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Preservation of Fisheries in Ganga Water of Kanpur

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Abstract— *Fisheries are a noteworthy wellspring of sustenance, recreation and salary for mankind and fishers' network universally. The Ganga River, revered for its cultural significance and ecological diversity, plays a pivotal role in sustaining life and livelihoods. Amidst urbanization, industrialization, and environmental degradation, the fisheries in the Ganga water of Kanpur have come under duress. This research endeavor aims to delve into the multifaceted aspects of preserving fisheries, recognizing their ecological significance and socio-economic importance. A multidisciplinary approach will be employed, integrating scientific research, ecological surveys, socio-economic assessments, and policy analysis. Field studies, interviews with fisherfolk, water quality assessments, and ecological surveys will provide a comprehensive understanding of the status of fisheries and their underlying challenges. The research on the preservation of fisheries in the Ganga water of Kanpur seeks to illuminate the intricate relationship between ecological balance and human reliance. By delving into the challenges faced by fish populations and the communities dependent on them, this study underscores the urgent need for conservation efforts that harmonize environmental health and sustainable livelihoods. Through policy interventions, public awareness, and collaborative action, the preservation of fisheries can become a beacon of hope for the restoration of the Ganga's ecological integrity and the prosperity of the communities it sustains.*

Keywords— ***Fisheries, Water, Quality, Ecological, Communities, fisherfolk, preservation***

I. INTRODUCTION

The Ganga River, often referred to as the lifeline of India, holds a rich cultural, ecological, and economic significance. It is not only a source of spiritual reverence but also a vital provider of sustenance through its diverse aquatic ecosystems. However, the rapid urbanization, industrialization, and pollution that accompany urban centers like Kanpur have posed serious threats to the fisheries within the Ganga waters. This introduction sets the stage for a comprehensive exploration of the critical endeavor to preserve fisheries in the Ganga water of Kanpur.

The fisheries within the Ganga water are essential components of the river's complex ecosystem. Fish species play pivotal roles in maintaining ecological balance by controlling insect populations, facilitating nutrient cycling, and serving as prey for other aquatic organisms. Their presence reflects the health of the river's habitats and influences the well-being of diverse flora and fauna.

The burgeoning urbanization and industrialization of Kanpur, accompanied by pollution discharge and alteration of river flows, have significantly impacted the health of the Ganga's aquatic ecosystems. The introduction of pollutants, such as heavy metals and organic waste, poses risks to fish populations and their habitats. Overexploitation, habitat degradation, and altered river dynamics further compound these challenges.

For many local communities in Kanpur, fishing is not only a tradition but also a source of livelihood. Fisherfolk, often reliant on the river's resources for sustenance, face economic uncertainty due to declining fish populations. The preservation of fisheries is intricately tied to the preservation of their way of life.

This study endeavors to delve into the preservation of fisheries in the Ganga water of Kanpur, recognizing both the ecological and socio-economic dimensions. By assessing the current state of fish populations, understanding the factors contributing to their decline, and evaluating the implications for local communities, the study aims to shed light on the urgent need for preservation efforts.

The preservation of fisheries in the Ganga water of Kanpur holds far-reaching implications. Beyond the ecological benefits, it is a testament to the delicate balance that must be maintained between urban development and environmental conservation. The study's findings can guide policymakers, conservationists, and local communities in making informed decisions to ensure the long-term sustainability of fisheries and the broader aquatic ecosystem.

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II. LITERATURE REVIEW

Sarita Tripathi (2017) Fisheries are a major source of food, leisure and income for humanity and fishers community globally. The Ganga River fauna and flora is threatened by anthropogenic activities and resulting water pollution, accumulation of heavy metals, eutrophication, damming, alteration of hydrology and introduction of exotic species. Current work was assumed to study the fish catch from the Ganga River at Allahabad during the period July 2015 to June 2016. The 89 fish species were recorded from the Ganga River at Allahabad. The examination of annual data on fish landing showed that the estimated annual catch was dominated by miscellaneous group followed by Cyprinus carpio and Oreochromis niloticus. They accounted for 19.09%, 15.50% and 14.56%, respectively. In case of Indian major carps, Cirrhinus mrigala shared maximum contribution. In the summer and monsoon seasons miscellaneous groups were dominating while in winter season, O. niloticus in the Ganga river. The fish O. niloticus is an exotic species which is known to invade the river. The catch data indicated towards a significant decline in Indigenous species and immediate need to address the restoration and conservation for stock of Indian major carps.

K. K. Vass (2010) This paper briefly describes the current status of ecology, fisheries and biodiversity of the river Ganges. Apart from being the original abode of the most prized Indian major carps, viz., Catla catla, Labeo rohita, Cirrhinus mrigala and Labeo calbasu, the river sustains fisheries of large catfish, mahseers, hilsa and other miscellaneous fishes. Over the years the fish catch per kilometre stretch in the river has declined significantly and species composition has changed more in favor of non-major carp and miscellaneous species. It has also been observed that some exotic fishes have gained a foothold in the ecosystem at favorable stretches, where flows have drastically reduced as a result of abstraction of water from the main river. Changing hydrology, apart from deteriorating environmental conditions, has been to a large extent responsible for change in the fishery scenario in the river. This change has also affected the income levels of riparian fishers. Review of the data generated, over the years, also indicated deteriorating water quality at the stressed sites. The contamination of river water, sediments and fish with heavy metal and pesticide residues is also a factor of concern. With continued stress on the river system an environmental restoration plan was launched by the Indian authorities; its impacts over the years on ecosystem health is also discussed.

Atul K. Singh (2013) In this study, we document an increasing trend of catches of alien fish species from the Ganga River system. The changing fishery during 1980 to 2011 and the fish yield rate (kg km−1) are positively correlated with an invasion coefficient index (Ixi) of alien species within the river. The reproductive propagule pressure (PPP) of alien fishes (Cyprinus carpio, Oreochromis niloticus, Aristichthys nobilis, Ctenopharyngodon idella, Hypophthalmichthys molitrix and Clarias gariepinus) was determined and found to be 19.45×106 for C. carpio, 0.33×106 for O. niloticus and 0.82×106 for A. nobilis at confluences suggesting that these alien species may be migrating into new habitats. Further, these invaded species exhibited all reproductive stages, indicating their likely establishment within the river. The trophic spectrum of alien fishes spanned all levels and the gut repetitive index (GRI) indicated that that food items in most of the fishes were similar showing early trends of food-web alteration and biotic homogenization. The results of this study suggested a continuous decline in the catch of local fishes by wet weight, particularly Indian major carps (IMC) from 128.91 kg km−1 to 38.58 kg km−1 owing to increased catches of alien species from nil to 384.27 kg km−1 . Invasion of alien species in the Ganga River represented one of many possible causes of the decline in river health and overall loss of native aquatic communities.

Basant Rai (2013) According to a World Bank Sponsored Study (State of Environment Report- U.P.) (In: Mallikarjun, 2003), pollution levels in the Ganga are contributing 9-12% of total disease burden in Uttar Pradesh (U.P.). The coliform bacteria levels are in excess of 2 lakh MPN as against the national water quality standard of 5000 (Mallikarjun, 2003). The report estimated total health damage on account of water pollution in up to is around 6.4 million daily (Disability Adjusted Life Year). According to the CPCB survey report, the total municipal sewage generated in the identified 25 towns in 1985 was of the order of1340 million litres per day (mld). Apart from this sewage, 260 mld of industrial wastewater, runoff from 6 million tons of fertilizers and 9,000 tonnes of pesticides used in agriculture within the basin, large quantities of solid waste, including thousands of animal carcasses and human corpses were being released into the river every day. Out of this, works corresponding to 873 mld only (65%) were taken up under the first phase of GAP. The remaining sewage was to be taken up under the 2nd phase of GAP which is already in progress. The Action Plan primarily addressed itself to the interception and diversion for treatment of the targeted municipal sewage of 873 mld.

Venkatesh Dutta (2020) Clean rivers and healthy aquatic life symbolize that the ecosystem is functioning well. The Ganga River has shown signs of rejuvenation and a

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significant improvement on many parameters, following the eight-week nationwide lockdown due to coronavirus pandemic. Since industrial units and commercial establishments were closed, water was not being lifted by them with a negligible discharge of industrial wastewater. It was observed that during the lockdown period most of the districts falling under the Ganga basin observed 60% excess rainfall than the normal, which led to increased discharge in the river, further contributing towards the dilution of pollutants. Further, data analysis of live storages in the Ganga Basin revealed that the storage during the beginning of the third phase of lockdown was almost double than the storage during the same period the previous year. Analysis of the storage data of the last ten years revealed that the storage till May 6, 2020 was 82.83% more than the average of the previous ten years, which meant that more water was available for the river during the lockdown period. The impact could be seen in terms of increased dissolved oxygen (DO) and reduced biological oxygen demand (BOD), Faecal coliform, Total coliform and nitrate (NO3-) concentration. A declining trend in nitrate concentration was observed in most of the locations due to limited industrial activities and reduction in agricultural run-off due to harvesting season. The gradual transformation in the quality of the water has given a sign of optimism from the point of restoration. Yet, it is believed that this improvement in water quality is 'short-lived' and quality would deteriorate once the normal industrial activities are resumed, indicating a strong influence of untreated commercial–industrial wastewater. The paper concludes that the river can be rejuvenated if issues of wastewater and adequate flow releases are addressed.

Pradip Kumar Maurya (2019) This paper assesses the potential human health risks posed by five heavy metals (Zn, Pb, Cu, Cd, and Cr) found in seven most consumable fish species (Cirrhinus mrigala, Cirrhinus reba, Catla catla, Lebio rohita, Crossocheilus latius, Clupisoma garua, and Mystus tengara) collected from local markets of Varanasi, Allahabad, Mirzapur, and Kanpur of Uttar Pradesh, India. The Cu concentration was found at Varanasi (4.58 mg/l), Allahabad (2.54 mg/l), and Mirzapur (2.54 mg/l). Pb was recorded 0.54, 0.62, 0.85, and 0.24 mg/l at Kanpur, Allahabad, Mirzapur, and Varanasi, respectively. The Cd concentration was recorded 0.54, 0.68, 0.78, and 0.85 mg/l at Kanpur, Allahabad, Mirzapur, and Varanasi, respectively. The Cr, Cd, and Pb concentrations in the river water were observed over the prescribed safe limits at all sampling sites, while Cu concentration was higher than the standards at all sites except Kanpur. However, Zn was observed under the permissible limits (15 mg/l) at all sampling sites. In case of fish tissues, WHO reported the concentration of Pb, Cd, and Cr higher than the prescribed safe limits. The results determined that the highest heavy metals accumulation was found settled in the liver of all selected fish species. Zn ranked the highest quantity, which was found in fish tissues with the concentration of 32.41 ± 2.55 μg/g in the gill of C. catla and 4.77 ± 0.34 μg/g in the gill C. Reba. The metals followed the magnitude order of Zn > Pb > Cu > Cd > Cr in selected fish tissues.

III. MATERIAL AND METHODS

1. **Ecological Surveys:** Field surveys will be conducted to assess the current state of fish populations, their diversity, and distribution within the Ganga water of Kanpur. Sampling techniques such as gill netting, electrofishing, and visual surveys will be employed to gather data on fish species composition, abundance, and size.

2. **Water Quality Assessment:** Water quality parameters, including temperature, pH, dissolved oxygen, turbidity, and pollutants, will be measured at various sampling sites along the river. This assessment will help identify pollution levels and their potential impact on fish health and habitat quality.

3. **Habitat Analysis:** The study will include an evaluation of aquatic habitats, including river morphology, substrate composition, and riparian vegetation. Understanding the quality and availability of suitable habitats is crucial for identifying areas that support healthy fish populations.

4. **Socio-Economic Surveys:** Interviews and surveys with local fisher communities will provide insights into their fishing practices, dependency on fisheries, and the socio-economic challenges they face. These perspectives will contribute to a comprehensive understanding of the human dimensions of fisheries preservation.

5. **Policy and Regulatory Analysis:** An assessment of existing policies, regulations, and conservation measures related to fisheries in the Ganga water of Kanpur will be conducted. This analysis will identify gaps, strengths, and opportunities for enhancing fisheries preservation efforts.

6. **Data Analysis:** Ecological, water quality, and socio-economic data will be analyzed using statistical methods to determine trends, correlations, and potential causes of fish population decline. This analysis will provide a scientific basis for identifying key challenges and potential mitigation strategies.

7. **Community Engagement:** Engaging with local fisher communities, stakeholders, and relevant authorities is crucial. Workshops, focus group discussions, and consultations will facilitate knowledge sharing, raise awareness, and foster collaboration in designing effective preservation measures.

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8. **Sustainable Strategies and Recommendations:** Based on the data collected and analysis conducted, the study will propose a set of sustainable strategies and recommendations for preserving fisheries. These recommendations may include habitat restoration, pollution control measures, sustainable fishing practices, and policy enhancements.

9. **Policy Advocacy:** The findings and recommendations of the study will be communicated to relevant policymakers, conservation organizations, and local authorities. Advocacy efforts will aim to integrate the study's outcomes into policy frameworks for the preservation of fisheries and the Ganga ecosystem.

IV. RESULT AND DISCUSSION

4.1 Canonical correspondence analysis (CCA)

We break down information in each of the three destinations all in all stretch since we evaluated a go along results for all locales. A CCA chart does not have to contain every one of the components (animal varieties, locales, environmental factors). To abstain from congestion of focuses, species and locales are regularly appeared separate outlines that can, on a basic level, be overlain. On the other hand, chose focuses or factors are shown. Sanctioned correspondence analysis (CCA) demonstrated that hub 1 and 2 represented 67% and 33% difference for species and environmental connection, individually. The biplots measurements created for every one of the three stations by CCA recommended that all out hardness was most imperative factor at pivot 1, while Nitrate and Phosphate were additionally essential at a similar hub. At pivot 2, pH was most critical factor pursued by broke down oxygen; water temperature and Zink metal (Table 1). These factors were connected altogether (p=0.6660, F-value=0.67) for hub 1 and 2. Complete hardness, alkalinity and broke up oxygen were in charge of the nearness of catla, rita and Sperata aor, while Labeo calbasu, Cyprinus carpio andCirrhinus mrigala favored nitrate, phosphate and all out disintegrated strong for their bounty. Oreochromis niloticus favored high organic oxygen request and lead while Zn and Sulfate were in More species are expected to protect a steady supply of ecosystem goods and services as spatial and temporal changeability expands, which commonly happens as longer timeframes and bigger regions are considered. Every natural environment has an assortment of animal categories, which contrast in their relative wealth. No people group comprises of types of equivalent wealth. A few animal categories are uncommon, others are normal and still others might be bounteous. Nautiyal et al. recorded 122 fish species from the Ganga River (Haridwar to Kanpur segment). Menon has charge of wealth of L. rohita.

Appointment analysis uncovered that environmental factors impact substantially the fish fauna in the Ganga stream; all out hardness, nitrate, phosphate, DO, pH and water temperature and Zn metal were most imperative factors for the bounty of L. rohita, L. calbasu, C. catla, C. mrigala, R. rita and C. carpio. O. niloticus was overwhelming metal favored fish. Environmental conditions impact fish appropriations, networks and occasional developments. To limit vitality exhausted for survival, species commonly support territories that advance their physiological procedures. Moyle et al., Bain et al., Lobb et al. likewise revealed water profundity, momentum speed and substratum as essential factor for the plenitude of R. alburnoides and L. pyrenaicus in the American streams.

4.2 Structure of the fish array

Fish arrays in the Ganga stream arrange are affected by both confined territories and bigger scene examples and water management system. Real neighborhood factors are 1) accessibility of various kinds of natural surroundings condition, 2) accessibility of various sorts of sustenance living beings and assets, and 3) communications with other amphibian species (e.g., predation, focused cooperations). About portion of Indian fishes are in the minnow family (Cyprinidae). Amid the investigation time frame diverse fish assortments have been recorded in the Ganga waterway at Kanpur, Allahabad and Varanasi destinations, India. Human exercises and mechanical influent most extreme announced in these destinations of the stream, so we have picked these locales. The outcome demonstrated that the region was wealthy in fish decent variety. Fish biodiversity of the Gang River from Kanpur to Varanasi harbors of 102 fish species (with assortment) have a place with 8 requests and 28 families (Table 2). Cypriniformes and Cyprinidae were the most rich species request and family. At complete stretch, Cypriniformes request was shared 49 species (48.04%), trailed by Siluriformes 26 species (25.49%) and Perciformes 17 species (16.67%). Requests Clupeiformes shared 5 species (4.90%) (Figure 2)

recorded 207 types of fish from the Gangetic fields which have a place with 29 families and 82 genera. As per another gauge, the Gangetic system alone harbors at the very least 265 types of fish. Freshwater biodiversity has declined quicker than either earthly or marine biodiversity in the course of recent years. Presentations of non-indigenous fishes can diminish assorted variety and change nearby network elements in freshwater systems. The physical and organic attributes of riverine systems have been appeared to shape fish network.

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4.3 Abundance of some important fishes

Abundance was recorded only commercially important fish species, which preferred by consumer and had high market price. Out of 102 species, species having higher economic value are *C. catla, L. rohita, C. mrigala, L. calbasu, S. aor, S. seenghala, W. attu, R. rita, E. vacha.*

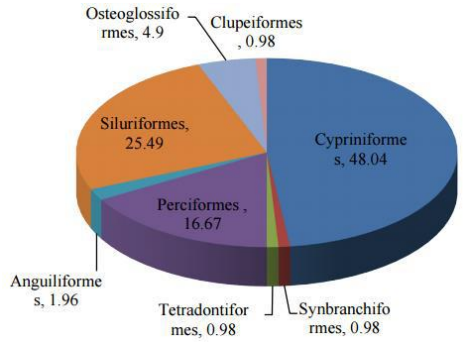

Fig.1: Contribution of different orders at Kanpur

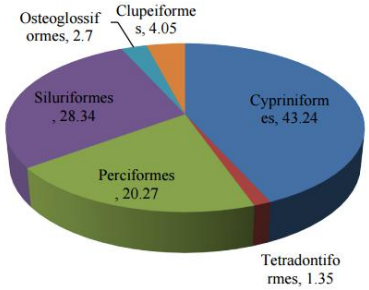

Fig.2: Contribution of different orders at Kanpur site

At Kanpur site, S. seenghala (15.76%) was ruled contrasted with C. garua (14.67%) and E. vacha (13.95%). Its seemed 2.32%, 3.56% and 4.55% of C. catla, L. rohita and C. mrigala, separately. C. catla, L. rohita and C. mrigala bounties were unequivocally associated with temperature. At Allahabad site, E. vacha (18.69%) was overwhelmed contrasted with C. garua (17.00%) and S. seenghala (15.17%). At Varanasi site, E. vacha (20.19%) was commanded contrasted with C. garua (19.09%) and S. seenghala (14.94%). Present examination demonstrated that the O. niloticus unequivocally connected with high organic oxygen request and lead. Lakra et al watched relative wealth 1.33, 2.75, 1.21 and 0.34 of C. catla, L. rohita, C. mrigal and C. carpio from the Betwa River. O. niloticus and C. carpio intensely attacked in the Ganga River and its biggest tributary the Yamuna River. Colorful species may become obtrusive and are equipped for spreading intriguing ailments, diminishing biodiversity through competition, predation and natural surroundings corruption, hereditary weakening of wild populaces through hybridization and quality introgression in short or long course of time.

V. CONCLUSION

The preservation of fisheries in the Ganga water of Kanpur is a complex endeavor that demands concerted efforts, multi-dimensional understanding, and collaborative action. This study embarked on a journey to unravel the challenges faced by fish populations, the ecological health of the river, and the socio-economic dimensions intertwined with the fishing communities' way of life. Through scientific assessment, community engagement, and policy analysis, the study sheds light on the path toward sustainable preservation. The ecological surveys unveiled the intricate tapestry of fish species within the Ganga waters of Kanpur. The assessment of water quality, habitats, and pollution levels illuminated the threats faced by these species – from habitat degradation to water pollution – underscoring the urgency of intervention. Engaging with the local fisher communities provided valuable insights into the intricate relationship between fishing and livelihoods. The socio-economic surveys highlighted the challenges faced by fisherfolk due to declining fish populations and underscored the need to balance preservation with the sustenance of their way of life. The analysis of policies and regulations revealed both opportunities and gaps in the current conservation framework. By advocating for policy enhancements and integrating the study's recommendations, it is possible to strengthen preservation efforts and ensure a supportive regulatory environment. The preservation of fisheries in the Ganga water of Kanpur is not an isolated goal; it is a microcosm of a larger vision – a vision of coexistence between humanity and nature. This study reaffirms that the health of the river's ecosystems and the prosperity of its communities are intrinsically linked. Through knowledge, awareness, and collective action, we can embark on a journey to restore the Ganga's vitality and ensure that its waters continue to sustain life in all its forms – now and for generations to come. ranges of few species is a serious concern in the long term conservation of fishes in the Ganges. Moreover, higher abundance of exotics, fragmentation and changes in the hydrology of river due to hydro projects and barriers are major threat to the fishes in the Ganges apart from indiscriminate fishing, pollution, poor land use pattern. So far, in India fishes are considered as commercial product and failed appreciate their ecological services which pushed large number of species under threatened categories. Fish conservation areas, landscape level conservation plan, proper Environment Impact Assessment for any developmental activities in the basin, habitat restoration plan, species recovery plan for certain threatened species in the Ganges etc. may help the native fish diversity restore inthe Ganges.

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