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# A Critical Review on Fisheries Dam Impact

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**Abstract:** Both positive and negative effects on aquatic fauna and flora can be caused by barriers in lotic water bodies, which can alter water current, fish patterns, and aquatic diversity. Dams contribute significantly to fish productivity as well as biodiversity development by providing new habitats and niches for their survival and growth in a suitable environment, resulting in economic wealth for the fishing community. With their harmful effects on aquatic ecosystems, dams have a few other downsides. On the other hand, Dams have a tremendous deal of fishery potential and play a vital role in the long-term sustainability of inland fisheries. In addition to bringing economic and social benefits to the entire world, reservoirs and dams on water bodies provide electricity. As a result, the focus of this research is on Indian dam fish diversity and potential and the harm they cause to inland fisheries. We've talked about a few tactics for keeping reservoir productivity high in the long term.

**Keywords:** Dam, water resources, environment, Aquatic ecosystem, ecology, biodiversity, Fisheries.

## Introduction:

One of the essential roles in making effective use of water resources is that played by dams. They were built long before current knowledge of hydrology and hydromechanics was available. There is nothing typical about these structures. The construction of dams to store water and regulate flow patterns has played a significant role in advancing civilization [1]. For centuries, dams have been built for a variety of reasons, including flood prevention, water supply, energy generation, and irrigation, to name a few. In addition to the benefits of managing stream regimes and preventing floods, receiving residential and irrigation water from the stored water & generating energy, dams have a wide range of negative and beneficial environmental effects. In addition to its benefits, including providing society's fundamental needs and raising the level of living, dams pose a significant threat to the lives of living things [2].

Inland fisheries cover a large portion of the country, and dams have the capacity to house a wide variety of inland fish species (Fig 1). According to the United Nations ' medium-growth projection scenario, the world's population has been growing fast since the turn of the twentieth century and will reach 9.7 billion people by 2050. Irrigation, electricity generating, flood control, & industrial water use all benefit from reservoirs, which are man-made lakes formed by storing river water. Other than that, dams are structures built across flowing water to restrict or divert the flow in order to create reservoirs or lakes. The practice of damming rivers for hydroelectric power generation is an age-old one that has been replicated countless times since its inception. Because of the numerous services they provide—including flood control, hydropower

generation, water supply for personal and industrial use, water storage, navigation, fish farming, and recreation—dams have become a necessary component of the nation's basic infrastructure [3]. Another major technical measure in dealing with the water-human interaction is dam development.. The Indian economy correctly referred to these dams as the 'Modern Temples of India'. Tourism and recreation provide significant social and economic benefits and cultural and aesthetic value to visitors from all over the world. More than 45,000 dams with an elevation of more than 15 meters have been built around the world, and around 73% of them were completed in the last 50 years. 2900 BC saw the construction of the world's first known dam, which was built across the River Nile to protect the Egyptian city of Memphis from floods. In China, the Yalong Jiang Dam is the world's highest dam (305 meters), followed by Tehri Dam in India (261.1 meters) on the Bhagirathi River in Uttarakhand. The Hirakud dam in Odisha, India, is the country's longest dam, measuring 26 kilometers in length and erected across the Mahanadi River. Human-made reservoirs with a surface greater than 0.01 mha are thought to exist in 16.7 million locations around the world. Power generation and irrigation are the primary goals of the country's numerous dams, which have been erected all around the country. Currently, the country's total reservoir area is 3.15 million hectares, with small reservoirs occupying 1.49 million hectares, followed by large reservoirs (1.14 million hectares) and medium reservoirs (1.0 million hectares) (0.52 mha). In spite of decades of large-scale groundwater recharge initiatives running in India's water-scarce areas, no meaningful emphasis has been placed on flood risk management. The principal land-to-sea transportation routes for water, nutrients, organic matter, and particulate matter are rivers.

River basin development, particularly dam construction, has an immediate and dramatic impact on ocean stream inputs. This is an important topic. Freshwater fish diversity is threatened by both hydroelectric dam and climate change. A reduction in fossil fuel consumption by shifting energy generation to large dams may reduce global warming, but this will have the unintended consequence of radically altering riverine habitats. However, the global demand for energy and the ongoing search for clean, renewable power has been a topic of interest to countries in both developed and developing countries around the globe.

Even though dams have been controversial for decades because of their negative environmental and social effects, the limited as well as uneven distribution of water on a global scale, has made the world realise that more dams, primarily large dams, are required to promote development and to meet basic human needs. Human involvement in the hydrological cycle is one of the most crucial, and to fulfill future angling demand, fishery biologists must use all available effective strategies to boost the production and capture of reservoir fishes (Fig 2).

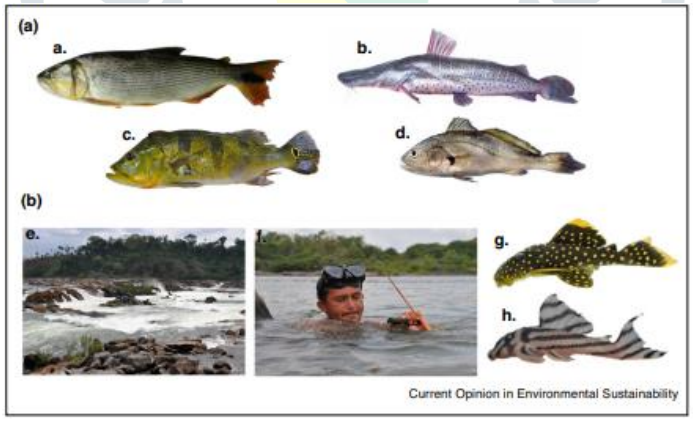


Figure 1: Examples of tropical river fish and habitats that have been impacted by dam construction

**Essential of Dams:**

Dams are mostly used to store water, whereas barricades and other structures like them are employed to control the flow of water into a certain land region. Dams are built to regulate and control the natural flow of water for various purposes, including water supply and irrigation, flood control, hydropower, navigation, recreation, and pollution abatement. Dams are also built to protect fish and wildlife and reduce salinity and sediment and recharge groundwater. As a result of increasing populations and increased economic activity, human demand for water & related services will continue to rise. Changes in population, economics, and technology all have an effect on how much water is needed. Dams, particularly huge ones, are now a must for the world's economic and social progress to continue. Population increase is driving up the need for water, but other factors such as rising energy, food, biofuel prices, and climate change fears are also weighing in.

**How dams affect aquatic ecosystems:**

Decomposing organisms initially boost the nutrient content of the water, but this effect wears off after a few days. BOD (Biological Oxygen Demand) water value increases as a result. An anaerobic breakdown media is performed using stationary layers along the reservoir depth. As a result, the lake will have a terrible odour. As a result of this, a massive increase in phytoplankton populations can be seen. Macroflora also grows on the water's surface in addition to the huge green-dark coloured bodies that blanket the water's surface. The lake's life, as well as the enjoyment of those who go fishing or boating, and even the dam gates & turbine propellers, can be jeopardised by these events. The macroflora that grows here can serve as a breeding ground for pathogens. The increased number of water plants also causes larger evaporation losses than would otherwise be the case due to regular evapotranspiration. Getting from one end of the river to the other might be a challenge for the animals that use it. The dam puts an end to the lives of fish that spend some of their lives in the floodwaters of the spring and others at the point where the river empties into the ocean. We know that certain marine fishes migrate to freshwater & swim up to the springs in order to lay their eggs [4]. Later on, they return to the ocean with a new batch of juvenile fish. The dam's construction will disrupt these creatures' life cycles, resulting in a large number of deaths. By-pass flows have been shown to be specifically intended for this function.


Figure 2: Traditional fishery.

**Dam and reservoir effects on fish biodiversity:**

More than only affecting the flow of water, damming a river has a number of repercussions on the freshwater ecosystem. For example, in the tropics there were considerable losses in both richness and variety as a result of dam construction; in temperate reservoirs, the changes were less pronounced but nonetheless similar; and in boreal reservoirs, there were no changes at all. Large and medium dams obstruct over half of the 397 freshwater ecoregions studied, and an additional 27% are hampered by impediments further downstream [5]. Since freshwater environments are under attack from a wide range of hazards, it is imperative that we fully comprehend these dangers if we are to stop this crisis from worsening. Put another way, by building big dams that are more than 15 metres high, large rivers are transformed into storage reservoirs, which alters the ecology [6]. Species that live in rivers have a variety of migratory routes. Catadromous fish, such as eels, are also included in the anadromous fish family. Anadromous species migrate up rivers to spawn, while catadromous species go the other way around. Other effects on fish (including aquatic mammals) included obstructing migration routes, fragmenting habitats and releasing hypolimnetic cold water from the reservoir, as well as alterations to downstream water flow. The development of dams around the country has severely harmed our native fish species. Deposition of silt as well as other suspended particles occurs as a result of the reservoirs' regular water level variations. There are many examples of dams causing the disappearance of mahseer in the Bhagirathi River.

**Dams harm fish in the following ways:**

The reproductive, juvenile, development and sexual maturation stages of the life cycle of a migratory fish all necessitate distinct habitats. Diadromous creatures spend some of their lives in freshwater and others in saltwater. For example, the Gulam Mahommed Dam on the Indus River has disadvantaged the migratory Hillsa Ilisha of 60% of their previous breeding areas and dam construction on the Columbia River and its main

tributary, the Snake River, resulted in the flooding of most spawning habitat, creating an unnatural environment for fish and aquatic species. Indirectly, the passage via spillways may enhance the vulnerability of disoriented fish or frightened to predation. For macroinvertebrates and fish, channel incisions caused by the outflow from dams can impair ecosystems within channels [7]. This is the most immediate effect of sediment deprivation. The United Nations has issued a dire warning that more than five billion people might face water shortages around the world if India's dams are not reined down. A number of studies have shown that man-made impediments, including power station outputs, residual flow stretches, dams, weirs, and fishways, can delay the upstream migration for many weeks.

**Dams' physiochemical profile:**

If the spillway is closed, the water's oxygen level drops, whereas if it's open, it rises. This physiochemical variation is dependent on the dam's spillway condition. The structure and functioning of a hydroelectric dam can have an impact on the downstream river's water quality. Soil physicochemical factors affect a wide range of processes, including microbiological activity and aquatic breeding, whereas physicochemical water parameters have an impact on domestic life. In addition, damming physically influences the reservoir's water quality, which in turn affects downstream rivers and their related wetlands, causing ecological consequences. Damming influences the reservoir's chemistry, which in turn alters the water's physical and chemical properties, resulting in ecological consequences for nearby rivers and wetlands.

**Dams' impact on the economy and society:**

Most of the people who live near rivers in rural areas of India rely on dams to provide for their basic needs by catching fish and engaging in other leisure fishing activities. A development tool over the past century, large dams have impacted millions of people's daily lives and the nations they've helped shape in terms of the environment, economy, and society. This isn't the only thing that makes dams a crucial part of water conservation [8]. A growing global population means that the water needed to produce electricity and guarantee food security is becoming increasingly competitive. Overall, dam construction in China has positively affected the country's socioeconomic development. One of the best alternatives available to satisfy future increases in freshwater, food, and energy demands, all of which are vital for maintaining economic development, is the construction of further major dams. Furthermore, dams have been a major component in adjusting the geographical and temporal variations in water accessibility, which, if adequately exploited, might provide human beings clean, efficient, reliable, and renewable energy. Dams, for example, have played a critical role in the economic and social development of the United States. Water loss can be minimised through the use of bunds and small dams. Sediment concerns are expected to be alleviated by short-chain building dams. People living in poverty can find work thanks to dams, and the economy in urban and rural areas benefits. According to Book Divine Providence Dam has also played an important role, and it will continue to do so for generations to come. On the contrary, the large dams in Punjab and Haryana have been the driving force behind a chain reaction of economic activity that has led to overall prosperity [9].

**Dams' impact on human life:**

But even if dams are a key development aim, they are not easily acceptable for the people whose agricultural regions, homes, and the environment in which they live are submerged. Despite the fact that an improved habitation space for 80 000 people was made available in another place when Ghana's Volta Lake was established in 1969, the original 100 000 inhabitants have relocated and built their own homes on the lake's coast without permission. A social-psychological failure might be extremely harmful to the biosystems in the region and the reservoir itself. Expropriation of land, hiring of construction employees, and delivery of construction materials on-site by machinery are all examples of changes that occurred before the dam was built. Technicians and experts are brought in from out of town, yet unqualified labour are hired on-site. All settlement areas and social buildings are often created for persons from outside the site. It becomes a sign of progress when more of these facilities are made available to the public. In this way, new settlements improve and give rise to new ecological demands and changes. This is a good thing. Drinking water, residential wastewater, wastewater treatment, and so on are all examples of this. In addition, the social scene is energised, trade flourishes and cultural pursuits take off. The transportation network has seen significant transformations. In this regard, the paths that lie below the surface of the water and the surrounding region are crucial. The new

roads built to ensure that transportation services would not be disrupted have resulted in increased costs and environmental damage.

As a result, dams reduce pollution in the downstream area by reducing the pollution load that originates there because of large reservoirs. In addition, they reduce the pollution burden by storing water in their beds during dry months, which further reduces pollution. Dams lower the risk of flooding downstream by their storage opportunity in their reservoir. It is undeniable that these projects yield actual and potentially significant advantages. The increased power output has accelerated industrial development, leading to improvements in irrigation systems and agricultural production. In the meantime, flood protection is provided by dams for those who live downstream. A dam decision might be made after weighing the advantages and disadvantages of the project for an extended period of time. Dams may no longer be necessary for the future because of their long-term benefits. On the other hand, these massive technical feats should remind us that we cannot alter only a portion of the ecosystem because the ecosystem is made up of many interconnected chains. The entire system can be brought to a grinding halt if even a single link or cog tooth breaks away. As a result, the surroundings should be thoroughly scrutinised during the conceptualization phase. Big risks can be avoided by taking precautions ahead of time to account for even the tiniest, most sensitive responses.

It is critical to reduce the negative environmental effects of dams to achieve sustainable development and the significant benefits they provide in terms of social and environmental well-being.

The environmental impact assessment concept takes into account the aforementioned consequences and their corresponding remedies. For the sake of clarity, the effects of damsa on the ecosystem are not uniform in magnitude or significance. Understanding the interrelationships between these impacts and foreseeing which positive and negative consequences will arise is difficult in advance. Each dam & reservoir should have its own estimate. On either hand, it is erroneous to perceive the repercussions wholly adversely. The most crucial question is who will do the evaluations and from what perspective they will be done.. Is it the fisherman, the industrialists, or the farmer whose land is submerged? No matter who has made the decision or whom the choice will take into the centre, as long as full environmental repercussions are described totally according to its importance level.

**Conclusion:**

However, as the coin mentioned above has two sides, the enormous modern barriers on many water bodies have an extremely severe influence on the aquatic ecology. This is especially true for the aquatic ecosystem's ecosystem. For example, one side of dams that have a positive impact is used to control flooding and irrigation & hydropower generation, while the other side of dams that have an antagonistic effect include the relocation of individuals, changes in suspended sediment flows as well as a disruption to natural environments as well as livelihood.

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