

# Exploring “Jhora Fishery”: A Study from Darjeeling, West Bengal, India

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## Abstract

**Introduction:** The Jhora fishery, a traditional and sustainable fish farming practice prevalent in the Darjeeling region, utilizes the natural streams (Jhoras) flowing from the Himalayan foothills. This work aims to provide a holistic understanding of the evolution and status of Jhora fisheries, elucidating the need for sustainable management strategies to ensure their preservation and resilience. **Methods:** The review compiles data from various sources, including academic journals, government reports, and local case studies. Field observations and interviews with local fishermen were conducted to gain firsthand insights. **Results:** Findings indicate that the Jhora fishery supports a diverse range of fish species, contributing to the region's biodiversity. The practice enhances food security and provides a significant source of income for local communities. Ecologically, Jhora fishery helps maintain water quality and ecosystem balance. However, Jhora fishery is facing a number of challenges due to water pollution, climate change, and modernization. **Conclusion:** Despite facing modern challenges, with proper management and conservation efforts, Jhora fishery can continue to thrive, preserving both the ecological and socio-economic fabric of the region. In a nutshell, Jhora fishery in Darjeeling exemplifies a harmonious relationship between humans and nature, fostering sustainable development. There are challenges that need to be mitigated through policies aimed at enhancing traditional knowledge, improving resource management and reducing other threats to ensure the longevity of this indigenous practice.

**Keywords:** *Darjeeling; Fish Species; Government Initiative; Jhora Fishery*

## Introduction

The region often referred to as the "Queen of the Hills" for its breathtaking beauty and renowned tea culture, Darjeeling is situated in the northern part of West Bengal, India. Nestled at an elevation of 6,700 feet, Darjeeling spans from 27°13'N to 26°27'N latitude and 88°53'E to 87°59'E longitude.

Darjeeling's landscape is adorned with numerous streams, locally known as "Jhora," a term derived from the Nepali language meaning "spring water" and "Jharna" in

Bengali. Jhoras may be of two types: perennial Jhora, which flows throughout the year, and seasonal Jhora, which is dependent on rainfall patterns.

The cold temperate climate and year-round water availability in perennial Jhoras have fostered the cultivation of cold-tolerant exotic carps, colloquially referred to as "Jhora Fishery." This is the first of its kind in India. It is a traditional way of fish culture (Sarma, 2015) and this practice has become a significant source of livelihood for the local communities inhabiting the Darjeeling hills.

Despite its importance, detailed information regarding Jhora fishery in Darjeeling has been scarce. Therefore, a comprehensive study was conducted to provide detailed insights into the Jhora fisheries in the Darjeeling-Kalimpong region of West Bengal. This research involved a thorough analysis of both primary and secondary data. Primary data were gathered through field visits and surveys conducted in the Darjeeling and Kalimpong (Pedong region) areas during the period of 2021-2022.

By delving deeper into the intricacies of Jhora fisheries, this study aims to shed light on this vital aspect of genesis, management and constraints of Jhora fishery. The support delivered by the government is also documented here.

### ***Historical Perspective***

The history of hill stream fisheries in Darjeeling can be traced back to indigenous fishing practices deeply embedded in local cultures and traditions. Early settlers relied on these streams for sustenance, and fishing techniques evolved over generations, reflecting a profound understanding of aquatic ecosystems. Colonial influences introduced modern fishing practices, altering traditional management systems and setting the stage for subsequent changes in Jhora fisheries dynamics. The idea of fish culture in Jhora ponds in the Darjeeling Kalimpong region of West Bengal came into a structured form about 40–50 years ago (Lepcha, Prithwiraj Jha & Sudip Barat, 2003). The initiative was taken by the Department of Fisheries, Govt. of West Bengal and Darjeeling Gorkha Hill Council in around 1981–1986 in the Kalimpong subdivision of Darjeeling district. The Fisheries Department set up nine small ponds, each about 13 sq m, that were fed by perennial springs called Jhora at different altitudes to study fish growth. The economically important fish that could thrive in the cold climatic conditions were selected. Following nine months of proper management, edible fish of good size were obtained from this Jhoras. Encouraged by the success, the fisheries department launched such a fishery on a much larger scale, with 50% subsidy assistance from the government for the beneficiaries. Since then, many Jhora fishery units have been constructed in this area by individuals as well as various fish farmer development agencies.

### **Site selection for Jhora fishery**

Key factors to consider in selecting an ideal site for a Jhora fishpond include topography, water availability, and soil quality. Optimal locations typically feature flat or gently sloping terrain, minimizing the risk of flooding and landslides. In regions like Darjeeling, where perennial hill springs are abundant, setting the pond near one ensures a constant water supply. A running water system is essential for trout culture. It is necessary to arrange alternative water sources during periods of drought. Clay-loamy soil is ideal for such ponds as it minimizes seepage and leakage while maintaining soil fertility. Additionally, for ease of management, it's advantageous to construct the pond near a household or within a vegetable garden, commonly referred to as kitchen ponds. This proximity enhances accessibility and facilitates day-to-day maintenance tasks.

### **Pond Construction**

Jhora ponds come in various shapes and sizes, including oval, round, rectangular or square, with an average area ranging from 15 to 20 square meters. However, to accommodate more extensive fish farming operations, larger ponds are currently under construction. The depth of these ponds usually ranges from 0.8 to 1.0 metres, although variations may occur depending on the cultured species (Jha, Barat & Lepcha, 2003; Jha, Barat & Lepcha, 2004).

The pond depth is very crucial, as extremely deep ponds can result in very low water temperatures, while very shallow ponds make fish more susceptible to predation. Additionally, the bottom of the pond should slope gently towards the outlet, typically at around 0.2%, to ensure proper water circulation and drainage. Both overflow and complete drying are avoided. Usually, bamboo grating or a wire net guard the inlet and outlet to prevent fish from escaping. An ideal Jhora pond needs a slow, continuous flow of water.

### **Types of Jhora ponds**

In Darjeeling Kalimpong region different types of Jhora ponds, each offering distinct characteristics and construction methods are found.

- (i) General/ Normal Pond: These ponds feature muddy embankments surrounding them entirely.
- (ii) Mud Bottom Pond: These ponds have a muddy bottom, while the embankments on all four sides are made of concrete.
- (iii) Cemented Bottom Pond: In these ponds, the bottom is covered with a cement mortar mixture, providing a more solid foundation.

(iv) Total Cemented Pond: This type involves constructing both the bottom and walls (embankments) using materials such as rods, stones, gravel, or bricks.

### ***Fish species selection, stocking management and feeding***

A prudent selection of compatible, fast-growing species is crucial for maximizing fish production. In the Darjeeling Hill area, more than 120 fish species have been documented, some of which thrive in torrential streams and demonstrate remarkable adaptation to clinging to rocks in swift currents. These indigenous and exotic species are chosen for commercial culture in the Jhora based on criteria such as growth performance, maturation, fecundity, and breeding. The commonly selected species include Golden Himalayan Mahasol (*Tor putitora*), Katli (*Neolissochilus hexagonolepis*), Asala (*Schizothorax richardsonii*), Kalabans (*Labeo dero*), goldfish (*Carassius auratus*), Common Carp (*Cyprinus carpio*), Grass Carp (*Ctenopharyngodon idella*), and Silver Carp (*Hypophthalmichthys molitrix*).

However, the cultivation of fish in the Jhora has not been extensively researched, and stocking combinations and densities are often chosen on an ad-hoc basis. Most farmers tend to prefer monoculture when stocking indigenous fish species.

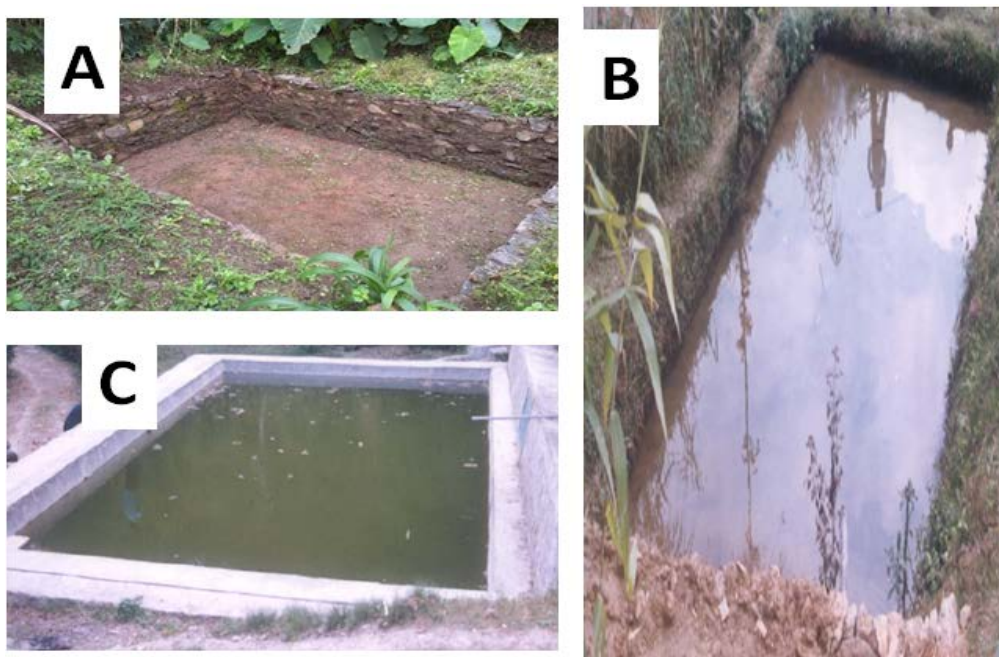
The stocking density is usually about 15000–20000 fingerlings of 6–8 cm per hectare. The cultural period runs from March to October. Low temperatures adversely affect the growth of the fish; hence, stocking times are adjusted in areas with very low temperatures. Common carp and grass carp exhibit much higher growth rates compared to Indian major carps.

In the Jhora fishery, there is a predominant focus on supplementary feeding rather than pond manuring, as commonly practiced in traditional aquaculture setups. This supplementary feeding regime involves the utilization of inexpensive and readily available waste products, such as slaughterhouse waste and grain waste. Additionally, alternative natural feeds like squash leaves, pumpkin leaves, and halhal leaves are used to nourish fish, particularly grass carp.

Recently, the Directorate of Coldwater Fisheries Research (DCFR) has initiated efforts to develop balanced, formulated feeds tailored specifically for cold-water fish species, with a particular emphasis on species like mahseer. This initiative aims to optimize the nutritional content of fish feeds to enhance fish growth and health while minimizing environmental impacts. By formulating feeds that meet the dietary requirements of cold-water fish, the DCFR aims to improve the efficiency and sustainability of Jhora fishery practices in the region.

This shift towards formulated feeds represents a promising step towards enhancing the productivity and profitability of Jhora fishery operations, while also promoting

environmental sustainability. By utilizing balanced feeds, fish farmers can optimize feed utilization efficiency, reduce nutrient waste, and improve overall fish health and growth rates. Additionally, the adoption of formulated feeds may help to mitigate the reliance on unconventional feed sources, thereby addressing concerns related to food safety and environmental contamination. Overall, the development and adoption of balanced, formulated feeds signify a positive advancement towards enhancing the sustainability and productivity of Jhora fishery practices in the region.



**Figure 1:** Jhora ponds. A: Normal Jhora pond without water. B. Normal Jhora pond with water, C: concrete Jhora pond

***Socioeconomic Importance:***

The Jhora fishery serves as a cornerstone of the socioeconomic landscape in Darjeeling's rural areas, deeply intertwined with the lives and livelihoods of local communities. Fishing in Jhoras represents a vital source of both protein and income for many households, particularly in remote and economically marginalized areas of Darjeeling. With limited access to alternative livelihood opportunities, residents often rely on the fishery as a primary means of sustenance and financial support. Fishermen rely on Jhora streams for food security, income generation, and cultural practices, reinforcing the integral connection between fisheries and community well-being. Moreover, the trade of indigenous fish species contributes to local economies and tourism, highlighting the economic value of Jhora fisheries.

**Table 1:** Commonly cultured fishes in Jhora fishery

| <b>Common name</b> | <b>Scientific name</b>                  |
|--------------------|---|
| bhitti             | <i>Danio aequipinnatus</i>              |
| katli              | <i>Acrossocheilus hexagonolepis</i>     |
| titay              | <i>Balitora brucei</i>                  |
| takataka           | <i>Barilius barna</i>                   |
| khasaray           | <i>Barilius bendelinsis bendelinsis</i> |
| lohari             | <i>Crossocheilus latius</i>             |
| grass carp         | <i>Ctenopharynsodon idella</i>          |
| Nak katwa          | <i>Garra gotyla</i>                     |
| kaabray            | <i>Glypothorax pentinopterus</i>        |
| Silver carp        | <i>Hypophthalmichthys molitrix</i>      |
| gurdi              | <i>Labeo dero</i>                       |
| utta               | <i>Labeo pangusia</i>                   |
| asala              | <i>Schizothorax richardsonii</i>        |
| shar               | <i>Tor putitora</i>                     |
| shar               | <i>Tor tor</i>                          |
| bam                | <i>Anguilla bengalensis</i>             |
| gooch              | <i>Bagarius bagarius</i>                |
| faketa             | <i>Barilius bendelinsis</i>             |
| chaley             | <i>Barilius vagra</i>                   |
| hilay              | <i>Channa garha</i>                     |
| kalkapur           | <i>Clupisoma montana</i>                |
| common carp        | <i>Cyprinus carpio</i>                  |
| budhuna            | <i>Garra lamta</i>                      |

### **Constrains of Jhora fishery in Darjeeling kalimpong region:**

Since 1981, Jhora fish farming has played a vital role in fostering economic opportunities for the economically disadvantaged community in Darjeeling's hilly terrain (Thapa *et al.*, 2021). However, various challenges, as outlined below, have hindered its efficacy.

### **Technical and Infrastructural Challenges**

The primary obstacles encountered by Jhora farmers in the Darjeeling region include a lack of access to quality feed and seeds. Insufficient hatcheries in the area compel farmers to procure fish seeds from neighbouring districts like Jalpaiguri. A similar finding was previously reported, stating that limited or non-availability of good seed is the top infrastructural constraint in Meghalaya (Das, 2018; Niangti *et al.*, 2020).

Additionally, farmers lack modern knowledge and techniques in fish farming, leading to issues such as water seepage, maintenance difficulties, and high mortality rates. Transportation challenges, inadequate marketing facilities, and an erratic power supply further exacerbate infrastructural constraints. Despite these hurdles, the Fisheries Department of the West Bengal Government has initiated efforts to provide technical guidance and ensure the availability of feed and seeds to farmers (Thapa *et al.*, 2023)

### ***Environmental Constraints***

Predation by birds, snakes, and other animals poses a significant threat to small fish in Jhora ponds. (Thapa *et al.*, 2023) Although measures like leaf netting have been employed to mitigate this issue, natural disasters such as frequent landslides during the monsoon and pollution from waste dumping near Jhora exacerbate environmental constraints.

### ***Economic Challenges***

Jhora farmers face significant economic hurdles, including a lack of self-financing, high initial investments, and limited financial support. The high costs of feed (Mishra *et al.*, 2022) and seeds add to the financial burden for poor farmers in different parts of West Bengal, including Darjeeling. Subsidies, primarily accessible to Scheduled Tribe category farmers under the Tribal Sub-Plan, have left other farmers deprived of financial assistance (Thapa *et al.*, 2023). However, the government now extends aid in the form of fingerlings and fish feed to alleviate economic constraints. Along with this, as previously also reported (Rahaman, Bera & Ananth, 2013; Das *et al.*, 2018) had reported theft/poaching as the most important constraint of fish production in West Bengal and Assam., theft/poaching is a big constrain in fish farming in West Bengal and Assam.

### ***Government initiatives and support***

Since the inception of Jhora fisheries, which significantly aid protein consumption among the economically disadvantaged communities in the hills, the Government of West Bengal has spearheaded efforts to promote Jhora fisheries practices across the Darjeeling Himalayan region. The Jhora fishery, unique to the cold-water hilly terrain, stands as a pioneering endeavour in India's fisheries landscape. The Jhora fishery had developed significantly from 1996 to 2013 (Ghosh, Mohapatra & Roy, 2017)

Under the West Bengal Accelerated Development of Minor Irrigation (ADMI) project of 2018, the state government identified and supported over 500 financially vulnerable locals by constructing tanks and supplying them with 150 fingerlings of tilapia, common carp, grass carp, and rohu. However, due to the inability of certain species, like tilapia and rohu, to adapt to the extreme cold, this initiative faced setbacks.

In response, a novel approach termed the 'Kalimpong model' emerged to mitigate fish mortality in jhora farming. This model involved the construction of poly tank-houses made of iron bars and blue polythene sheets, housing PVC tanks within. While cemented tanks developed cracks over time, the polyhouse tanks proved resilient.

The Department of Fisheries, Aquaculture, Aquatic Resources, and Fishing Harbour, Government of West Bengal, now extends support in terms of providing fingerlings and fish feed. Furthermore, the Government of India has integrated the Jhora fisheries of the hill districts of West Bengal into the Blue Revolution scheme (2016) under the Central Sector Scheme on integrated development and management of fisheries, which is now part of the larger framework for fisheries development under PMMSY.

As per the West Bengal Inland Fisheries Policy of 2023, issued by the Government of West Bengal, initiatives have been outlined to enhance cold water pisciculture in the hilly regions of Darjeeling and Kalimpong districts.

One of the key strategies involves the utilization of existing natural ponds known as "Jhoras," which have inlets and outlets, for cold water pisciculture. The government has pledged to provide 40 percent of financial assistance to support this endeavour.

Furthermore, the promotion of re-circulatory Aquaculture Systems (RAS) is prioritized, with progressive farmers being encouraged to adopt this advanced aquaculture technique. The government is committed to helping up to 40 percent to facilitate the implementation of RAS among interested farmers.

Additionally, the policy emphasizes the establishment of hapa, which are small rearing or grow-out ponds, for the purpose of raising fingerlings for table fish. Financial aid of up to 40 percent will be provided to support the construction of such hapas and the associated activities.

These initiatives underscore the government's commitment to promoting sustainable aquaculture practices and supporting the development of the fisheries sector in the hilly regions of Darjeeling and Kalimpong.

## **Conclusion**

In this work, information regarding the history of the Jhora fishery, its management and feeding, constraints and government initiatives has been discussed in detail. In conclusion, Jhora fisheries in Darjeeling represent invaluable natural resources that require careful stewardship and sustainable management to safeguard their ecological integrity and socio-economic contributions. By acknowledging the historical legacy and socio-economic significance of Jhora fisheries, stakeholders can work together to address existing challenges and chart a path towards a more sustainable and resilient future.



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