exception of the iron value in the pond water, while bore well water and river water all had values that were higher than the maximum allowable limit, with the exception of sulphate and dissolved oxygen in the bore well water and nitrate in the river water. The results of the microbiological examination showed that all other waters, with the exception of bore well water, do not meet the requirements for drinking water. As a result, the study found that all of the water samples examined in the current study failed to meet the requirements for drinking water either in the physico-chemical aspects, the microbiological aspects, or both.

In 2015 a case study based on Water Quality Index Determination of Ponds in Anad Panchayath, Thiruvananthapuram, Kerala–A Geospatial Approach. The goal of the current task is to evaluate the Anad panchayath in Nedumangadu block's pond water quality to determine whether it is suitable for a variety of uses by calculating the WQI and utilising GIS techniques. For a thorough physico-chemical study, 13 samples of pond water were taken from the ponds in the Anad panchayath. The WQI was calculated using nine factors, including pH, chloride, calcium, and magnesium, total hardness, total dissolved solids, potassium, and dissolved oxygen. Using GIS tools, spatial distribution maps for the 13 factors were created. The calculated WQI number is between 10 and 23. Since the pond water in the study region is in the Good category, it can be used for both domestic and agricultural uses.

Smitha Asok and Sajitha (2015) case studies on Application of Water Quality Index for the spatial evaluation of pond water quality: a study from Vizhinjam Panchayath, Thiruvananthapuram, Kerala, India. Ponds are essential to many aspects of a region's hydrogeological balance. Many ponds are currently suffering from irreversible deterioration. The amount and quality of the water in the ponds must therefore be preserved. Ponds serve the dual purpose of storing water on the surface and transmitting water to the subsurface, thereby reviving the amount and quality of both the surface and subsurface water habitats. One of the main benefits of the water quality index (WQI) is that it uses data from parameters that affect water quality to inform a mathematical equation that quantifies the state of the water's purity. The goal of the current research was to use the water quality index method to assess the water quality of Vizhinjam Panchayath. Testing different physico-chemical parameters, including pH, TDS, DO, Na, K, Cl, TH, Ca, and Mg, and calculating their water quality indicator were used to assess the pond water's quality. The spread of the water quality indexes for all samples was 8.4 to 38.11. The majority of the study area's pond water samples were found to fall into the excellent to good category, suggesting that the ponds are appropriate for domestic use. The research has thus demonstrated the value of using the Water Quality Index as a technique for evaluating the water quality of a water body as a whole. The study also includes recommendations for site-specific action plans, whose stringent execution will guarantee the preservation and protection of these tiny water bodies. The foundation of life on earth is water, around which the web of life is formed.

Ponds are essential to human existence as sources of water. All living things require fresh water, so the quality of all available water supplies is crucial. The aforementioned research shows that Vizhinjam Panchayath has excellent and good quality water. It is implied that the pollutants in the study region are within the permitted standard based on the aforementioned observations. However, samples indicate that the water needs to be treated before use. To lower the levels of contaminants in the study region, appropriate water treatment techniques must be used. Since the aforementioned locations are used as household water sources, strict rejuvenation and reconstruction techniques must be used. The research has thus demonstrated that using the Water Quality Index is a useful method for evaluating the water quality of a water body in its entirety. The authorities can use the data from this research to pursue sustainable planning and management strategies for pond water resources.

In 2016 ,A case study based on Study of physico-chemical parameters and pond water quality assessment by using water quality .The goal of this study was to evaluate the pond water quality in Athiyannoor panchayath, Thiruvananthapuram District, Kerala, in relation to temperature, pH, electrical conductivity, total dissolved solids (TDS), total alkalinity, dissolvable oxygen, total hardness, sodium chloride (NaCl), calcium, magnesium, sodium, and potassium. (Potassium). The outcomes were assessed and contrasted with the water quality criteria set by the WHO and BIS. The area's overall pond water quality state was calculated using the data collected to create the water quality index. Based on the WQI results, it is discovered that the samples are excellent and thus appropriate for domestic use.

AjithVerghese George and Mathew Koshy(2008) case studies on Water quality studies of sasthamkotta lake of Kerala. The largest freshwater lake in Kerala is Sasthamkotta Lake. Due to anthropogenic activities like the disposal of human waste, soil erosion brought on by the removal of vegetation, and the dumping of refuse from hotels and slaughterhouses, the lake is degrading. The entire Kollam Dist receives water from this lake. From March 2006 to August 2006, water samples from various locations were analysed to look into the water quality parameters. Using industry-standard techniques, the samples were examined for physical, chemical, and biological factors such as pH, electrical conductivity, free CO2, total alkalinity, dissolved oxygen, hardness, chloride, phosphate, and total coliform count (MPN).The bacterial population of Sasthamkotta Lake is almost within the limit in the current research. In light of this, even though the MPN of coliform bacteria barely exceeds the upper permissible limit, the water is not significantly contaminated with them. Since coliform bacteria tend to pollute water bodies, constant surveillance of this water body is actually required. The goal of the current research is to examine the Sasthamkotta Lake's water quality parameters.

The results of the analysis indicate that all of the lake's stations' quality parameters—aside from the bacterial count, which exhibits a slightly higher value in some stations—are within acceptable ranges.These water samples exhibit a low likelihood of pollution and can be used without remediation for routine tasks. For drinking reasons, coliform bacteria should be treated. The results of the analysis indicate that all of the lake's stations' quality parameters, with the exception of the bacterial count, which exhibits a slightly higher value in some stations, are well within acceptable ranges. However, despite the fact that this water has little potential for pollution and can be used for routine tasks without any special preparation, coliform bacteria should be remedied before consuming.

In 2021,a case study based on Phytoplankton communities of eutrophic freshwater bodies (Kerala, India) in relation to the physicochemical water quality parameters. Eutrophic freshwater algal bloom is significant from various viewpoints on sustainable development. In addition to identifying the types of algae that proliferate quickly in reaction to eutrophication, phytoplankton studies on the water quality parameters of eutrophic waters aid in the environmental inventory of such rapidly proliferating algae. The industrial use of non-toxic species in phytoremediation or as new bioresources for fuel, food, or feeds, as well as the control of toxic algal blooming, depend greatly on our understanding of the particular environmental requirements of fast-growing algae. In this context, two seasons were used to quantify the seasonal dynamics of the phytoplankton community in seven different types of eutrophic waters from 66 representative locations in Kerala, South India.

A total of 297 algal species from 8 groups, 11 classes, and 26 orders were collected. Evaluation of the ecological amplitude of a number of distinct dominant species common to eutrophic waters in Kerala was made possible by comparing the ecology and diversity of algal communities with respect to physicochemical water quality metrics. Five sets of components that contribute to the cause of algal blooms were extracted from all of the water quality parameters using principal component analysis. In general, the research has produced useful new information about a number of previously unstudied fast-growing non-toxic algal species, including *Kirchneriellalunaris, Ankistrodesmusfalcatus, Radiococcusnimbatus, Coelastrummicroporum, and Scenedesmus dimorphus,* which are useful for industry and can contribute to ecotechnological innovations crucial for sustainable development

2.5 COMPARISON STUDY

Any aquatic ecosystem's physio-chemical properties, as well as the type and distribution of its biota, are directly related to, impact, and are all under the control of several natural regulatory systems. The normal dynamic balance in the aquatic ecosystem is continuously disrupted by man's use of the water resources, which frequently has dramatic effects like the extinction of flora and fauna, fish kills, changes in physio-chemical characteristics, etc. Pollution is the term used to describe man-made changes that cause these biological responses, and it can progress to the point where these important aquatic resources are no longer suitable for human use. Fresh water is one of the most important natural resources for sustainable development. The investigation of physical, chemical, biological, and microbiological characteristics that determine water quality typically includes reflections on the abiotic and biotic status of the environment (IAAB, 1998; Kulshrestha and Sharma, 2006; Mulani et al., 2009).

According to Jose & Sreekumar (2006), the biological indices offer a cheap, fast and effective means of finding the pollution status of waters. By employing Palmer's algal pollution index, it was found that about 10 percent of the ponds have confirmed high organic pollution and another ten- showed probable high organic pollution. Fifty percent of the ponds showed moderate organic pollution and thirty percent showed lack of organic pollution. As a result of the present study, it has been concluded that the water in majority of the temple ponds is in potential danger of becoming more polluted due to anthropogenic activities

3. MATERIALS USED AND METHODOLOGY

3.1 Collection of Sample

Water samples will be taken from a few urban and rural habitats in Kannur. Periodic sampling will take place in the mornings between 9.00 and 11:00. The sampling stations are situated over random places in Kannur district.4 out of 7 ponds are situated near urban areas and are associated with religious institutions and the rest of the sampling sites are situated in rural areas with low human activity. samples have been collected following the standard procedures and techniques. Fig: 1 shows the location map of the study area prepared using the google earth software. The study was carried out during the month of December 2022 to February 2023. About 1 L of water samples were collected from 7 ponds (sample ID: W- 1–W- 7) in a PET bottle and brought to the laboratory for further analysis. Table 1 shows the details of the location points of the sampling stations.

Fig.1: Map showing the distribution of sample sites

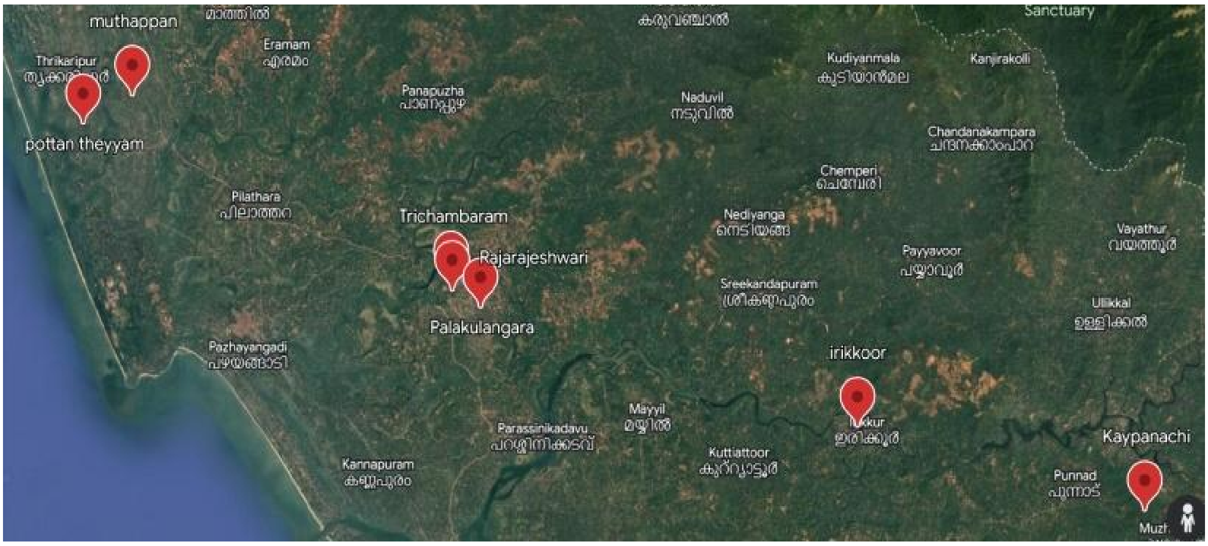


Table.1: List of sample sites with site code

SI No	SITE NAME	SITE CODE
1	Kaypanachi	W-1
2	Irikkoor	W-2
3	Palakulangara	W-3
4	Trichambaram	W-4
5	Rajarajeshwari	W-5
6	PottanTheyyam	W-6
7	Muthappan	W-7

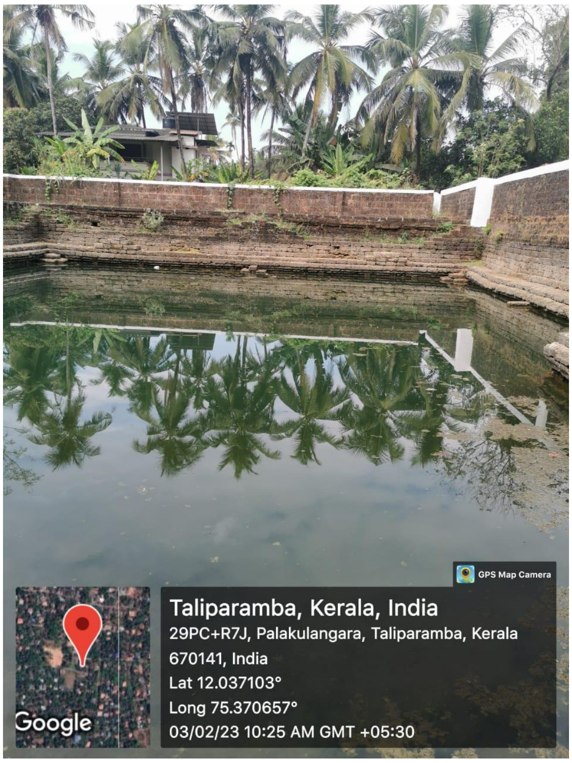


Fig.2: Palakulangara

Fig.3: Pottantheyyam

Fig.4: Irikkoor

3.2 Biochemical Evaluation

Plankton will be examined under a microscope at the KFRI Phyto-technology Lab and identified with the aid of accepted sources (Adoni et al., 1985; Agarker et al., 1994). Species richness, diversity, and evenness were quantified using a plankton-counting cell (Sedgwickrafter) and the methods of Ludwig and Reynolds (1988) and Ismael and Dorgham (1991). (2003).

3.3 Physicochemical Evaluation

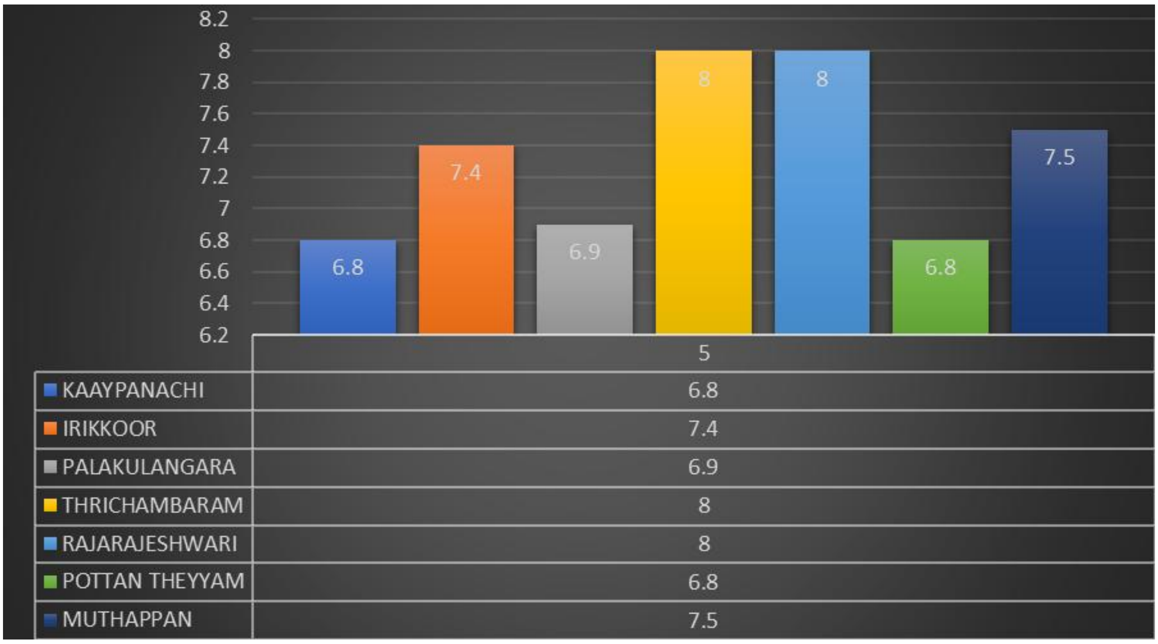
On-site measurements of pH and temperature (air and surface water) will be taken using an infrared thermometer and a pH metre, respectively. The sample will be subjected to normal procedures for the measurement of (dissolved oxygen, and biological oxygen demand) (APHA, 1975

4. RESULT

4.1 Hydrogen Ion Concentration (pH)

The pH of 7 pond water ranged from a minimum of Pottantheyyam and Kayappanichi pond water 6.8 to a maximum Thrichambaram and Rajarajeshwari pond at8 (Table.1, 2; Fig.2) shows the variation in pH of pond water.

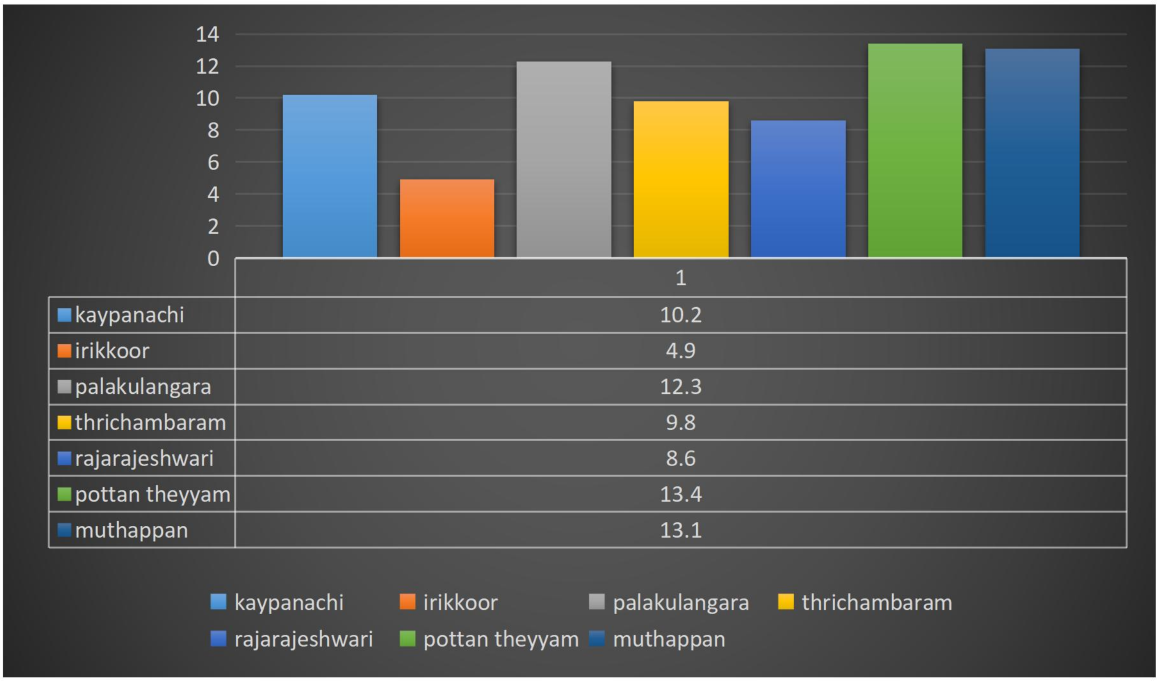
Fig.5: Variation in pH of pond water at different study areas



4.2 Dissolved oxygen (DO)

The dissolved oxygen of pond water ranged from a minimum of Irikkoorpond water 4.9(Mg/L) to a maximum at Pottantheyyampond water 13.4 (Mg/L).

Fig .6: Variation in dissolved oxygen of pond water at different study areas



4.3 Biological oxygen demand (BOD)

The biological oxygen demand of pond water ranged from a minimum atpottantheyyam pond water 3.5(Mg/L) to a maximum at Irikkoor pond water 12.1 (Mg/L). shows the variation in biological oxygen demand of pond water

Fig.7: The biological oxygen demand at different study sites

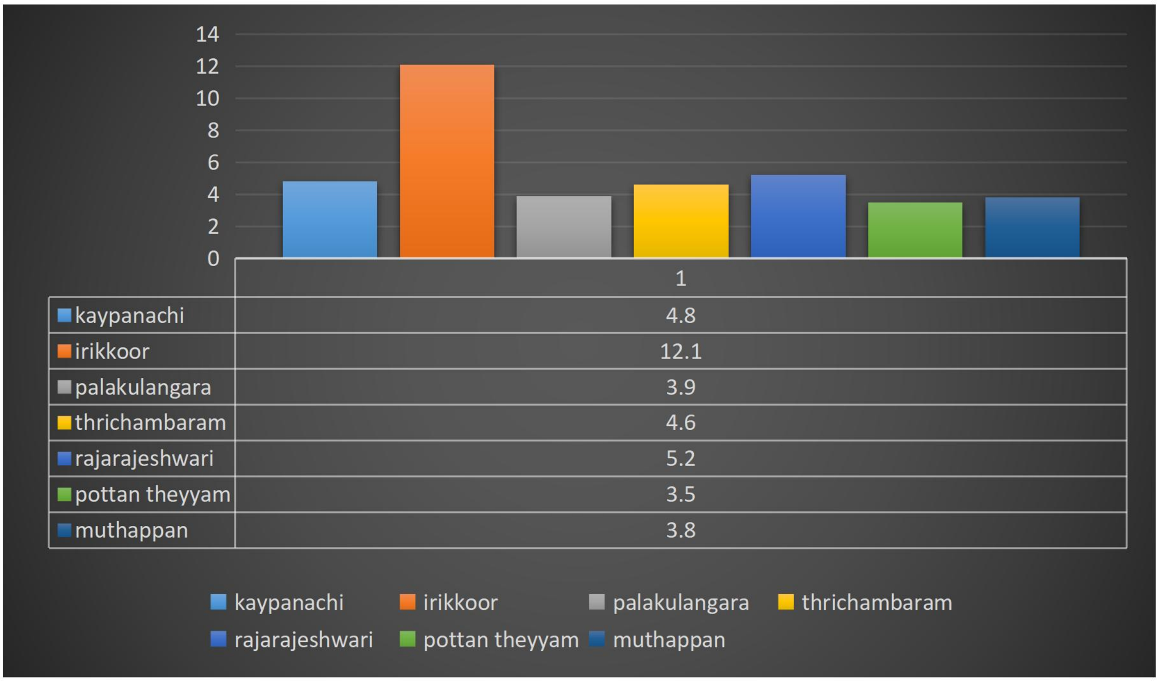
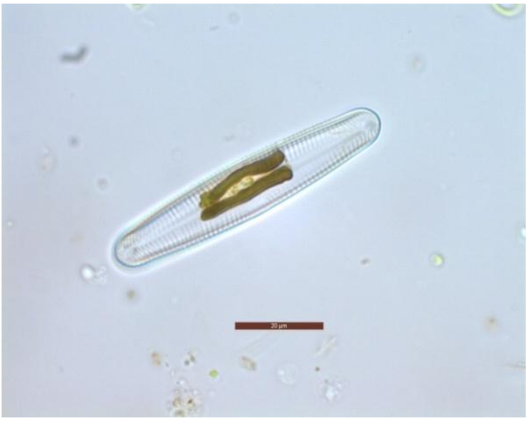


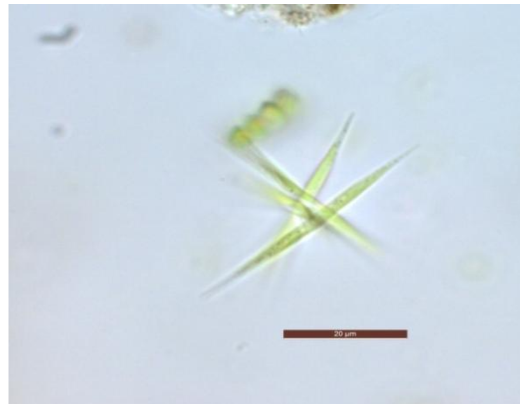
Table.2:Tabulated statement of the genus observed from different pond

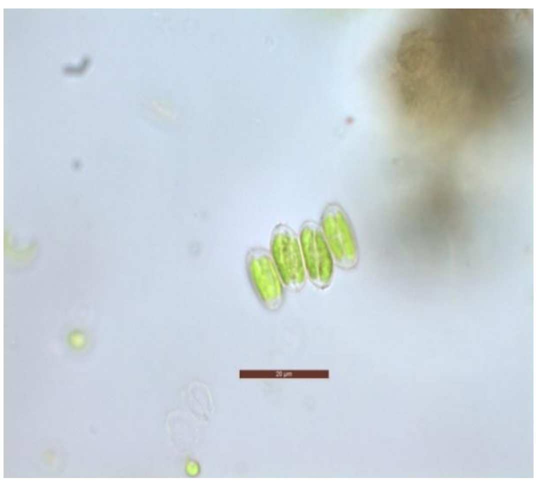
		PONDS					
		IRIKKOOR	KAYPANCHI	MUTHAPPAN	PALAKULANGARA	RAJARAJESHWARI	POTTANTHEYYAM
GENUS	*Pediastrum*	☑		☑	☑		
	Ankistrodesmus	☑		☑			
	Micratinium	☑					
	Phacus	☑					
	Scenidesmus	☑					
	Melosira	☑		☑			
	Pinnularia	☑					
	Flagellareae	☑					
	Clostrerium	☑		☑			
	Navicula	☑					☑
	Osillatoria	☑					☑
	Spirogyra		☑				
	Cosmarium		☑		☑		☑
	Pleurotaenium		☑				

	Krichneriella			☑			
	Bambusina				☑		
	Netrium				☑		
	Bulbochaete				☑		
	Staurastrum				☑	☑	
	Anthrodesmus				☑		
	Scenedesmus				☑		
	Spaerozoma					☑	
	Perinidium					☑	
	Planktolyngbya					☑	
	Cyclotella					☑	☑
	Monoraphidium					☑	
	Fragilaria						☑
	Nitzchia						☑
	Mougatia						☑
	Coelastrum				☑		

Plate.1:Algal genera from Irikkoor Pond







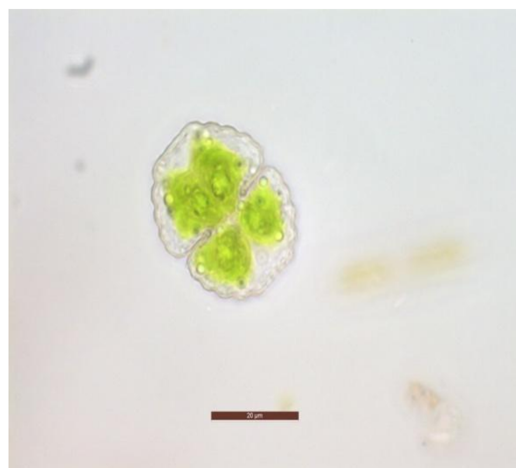
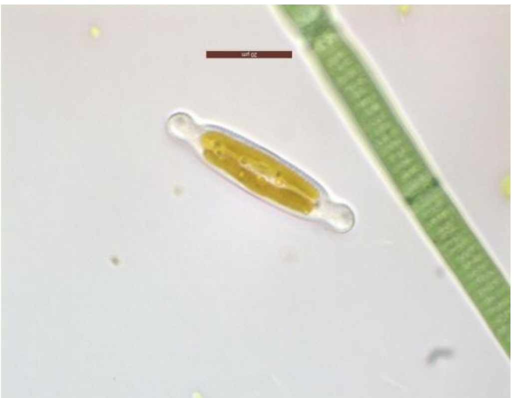
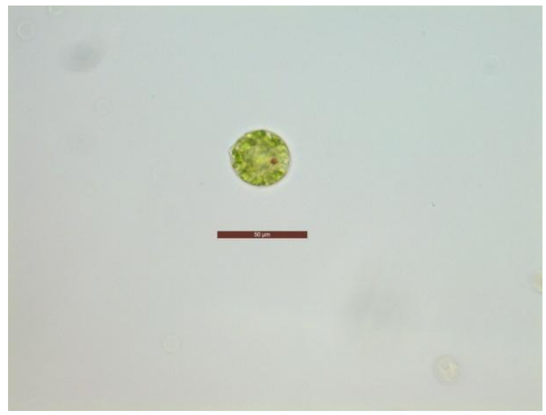
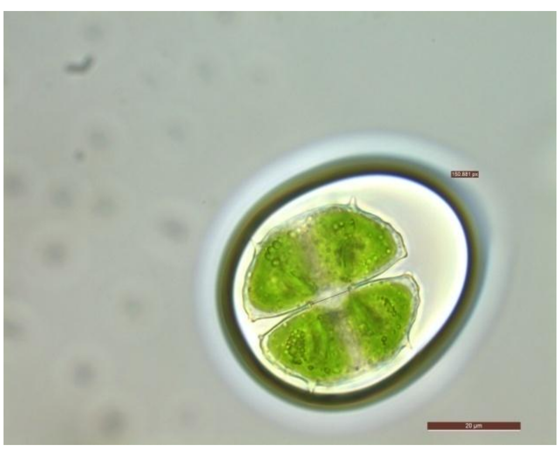


Plate.2:Algal genera of Kaypanachi Pond







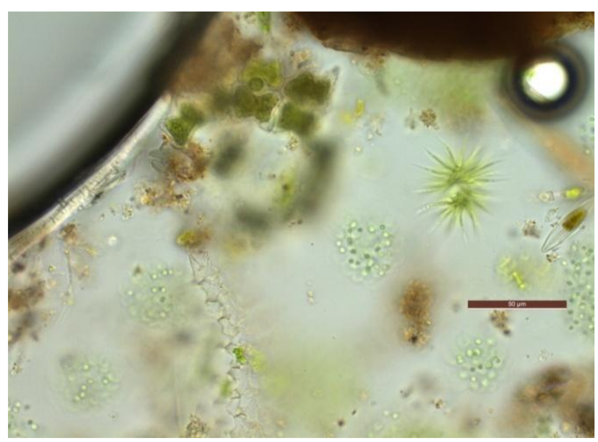
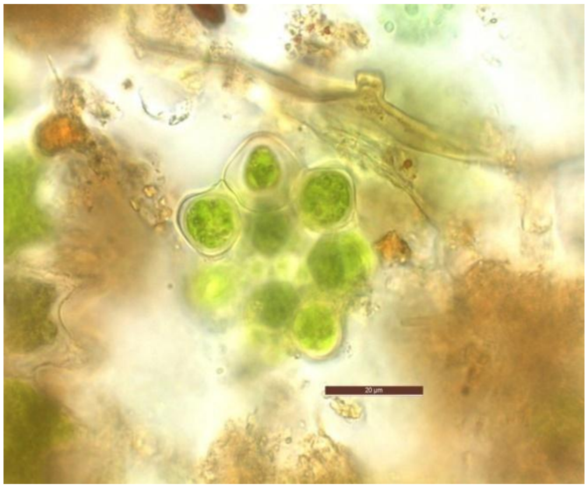
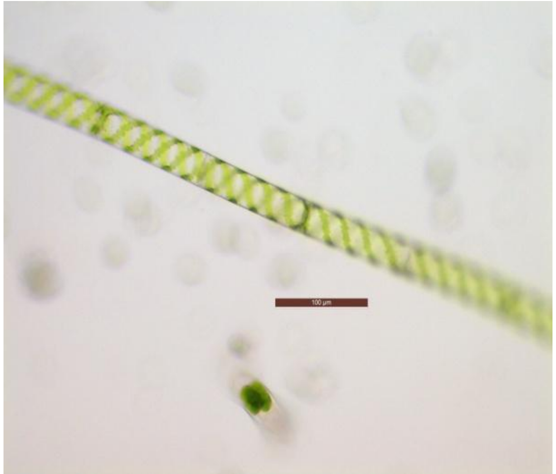
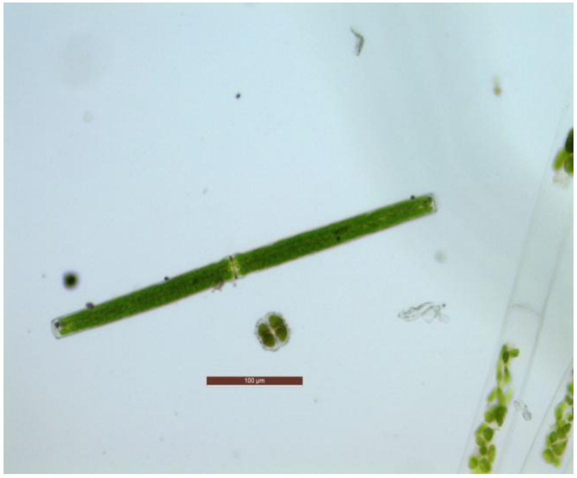


Plate.3:Algal genera of Muthappan Pond







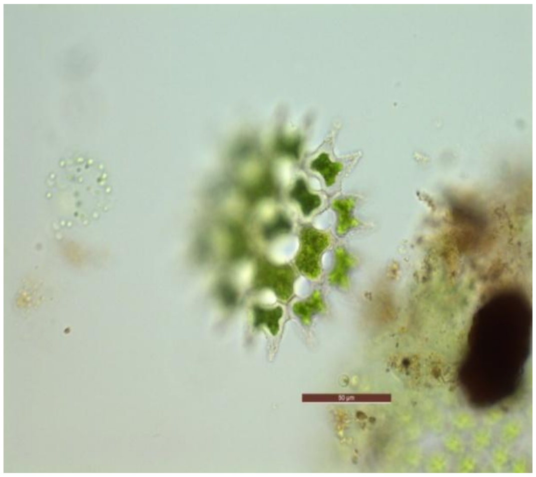
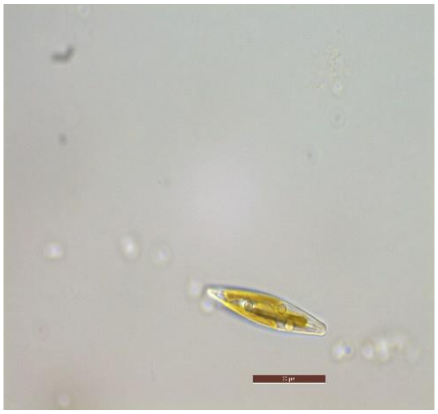


Plate.4:Algal genera of Pottan Theyyam Pond



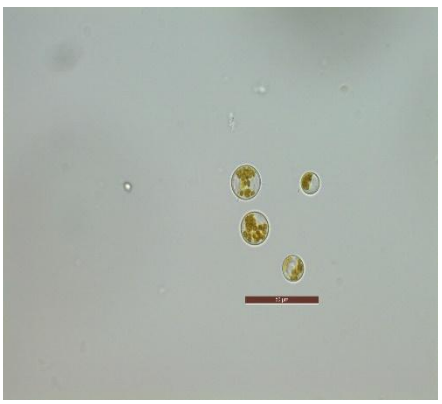
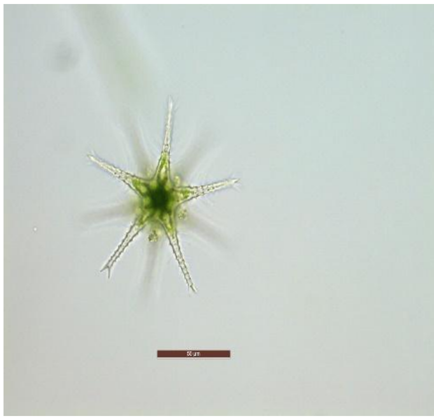
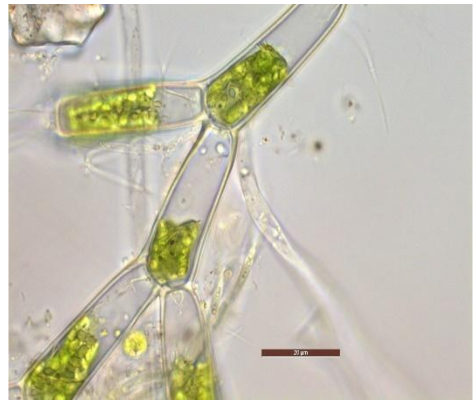
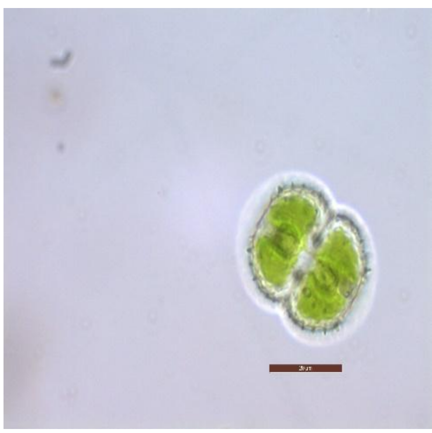


Plate.5:Algal genera of Palakulangara Pond







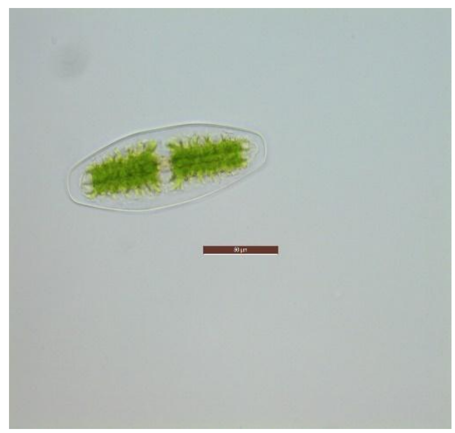
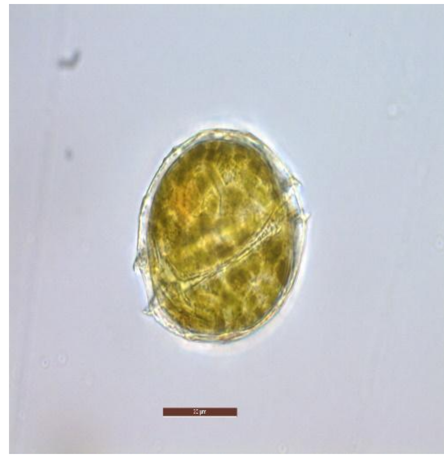
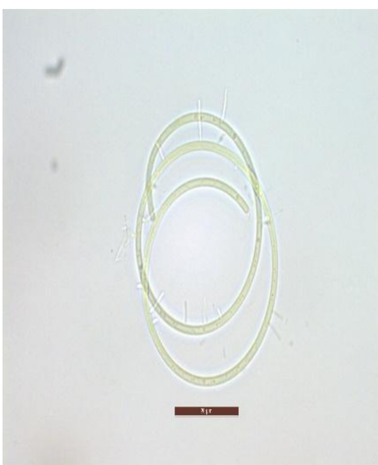


Plate.6:Algal genera of Rajarajeshwari Pond





SUMMARY

The study entitled as "comparison of phytoplankton species diversity in connection with physio-chemical parameters of perennial ponds in urban and rural areas of Kannur:" was undertaken to study about 7 perennial pond systems in Kannur district.the results obtained from the study are;

1. Most of the ponds in Kannur district is not polluted, especially those in the rural areas.
2. The polluted ponds are situated in places of high human activities such as places which is in close vicinity to towns, religious institutions etc..
3. Out of the 7 ponds studied, the most polluted (when compared to the rest of the sample sites) one is situated in the middle of the town of Irikkoor.
4. Polluted ponds have shown to have high degree of algal growth leading to algal blooms.
5. These algal blooms are homing a wide variety of algal diversity
6. Polluted ponds have low DO and high BOD values
7. Irikkoor water level is not up to the pollution level but the increasing trend are need to

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