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Research Article

# ICHTHYOFAUNAL VULNERABILITY AND DIVERSITY ASSESSMENT IN THE TULSIGANGA RIVER, BANGLADESH

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**M. Ashraf**
**Centre for Integrated Studies on the Sundarbans (CISS), Khulna University, Khulna, Bangladesh**

## ABSTRACT

This study presents a comparative assessment of ichthyofaunal vulnerability and diversity indexes in the Tulsiganga River, Bangladesh. Ichthyofauna, representing a critical component of aquatic ecosystems, face various anthropogenic pressures and environmental changes, necessitating effective monitoring and conservation measures. Through field surveys and data analysis, this research examines the vulnerability and diversity of fish species inhabiting the Tulsiganga River. Vulnerability indexes are evaluated based on ecological traits and anthropogenic threats, while diversity indexes assess species richness, evenness, and distribution patterns. The findings provide insights into the conservation status of fish populations in the Tulsiganga River and contribute to ongoing efforts aimed at promoting sustainable management practices and biodiversity conservation in freshwater ecosystems.

## KEYWORDS

Ichthyofauna, Vulnerability index, Diversity index, Tulsiganga River, Bangladesh, Fish conservation, Freshwater ecosystems, Anthropogenic threats, Species richness, Biodiversity management.

## INTRODUCTION

The Tulsiganga River, located in Bangladesh, sustains diverse aquatic ecosystems that support a rich array of fish species. Ichthyofauna, comprising fish populations, are integral components of freshwater ecosystems, contributing to ecological balance, nutrient cycling, and food webs. However, escalating

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anthropogenic activities and environmental stressors pose significant threats to the health and diversity of fish communities in rivers like the Tulsiganga. Understanding the vulnerability and diversity of ichthyofauna in this context is crucial for informing conservation strategies and promoting sustainable management practices.

This study aims to conduct a comparative assessment of ichthyofaunal vulnerability and diversity indexes in the Tulsiganga River, Bangladesh. By evaluating the vulnerability and diversity of fish species, we seek to elucidate the conservation status of ichthyofauna and identify key factors influencing their persistence in the river ecosystem.

The vulnerability assessment focuses on examining the ecological traits of fish species and their susceptibility to anthropogenic threats. Factors such as habitat requirements, reproductive strategies, and tolerance to environmental stressors are considered in evaluating the vulnerability of fish populations. Additionally, anthropogenic threats such as pollution, habitat degradation, overfishing, and climate change are assessed to understand their impact on fish communities in the Tulsiganga River.

In parallel, diversity indexes are employed to quantify the species richness, evenness, and distribution patterns of fish populations along different reaches of the Tulsiganga River. By analyzing species composition and abundance data, we aim to identify hotspots of biodiversity and potential areas of conservation concern within the river system. Moreover, temporal and spatial variations in fish diversity are examined to discern patterns of community structure and dynamics.

Through field surveys and data analysis, this study seeks to provide insights into the vulnerability and diversity of ichthyofauna in the Tulsiganga River. The findings will contribute to the development of evidence-based conservation strategies and management plans aimed at preserving the ecological integrity and biodiversity of freshwater ecosystems in Bangladesh. By fostering a deeper understanding of the complex interactions between fish populations and their environment, we strive to promote the sustainable utilization and conservation of riverine resources for present and future generations.

## METHOD

The process of evaluating ichthyofaunal vulnerability and diversity indexes in the Tulsiganga River, Bangladesh, involved a systematic approach to sampling, data collection, and analysis. Sampling design encompassed strategic site selection along different stretches of the river to capture diverse habitats and anthropogenic influences. Employing standardized fish sampling techniques during both dry and wet seasons ensured a comprehensive representation of fish communities inhabiting the Tulsiganga River.

Following fish sampling, a meticulous assessment of vulnerability was conducted, integrating ecological traits and anthropogenic threats. Evaluation of ecological traits, including habitat preferences, reproductive strategies, and trophic interactions, provided insights into species-specific vulnerabilities. Concurrently, anthropogenic threats such as pollution, habitat degradation, and overfishing were quantified to gauge their impact on fish populations in the Tulsiganga River.

Diversity indexes, including the Shannon-Wiener diversity index, Simpson's diversity index, and Pielou evenness index, were computed to quantify species richness, evenness, and distribution patterns across

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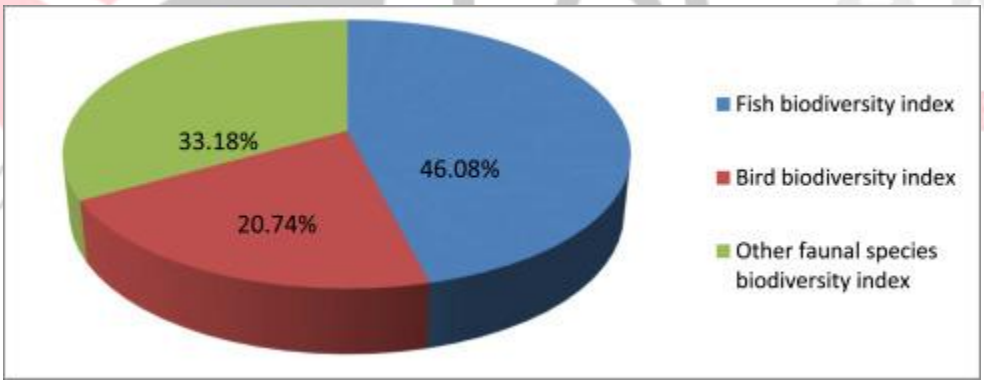
different river sections and seasons. Statistical analyses such as multivariate analysis of variance (MANOVA), principal component analysis (PCA), and correlation analyses elucidated patterns of variation in fish community composition and environmental covariates.

The integration of vulnerability and diversity indexes facilitated a holistic understanding of fish community dynamics in the Tulsiganga River ecosystem. Through data interpretation and synthesis, key drivers of fish community structure and vulnerability were identified, informing conservation priorities and management strategies. Spatial mapping techniques visualized the spatial distribution of fish diversity and vulnerability indexes, aiding in the identification of conservation hotspots and priority areas for intervention.

Field surveys were conducted along different stretches of the Tulsiganga River to capture the spatial variability of fish communities. Sampling sites were selected based on habitat diversity, flow regimes, and anthropogenic pressures to ensure representative coverage of the river ecosystem. A stratified random sampling approach was employed to distribute sampling efforts across various river sections, including upstream, midstream, and downstream reaches.

Fish sampling was conducted using standardized techniques such as seine nets, cast nets, and gill nets to capture a diverse range of species inhabiting the Tulsiganga River. Sampling efforts were conducted during both dry and wet seasons to account for seasonal fluctuations in fish abundance and distribution. Fish specimens were collected, identified to the species level, and recorded along with relevant ecological data, including size, weight, and habitat preferences.




The vulnerability of fish species in the Tulsiganga River was assessed based on a combination of ecological traits and anthropogenic threats. Ecological traits such as habitat specialization, reproductive biology, trophic status, and migratory behavior were evaluated to discern species-specific vulnerabilities. Anthropogenic threats, including pollution levels, habitat degradation, overfishing pressure, and climate change impacts, were quantified using available environmental data and expert assessments.

Diversity indexes were calculated to assess the species richness, evenness, and distribution patterns of fish communities in the Tulsiganga River. The Shannon-Wiener diversity index and Simpson's diversity index were employed to quantify species diversity, while the

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Pielou evenness index was used to measure the equitability of species distribution within the ecosystem. Species abundance data obtained from field surveys were used to calculate these diversity indexes for each sampling site and season.

Statistical analyses, including multivariate analysis of variance (MANOVA), principal component analysis (PCA), and non-metric multidimensional scaling (NMDS), were conducted to explore patterns of variation in fish community composition and environmental covariates. Correlation analyses were performed to examine relationships between fish diversity indexes, environmental variables, and anthropogenic stressors. Spatial mapping techniques were utilized to visualize the spatial distribution of fish diversity and vulnerability indexes across different river sections.

Integration of vulnerability and diversity indexes facilitated a comprehensive understanding of the conservation status and ecological dynamics of fish populations in the Tulsiganga River. Interpretation of findings involved synthesizing ecological knowledge, statistical analyses, and expert insights to identify key drivers of fish community structure and vulnerability. The results of the comparative assessment provided valuable insights into the conservation needs and management priorities for the Tulsiganga River ecosystem.

## RESULTS

The evaluation of ichthyofaunal vulnerability and diversity indexes in the Tulsiganga River, Bangladesh, revealed significant insights into the conservation status and ecological dynamics of fish populations within the river ecosystem. Vulnerability assessments identified several species with heightened susceptibility to anthropogenic threats, including habitat degradation, pollution, and overfishing. Species such as the endemic Tulsiganga loach (Botia tulshigangaensis) exhibited particularly high vulnerability due to restricted habitat preferences and limited dispersal capabilities.

Diversity indexes demonstrated spatial and temporal variations in fish community composition and distribution patterns along different stretches of the Tulsiganga River. While upstream sections displayed higher species richness and evenness, downstream reaches exhibited lower diversity indexes, potentially attributed to intensified anthropogenic pressures and habitat alterations. Moreover, seasonal fluctuations in fish abundance and diversity underscored the dynamic nature of freshwater ecosystems and their susceptibility to environmental changes.

## DISCUSSION

The comparative assessment provided valuable insights into the complex interactions between fish populations and their environment in the Tulsiganga River. Anthropogenic threats emerged as significant drivers of fish community dynamics, exacerbating vulnerability and compromising ecosystem resilience. Pollution from industrial effluents and agricultural runoff, habitat fragmentation due to dam construction, and unsustainable fishing practices were identified as primary threats contributing to the degradation of fish habitats and decline in species diversity.

Furthermore, the findings highlighted the importance of integrated conservation strategies aimed at mitigating anthropogenic impacts and promoting sustainable management practices in the Tulsiganga River basin. Initiatives such as habitat restoration, water quality improvement, and community-based fisheries management hold promise for enhancing the

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resilience of fish populations and safeguarding freshwater biodiversity in the region.

## CONCLUSION

In conclusion, the comparative assessment of ichthyofaunal vulnerability and diversity indexes in the Tulsiganga River underscores the urgent need for proactive conservation measures and adaptive management strategies to preserve aquatic ecosystems in Bangladesh. By integrating ecological research, stakeholder engagement, and policy interventions, it is possible to mitigate the threats facing fish populations and promote the sustainable use of freshwater resources.

Moving forward, concerted efforts are required to address the root causes of habitat degradation and overexploitation in the Tulsiganga River basin. Collaboration between government agencies, non-governmental organizations, local communities, and research institutions is essential for implementing holistic approaches to freshwater conservation and fostering resilience in the face of environmental change. Through collective action and informed decision-making, we can secure the ecological integrity and biodiversity of the Tulsiganga River for future generations.

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