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# Mumbai's Mithi River : An Environmental Review

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**Abstract:** *The Mithi River is a major urban river in Mumbai that originates from the overflow of Vihar Lake and Powai Lake. It flows through several densely populated and industrialized areas of the city before ultimately meeting the Arabian sea at Mahim Creek. Rapid urbanization, land reclamation and uncontrolled waste disposal has resulted in severe degradation of the river ecosystem.*
*The current review integrates multidisciplinary research findings on the Mithi River focusing on physicochemical characteristics, pollution parameters, biodiversity loss and restoration measures. Physicochemical assessments across several studies reveal deterioration in water quality, with elevated concentrations of BOD, COD, heavy metals, PAHs and low dissolved oxygen levels. Heavy metals such as Pb, Cd, Cr, and Hg, were exceeding permissible limits set by BIS and CPCB.*
*Several initiatives and studies have been undertaken to monitor, restore, and manage the Mithi River ecosystem. Hydrological and flood management studies employing models such as HEC-RAS, HEC-HMS, SWMM, and DRAINS indicate that bio-drainage and detention ponds can significantly reduce flood vulnerability. Social, architectural, and policy perspectives emphasizes on community-based conservation. Several studies also highlight successful bioremediation by heavy metal resistant bacterial isolates such as Bacillus, Klebsiella, and Acinetobacter spp. Overall, the reviewed studies underscore the urgent need for integrated river basin management combining scientific and social approaches to restore the Mithi River's ecological integrity and promote its sustainable coexistence with the urban environment..*

**Keywords***:* Mithi River, Physicochemical, Domestic sewage, Industrial effluents, Heavy metal pollution, Microbial contamination, River restoration

## I. INTRODUCTION

Mithi River is one of the important rivers of the Mumbai region, originating at Vihar Lake and flowing into the Arabian Sea at Mahim Creek. It flows southward for approximately 17.8 km, passing through Powai Lake, Andheri, Kurla, and the Bandra-Kurla Complex (BKC) before finally merging with the Arabian Sea. The banks of the river are occupied by slums, illegal factories, small scale industries etc. dumping off domestic sewage, industrial waste, and municipal waste into the river each day. Nearly two-thirds of the streams and drainage channels in the Mithi River's catchment area have been affected by land reclamation and urbanization [1]. Water quality studies conducted across 17 seafronts and beaches in Mumbai revealed that Mahim beach was worst affected due to incoming organic pollutants from the Mithi River, as compared to other coastal sites [2]. The average Water Quality Index (WQI) of the Mithi River was 42 but post covid studies reveal WQI dropped to 22 indicating that the river water was neither potable nor can be used for domestic or industrial purposes [3].

Research studies advocate the implementation of bio‐drainage, based on the twin principles of segregation of rainwater from urban waste water and achieving zero run‐off drainage through creation of retention ponds, lakes and storage systems [4]. Australian urban drainage modelling software DRAINS was used to simulate a reduction of flooding by 50 to 95% at various points in the catchment [5]. Following the 26th July 2005 deluge, a standard operating procedure based on real time rainfall data was established to manage heavy rainfall. Additionally, two detention ponds have been designed for the flow of sewage and for delay of flood waters during extreme rainfall events [6]. In yet another study there was use of HEC-HMS 3.4 (Hydrologic Engineering Centre's-Hydrologic Modelling System) and HEC-RAS 4.0 (Hydrologic Engineering Centre's-River Analysis System) to simulate the efficiency of the flood detention pond and for flood forecasting [7].

The evaluation of spatial and temporal variations in land use and land cover (LULC) across Mithi River catchment indicated marginal increases in the runoff peak discharges and volumes. These studies can be used as effective tool for mitigating flood-related damages in the flood-prone areas of the river [8]. In several studies, sustainable approaches to dealing with runoff in metropolitan was considered using SWMM (Storm Water Management Model) [9,10].

A numerical study using one dimensional mathematical model HEC-RAS indicates that the telescopic channelization recommended by MMRDA (Mumbai Metropolitan Region Development Authority) is effective in mitigating floods, resulting in a 20 % to 25 % reduction in water levels [11]. Also, various methods such as Khosla method and rainfall-runoff correlation method were used for estimation of runoff around Mithi River to estimate the flood [12]. Using hydrochemical and isotopic studies with 222Rn various hypotheses regarding the occurrence of low salinity water in the Mahim Bay were tested. 222Rn was found to be a useful tracer for identifying the subsurface flow of water to the coastal system [13].

Studies to understand ambivalent forms of governance and assemble a counter-politics to reclaim environmental protection was conducted on Mithi River [14]. An insightful article illustrates how city planners can engineer the rivers to fit the state's development plans, converting natural estuaries and flexible waterways into controlled, manageable channels [15]. Various hydraulic scenarios were integrated into the framework for evaluating different combinations of channel cross-section and lining materials along the river to reduce the flood impact [16]. Mithi River extension structures like flyover, Mahim Causeway, Dharavi Bridge, Railway Track and old Pipeline of water supply were constructed using specialized underwater blasting techniques [17]. Similar construction challenges faced during tunnelling underneath the Mithi River at Mumbai Underground Metro Line were studied and the article highlights the precautionary measures to guide future underwater tunnelling projects [18].

To curb pollution of Mithi River, Dry Weather Flow Interceptors (DWFI), an improved sewer network and sewage treatment plant were designed and proposed to treat the dry weather flow to meet the required standards [19]. River Culture (living with the river, learning from the river, identification with the river) can be inspired by Community-Based Conservation Initiatives (CBCI) in river conservation and vice versa. Actions for environmental protection can motivate a society, eventually resulting in practical collaborative actions such as community-based conservation [20,21,22].

Another study examines the social and physical connections of riverine system with city through people's perception and memories while addressing both tangible and intangible challenges using Mumbai's Mithi River as a case study [23]. The BKC has been developed on the reclaimed edges of the Mithi River. Unsustainable construction in this area can worsen the environmental challenges. The study recommends the inclusion of green corridors, wetlands, river buffer zones, water treatment plants, and green pockets within public infrastructure [24].

The restoration of Maharashtra Nature Park (MNP), formerly a dumping ground for nearly 27 years along the Mithi River, has resulted in the development of rich herpetofauna diversity comprising 44 species belonging to 18 families and also witnessed the development of butterfly diversity [25]. Studies propose a holistic approach to Mithi River's revitalization that combines ecological, social, and architectural strategies to reduce flooding and enhance urban livability [26].

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## II. REVIEW METHODOLOGY

### 2.1 Literature Sources

This review article is based on a comprehensive survey of published literature related to the Mithi River. Various peer-reviewed papers, research articles, reports, and government documents were retrieved from recognized databases such as Google Scholar, PubMed, ScienceDirect, SpringerLink, ResearchGate. In addition, reports and publications from statutory and regulatory bodies including the Central Pollution Control Board (CPCB), Maharashtra Pollution Control Board (MPCB), Municipal Corporation of Greater Mumbai (MCGM), and other relevant agencies were examined. The review primarily encompasses studies published during the period 2000–2024.

### 2.2 Search Strategy

The literature related to studies on Mithi River were collected using specific keywords such as "Mithi River Mumbai" "Mithi River domestic sewage" "Mithi River effluent discharge" "physicochemical parameters" "microbial contamination" "Mithi River fauna, flora" "heavy metal pollution" "river restoration".

### 2.3 Data compilation and Analysis

The data obtained from different sources were systematically arranged and categorized under major themes such as physicochemical parameters, domestic sewage and industrial effluent discharge, heavy metal pollution, microbial, floral, and faunal studies.

Comparative analysis was done to identify spatial and temporal trends, variations in pollution levels, and ecological impacts. The reviewed data were presented in the form of descriptions and tables to focus on key findings. River restoration and management strategies were highlighted to promote the ecological health of the Mithi River.

## III. PHYSICO-CHEMICAL PARAMETERS

One of the key aspects of Water Quality Index (WQI) is to determine the physico-chemical properties of water. Studies on Mithi River conducted over a period of two years i.e. 2009-10 and 2010-11 reveal a decrease in the pH value thereby indicating an increase in the acidity of the water. The values of electrical conductivity (EC), chloride, sulfate, sulphide and phosphate were also found to be higher in 2010-11 suggesting a deterioration in the quality of water [27]. Other physico-chemical parameters such as solid content, hardness, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), surfactants, oil/ grease and phenol content were found to be higher in river water samples over a period of two years [28].

Physico-chemical parameters such as pH, temperature, turbidity, conductivity, Dissolved oxygen (DO), BOD, COD, free CO2 and ammonical nitrogen (NH3-N) were analysed and the results reveal that pH, temperature, NH3-N and CO2 were within the permissible limits of MPCB (Maharashtra Pollution Control Board) standards for industrial discharge. However, the exceptionally high values of BOD, COD, turbidity and significantly low values of DO compared to standards show that the river water had deteriorated to a great extent [29]. The physico-chemical parameters viz., pH, EC, DO, BOD, COD, total hardness, total alkalinity, chlorides, nitrates and phosphates were found to be exceeding the limits when compared with the standards set by BIS (Bureau of Indian Standards) and CPCB [30, 31].

In another study, the water samples of Mithi River were collected from locations with ecological importance and geographical variation. Analysis of pH, Sodium, Potassium, Magnesium, Total Phosphorous, Total Kjeldahl Nitrogen, Chloride, DO, BOD, COD, exhibited higher levels indicating pollution load due to domestic sewage discharge and addition of effluents from nearby areas [32,33].

Multispectral satellite images and remote sensing studies have been conducted to determine water quality index parameters such as Chlorophyll-a (vegetation index), COD and BOD [34]. The COD of river water was found to vary from 200-2500 mg/L indicating high levels of pollution [35]. Table-1 present a comparative review of physicochemical parameters reported in the previous studies. Table-2 gives comparative seasonal averages of river across different studies.

TABLE I : Review of Physicochemical parameters (pH, Temp. Conductivity, DO, BOD, COD, Cl) Across Sampling Sites of Mithi River.

| SAMPLING SITES | pH | Temp. ($^oC$) | Conductivity µmhos.($Cm^{-1}$) | DO (mg/L) | BOD (mg/L) | COD (mg/L) | Chlorides (mg/L) | References |
|---|---|---|---|---|---|---|---|---|
| S1 | 5.85 | ----- | 256 | ----- | ----- | ----- | 3217 | Singare et al. [47] |
| S2 | 5.35 | ----- | 253 | ----- | ----- | ----- | 3012 | |
| S3 | 4.16 | ----- | 307 | ----- | ----- | ----- | 1986 | |
| Airport (2009-10) | 5.08 | ----- | 246 | ----- | 433 | 470 | 285 | Singare et al. [39] |
| (2010-11) | 4.3 | ----- | 258 | ----- | 489 | 527 | 298 | |
| CST Kalina Road (2009-10) | 4.71 | ----- | 253 | ----- | 426 | 457 | 1133 | |
| (2010-11) | 3.96 | ----- | 258 | ----- | 446 | 519 | 1171 | |
| BKC Taximen's Colony(2009-10) | 5.78 | ----- | 304 | ----- | 416 | 484 | 218 | |
| (2010-11) | 5.21 | ----- | 331 | ----- | 488 | 540 | 240 | |
| Mahim | 7.3 | 27.6 | 47.7 | 2.2 | 76.8 | 227.8 | ----- | Padalkar et al. [29] |
| Vakola | 7.3 | 28.3 | 25.3 | 1.9 | 122.9 | 259.7 | ----- | |
| Dharavi | 7.4 | 27.7 | 24.3 | 2.0 | 101.9 | 217.3 | ----- | |
| Cst2 | 7.2 | 27.4 | 14.8 | 1.4 | 69.5 | 328.2 | ----- | |
| Cst3 | 7.2 | 28.1 | 14.7 | 1.5 | 60.7 | 296.7 | ----- | |
| L1- Vihar Lake | 7.14 | 21.47 | 0.41 | 5.59 | 18.58 | 25.91 | 87.33 | Varshini [31] |
| L2- LBS Marg, Andheri Kurla Road | 6.12 | 24.25 | 3.08 | 2.33 | 109.65 | 161.41 | 227 | |
| L3- Tata colony, BKC Road | 8.1 | 24.43 | 51.3 | 1.47 | 193.95 | 546.67 | 445.91 | |
| L4- Kalanagar | 8.38 | 22.4 | 18660 | 1.87 | 241.33 | 373 | 18417.67 | |

TABLE II : Comparative Seasonal Averages of Common Physicochemical Parameters of Mithi River Across Different Studies.

| Parameter | **Pre-Monsoon** | | **Monsoon** | | **Post-Monsoon** | |
|---|---|---|---|---|---|---|
| | Nagarsekar et al.[30] | More et al. [33] | Nagarsekar et al. [30] | More et al. [33] | Nagarsekar et al. [30] | More et al. [33] |
| pH | 6.662 | 6.911 | 7.253 | 7.186 | 7.525 | 7.166 |
| DO mg/L | 0.6525 | 2.35 | 0.735 | 2.45 | 1.007 | 2.05 |
| BOD mg/L | 231.8 | 0.525 | 199.2 | 1.5 | 197.8 | 1.7 |
| COD mg/L | 601.8 | 13.83 | 360.2 | 23.38 | 452.8 | 59.1 |
| Hardness mg/L | 804 | 3235.8 | 764 | 2841.6 | 844.2 | 3052.3 |
| Chlorides mg/L | 1.2891 | 2.408 | 1.136 | 3.375 | 1.253 | 2.2 |
| Phosphorous mg/L | 0.1825 | 1.358 | 0.185 | 0.524 | 0.1625 | 1.366 |

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## IV. DOMESTIC SEWAGE AND INDUSTRIAL EFFLUENT DISCHARGE

According to the MPCB report-2004, the domestic sewage volume in the Mithi River was much more than industrial effluent discharged [36]. The Mithi River receives pollutants from many different sources, including oxygen-demanding organic wastes from cotton textile mills, cattle sheds, barrel cleaners, scrap dealers, and untreated municipal wastewater. Additionally, it receives chemical effluents from around 1,500 industrial units, unauthorized discharges of hazardous waste, sludge deposits, and large amounts of solid garbage dumped along its course [37].

One of the studies proposed a 'design-based three-phase restoration model' for the Mithi River, emphasizing the integration of socio-economic factors to achieve a long-term, sustainable riparian ecosystem [38]. Quantification of three major Non-Biodegradable Solid Wastes (NBDSW) viz. plastics, synthetic rubber and glass in the Mithi River of Mumbai was achieved and the preliminary investigation revealed plastic accounted for 34.3% to 62.7%, synthetic rubber materials for 35.0% to 59.5%, while glass materials for 2.2% to 6.2%. These observation indicate a substantial presence of NBDSW [39]. Also, about 17 polycyclic aromatic hydrocarbons (PAHs) were identified from the surface sediments of Mithi River. The high molecular weight PAHs (HMW PAHs) made greater contributions of 90.83% as compared to that of low molecular PAHs (LMW PAHs) contributing to 9.17% to the total PAH concentrations [40]. Studies also reveal that the overall concentration level of ΣPAHs was 157.96 ± 18.99 μg/L while that of carcinogenic PAHs was 81.31 ± 9.75 μg/L, which corresponds to 51.5 % of the ΣPAHs [41].

A case study was conducted to understand whether the Mumbai Sewage Disposal project (MSDP) would offer economic, social, and environmental benefits [42]. The Mithi River clean-up initiative began after the success of the Versova Beach clean-up in 2015, during which more than 1 million kg of solid waste was removed [43]. Manufacturing industries like fertilizer, chemicals, medicine, etc. discharge waste that contains a high amount of phosphate, sulphur, heavy metal, toxic chemicals, etc. The mining sector wastewater is high in arsenic, lead, mercury, toxic chemicals and gas, etc. and these sectors are the major sources of groundwater contamination. The petrochemical industry discharges waste that contains a high amount of hydrocarbon and their by-products [44].

Mithi River also exhibited higher Triclosan (TCS) concentrations (water: 1.68 μg/L, sediment: 3.19 μg/kg) than Versova Creek (water: 0.49 μg/L, sediment: 0.69 μg/kg) due to ineffective treatment of effluents [45]. Findings record that Mithi River is severely polluted due to human activities such as slum encroachment, discharge of industrial waste, poor sanitation, effectively transforming the river into an open sewer [21]. The slumdwellers along the river banks were directly disposing the garbage, causing small pockets of water to be obstructed and stagnated. The study focused on creating a system that will assist slumdwellers to increase their usage of garbage bins and indulge in a healthier community mindset [46].

## V. HEAVY METAL POLLUTION

Heavy metal pollution degrades the Water Quality Index (WQI) of river water, posing serious risks to human health and aquatic ecosystems, highlighting the need for innovative and sustainable treatment strategies. The analysis for the majority of the trace metals like iron (Fe), copper (Cu), chromium (Cr), cadmium (Cd) and Nickel (Ni) was done by Perkin Elmer Analyst 200 flame atomic absorption spectrophotometer 2003 model [47]. Studies reveal that the concentration levels of the heavy metals like Al, As, Cd, Cr, Hg, Ni, Pb, Sr and Mn obtained during the assessment year 2010-11 was higher than that obtained during 2009-10 by the factor of 1.4 to 5.7 μg/L [39].

The heavy metals viz., As, Hg, Pb, Cd, Cr, Al, Ni, Mn and Zn were analysed at different sampling stations in Mithi River and the results reveal that some of the metals have exceeded the permissible levels as prescribed by environmental authorities [48]. A quantitative analysis of heavy metals, zinc, copper, and cadmium, was also performed. Assessment of heavy metals present in the downstream areas of Mithi River suggest that the concentrations of metals except for lead are within the permissible limits suggested by the CPCB but none fit into the WHO limits for drinking water [49]. The total mercury content in water was quantified in a research study and its relationship with other pollution parameters were analysed [50].

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Studies on the water quality of inland water bodies in Mumbai, including Mithi River, were conducted using Hyperion Earth-Observing one (EO1) hyperspectral satellite which revealed significant heavy metal contamination in the Mithi River [51]. The Dharavi slum, along the Mithi River is studied to create a landscape framework for flood adaptation. It was based on the functions of different zones, showing how river basins can support an integrated approach to managing floods in urban slums [52]. Table 3 presents comparative values of heavy metals of Mithi River reported across different studies.

TABLE III : Comparative values of heavy metals of Mithi River Across Different Studies.

| Heavy Metals | References | | | | |
|---|---|---|---|---|---|
| | More et al. [32] | Singare et al. [39] | Singare et al. [47] | Nagarsekar [48] | Bhave et al [50] |
| Copper (Cu) mg/L | 0.08 | ---- | 2.7 | ---- | ---- |
| Zinc (Zn) mg/L | 6.2 | 48.6 | 6.5 | 0.237 | ---- |
| Mercury (Hg) µg/L | ---- | ---- | 30 | 0.0775 | 0.004 |
| Nickel (Ni) µg/L | ---- | 206.6 | 3500 | 0.627 | ---- |
| Chromium (Cr) mg/L | ---- | ---- | 0.4 | 0.602 | ---- |
| Arsenic (Ar) µg/L | ---- | 100.6 | ---- | 0.152 | ---- |
| Lead (Pb) mg/L | ---- | 201.6 | ---- | 0.718 | ---- |
| Aluminium (Al) µg/L | ---- | 43.66 | ---- | 8.09 | ---- |
| Manganese (Mn) µg/L | ---- | 99 | ---- | 1.12 | ---- |
| Iron (Fe) µg/L | ---- | ---- | 1.9 | 5.872 | ---- |

## VI. MICROBIAL, FLORAL, AND FAUNAL STUDIES

Mithi River, being one of the polluted rivers in Mumbai, is contaminated with bacteria. Investigation of biological parameters like SPC (Standard Plate Count) of bacteria, MPN (Maximum Probable Number) of total and faecal coliforms, phytoplanktons and aquatic macrophytes reveal the presence of bacteria such as Scenedesmus, Closterium, Ulothrix, Oscillatoria, Lyngbya and Phormidum and diatoms like Navicula and Nitzschia and aquatic macrophytes such as Lemna, Hydrilla and Eichhornia which are considered to be indicators of pollution [53]. The concentrations of Total Heterotrophic Bacteria, Total Coliform and Fecal Coliform substantially exceeded the permissible limits specified by various bodies for water intended for domestic consumption [48]. Analysis of water samples for ten physicochemical parameters, and bacteriological analysis was carried out using the standard methods. The bacteriological analysis revealed that the coliform bacteria count (303 to 886 MPN index/100ml) exceeded the standard limits (BIS - IS: 10500:1991 and CPCB, 2009) [31]. Approximately 51 bacteria isolated from different samples of Mithi River were characterized [54]. Certain microorganisms having the potential of bioremediation of heavy metals were isolated successfully from Mithi River and their identity was confirmed [55]. There was the isolation and narrowing down of copper resistant bacteria belonging to the Staphylococcus genus. There was considerable removal of copper from the medium, proving the capacity of Staphylococcus. sps. to bioremediate copper [56]. Mercury-resistant bacteria were isolated and identified as Bacillus sp. strain CSB_B078, Klebsiella pneumoniae strain FY2, Klebsiella pneumoniae isolate 23, Enterobacter sp. strain Amic_7, Enterobacter sp. strain 08, Acinetobacter seohaensis strain S34, Acinetobacter sp. 815B5_12ER2A. These bacterial isolates could be used for bioremediation of mercury [57]. Acinetobacter junii strain b2w, also isolated from the Mithi River, was able to bioremediate 83.06% of total chromium and reduced 98.24% of Cr6+ to C3+ at a concentration of 10 ppm of chromium [58]. In yet another study a Total Heterotrophic Bacteria (THB) and lead-resistant bacteria were detected in Mithi River water sample. A total 21 lead-resistant bacterial isolates were isolated with gram negative coccobacilli being the most dominant form. The results indicate that the bacteria P. mirabilis demonstrated ability to bioremediate up to 100% of lead within 48 hours [59].

Biodiversity of algae in Mithi River was studied and found that these belong to divisions such as, Cyanophyta, Chlorophyta, Bacillariophyta, Euglenophyta and Dinoflagellata with varying numbers of their families in different seasons. Also, the diversity of Chlorophyceae algae was studied in the Mithi River during the pre and post monsoon period [60]. The extraction and estimation of proteins were done from plants like Avecinia marina, Ricinus communis, Peltophera inerme, Salvadora persica, Sida acuta, Ficus raecemosa, and Ficus hispida growing in the stressful environment of Mithi River [61].

In a proposed Mithi River restoration model, the mangrove cultivation is recommended, highlighting their vital role in coastal protection, biodiversity conservation, and ecosystem restoration. Vegetative propagation methods such as shoot cutting, air layering, and seedling planting can be adopted to support mangrove regeneration [62].

The Zebra Fish Embryo Toxicity Test (ZFET) was performed to evaluate the toxicity of water samples from Mithi River, and the results indicated a maximum mortality rate of 100% in zebra fish embryos. Additionally the Comet Assay (single-cell gel electrophoresis) was performed to evaluate DNA damage in zebrafish embryo [31]. In another study the fish embryos were subjected to embryotoxicity and teratogenicity assays for various end points such as mortality, egg coagulation, pericardial edema, yolk sac edema, tail bend, and skeletal deformities. The histopathological analysis revealed various lesions, ascertaining the toxic effects of water samples. The comet assay revealed significantly higher DNA damage in embryos [63]. Overall, the studies on the impact of river water on animals indicate toxic effects.

## VII. DISCUSSIONS

The review of physicochemical parameters of water quality across the various sampling sites presented in table 1 reveals substantial spatial and temporal variability. In the studies conducted, sites such as S1–S3, the Airport region, CST Kalina Road, and BKC Taximen's Colony consistently showed acidic pH values while relatively undisturbed area such as Vihar Lake maintained a near-neutral pH. Conductivity values show extreme variation, Kalanagar showing highest levels, indicating significant concentration of ions and dissolved solids. The elevated BOD and COD values at several industrial sites suggests high concentration of domestic and industrial pollutants. The progressive increase in BOD and COD between 2009–10 and 2010–11 at certain locations indicates a decline in water quality over time.

The temperature and dissolved oxygen (DO) data show clear differences along the Mithi River. Most of the urban stations such as Mahim, Vakola, Dharavi, CST2, CST3, and the BKC region shows water temperatures between 27–28°C, which is typical of rivers with shallow water depth, reduced vegetation cover, and thermal contributions from effluents. These sites also show critically low DO levels (1.4–2.2 mg/L), suggesting a high organic load and intense microbial decomposition. Contradictorily the less polluted Vihar Lake shows a significantly lower temperature (21.47°C) and the highest DO (5.59 mg/L).

The chloride concentration across the sampling sites recorded in the reviewed studies shows significant variation. Among all locations, Vihar Lake shows the lowest chloride concentration (87.33 mg/L). However, the exceptionally high chloride concentration at Kalanagar (18417.67 mg/L), exceeds typical freshwater or even polluted-water ranges.

Seasonal data from Nagarsekar et al. [30] and More et al. [33] given in table 2 reveals variations of physicochemical parameters during pre-monsoon, monsoon and post monsoon periods. pH values show a consistent increase from pre-monsoon to post-monsoon in both studies while DO remains critically low in Nagarsekar et al. [30] dataset across all seasons while data reported by More et al. [33] reveals reduced pollution levels in the later study period. Also, BOD and COD reported by Nagarsekar et al. [30] signifies heavy organic and chemical pollution, while values reported by More et al. [33] suggest a comparatively healthier conditions or implications of effective waste management strategies. Hardness, chlorides, phosphorus values show elevated concentrations, suggesting enhanced nutrient enrichment and potential eutrophication risk. The overall seasonal pattern reveals that monsoon rainfall generally dilutes pollutant concentrations, but persistent high levels of organic, chemical, and nutrient pollution reported in Nagarsekar et al. [30] findings focus on anthropogenic activities and inadequate wastewater management, which perhaps were rectified in the later years as in evident in the recording by More et al. [33].

The review indicates that Mithi River remains critically polluted not only due to domestic sewage but also due to the effluents from nearly 1,500 industrial units. High concentrations of non-biodegradable solid waste, toxic heavy metals, PAHs, and hazardous pollutants like Triclosan is the major source of degradation of Mithi River. The heavy metal concentrations reported by various researchers across different years reveals a decline in heavy metal pollution in the subsequent years. Earlier studies, particularly those by Singare et al. [39,47] documented markedly elevated levels of several metals such as zinc, nickel, lead, and mercury. Investigations by Nagarsekar [48] , More et al. [32] , and Bhave et al. [50] consistently report significantly lower concentrations of heavy metals. This decline may be attributed to improved pollution-control measures, reduced industrial activity, seasonal flushing, or perhaps differences in sampling locations. Over a period of time, the sharp reductions in mercury, nickel, manganese, and arsenic levels highlight an improvement in water quality conditions. However certain metals such as chromium and lead continue to exceed accepted environmental thresholds.

The reviews on microbial, floral and faunal studies suggests extremely high levels of heterotrophic bacteria, total coliforms, and fecal coliforms far exceeding permissible limits. Pollution-indicator algae, diatoms, and macrophytes dominate the flora. Bacterial strains with bioremediation potential have been isolated, however their presence in water indicate contamination. Faunal bioassays, including zebrafish embryotoxicity and comet DNA-damage tests, consistently show high mortality, deformities, and genotoxic effects.

## VIII. CONCLUSIONS

Although clean-up drives and proposed restoration models indicate progress, sustained improvement will require integrated pollution control, strengthened waste-management systems, and active community participation. Overall, the integrated dataset demonstrates that while water quality shows marginal improvement in the recent years, heavy-metal contamination remains a critical environmental concern. Sustained monitoring, stricter enforcement of policies, and remediation strategies are essential to safeguard the ecological health of the Mithi River.

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## REFERENCES

[1] Kamini J., Jayanthi S. C., Raghavswamy R., “Spatio-temporal analysis of land use in urban Mumbai using multi-sensor satellite data and GIS techniques,” Journal of the Indian Society of Remote Sensing, vol. 34, no. 4, pp. 385–395, 2006.

[2] Kamble S.R., Vijay R., “Assessment of water quality using cluster analysis in coastal region of Mumbai, India,” Environmental monitoring and assessment, vol. 178, no. 1, pp. 321–332, 2011.

[3] Ranjith M., Sherla A. R., “Environmental perception and river rejuvenation: A study of the Mithi River, Maharashtra, India,” InFluvial Systems in the Anthropocene: Process, Response and Modelling Cham: Springer International Publishing, pp. 105–123. 2022.

[4] Jain A.K, “The concept of bio-drainage in flood prevention and the avoidance of water scarcity,” International journal of environmental studies. vol. 63, no. 1, pp. 39–48, 2006.

[5] Sharma M., Gupta K., “Flow modeling of Mithi River in Mumbai catchment,” Water Practice and Technology., vol. 2, no. 2, 2007.

[6] Gupta K., Nikam V., “Technological and innovative measures to improve flood disaster recovery following Mumbai 2005 mega-flood,” In Disaster Recovery: Used or Misused Development Opportunity, Tokyo, Japan: Springer, pp. 287–297, 2013.

[7] Mujiburrehman K., Nikam V., Kapil G., “Flood mitigation on Mithi River using detention pond, Mumbai, India,” IOSR Journal Of Environmental Science, Toxicology And Food Technology, vol. 8, no. 2, pp. 34–39, 2014.

[8] Zope P. E., Eldho T. I., Jothiprakash V., "Impacts of urbanization on flooding of a coastal urban catchment: A case study of Mumbai City, India," Natural Hazards, vol. 75, no. 1, pp. 887–908, 2015.
[9] Pathak H., Chaudhari P., "Simulation of best management practices using SWMM," International Research Journal of Engineering and Technology, vol. 2, no. 1, pp. 129–132, 2015.
[10] Shetty S., "Flood mitigation by using hydraulic and hydrologic modelling," Journal of Recent Activities in Infrastructure Science, vol. 7, no. 1, 2022.
[11] Choudhury R., Patil B.M., Chandra V., Patil U.B., Nagendra T., "Assessment of flood mitigation measure for Mithi River – A case study," Technology, vol. 7, no. 3, pp. 56–66, 2016.
[12] Lakhote A., Pawar V., Kasekar A., Chapke V., Pawar S., "Rainfall runoff analysis for Mithi River to estimate flood," International Journal of Water Resources Engineering, vol. 7, no. 2, pp. 1–9, 2021.
[13] Noble J., Keesar T., "Freshening of seawater in the Mahim Bay, Mumbai, India: Insight from an environmental isotope study," Journal of Operational Oceanography, vol. 14, no. 2, pp. 129–141, 2021.
[14] Kamath L., Tiwari A., "Ambivalent governance and slow violence in Mumbai's Mithi River," International journal of urban and regional research, vol. 46, no. 4, pp. 674–686, 2022.
[15] Chitra V., "Remembering the river: Flood, memory and infrastructural ecologies of stormwater drainage in Mumbai," Urban Studies, vol. 59, no. 9, pp. 1855–1871, 2022.
[16] Ghosh M., Karmakar S., Ghosh S., "Flood modelling for an urban Indian catchment: Challenges and way forward," InClimate Change and Water Security: Select Proceedings of VCDRR 2021 Springer:Singapore, pp. 51–62, 2021.
[17] Lanjewar R., Pawar V., Kaithwas S., Sanodiya Y., Petkar S., "Underwater blasting on Mithi River extension: A case study," Journal of Thermal and Fluid Science, vol. 4, no. 2, pp. 46–52, 2023.
[18] Pandey V.K., Mishra S.C., "Construction challenges during tunnelling underneath the Mithi River, Mumbai, India," Research Journal of Engineering Sciences, vol.12, no. 2, pp. 22-30, 2023.
[19] Kumbhar D.S., More A.B., Mane S.J., "Curb pollution of river -dealing with dry weather flow interception"Materials Today: Proceedings, vol. 77, no. 1, pp. 335–341, 2023.
[20] Vazhayil A. M., Wantzen K. M., "life as a dance to the rhythm of the waters," River culture – Paris, France: UNESCO Publishing, pp. 241–260, 2023.
[21] Bhattacharjee S., Sharma M., "Ramifications of anthropogenic activities on urban riverine ecosystem: A study of Mithi River in Mumbai," in Remotely Sensed Rivers in the Age of Anthropocene, Switzerland: Springer publication, pp. 209–228, 2025.
[22] Deshpande S., Kundu S., "Towards a flood-resilient Mumbai: The case of Mithi River rejuvenation," InInternational Conference on Humanizing Work and Work Environment, Singapore: Springer, pp. 1–9, 2023.
[23] Madav A. V., "Re-negotiating lost edge of Mumbai's Mithi River," Master's thesis, SPA Bhopal, India, 2020.
[24] Pothuganti C., "A new centrality: Metropolitan dynamic on the lost edges of Mithi reshaping urban centrality in Mumbai, India," Master's thesis, Politecnico di Milano, Italy, 2020.
[25] Gokarnkar P., Chorghe S.V, Rajbhor A., "Butterfly diversity of Maharashtra Nature Park," InProceedings of the Seminar on Wonderful World of Insects. Thane, India, pp. 63–64, 2008.
[26] Saji N., "Rewilding the Mithi: Reviving the lifeline as a model for urban resilience," Master's thesis, Politecnico di Milano, Italy, 2025.
[27] Singare P. U., Mishra R.M., Trivedi M.P., "Assessing the health of sediment ecosystem of Mithi River of Mumbai using physico-chemical measurements," Resources and Environment. vol. 1, no. 1, pp. 32–41, 2011.
[28] Singare P. U., Mishra R.M., Trivedi M. P., "Aquatic pollution in Mithi River of Mumbai: Assessment of physico-chemical parameters," Interdisciplinary Environmental Review, vol. 13, no. 4, pp. 245–268, 2012.
[29] Padalkar A. V., Kaur S., Kumar R,, "Assessment of spatio-temporal variations in physico-chemical characteristics of Mithi River water quality," 2014.

[30] Nagarsekar A. S., Kakde U. B., "A study of physico-chemical parameters of Mithi River water in Mumbai metropolis," , International Research Journal of Chemistry, vol. 5, pp. 24–42, 2014.
[31] Varshini S. V., "Evaluation of surface water quality and toxicity of Mithi River water using zebrafish embryos," M.Sc. thesis, ICAR-CIFE, Mumbai, India, 2020.
[32] More R. S., Chaubal S. S., "Studies on the present status of Mithi River, Mumbai," Journal of Global Biosciences, vol. 5, no. 4, pp. 3921–3927, 2016.
[33] More R.S., Chaubal S.S., "Evaluation of water quality through physico-chemical characteristics of Mithi River, Mumbai," Asia Pacific Journal of engineering Science and technology, vol. 3, no. 1, pp. 22–27, 2017.
[34] Deshmukh S., Karkera S., Rawale P., Narvekar C., "Evaluation and transformation analysis of the Mithi River," Proceedings of ICCSDF 2021, Singapore: Springer, pp. 501–512, 2021.
[35] Sonule K. K., Bhave P. P., "In-situ treatment of urban water body– Mithi River, Mumbai," Journal of Indian Water Works Association, pp. 141–145, 2021.
[36] Klean Environmental Consultants Pvt. Ltd., Survey Report on Mithi River Water Pollution and Recommendations for its Control, MPCB, Mumbai, India, Ref.No.0407/Mpcb Mithi River Survey/ 109, July 10, 2004.
[37] Shelar J., "How the Mithi was destroyed," The Hindu, Mumbai, India, 2019.
[38] Sanghani H., "Mithi River restoration project," Master's thesis, KTH Royal Institute of Technology, Stockholm, Sweden, 2009.
[39] Singare P.U., Mishra R.M., Trivedi M.P., "Heavy metal pollution in Mithi River of Mumbai", Frontiers Science, vol. 2, no. 3, pp. 28–36, 2012.
[40] Singare P. U., "Studies on polycyclic aromatic hydrocarbons in surface sediments of Mithi River near Mumbai," Marine pollution bulletin, vol. 101, no. 1, pp. 232–242, 2015.
[41] Singare P. U., "Carcinogenic and endocrine-disrupting PAHs in aquatic ecosystem of India," Environmental monitoring and assessment, vol. 188, no. 10, Art. no. 599, 2016.
[42] Mohite R. A., Joya L. K., "A case study report on wastewater management and sewage disposal in Mumbai suburban region," Journal of Emerging Technologies and Innovative Research, vol. 8, no. 4, 2021.
[43] McCarthy, "World's largest beach clean-up: Trash-ridden to pristine in 2 years," EcoWatch, 2017.
[44] Khan A.S, Anavkar A., Ali A., Patel N., Alim H., "A review on current status of riverine pollution in India," Biosciences Biotechnology Research Asia, vol. 18, no. 1, pp. 9–22, 2021.
[45] Kumar G., Kumar S., Paul T., Pal P., Shukla S.P., Kumar K., Jha A.K., Pradeep S., "Ecotoxicological risk assessment of triclosan in riverine and estuarine ecosystems," Marine Pollution Bulletin, vol. 205, 2024.
[46] Swaminathan T., Thakurta A. G., "Reducing the pollution of Mithi River: A waste disposal intervention," in North-East Research Conclave, Singapore: Springer, pp. 87–99. 2022.
[47] Singare P. U., Jagtap A. G, Lokhande R.S, "Water pollution by discharge effluents from Gove industrial area of Maharashtra," International Journal of Global Environmental Issues, vol. 11, no. 1, pp. 28–36, 2011.
[48] Nagarsekar A. S., "Studies on heavy metal contamination in Mithi River, Mumbai," Online International interdisciplinary research journal, vol. 4, pp. 202–216, 2014.
[49] Handa S., Jadhav R., "Status of heavy metal pollution in Mithi River then and now," International Journal of Engineering Science , vol. 4, no. 1, pp. 62–68, 2016.
[50] Bhave P. P., Shrestha R., "Total mercury status in Mithi River, Mumbai," Environmental Monitoring and Assessment, vol. 190, no. 12, Art. no. 711, 2018.
[51] Sawant S., Rathod R., "Water quality of inland water bodies of Mumbai using hyperspectral remote sensing," Roorkee Water Conclave, 2020.
[52] Goyal A., Proença S.B., Silva M. M., Goyal A., "River basin flood adaptation for coastal urban slums: Mithi River basin," Ri-Vista, vol. 21, no. 1, pp. 142–153, 2023.
[53] Shahana Khan S. K., "Impact of urban pollution on biological parameters of River Mithi," CABI Databases, pp. 581–584, 2008.

[54] River K. M., “Biochemical characterization and identification of bacteria isolated from Mithi River,” in proceedings Lake 2016: Conference on Conservation and Sustainable Management of Ecologically Sensitive Regions in Western Ghats, 2016.

[55] Pushkar B. K., Sevak P. I, Singh A.,“Isolation and characterization of potential microbe for bioremediating heavy metals from Mithi River,” Annals of Applied Bio-Sciences, vol. 2, no.2, pp. 20–27, 2015.

[56] Handa S., Jadhav R., “Bioremediation of copper using indigenous bacteria isolated from Mithi River,” Elixir Appl. Zoology vol. 104, pp. 45903–45905, 2017.

[57] Pushkar B., Sevak P., Sounderajan S., “Assessment of bioremediation efficacy of mercury-resistant bacterium from Mithi River,” Water Supply, vol. 19, no. 1, pp. 191–199, 2019.

[58] Sevak P., Pushkar B., Mazumdar S., “Mechanistic evaluation of chromium bioremediation,” Journal of Environmental Management, vol. 328, Art. no. 116978, 2023.

[59] Sevak P., Pushkar B., Mazumdar S., “Comprehensive analysis of Mithi River water quality,” World Journal of Microbiology and Biotechnology, vol. 41, no. 10, Art. no. 350, 2025.

[60] Handa S., Jadhav R., “Biodiversity of algae in the Mithi River,” Global Advanced Research Journal of Educational Research, vol. 2, no. 8, pp. 1245–1250, 2015.

[61] More R. S., Chaubal S. S., “Determination of proteins and plant stress from polluted waters of Mithi River,” Journal of Global Biosciences, vol. 5, no. 7, pp. 4396–4401, 2016.

[62] Kaushik S.S., Dawda H.G., “Propagation of selected mangrove species and proposed restoration model for Mithi River,” Ecology, Environment and Conservation, vol. 30, no. 6, pp. 191, 2024.

[63] Harshvarthini M. H., Pathan M. A., Poojary N., Kumar S., Gurphale N., Varshini S.V., Kumari R., Nagpure N.S., “River water toxicity assessment using zebrafish biomarkers,” Environmental Monitoring and Assessment, vol. 195, Art. no. 950, 2023.