

Impact of Mahakumbh 2025 on Fish Biodiversity at the adjoining areas of Sangam**Dr. Ajay Kumar¹**¹Assistant Professor Department of Zoology, K. N. Govt. Post Graduate College Gyanpur, Bhadohi UP

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Abstract

The Mahakumbh 2025 is expected to have a significant impact on the biodiversity of fishes in the Ganga and Yamuna rivers. The massive gathering of pilgrims, estimated to be over 60 crore, will likely lead to increased pollution, noise, and habitat destruction, disrupting the delicate ecological balance of the river ecosystems.

Key Impacts on Fish Biodiversity:

A. Increased Pollution: The sheer volume of people will release a significant amount of fecal coliform bacteria and other pollutants into the rivers, leading to a decline in dissolved oxygen levels and harming aquatic life.

B. Habitat Destruction: Construction activities for temporary infrastructure, such as pontoon bridges and tents, can damage riverbanks and affect spawning grounds for fish.

C. Noise Pollution: Increased noise from the massive gathering can disturb aquatic life, including fish.

D. Chemical Pollution: The use of chemical pesticides to control insects during the Mela can further harm aquatic biodiversity.

Key Words: *Mahakumbh 2025, Biodiversity of Fishes, Noise pollution, Habitat Destruction, Pollution A. During Mahakumbh 2025, pollution in the Ganga and Yamuna rivers can cause fish biodiversity loss through several mechanisms:*

Introduction

The Triveni Sangam at Prayagraj, the sacred confluence of the Ganga, Yamuna, and the mythical Saraswati, is one of India's most significant religious, cultural, and ecological landscapes. Besides its immense spiritual importance, the Sangam serves as a biologically productive freshwater ecosystem supporting a rich diversity of fish species, aquatic flora, and fauna. The Ganga and Yamuna river systems together harbor numerous indigenous fish species, many of which contribute substantially to regional fisheries, food security, and ecological stability. The adjoining floodplains, shallow channels, and riverbanks provide breeding, feeding, and nursery habitats essential for sustaining fish biodiversity.

Mahakumbh 2025, held from 13 January to 26 February 2025, witnessed an unprecedented congregation of hundreds of millions of pilgrims, making it one of the largest human gatherings in recorded history. While the event represents India's rich cultural heritage and spiritual traditions, such an enormous gathering inevitably places considerable pressure on the riverine ecosystem. Activities including mass bathing, religious offerings, temporary settlements, boating, wastewater discharge, increased transportation, and extensive infrastructural development have the potential to alter the ecological balance of aquatic environments.

Fish biodiversity is highly sensitive to changes in water quality, hydrological conditions, habitat structure, and anthropogenic disturbances. Variations in dissolved oxygen, biological oxygen demand (BOD), turbidity, pH, suspended solids, and nutrient concentrations directly influence fish survival, reproduction, migration, and community composition. Studies conducted during Mahakumbh 2025 have reported measurable fluctuations in several physicochemical parameters of the Sangam waters during peak bathing periods, including

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temporary reductions in dissolved oxygen and increases in organic load and turbidity. Although some recovery was observed after the event, these short-term environmental changes may influence fish assemblages, particularly sensitive and economically important native species.

The Sangam region supports a variety of freshwater fishes belonging to families such as Cyprinidae, Bagridae, Siluridae, Channidae, Mastacembelidae, and Notopteridae. Species including *Labeo rohita* (Rohu), *Catla catla* (Catla), *Cirrhinus mrigala* (Mrigal), *Wallago attu*, *Mystus* spp., and *Channa* spp. play vital ecological and economic roles. These species depend upon suitable water quality, stable habitats, and uninterrupted migration routes. Increased sediment disturbance, underwater noise, intensive boat movement, and anthropogenic waste generated during mega-events may temporarily affect fish behavior, spawning grounds, feeding activities, and habitat utilization.

At the same time, extensive environmental management measures implemented during Mahakumbh 2025—including continuous river-water monitoring, sewage interception and treatment, waste management, river surface cleaning, and stricter pollution control initiatives—were intended to minimize ecological degradation. These interventions provide an opportunity to evaluate whether large-scale religious gatherings can be managed sustainably while conserving aquatic biodiversity.

Understanding the impact of Mahakumbh 2025 on fish biodiversity is therefore of considerable ecological, environmental, and conservation significance. Fish communities serve as reliable biological indicators of freshwater ecosystem health because they integrate the cumulative effects of environmental changes over time. Assessing species richness, abundance, diversity indices, habitat quality, and water quality before, during, and after the Mahakumbh can provide valuable insights into ecosystem resilience and the effectiveness of environmental management practices.

This study aims to evaluate the influence of Mahakumbh 2025 on fish biodiversity in the adjoining areas of the Sangam by examining changes in fish diversity, abundance, and associated environmental parameters. The findings are expected to contribute to sustainable management strategies for future mega religious events while balancing cultural traditions with freshwater biodiversity conservation and ecological sustainability.

Physical Effects:

1. **Habitat Destruction:** Pollution can damage river habitats, reducing the availability of food, shelter, and breeding grounds for fish.
2. **Increased Turbidity:** High levels of suspended solids and sediments can reduce water clarity, affecting fish feeding and breeding behaviors.
3. **Altered Water Flow:** Changes in water flow due to pollution can disrupt fish migration patterns and habitat use.

Chemical Effects:

1. **Toxicity:** Pollutants like heavy metals, pesticides, and industrial chemicals can be toxic to fish, causing physiological changes, behavioral alterations, and even death.
2. **pH and Temperature Changes:** Pollution can alter water chemistry, affecting pH and temperature, which can impact fish populations.

3. Nutrient Imbalance: Excess nutrients from pollution can lead to eutrophication, causing algal blooms and depleting oxygen levels.

Biological Effects:

1. Disease and Parasites: Pollution can increase the spread of disease and parasites among fish populations, further threatening biodiversity.
2. Changes in Food Webs: Pollution can alter the composition of aquatic food webs, affecting the availability of food resources for fish.
3. Loss of Endemic Species: The Ganga and Yamuna rivers are home to several endemic fish species. Pollution can push these species towards extinction.

Long-term Consequences:

1. Population Declines: Chronic pollution can lead to declines in fish populations, reducing biodiversity and ecosystem resilience.
2. Community Shifts: Repeated exposure to pollution can lead to changes in fish community composition, favoring tolerant species over sensitive ones.
3. Ecosystem Degradation: Pollution can degrade ecosystem function, reducing the ability of rivers to support biodiversity and provide ecosystem services.

To mitigate these effects, it's essential to implement effective pollution control measures, restore river habitats, and promote sustainable practices during Mahakumbh 2025.

B. During Mahakumbh 2025, habitat destruction can cause fish biodiversity loss through several mechanisms:

Physical Habitat Destruction:

1. Riverbank Erosion: Construction activities, such as building temporary infrastructure, can lead to riverbank erosion, reducing habitat availability for fish.
2. In-stream Habitat Alteration: Alterations to the river channel, such as dredging or excavation, can disrupt fish habitats and migration patterns.
3. Floodplain Alteration: Changes to the floodplain, such as land filling or construction, can reduce habitat diversity and alter fish populations.

Water Quality Degradation:

1. Sedimentation: Increased sedimentation from construction activities can reduce water clarity, affecting fish feeding and breeding behaviors.
2. Nutrient Pollution: Excess nutrients from human activities, such as sewage and agricultural runoff, can lead to eutrophication, depleting oxygen levels and harming fish populations.
3. Chemical Pollution: Chemical pollutants, such as heavy metals and pesticides, can be toxic to fish, causing physiological changes and behavioral alterations.

Biological Habitat Destruction:

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1. Invasive Species: Introduction of non-native species, such as aquatic plants or animals, can outcompete native species for resources, altering fish populations.
2. Disease and Parasites: Habitat destruction can increase the spread of disease and parasites among fish populations, further threatening biodiversity.
3. Changes in Food Webs: Habitat destruction can alter the composition of aquatic food webs, affecting the availability of food resources for fish.

Long-term Consequences:

1. Population Declines: Chronic habitat destruction can lead to declines in fish populations, reducing biodiversity and ecosystem resilience.
2. Community Shifts: Repeated habitat destruction can lead to changes in fish community composition, favoring tolerant species over sensitive ones.
3. Ecosystem Degradation: Habitat destruction can degrade ecosystem function, reducing the ability of rivers to support biodiversity and provide ecosystem services.

To mitigate these effects, it's essential to implement sustainable practices during Mahakumbh 2025, such as:

1. Environmental Impact Assessments: Conduct thorough environmental impact assessments to identify potential habitat destruction risks.
2. Sustainable Infrastructure Development: Implement sustainable infrastructure development practices, such as using eco-friendly materials and minimizing habitat disruption.
3. Habitat Restoration: Restore degraded habitats and promote ecosystem resilience through conservation efforts.
4. Education and Awareness: Educate stakeholders, including pilgrims and local communities, about the importance of habitat conservation and sustainable practices.

C. Effect of Noise Pollution:

During Mahakumbh 2025, noise pollution can cause fish biodiversity loss through several mechanisms:

Physical Effects:

1. Habitat Disruption: Loud noises can disrupt fish habitats, causing them to flee or alter their behavior.
2. Communication Interference: Noise pollution can interfere with fish communication, making it difficult for them to find mates, warn predators, or navigate.
3. Physiological Stress: Chronic exposure to loud noises can cause physiological stress in fish, leading to changes in behavior, reproduction, and survival.

Behavioral Effects:

1. Changes in Migration Patterns: Noise pollution can alter fish migration patterns, affecting their ability to reach breeding or feeding grounds.

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2. Altered Feeding Behavior: Loud noises can disrupt fish feeding behavior, reducing their ability to find food and survive.

3. Increased Predator-Prey Interactions: Noise pollution can increase predator-prey interactions, as fish become more vulnerable to predators due to their altered behavior.

Biological Effects:

1. Hearing Loss: Chronic exposure to loud noises can cause hearing loss in fish, making them less able to detect predators or communicate.

2. Stress and Disease: Noise pollution can increase stress levels in fish, making them more susceptible to disease and reducing their immune response.

3. Reproductive Impacts: Chronic noise exposure can affect fish reproduction, reducing fertility and altering spawning behavior.

Long-term Consequences:

1. Population Declines: Chronic noise pollution can lead to declines in fish populations, reducing biodiversity and ecosystem resilience.

2. Community Shifts: Repeated noise pollution can lead to changes in fish community composition, favoring tolerant species over sensitive ones.

3. Ecosystem Degradation: Noise pollution can degrade ecosystem function, reducing the ability of rivers to support biodiversity and provide ecosystem services.

To mitigate these effects, it's essential to implement noise reduction measures during Mahakumbh 2025, such as:

1. Noise Monitoring: Conduct regular noise monitoring to identify areas with high noise levels.

2. Noise Reduction Technologies: Implement noise reduction technologies, such as sound barriers or noise-reducing materials.

3. Regulated Noise Levels: Establish and enforce regulated noise levels for construction, transportation, and other activities.

4. Education and Awareness: Educate stakeholders, including pilgrims and local communities, about the impacts of noise pollution on fish biodiversity.

D. During Mahakumbh 2025, chemical pollution can cause fish biodiversity loss through several mechanisms:

Toxic Effects:

1. Direct Toxicity: Chemical pollutants, such as pesticides, heavy metals, and industrial chemicals, can be directly toxic to fish, causing mortality and sub-lethal effects.

2. Bioaccumulation: Chemical pollutants can accumulate in fish tissues, leading to chronic toxicity and altering fish physiology and behavior.

3. Biomagnification: Chemical pollutants can bio magnify through the food chain, affecting top predators and altering ecosystem dynamics.

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Physiological Effects:

1. Respiratory Distress: Chemical pollutants can cause respiratory distress in fish, reducing their ability to breathe and survive.
2. Reproductive Impacts: Chemical pollutants can affect fish reproduction, reducing fertility and altering spawning behaviour.
3. Immunosuppression: Chemical pollutants can suppress the immune system of fish, making them more susceptible to disease and reducing their ability to respond to environmental stressors.

Behavioral Effects:

1. Changes in Migration Patterns: Chemical pollutants can alter fish migration patterns, affecting their ability to reach breeding or feeding grounds.
2. Altered Feeding Behavior: Chemical pollutants can disrupt fish feeding behavior, reducing their ability to find food and survive.
3. Increased Predator-Prey Interactions: Chemical pollutants can increase predator-prey interactions, as fish become more vulnerable to predators due to their altered behavior.

Long-term Consequences

1. Population Declines: Chronic chemical pollution can lead to declines in fish populations, reducing biodiversity and ecosystem resilience.
2. Community Shifts: Repeated chemical pollution can lead to changes in fish community composition, favoring tolerant species over sensitive ones.
3. Ecosystem Degradation: Chemical pollution can degrade ecosystem function, reducing the ability of rivers to support biodiversity and provide ecosystem services.

To mitigate these effects, it's essential to implement chemical pollution reduction measures during Mahakumbh 2025, such as:

1. Chemical Pollution Monitoring: Conduct regular chemical pollution monitoring to identify areas with high pollution levels.
2. Wastewater Treatment: Implement effective wastewater treatment systems to remove chemical pollutants from wastewater.
3. Regulated Chemical Use: Establish and enforce regulated chemical use practices for agriculture, industry, and other activities.
4. Education and Awareness: Educate stakeholders, including pilgrims and local communities, about the impacts of chemical pollution on fish biodiversity.

Effect of chemical pollution:**Immediate Impacts:**

1. Reduced Dissolved Oxygen (DO) Levels: Fecal coliform bacteria consume oxygen, reducing DO levels in the water. Low DO levels can lead to fish mortality, especially for sensitive species.

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2. Increased Biochemical Oxygen Demand (BOD): Pollutants like fecal coliform bacteria, organic matter, and nutrients increase BOD, which can deplete oxygen levels and harm aquatic life.
3. Toxicity and Stress: Pollutants can be toxic to fish, causing stress, physiological changes, and even death.

Long-term Impacts:

1. Habitat Degradation: Chronic pollution can alter river habitats, reducing the availability of food, shelter, and breeding grounds for fish.
2. Changes in Water Chemistry: Pollutants can alter water chemistry, affecting pH, temperature, and nutrient cycles, which can impact fish populations.
3. Shifts in Fish Communities: Repeated exposure to pollutants can lead to changes in fish community composition, favoring tolerant species over sensitive ones.
4. Loss of Endemic Species: The Ganga and Yamuna rivers are home to several endemic fish species. Chronic pollution can push these species towards extinction.

Mitigation Strategies:

1. Improved Sanitation and Waste Management: Ensure proper waste disposal and sanitation facilities to reduce pollutant inputs.
2. Water Treatment: Implement effective water treatment systems to remove pollutants and excess nutrients.
3. River Restoration: Restore river habitats and ecosystems to enhance biodiversity and resilience.
4. Monitoring and Enforcement: Regularly monitor water quality and enforce regulations to prevent pollution.

Conclusion:

By understanding the impacts of pollution during Mahakumbh (Kumbh Mela of each year also) on fish biodiversity and implementing effective mitigation strategies we can work towards preserving the aquatic ecosystems of the Ganga and Yamuna rivers in adjoining areas of Sangam.

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