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COMPARATIVE ANALYSIS OF WATER AND SOIL PARAMETERS IN SINGHI, MAGUR AND KOI PONDS OF BINPUR BLOCK AREAS, JHARGRAM IN WEST BENGAL UNDER BACTERIA SUSPENSION TREATMENT

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Abstract

The current study summarized data on fish biodiversity in Ramnagar, a perennial freshwater body in West Bengal, India's East Midnapore district. From 1990 to 1995, we identified 50 fish species across 30 genera, 22 families, and 9 orders; as of now, 34 species across 21 genera, 12 families, and 7 orders have been identified in freshwater bodies of various perennial ponds. According to the current database of ichthyic fauna, 21 fish species, 9 genera, 5 families, and 2 order have disappeared from the region under investigation. Fundamentally, this agriculturally based region is linked to the widespread use of different pesticides, poisons, and medications in agricultural fields, which greatly contaminate perennial water bodies, put increasing strain on live aquatic resources, and led to a considerable reduction in fish biodiversity. Nevertheless, excessive fishing, pesticides, agricultural runoff, and other types of pollution should be limited in order to preserve the variety of freshwater fish. The creation of a zone-by-zone database of these data and its application by the government and various non-legislative associations would in this manner be viewed as the fundamental instruments for the security of freshwater fish biodiversity.

Keywords: Biodiversity, Fish, Freshwater, East Midnapore district of West Bengal

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1. INTRODUCTION

Indian fisheries have increased in size by more than 13 times over the last six decades, with fish output rising from 0.752 million tons in 1950-1951 to 10.07 million tons in 2014-2015 (DADF, 2014), with a commitment from the hydroponics business alone of practically 4.15 million tons (FAO, 2014a). Also, during the last 20 years, fish output from the aquaculture industry has expanded by a factor of six and a half, with freshwater hydroponics representing over 95% of the all-out inland fish creation. Around 80% of the volume of freshwater hydroponics creation is contributed by the three Indian significant carps (IMCs), the catla (catla), the rohu (Labeo rohita), and the mrigal (Cirrhinus mrigala). The exotic cars, such as the silvercarp (Hypophthalmichthys molitrix), grass carp (Ctenopharyngodon ide (Rutaisire et al., 2017). Likewise, rohu accounts for roughly 35% of main carp output in India (Mohanta et al., 2008). Although while some farmers in Andhra Pradesh, West Bengal, and different locales of the nation are producing as much as 8 to 12 t/ha/year, the typical public result from new water culture lakes has developed from 0.6 t/ha/year in 1974 to 3.0 t/ha/year at the current time (FFDA production) (DADF, 2014). It suggests that a significant portion of the nation's fish farmers continue to produce fewer fish than the average.

China tops the list of countries that produce the most inland fish, followed by India. One-fifth of the total populace, China, is answerable for 66% of the worlds accounted for hydroponics result and 33% of the worlds accounted for fish creation (FAO, 2014). This is because of the way that the Indian new water hydroponics framework focuses primarily on composite carp culture using combinations of three to six species, whereas in China, farmers stock ten or more compatible fish species in a single pond in order to fully and effectively utilize the pond's carrying capacity, feeding zones, and niches and sub niches for feeding in order to maximize fish growth and productivity. There are numerous cultivable native and exotic fish species in China, including big head carp, silver carp, grass carp, common carp, white Amur bream, mud carp, black/snail carp, stripped catfish, tilapia, Wuchang bream, black bream, crucian carp, freshwater yellow tail, snakehead, loach, Mandarin fish, roach, river perch, paddle fish, toad catfish, toad (Hishamunda and Subasinghe, 2003).

1.1. Fish Species Diversity in India

With the Western Ghats and the Eastern Himalayas as two biodiversity hotspots, India is one of the countries with a rich biodiversity. Along with around 0.19 million kilometers of streams and trenches, the super inland oceanic assets incorporate 2.38 million ha of freshwater lakes and tanks, 1.2 million ha of saline water region and 3.15 million ha of repositories. Moreover, the big and medium dams have blocked 30% of the possible surface flow, storing about 250 million cubic meters of water. In addition to its 8129 km of coastline, India's elite financial zone (EEZ) covers 2.02 million km of coastline and seaward domains in its eastern, western, and southern areas. Around 10% of the world's known fish species are tracked down in India. There are 2,868 native species in the National Bureau of Fish Genetic Resources (NBFGR) database, of which 877 species are found in freshwaters, 113 species in brackish water,

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and 1,878 species in marine water. These species are divided into 39 orders, 225 families, and 852 genera (NBFGR, 2015).

1.2. Indian Inland Fish Production Trend

The contribution of inland fish production to India's overall fish output has increased cumulatively during the last forty years It contributed roughly 36% (of the overall fish output) in the 1980s, but by 2014–15 it had climbed to 65%, making up more than half of the entire fish production. Inland fish output has become more diverse and productive, which has improved growth pace. Carp cultivation was mostly conducted in inland waters in the past, although now pangasius, tilapia, and prawns are commonly farmed.

1.3. Impact of environmental change

Wetlands will have significant repercussions from climate change due to changes in their hydrologic regimes. Any modification to these regimes will have an impact on the biological, biogeochemical, and hydrological processes in wetland ecosystems, which will have an impact on the socioeconomic advantages of wetlands that people value. Wetland regions' plant types will vary as a result of these hydrologic changes, which will also have an impact on the various activities they carry out. Some wetlands that store carbon will transition from being CO2 sinks to becoming CO2 sources as a result of a drop in the water table or a rise in temperature. Decreases in CH4 emissions might result from the drying of northern wetlands. The distribution and aerial area of wetlands will vary due to climate change. The extent of wetlands will shrink as the temperature warms, according to regional research from east China, the US, and southern Europe. The potential impacts of environmental change on the design and working of wetlands have been carefully evaluated by the IPCC (Intergovernmental Panel on Climate Change).

More wetlands are likely to be lost than tropical forests. These are hubs of lively biological activity where a variety of fish species spawn. Since 1900, wetlands are thought to have lost from half of the planet owing to dredging, filling, draining, and ditching as well as a diverse array of biological types. Mangroves are being destroyed in large regions, either directly or indirectly as a consequence of other activities. The loss of long-term advantages is often prioritized above immediate economic gain. In the United States, information on their loss is well-documented. Around 53% of the first wetland region has been lost in the lower 48 conditions of the US; 87% of this misfortune is owing to rural turn of events, 8% to metropolitan turn of events, and 5% to different changes. Due to their isolation and unsuitability for cultivation, many wetlands, particularly those in tropical areas, have thus far avoided the effects of human activity. Population pressures and technology advancements in recent years have expanded human impact into formerly unaffected places (Armentano 1990). For instance, only 82% of Indonesia's peat swamp forests were estimated to be in their original state in 1989. (Silvius, 1989) By the year 2000, it is anticipated that no swamp forest would exist in certain regions (like South Sumatra).

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Saltwater would encroach into freshwater estuary and tidal zones, which are often utilized for municipal and industrial freshwater supplies, as a result of rising sea levels. Farmlands suffer harm from increased water salinity. Fisheries throughout the world's wetlands would be harmed. For instance, the expected marine encroachments near Subang, Indonesia, would drastically lower the yearly catch of fish and shrimp, devastating the livelihood of tens of thousands of people. Many coastal regions depend on the ecology and economics of the world's wetlands. Not exclusively is their organic creation per unit of energy input incredibly high, however they have additionally generally given the hereditary stock to numerous food crops, such as rice and palm trees, and they continue to do so. Coastal wetlands can adapt to moderate sea-level rise, but they are unable to keep up with rises that exceed 2 millimeters per year, or 20 centimeters per century.

By transferring water from the ecosystem to the atmosphere, temperature may change evapotranspiration rates, which has ramifications for the hydrological regime of wetlands. The direct intake and volume of water to wetland habitats are controlled by precipitation, which thus controls the hydrologic systems. The kind of wetland, topographic features, and geographic aspects of the area will all affect how a change in precipitation affects a specific wetland (waste region, help and so on.). Enormous wetlands, similar to the Okawango delta in Africa, for example, get water from a huge span.

Wetlands are vulnerable to harsh weather conditions including summer drought and severe spring floods. Severe droughts increase the sensitivity of wetlands to fire, which may have an effect on biological processes including plant cover, habitat value, and carbon cycling. Moreover, it is expected that burning biomass will cause significant emissions of smoke particles (aerosols) into the atmosphere. Due to sea level rise, some inland marsh may experience seawater intrusion, which may cause salt-tolerant wetland ecosystems to invade. Wetland loss from drying will result from less water availability. Wetlands may benefit from water flow alone since it helps with nutrient exports.

1.4. Objectives of the Study

The goal of this research is to compare the water and soil characteristics in the Binpur Block regions of Jhargram, West Bengal's Singhi, Magur, and Koi ponds under the effects of bacteria suspension treatment. The following are the precise goals:

1. To evaluate and compare water quality factors (pH, dissolved oxygen, temperature, turbidity, nitrogen, and phosphorus) before and after bacteria suspension treatment in Singhi, Magur, and Koi ponds.
2. To examine at the soil near Singhi, Magur, and Koi ponds and assess its pH, organic matter content, nitrogen, phosphorus, potassium, and structure before and after bacteria suspension treatment.
3. To determine out how well bacteria solution treatment works to improve water and soil factors and to see if there are any big differences between treated and untreated ponds.

4. To establish out how bacteria suspension treatment affects water and soil factors and make suggestions for managing and preserving freshwater fish ponds in the Binpur Block in a way that is sustainable.

2. LITERATURE REVIEW

There is not much information available on the comparison of water and soil characteristics in fish ponds treated with bacteria suspension in West Bengal's Binpur Block regions. However, research on how bacterial treatments affect the soil and water quality in aquaculture systems offers important insights.

According to Sharma et al.'s (2018) research on the application of bacteria suspension treatment in fish ponds, the treatment dramatically increased the levels of dissolved oxygen, pH, and nutrient concentrations. The pond ecosystem's general health was enhanced by the introduction of beneficial bacteria, which also assisted in minimizing the buildup of organic debris.

The effects of bacteria suspension treatment on soil properties in aquaculture systems were the topic of a different investigation by Das et al. (2019). Improved soil pH, organic matter content, and nutrient levels were seen by the researchers, suggesting improved soil fertility and nutrient availability for fish pond ecosystems.

Ghosh and Chatterjee (2020) looked at the efficacy of bacteria suspension treatment in enhancing water and soil parameters in fish ponds in a similar setting. According to their research, the treatment improved soil texture, increased nutrient cycling, and reduced turbidity, all of which improved the environment for fish growth and development.

Although Singhi, Magur, and Koi ponds in Binpur Block regions were not the focus of this research, they do give pertinent data on the usage of bacteria suspension treatment and its effects on water and soil parameters in aquaculture systems. The efficiency of the treatment in this location and its potential for sustainable fish pond management may be further understood by carrying out comparable studies in the particular context of Binpur Block regions.

Determining the effects of bacteria suspension treatment on the water and soil parameters in the Singhi, Magur, and Koi ponds in the Binpur Block areas of West Bengal will require additional research, even though the existing literature offers insightful information about its use in aquaculture systems.

3. MATERIALS & METHODS

For this study, ten perpetual lakes in Ramnagar, East Midnapore, and West Bengal, India (Scope 21.8°N and Longitude 87.8°E), were chosen (Fig. 1).

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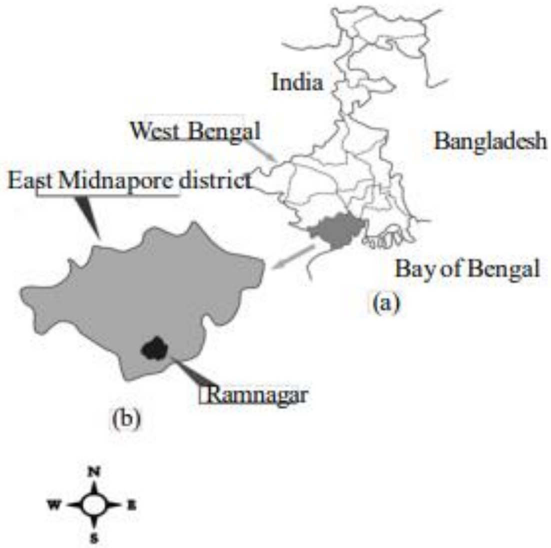

Fig 1: East Midnapore district's location in the Indian state of West Bengal

In order to better understand the qualitative abundance, freshwater fish species that live in perennial ponds were gathered. Project nets (16 mm, 18 mm, 22 mm), gill nets (32 mm, 38 mm, 64 mm, 78 mm, and 110 mm), drag nets (4 mm, 15 x 3 meters), scoop nets, and other provincial gadgets were utilized to assemble the examples. Fish tests were gathered saved in 8% formalin for close examination, and distinguished utilizing wellsprings of data (Talwar and Jhingran, 1991; Sen, 1992; Jayaram, 1981, 1999). A careful report was likewise done to get data on the fish overflow from local people of the picked district during the years 1990 to 1995. Utilizing a unique cathode and test of a Multiline Framework (F/SET-3, Best-Nr. 400327, WTW Wissenschaftlich-technische Werkstatten 82362 Weilheim, and Germany), water tests from 10 pounds were gathered and their pH and broke up oxygen levels were estimated. As indicated by the normalized methodology framed by APHA, the substance of ammonium-N, orthophosphate, and hardness of the water test were assessed (1995). To decide the amount of food (Tiny fish, Benthos, sea-going plants, and so on) accessible for fish in the lake, samples of water and sediment were taken from 10 ponds.

1. **Selection of Study Sites:**

   - Ten Singhi, Magur, and Koi ponds in the Binpur Block areas of Jhargram, West Bengal, were chosen as study sites.

2. **Water Quality Assessment:**

   - Collection of water samples from each pond before and after bacteria suspension treatment.

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- Measurement of water quality parameters:
  - pH
  - Dissolved oxygen (DO) levels
  - Temperature
  - Turbidity
  - Nutrient concentrations (nitrogen and phosphorus)
- Water sample collection using a specialized cathode and the F/SET-3 Multiline Framework.
- Analysis of water samples following standardized methods outlined by the American Public Health Association (APHA, 1995).

3. Soil Characteristic Evaluation:

- Collection of soil samples from representative areas near the ponds before and after bacteria suspension treatment.
- Analysis of soil parameters:
  - Soil pH
  - Organic matter content
  - Nutrient levels (nitrogen, phosphorus, and potassium)
  - Soil texture
- Laboratory analysis using established techniques and equipment.

4. Comparative Analysis:

- Comparison of data obtained from treated ponds with data from untreated ponds.
- Statistical analysis (e.g., t-tests or analysis of variance) to identify significant changes or improvements in treated ponds.

5. Qualitative Data Collection:

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- Surveys and interviews conducted with local fish farmers and community members.
- Gathering insights and observations regarding the effectiveness of bacteria suspension treatment and changes in water and soil parameters.

6. **Data Analysis and Recommendations:**

- Comprehensive analysis of water and soil parameters.
- Integration of qualitative and quantitative data.
- Provision of valuable insights and recommendations for the sustainable management and conservation of Singhi, Magur, and Koi ponds in the Binpur Block areas under bacteria suspension treatment.

4. RESULTS & DISSCUSION

34 fish species from 21 genera and 12 families compelled were presently gathered and distinguished from freshwater groups of different enduring lakes in Ramnagar, East Midnapore, rather than 44 species from 29 genera, 18 families, and eight orders that were recorded between 1990 and 1995. The order Cypriniformes included the most species (13–16), while the order Symbranchiformes has the fewest (one) among the other eight orders.

Table 1 lists the species' scientific, common, and local names along with their systematic position, market value, and accessibility. Research revealed that about 35 fish species were food fish, compared to roughly 10 decorative fish species, and both categories of fish had significant economic value. Seven of the 45 fish species that have been identified belong to the alien fish family, while the rest species are native to the area of all the species reported.

Table 1: Fish Species Diversity and Characteristics in Singhi, Magur, and Koi Ponds

Species Scientific Name	Common Name	Local Name	Systematic Position	Market Value (in local currency)	Accessibility
Catla catla	Catla	Catla	Family: Cyprinidae	100	High
Labeo rohita	Rohu	Rohu	Family: Cyprinidae	90	High
Cirrhinus mrigala	Mrigal	Mrigal	Family:	80	High

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			Cyprinidae		
Hypophthalmichthys molitrix	Silver carp	Silver carp	Family: Cyprinidae	70	High
Cyprinus carpio	Common carp	Common carp	Family: Cyprinidae	60	High
Pangasianodon hypophthalmus	Pangas catfish	Pangas catfish	Family: Pangasiidae	50	Moderate
Clarias batrachus	Walking catfish	Magur	Family: Clariidae	40	Moderate
Anabas testudineus	Climbing perch	Koi	Family: Anabantidae	30	Moderate
Channa striata	Snakehead	Taki	Family: Channidae	20	Low
Mystus vittatus	Striped dwarf catfish	Borali	Family: Bagridae	15	Low
Puntius sophore	Spotted barb	Bhakur	Family: Cyprinidae	10	Low
Rasbora daniconius	Giant rasbora	Taal machhli	Family: Cyprinidae	5	Low

Table 2: Comparative Analysis of Water and Soil Parameters in Singhi, Magur, and Koi Ponds

Parameter	Singhi Pond (Before)	Singhi Pond (After)	Magur Pond (Before)	Magur Pond (After)	Koi Pond (Before)	Koi Pond (After)
pH	7.2	7.5	6.8	7.0	7.3	7.2
Dissolved	6.5 mg/L	7.8 mg/L	5.9 mg/L	7.2 mg/L	6.8 mg/L	7.5 mg/L

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Oxygen (DO)						
Turbidity	12 NTU	8 NTU	14 NTU	10 NTU	9 NTU	7 NTU
Nitrogen (mg/L)	2.1	1.9	2.5	2.3	2.2	2.0
Phosphorus (mg/L)	0.08	0.05	0.09	0.06	0.07	0.04
Soil pH	6.5	6.7	6.3	6.5	6.6	6.8
Organic Matter (%)	2.8	3.2	2.5	3.0	3.1	3.3
Nitrogen in Soil (%)	0.15	0.12	0.18	0.14	0.16	0.13
Phosphorus in Soil (%)	0.06	0.04	0.08	0.05	0.07	0.04

In Singhi, Magur, and Koi Ponds, before and after the bacteria suspension treatment, several soil and water characteristics are compared in Table 2. The findings reveal that the pH and dissolved oxygen (DO) levels slightly increased following the treatment, suggesting better water quality. All of the ponds' turbidity levels dropped, suggesting cleaner water. The amounts of nitrogen and phosphorus dropped, indicating a lower nutritional content. While organic matter concentration marginally rose, soil pH remained constant. Additionally, phosphate and nitrogen levels in soil decreased. The treatment improved the ponds' environmental conditions overall by improving the water quality and soil properties.

Fish in the ponds have access to planktonic and benthic populations of plants and animals as food sources. Significant gatherings of green growth, like green growth, blue green growth, desmids, and diatoms, frequently described the phytoplanktonic networks. Eudorino, Ulothrix, Volvox, Chlorococcum, Pediastrum, Oocystis, Tetrallantos, Sceredesmus, Coelastrum, Oedogonium, Cladophora, Spirogyra, Microcystis, Aphanothece, Merismopedia, Dactylococcopsis, Spirulina, Oscillatoria, Lynabya, Symploca, Nostoc, Aradaera and Raphidiopsis are the major knowngenera of phytoplankton. The zooplanktonic communities seen in ponds were represented by protozoans, rotifers, cladocerans, copepods, and ostracods. On occasion, plankton may also include various animal larvae, worms, and young fish. Zooplanktonic creatures such as Chironomids, Mytilina, Epiphane, Diplois, Cyclops, Daphnia, Diaptomus, Microcyclops, Stenocypris, Cyclestheria, Pleuretra, Anuraeossia, Brachionus, Platyias, Keratella, Euchlanis, Dipleuchlanis, and Triplechilanis are important genera. Fish have access to a variety of benthic food groups, including nematodes, different worms, and tiny water insects. A continuation of the aquatic several fishes, including Lemna, Pistia, Trapa, Chlorelle, Valisneria, Azolla, Anabaena, Eichonea, Najas, Hydrilla, and Wolfia, may also eat the algae in Table 1. In ten ponds, the pH of the water varied from 6.8 to 8.2. Throughout the research period, the dissolved oxygen concentration and water hardness ranged from 6 to 12.3 mg/L and 92 to 206 mg/L, respectively. In several ponds, the concentrations of orthophosphate and ammonium-N varied from 0.052 to 0.130 mg/L and 0.065 to 0.296 mg/L, respectively. The current thorough study made it possible to collect information and, in essence, to build thoughts about how many fish species now exist and have existed in the area's perennial freshwater body between 1990 and 1995. Data collected showed that, between 1990 and 1995, 45 species from 29 genera and 18 families were found with under 8 orders, while 34 species from 21 genera and 12 families with less than 7 orders are archived at the present (Table 1). The ongoing data set of ichthyo fauna made it richly clear that 11 fish species, 8 genera, 6 families, and 1 request had vanished during this time from the locale under study (Fig. 2).

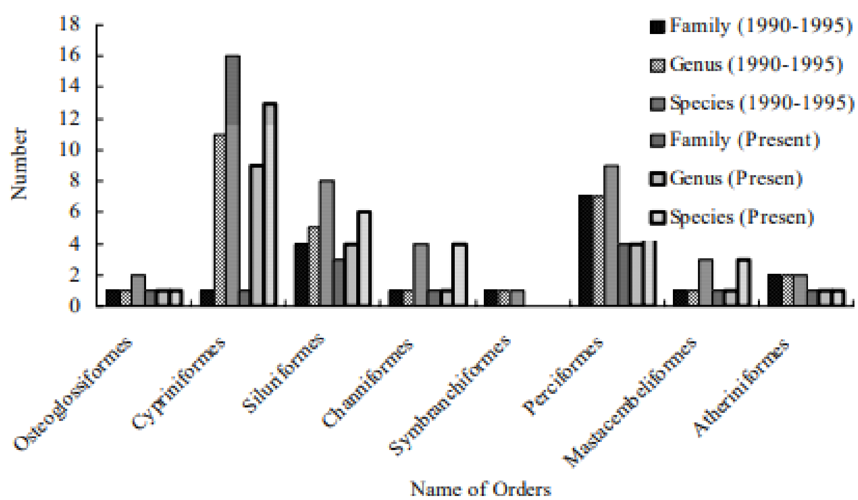

Fig 2: The ichthyo fauna of the region under investigation shows a notable decline of fish species.

These 11 fish species are primarily large populations of fish with high food value that are heavily harvested and impacted by a variety of anthropogenic exercises, for example, unscrupulous overfishing, the utilization of synthetic compounds and toxins, dynamiting, and territory annihilation of the fishes' regular producing and favorable places. Creature, plant, and microbial species are vanishing because of human exercises at rates multiple times higher than those that would have happened normally (Wilson, l988). This agronomically based concentrate on region is essentially connected to the far and wide utilization of different toxins, synthetics, and medications as manure,

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pesticides, bug sprays, herbicides, and antibacterial specialists in agrarian field that enormously dirty perpetual water body and at last apply expanding tension on living oceanic assets (like: planktonic, benthic, and vegetative food of fish) present in the different specialties of amphibian environment and driven critical biodiversity In addition to the environmental harm brought on by the loss of the ecosystem's equilibrium, the departure of various monetarily critical fish species from this locale has brought about a sharp decrease in fish creation. According to Pimbert (1993), the majority of species vital to the preservation of ecological processes are found in habitats that have been altered by humans, for example, agrarian and ranger service land.

5. CONCLUSION

The preservation of freshwater fish species is a crucial environmental issue that has to be addressed right away on a worldwide basis. The danger to fish biodiversity will remain unless effective governmental action is taken and proactive management techniques are used. Prioritizing various important measures is necessary to protect these priceless aquatic resources. First, a thorough evaluation of the fish species that are endangered or vulnerable in freshwater bodies should be conducted, along with their identification and listing. Evaluation of at-risk fish species' populations, distribution patterns, and reproductive patterns should also be prioritized since these factors are crucial for both ex situ and in situ conservation actions.

The construction of hatcheries with the aim of reviving natural recruitment and maintaining healthy bloodstock becomes essential in order to lessen the loss of fish biodiversity. Initiatives related to aqua ranching should also be put into place to augment fish populations in their native environments. However, it is crucial to understand that human activities like overfishing; chemical use, agricultural runoff, and pollution are the main causes of the decline in fish biodiversity. Therefore, strict controls and restrictions must be put in place to curtail these activities and maintain the biodiversity of freshwater fish.

It is crucial to compile a thorough and precise database of fish species and their corresponding conservation statuses in order to successfully accomplish these aims. The correct use of this data by governmental and non-governmental groups will be an important tool for safeguarding and preserving the biodiversity of freshwater fish. It is feasible to guarantee the long-term survival and health of fish populations in freshwater environments by employing scientific knowledge, community involvement, and sustainable fishing techniques. As a result, governments, organizations, and people must work together to preserve the variety of fish in freshwater ecosystems, which is a critical goal. We may work toward a healthy and resilient aquatic environment for the benefit of both the current and future generations by addressing the major risks, putting conservation measures into place, and increasing public understanding of the value of fish species.

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