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## Overview of Coldwater Fisheries in India

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### Abstract

Unique biogeographical, climatic, and hydrological setting, the Himalayan region is regarded as the “Water Tower of Asia” or the world’s third pole. Technology developed for the culture, breeding, and management of economically viable cold-water fish species has a favourable impact on the production and productivity, as well as the creation of jobs and the long-term management of aquatic resources and their aquatic fauna. In India, the DCFR is solely responsible for coldwater fisheries. Coldwater fisheries and their production are under threat by human activities and climate change.

### Introduction

Coldwater fisheries are those that take place in water with a temperature ranging from 5 to 25 °C. Even in the summer, the water temperature in Coldwater fisheries should not exceed 25 °C. In India, such conditions can be found in the Himalayan and peninsular regions. In temperate regions, upland water at high altitudes of mountains and spring water at low altitudes remain cooler than the rest, allowing Coldwater fish to thrive. The Himalayan region and the Deccan plateau region of peninsular India are rich in such water features, which include numerous hill streams, rapids, pools, lakes, and reservoirs. These are either fed by snowmelt and springs in the north or rainwater in the Deccan plateau. Since the production from Coldwater is negligible in relation to overall inland catch, there has been increased recognition in recent years for the development of Coldwater fisheries in India. Brown trout have been transplanted to the upland waterways of Jammu, Kashmir, Kullu, Simla, Kangra, Nainital, Shilong, and Arunachal from a trout hatchery established in Kashmir. Other hatcheries have been built in the Nilgiris and Kerala.

### ICAR - Directorate of Coldwater Fisheries in India (DCRF, 2022)

Coldwater fisheries hold a lot of promise for generating rural income and guaranteeing food security for those in the Indian uplands who are economically disadvantaged. The Indian Council of Agricultural Research began working in the coldwater fisheries sector in the late 1960’s to make the most of the available resources and opportunities, culminating in the establishment of the National Research Center on Coldwater Fisheries as an independent Research Center on September 24, 1987, during the VII Five Year Plan.

This is the country’s only national centre dedicated to research into catches and cultures, with a focus on foreign and native coldwater fish species. Since its inception, the NRCCWF has made significant contributions to the proper assessment

of coldwater fisheries resources and the development of appropriate technology for propagating major coldwater fish species in the highlands, despite manpower and infrastructure constraints. A Directorate of Coldwater Fisheries Research (DCFR) was established during the XI plan to develop location, situation, and system specific technologies by utilising and augmenting resources in all Himalayan states from Jammu and Kashmir to Arunachal Pradesh, in light of the NRCCWF's ever-expanding activities and the greater potential of coldwater fisheries in various Himalayan states. By distributing a plethora of great research in the production of sustainable coldwater fisheries and their conservation, the DCFR is on its way to effectively realising its objective.

## Indigenous Coldwater Fishes of India (TNAU Agritech Portal, 2022)

**M**ahaseer, Snow trout, and Indian hill trout are the most common cold-water fish species found in India's Himalayan streams. Mahaseer cold-water fishing: It is one of the Himalayan's most popular game fish. However, it has not attracted much attention in India as an exotic fish. It can be found in vast quantities and in large sizes in alpine streams and rivers. The following are some of the most important mahaseer species:

### *Tor tor*

**I**t has a head that is shorter than the depth of the body. It grows to a length of 1.5 metres and can be found along the Himalayan foothills from Kashmir to Assam, as well as in the Narmada and Tapti rivers. In its juvenile stage, it is insectivorous, but as an adult, it becomes herbivorous. From July to December, it enjoys a long breeding season. Batches of eggs are deposited. It includes the Narmada and Tapti rivers' significant fisheries.

### *Tor putitora*

**T**he Himalayan Mahaseer is sometimes known as golden or common Mahaseer. It has a head that is longer than the body's depth. It may be found throughout the Himalayas from Kashmir to Darjeeling. This fish breeds three times a year, first in the winter (January to February), then in the summer (May-June), and finally in the fall (August-September).

### *Tor mosal*

**M**osal Mahaseer has head more or less equal to the depth of the body. It is found in the Mountain Rivers on foot hills of Himalayas, Kashmir, Assam and Sikkim.

### *Tor mosal mahanadicus*

**I**t resembles the mosal mahaseer in all aspects except, it is found in the river Mahanadi and that its head having small eyes is often higher than the depth of the body.

### *Tor khudree*

**I**t is characterized by its head being as long as the depth of the body. It is found in Orissa and throughout peninsular India. It attains a length of about 1.3 m.

### *Acrossocheilus hexagonolepis*

**I**t's also known as copper Mahaseer or chocolate Mahaseer. It has an oblong, compressed body with a large, obtusely rounded mouth. The body has a deep bluish grey colour with darker fins. Upper India, Assam, and the Cauvery River in Tamil Nadu are the most common. It reaches a length of more than 60 cm. It varies from Tort or in that its scales are hexagonal in shape and it has narrow lips.

### *Snow trouts*

**S**now trouts are chiefly represented by two genera, namely *Scizothorax* and *Schizothoraichthys*.

### *Schizothoraichthys*

**I**n the Himalayas, it is represented by three species: *S. richadsonii*, *S. Plagistomus*, and *S. molesworthi*. Snow-fed streams can be found in Assam, the eastern Himalayas, Sikkim, Nepal, and Kashmir. *S. esocinus*, *S. progastus*, and *S. kumaonensis* are the genera' representatives; *S. esocinus* is found in Kashmir and Ladhak, *S. progastus* in the Ganges' hill streams at Hardwar and Darjeeling, and *S. kumaonensis* in Nainital.

### *The Indian Hill Trout*

**B**erilius is known as Indian hill trout. It is represented by four species, namely *B. bendelisis*, *B. bola*, *B. vagra* and *B. gatensis*.

### *Exotic Coldwater Fishes*

**T**he exotic fishes found in the hill streams of India chiefly include the trouts, mirror carps, crucian carps and tenches.

## Trouts

**E**xotic trouts in India are represented by three species, two of them belonging to genera *Salmo* and one to *Onchorhynchus*.

### *(a) Salmo gairdneri gairdneri*

**I**t is a native of North American Pacific water and was transported to India in 1907. It is also known as rainbow trout or steelhead trout. These are currently one of the most successful trouts in Indian waterways for cultural purposes, as they adapt more easily than brown trout. Furthermore, they quickly consume artificial food and can survive extreme temperatures and oxygen-depleted water. They have a shorter incubation period and a faster pace of development and growth. They reach a length of 400-500 mm and a weight of roughly 5.5 kg in three years if they are well nourished. The body is elongated, with a short head and

a small mouth. The colour of the body varies according to sex and environmental factors. It is mostly a river fish, but it is also cultivated in confined water. It does not reproduce in ponds, but it can be artificially fertilised. The fry eat mostly planktons, although the half-grown and adults eat meat. It's also a game fish.

**(b) *Salmo trutta fario***

**B**rown trout is the common name for this species. It is a native of Central and Western Europe's mountain water. This was India's first artificially created and grown fish. Despite being brought to mountain waters from all hills, it was only able to establish itself in Kashmir's streams and fields, as well as Punjab's river basins. At the bottom, it feeds on crabs and huge live prey. It grows to a maximum length of around 46.5 cm, depending on the availability of natural food. During the breeding season, the fish moves upstream to spawn on gravel-bedded shallows in fast-moving water.

### **Challenge Due to Climate Change (Singh, A.K., 2015)**

**C**limate change is an international phenomena. It refers to any substantial shift in climate, such as temperature and rainfall patterns, over a long period of time, such as decades or more, as a result of both natural and manmade forces. As the temperature of the atmosphere rises as a result of global warming, the zero temperature line (snow line) will continue to travel upwards. Climate change has an influence on coldwater resources and fisheries by influencing stream flow regimes, phenological fluctuations, the food chain, micro habitats, and overall productivity. The pristine feeding and breeding sites of native coldwater fish species, as well as their population, maturity state, spawning, and other essential life cycle phenomena, will be negatively impacted by the changing eco-climatic circumstances.

### **Management Strategies (Singh, A.K., 2019)**

**I**t's necessary to establish a management strategy to conserve, enhance, and restore river/ reservoir fisheries habitats that support cold-water fish communities, as well as critical habitat components including the riparian zone and vegetation. Minimum winter pool depths, Wetland

habitats, High dissolved oxygen concentrations, Groundwater discharges, Coldwater spawning and nursery habitats offered by tributary streams are all part of a water level management plan to protect spawning and nursery habitats. Reservoir management strategies should also take into account the requirement to safeguard cold-water stream ecosystems downstream of reservoirs (e.g., the need to maintain bottom-discharge structures on dams).

### **Conclusion**

**T**he aquatic resources in the hills are extremely valuable for the development of fisheries for food, sport, recreation, and employment, but they must be managed scientifically in order to fulfil the goals. In order to manage these ecosystems, adequate strategic plans and actions must be implemented so that hill aquatic resources and aquaculture activities can contribute significantly to fisheries and aquaculture in remote hilly regions on a long-term basis. Mountain fish resources and their promotion for better aquaculture and fisheries are extremely important in the national context, which has resulted in a variety of technological approaches and support services. Such resources, as well as our efforts to promote them, must be effectively exploited on a long-term basis in order to increase fish output. Such resources, as well as our efforts to promote them, must be effectively utilised on a long-term basis in order to boost fish production for the national basket and rural upliftment in the hills. However, increasing anthropogenic demand, changing stream flow regimes, and climate change are wreaking havoc on cold-water resources and fisheries, resulting in lower overall productivity.

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