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Conservation strategies for fish biodiversity to maintain healthy ecosystem

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Abstract
Fish is a distinctive aquatic food item that benefits both physical and mental health. Fish serves as a useful diet that contributes to human growth and development as well as the prevention and treatment of many ailments that are linked to modern civilization. High quality protein, fat, carbohydrate, minerals, and vitamins found in fish are all beneficial to human nutrition. The most important requirement for sustainable development is to eradicate hunger and malnutrition. As a result, numerous methods of ensuring food and nutritional security are being investigated. Anthropogenic activities such as urbanization, industrialisation, agriculture, cultural deterioration, and overpopulation have had a particularly negative impact on aquatic habitats. The available data clearly suggests that human populations and damaging activities, including as fishing, are growing at the same time as fish numbers and variety are declining. Thus, this study focused on Conservation strategies for fish biodiversity to maintain healthy ecosystem.

Keywords: Fish conservation, biodiversity, freshwater, overfishing

1. Introduction
According to current estimates, there are over 27,300 species of ichthyofauna in the world, and 300–350 new species are discovered each year (Scott, 2001) [5]. From mountain lakes above 5,000 m in elevation to deep sea depths surpassing 8,000 m, fish can be found wherever there is water of a tolerable integrity. The other 1% of fish are classified as diadromous, regularly alternating between freshwater and marine environments. Of all fish, about 58% reside in the ocean and 41% in freshwater. Given the abundance of watery habitats, the proportion of freshwater species is quite striking. Only 2.5% of the water on Earth is fresh; the majority, 97.5%, is oceanic salt water. However, 99.7% of the freshwater is frozen in glaciers and polar ice caps, stored as groundwater, or trapped in permafrost or soil moisture (Harrison, 1999.) [3] In actuality, the more than 10,250 freshwater fish species (as well as all other animals with a freshwater habitat restriction) only have access to around 0.009% of the total amount of water on Earth. We face competition from other organisms like fish for this finite supply of freshwater.

Fishes both directly and indirectly meet human needs. They give us food, medicine, entertainment, and jobs. Fishes are the only category of vertebrates we still predominantly employ in the wild, and their most evident function is as food. The current level of human reliance on wild fish for food is high, rising, and unsustainable. Additionally, just 1% of this freshwater is found in rivers and 99% of it is found in lakes (Watson, 1996.) [9] Given the greater fish diversity of flowing (lotic) as opposed to lake (lentic) habitats, this difference is all the more pronounced. There is no thorough investigation of the relative richness of the two habitat types, yet there must be a big difference. Another fundamental issue is that the knowledge we have of fish diversity and endangerment is substantially skewed in favour of the developed world. There are still many fish species that are unknown. Since it is unknown how diverse fish actually are, all estimates of the number of threatened species are shrouded in mystery. Various extrapolations from rates of discovery and coverage regions place the total number of fish species at around 31,500. (Berra, 2001) [1].

1.1 Evidence that fishes are declining

The available data clearly suggests that fish variety and abundance are declining at the same time that human populations and harmful activities, including fishing, are increasing. In terms of level of threat, fishes are only second to amphibians among vertebrates. (Maruyama, 1992) [4] According to (Stuart, 2004) [7], 48% of amphibians are in significant decline, and several regional and international estimations of the state of fishes show that their degrees of imperilment are nearing those of amphibians.

1.2 Causes and Trajectory of Extinction

The same reasons that cause fish population decreases initially are also those that cause fish extinction (figure 1.4). In conservation biology lectures, students learn about the so-called HIPPO factors, which include habitat loss, invasive species, pollution, human population expansion and consumption (The root of all evil), and overexploitation.

The main factor in decreases and extinctions of freshwater fish is habitat degradation, which includes disruption of the bottom, removal of structural elements, water withdrawal, hydrologic changes (including impoundments), eutrophication, and sediment deposition.

1.3 Why care about biodiversity, especially of fishes?

Diversity both creates and is dependent upon other forms of diversity. Beyond the general observation that systems with moderate diversity tend to be more durable and resistant than systems with low diversity, diversity per se is not a good predictor of ecosystem integrity or health. The actual species present or absent, as well as how they interact with other species, are more important. The ecological integrity of ecosystems is weakened by extinct species and declining populations of specific species. (Chapin, 2000.) [2] System health, or the ongoing ability to support and maintain naturally operating, adapting assemblages and processes without human intervention, is referred to as integrity.

1.4 Ecosystem Services Provided by Fishes

In many environments, fish are at the top of the food chain. As a result of their feeding behaviour, fish can have an impact on species further down the food chain. On reefs, herbivorous fish keep algae from overgrowing and suffocating coral, which is essential habitat for fish and invertebrates. Urchin explosions, which can deplete reefs of both algae and coral, are prevented by fish that live on the reef and consume urchins. Lake piscivores consume smaller fish that consume zooplankton. Phytoplankton is consumed by zooplankton. When piscivores are gone, lakes begin to bloom with algae, some of which are harmful.

Fish that are zoo-planktivorous and micro- (Stauffer, 1997) [6] carnivorous eat mosquito and biting fly larvae, some of which carry human illnesses. Snails that serve as intermediary hosts for human parasites are consumed by other fish.

Sand and gravel are produced and moved by some fish, making them habitat engineers. Sand is produced by parrotfish as they break down coral and is transported between various reef locations. When creating their nests, salmonids and minnows move the gravel and stones around. This concentration and reorganisation of bottom types improves life conditions for juvenile engineers as well as many other fishes and invertebrates. Despite the fact that fish are not known to pollinate plants, they do help with seed germination and transportation.

2. Conservation strategies for fish biodiversity

A conservation program's principal objective is to preserve genetic variety. Protecting an ecosystem with a broad-based, on-specific, cost-effective, and generally straightforward method will help safeguard the fish genetic resources. It may be directed at all species or at particular ones, such as threatened or endangered ones. There are numerous ways to accomplish this, such as in situ and ex situ techniques.

2.1 In-situ conservation

Fish landraces and their wild relatives can be preserved in-situ in areas with genetic diversity and wild forms. This is achieved by keeping them in good condition within the ecosystem, whether it be one created by humans or nature. The primary benefits of in-situ conservation are

(i) The ability to co-evolve with other forms, giving breeders a dynamic source of resistance that is lost in ex situ conservation, and

(ii) The possibility that natural parks and biosphere reserves may offer less expensive protection for the wild relatives than ex situ measures.

2.2 *Ex-situ* conservation

The imperilled are protected outside of their natural habitats under this protection. The live gene bank, gamete gene bank, and DNA gene bank are the three primary foundations of the ex-situ conservation initiative.

2.3 Genes: The Greatest Indicator and Promoter of Diversity

Although most worries about variety loss are at the species level or higher, conservation efforts must eventually encourage the survival of genetic diversity within species. (Vrijenhoek,. 1989.) [8] In fish, reduced genetic variety within a species lowers egg production, hatching success, survival rate, and population growth, according to ecological theory and observations.

2.4 Conservation aquaculture

Although the possibility of inbreeding in hatchery-bred seed is typically impossible to rule out, conservation aquaculture is becoming more and more important in programmes for the rehabilitation of threatened or endangered fish. It suggests using aquaculture to boost the effective population size (Ne) of threatened species in rehabilitation programmes for fish populations in danger of extinction. The mahaseeer (*Tor putitora*) fry were successfully raised in India as well, growing from 0.20 g to 105 g in around 240 days under pond conditions in the mountainous region of Uttaranchal State.

2.5 Marine Reserve/Protected waters

A marine reserve is a designated area of the sea where fishing is prohibited and other limitations are in place to save habitats, species, and other living things in an effort to preserve biodiversity. In addition to increasing fisheries yields by bolstering the dwindling fish populations, marine reserves can be used for education, recreation, and tourism. Additionally, marine reserves resemble marine protected areas, fisheries reserves, sanctuaries, and parks quite a bit.

2.6 Aquatic Diversity Management Areas (ADMAs)

The establishment of ADMAs is a methodical way to managing watersheds, with the main objective being to safeguard the local aquatic biodiversity. ADMAs range from

small-scale programmes focused on biodiversity to comprehensive legislation protecting specific species. Stopping or significantly reducing any human activity that contributes to habitat deterioration in that area is the best strategy to manage ADMAs effectively.

2.7 Managing Bioregions

The goal of bioregional management is to balance the interests of the local economy, society, and conservation in order to control factors that affect aquatic biodiversity. This includes both modest and substantial biosphere reserves. The majority of biosphere reserves are small in size, heavily emphasise conservation, and include one or more centrally protected habitats as well as adjacent buffer zones. Activities like fishing, hunting, harvesting, and development are strictly prohibited in these bio conservation units.

2.8 Threatened or endangered species designations

Organisms that, if improperly safeguarded, could end up being endangered are considered threatened species. Plants and animals that are in urgent danger of going extinct are considered endangered species and require protection in order to exist. Once a species is "listed," national recovery efforts are required, and it is under international protection. If laws governing threatened and endangered animals are broken, severe monetary fines and even jail terms may result.

2.9 Local watershed organisations

Regardless of their state, rivers and streams frequently go unprotected because they frequently cross multiple political jurisdictions, making it challenging to enforce resource management and conservation. However, in recent years, local watershed groups' efforts to safeguard lakes and isolated watershed sections have made a positive difference.

2.10 Freshwater Projects

The Freshwater Initiative is an initiative started by The Nature Conservancy. The FWI's three strategies-watershed action, water science, and water lessons-are intended to greatly boost freshwater conservation across the nation.

2.11 Expanding Public Awareness

One of the most crucial strategies to preserve aquatic biodiversity is to raise public awareness. Programs for education, rewards, and volunteer monitoring can all be used to achieve this. For instance, the State of Delaware maintains an Adopt-a-Wetland Program intended to raise public awareness of the need of conservation and the value of wetlands.

2.12 Efforts at restoration and mitigation

It is possible to repair aquatic areas that have been harmed, lost habitat, or undergone habitat degradation. Even declining species populations might be the focus of restoration efforts (e.g., Pacific Northwest salmon populations). In riverine environments, several management techniques are being used, such as the creation of riparian buffer zones and the restoration of natural flow patterns and discharge regimes. A lot of wetland ecosystems have recently undergone habitat restoration to make up for losses caused by dredging projects.

2.13 Regulatory Actions

In terms of fish protection, the Indian Fisheries Act of 1897 (as amended in 1956) is a turning point. The Indian Fisheries Act is currently being modified by the ministry of agriculture to include all pertinent legal provisions to maintain fish germplasm resources, in addition to making provisions for and monitoring gears, mesh size, and observance of fishing or restricted seasons. This could involve steps to conserve fisheries, such as NPDES controls on wastewater discharge, or even fishery bans. The best scientific data are gathered in order to create sustainable fisheries, which is mostly accomplished through regulatory actions.

2.14 Live gene repository

The endangered species are raised in captivity, bred there, and genetically managed to prevent domestication, inbreeding depression, and inadvertent selection in a live gene bank, which is a genetic resource centre. In the Mini Germplasm Repository, the NBFGR keeps wild stocks of endangered species such *Notopterus chitala*, *Channa marulius*, *Tor putitora*, Labeo bata, and *L. dyocheilus* and *L. Calbasu*. These repositories are being established simultaneously in various areas. One of them has already been set up in Guwahati for various North-East regions.

3. Conclusion

Therefore, a healthy ecosystem depends on its biodiversity, on the presence of the necessary components, and on those components carrying out their ecologically determined functions. Regardless, fishes deserve to be protected for their value as commodities, for their role in ecosystems, for the information they contain that may or may not be useful to humans, and especially for their intrinsic value as the amazing result of the evolutionary process. In order to protect diversity, one must take into account the ecosystem and the biodiversity that makes up it.

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