



An Overview of Fisheries Business in Pithoragarh District of Uttarakhand

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Abstract: The potential cold areas in Uttarakhand include the long stretch of Himalayas. These regions boast a variety of coldwater resources, including upland streams, rivers, and lakes at both high and low altitudes, as well as natural and manmade reservoirs. The high-altitude areas are home to a rich diversity of native and exotic coldwater fish species in their mountain waters, offering great potential for aquaculture and capture fisheries. This paper deals with information on the production of fishery resources and economic aspects of fishing activity and raises the need for a management approach that should be robust with uncertainties, suitable for multi-species fisheries, and meet ecosystem objectives. This paper also emphasizes the district-wise fish diversity, Cost price/ profitable challenges, profit margin marketing channel, altitudinal variations in fish distribution and Diversity in culture fishery. Mountain fish resource bases are essential and their development has become a national concern, necessitating a particular technological approach and support services. Such areas must be explored to improve fish output for the national basket and rural development in the hills. The accessible aquatic resources are precious for developing fisheries for both food and sport, but scientific management of these resources is required to fulfill the goals.

Keywords - Cost price, profitable challenges, marketing channel, fisheries, coldwater resources.

I. INTRODUCTION

Fishing is a complex and ancient practice that belongs to the primary sector, dating back 60,000 years. Much like hunting, it originally served as a means for human survival. Fishing goes beyond merely catching and consuming fish; it offers a profound understanding of human life and our connection to nature (Stedman, 2003). In essence, fishing encompasses all facets of civilization (Khakzad, 2016). It imparts knowledge, skills, and techniques that are passed down through generations. The fishing industry has three main branches i.e., commercial, professional, and amateur or recreational fishing (Ransley, 2011). Aquaculture, an integral component of the fishing industry, plays a significant role in enhancing global food security and reducing poverty. It supplies freshwater fish, which, although often low in market value, provide essential nutrition and variety to diets worldwide. Freshwater fish farming creates diverse livelihood opportunities for several people, many of whom live below the poverty level, in the form of farmers, operators, employees, traders, intermediaries, day labourers and transporters (Ahmed and Rahman, 2004). Pond fish farming has proved more profitable than crop cultivation (Islam, 2002).

Since 2008, Pithoragarh has experienced a dramatic increase in aquaculture production. Over ten years, aquaculture production increased from 2008 to 2018. The achievements in aquaculture have drawn the interest of the private sector, which bodes well for the future advancement of this industry. The Pradhan Mantri Matsya Sampada Yojana recognizes aquaculture as a promising avenue to drive Uttarakhand's economic growth. Pond fish farming in Pithoragarh is a rich canvas for developing these specialized forms of hill aquaculture. This integrated approach not only diversifies income sources for rural communities but also promotes sustainable and responsible aquaculture, contributing to the overall socioeconomic development of Uttarakhand.

II. WATER RESOURCES OF KUMAUN REGION

The Kumaun lakes-Nainital, Bhimtal, Naukuchiatal, Sattal, Khurpatal, Garurtal and Shymlatal are more extensive than 4.0 hac. Many small lakes in the area are less than 4.0 ha and do not harbour any significant fishery. Six reservoirs are in the Tarai region of Kumaun in the district of Udham Singh Nagar. The total area of these reservoirs is approx 14120 ha. The average temperature of these reservoirs always remains above 20°C, hence suitable for harboring all tropical fish. The essential reservoirs in the Tarai region of Kumaun are Tumaria, Nanaksagar, Baur Bagul, Dhaura and Haripura (Table 2.1)

Table 2.1: Approximate area and stream length of fishery resources in Kumaun

S. No	Resource	Area/stream length	Number
1.	Rivers/streams	1090 km.	Eight major river + many rivulets & stream
2.	Lakes	225.0 hac.	Six longer lakes +smaller lakes
3.	Reservoirs	14120 hac.	Six Tarai reservoirs

4.	Ponds	465 hac.	1350 Nos (ponds + tanks)
5.	Farms/hatcheries	17 hac	11 Nos.
Source: Vass 2002; Field survey during 2021-2023			

The essential reservoirs in the Tarai region of Kumaun are Tumaria, Nanaksagar, Baur Bagul, Dhaura and Haripura of these reservoirs, the first two are large reservoirs and others are of small size varying from 1200 to 2600 ha (Nayak, 2014). There is approximately 1350 number of small and medium-sized ponds in the Kumaun region with a covered area of approximately 465 ha these ponds usually range from 100 sq. m to 500 sq. m in the hills and 400 to 1000 sq. m in Tarai, used to culture the carp fish. In the Kumaun region, there are 11 hatcheries/fish farms, most of which are used for seed production of carp fishes (Kumar, 2002). The trout, a famous exotic game fish, is cultured at the Chirapani farm in the Champawat district of the Kumaun region, while mahseer culture is in Bhimtal and Pantnagar. Besides the fish farms/hatcheries of the state government, NRC on Cold water fisheries, Bhimtal, Pantnagar University, and six fish farms of the private sector at Udham Singh Nagar also produce fish seed. Besides the lakes, rivers and reservoirs, a few tanks, barrages and river pools are also available in Kumaun for fisheries. Among these, Naldamyanti Tal in district Nainital and Baijnath pool in river Gomti in district Bageshwar are good mahseer fishery resources (Kumar, 2006).

III. REVIEW OF LITERATURE

Meah, M. M., and Akther, K. R. (2001) highlight that aquaculture is a remunerative and rising sector in income generation. The farmers in the Muhuri Project area have practised many patterns of aquaculture systems. Among them, carp-tilapia polyculture is primarily dominant. Fish production and financial benefits in carp-tilapia polyculture were higher. The present findings reveal that the carp-tilapia polyculture system is a more suitable and profitable culture system.

Verma, R. (2013) study asserts that the Pithoragarh region of Uttarakhand has rich and diversified aquatic resources in the form of glacial rivers, spring-fed streams, natural lakes, manmade reservoirs, barrages, small and medium-sized ponds, fish farms and hatcheries. These aquatic resources are broadly divided into capture and culture fisheries resources.

Robert, B. D., Stephen, M. H., and Anderson, D. K. (2011) studied rivers, streams and lakes are included under the capture fisheries, whereas the culture fishery mainly is exercised in the ponds, fish farms and hatcheries. Improving the utilization of these water resources for angling and recreational opportunities can generate income for the livelihoods of hill people.

Kumar, B. G., Salim, S. S. and Katiha, P. (2014) Highlight that Pithoragarh has rich and diversified aquatic resources in the form of glacial rivers, spring-fed streams, natural lakes, manmade reservoirs, barrages, small and medium-sized ponds, fish farms and hatcheries. These aquatic resources are broadly divided into capture and culture fisheries resources. The rivers, streams, and lakes are included under the capture fisheries, where the culture fishery is mainly exercised in the ponds, fish farms, and hatcheries.

IV. IMPORTANCE OF FISHERIES BUSINESS

4.1 Fisheries industrial role play in economy of the places

It plays an essential role in the socioeconomic life of thousands of people directly or indirectly involved, as it provides employment and income to millions of rural farmers. The expansion of fish production and the progress of the fishery sector's economy and infrastructure rely heavily on the effectiveness of a well-functioning fish marketing system (Hall, 2021). Rural India is one of the fastest-growing big markets in the world. Today, rural India accounts for more than 50% of India's gross domestic product (GDP). Rural India is growing about 14% for fast moving consumer goods (FMCG) compared with 8% from urban India. The companies are quickly going to rural India because 80% of our villages are connected by roads, meaning more than 90% of the rural population is connected by road, and more than 95% of rural wealth is accessible. Not only roads but also the literacy rate is increasing very fast; already, 70% of rural India has become literate due to literacy, more opportunities for better jobs and higher incomes.

4.2 Generate employment

The growth of fish production and development of the fishery sector in terms of economy and infrastructure is highly dependent on an efficient fish marketing system (Chourey, 2014). The fisheries sector includes production and sale of inputs, fishing, fish farming, processing, and marketing and distribution. These may be informal, small-scale, or highly organized industrial operations. Fisheries contribute to the gross value added of the agriculture sector and employ people directly.

4.3 Scarce resources utilized

Pithoragarh district has vast fisheries resources, including open and closed water bodies and significant pond fish production constraints. The higher growth in fish supply for the species used in the domestic market would benefit the commoner as these fish species will be available at cheaper prices in the future. In export-oriented fish species, the rise in supply will not cut down the price in the domestic market substantially, and the price will keep rising, which would benefit the producer.

4.4 Those were unutilized due to encroachments of wild animals

Fish farming has been proven profitable and attractive compared to cash crop cultivation. Therefore, many farmers are converting their fields into fish culture ponds with government subsidies. Many people have improved their socioeconomic conditions by farming fish in the district of Pithoragarh.

4.5 Family businesses

Most farmers have other jobs in agriculture, livestock, business, the Indian army, and other government services. The farmers at the Pithoragarh blocks area were observed conducting fish culture commercially on a very small scale, especially in

rural areas. The higher involvement of old and retired people in fish farming indicates that the young are moving to other occupations. A few young people opted for the fisheries business.

4.6 Individual incomes

Most of the homes we visited had at least one soldier in the family, enabling them to maintain a respectable quality of living thanks to the government pensions. We saw that the primary source of income for many households was pensions. The majority of homes had access to banks. NREGA disbursement accounts comprised 70% of these accounts, with voluntarily opened savings accounts making up the minority. Private players can enter the savings market since the area's living level suggests that considerable funds can be mobilized. Currently, villagers spend their money on jewellery and their homes. Nearly all families had younger members who had left the area for better employment. The younger members were sending money home via the postal service or through friends. We advise investigating the villagers' desire for effective remittance services.

4.7 Standard of living, infrastructure liter

The second-fastest developing state of India is Uttarakhand. From Financial Year (FY) 2006 through FY 2012, its gross state domestic product (GSDP) consumption (at constant prices) more than doubled, from 24,786 crores to 60,898 crores. The GSDP increased by 13.7% compound annual growth rate (CAGR) between FY 2005 and FY 2012. The service sector contributed over 50% of Uttarakhand's GSDP in FY 2012. Uttarakhand has a per capita income of \$103k (FY 2013), greater than the national average of \$74,920. (FY2013). The Reserve Bank of India (RBI) estimates that from April 2000 to October 2009, the state earned \$46.7 million in foreign direct investment (The Indian Express, 2015). The state's per capita earnings are Rs. 15,186 (US\$337). Living in poverty makes up 36.4% of the state's population. The poverty rate varies significantly from district to district, reaching as high as 68.5% in the Uttarakhand district and as low as 17.6% in The Haridwar district. Uttarakhand has established various programs to help people become more autonomous, socially and economically powerful. The main programs are the Swarna Jayanti Gram Swarozgar Yojana, joint forest management (JFM), Swashakti Project, and Swayamsiddha Program. Self-help groups (SHGs) and village forest management committees (VFMCs), which act as a conduit to facilitate micro-financing and management of the economic activities leading to the effective transmission of the benefits of macroeconomic reforms, are two community-based organizations that are critical to the success of these programs. Externally funded initiatives, including the Swajal (4%), Swashakti (5%), and Uttarakhand Diversified Agriculture Support Project (6.67%), have helped increase the number of SHGs (Devi, 2007).

V. PRODUCTION OF FISHERIES IN KUMAUN REGION

Farming in the hills is a curse owing to the fear of wild animals, but the residents of Pithoragarh Dungri village have chosen a new method of fish production instead of farming. In 2019, the locals began producing fish. In the last four years, 72 families have begun to produce fish. The people have also constructed around 200 Ponds for fish farming. In four years, fish production has altered the landscape of this community to the extent that every family now earns 4 to 5 lakh rupees per year. Villagers produce more than 100 quintals of fish per year. Dungri produces everything from grass carp to silver and common carp. Not only that but Chinese fish are also grown here, in addition to American Rainbow Trout. The government has also designated Dungri as an ideal fishing hamlet in Uttarakhand to chart a new course in fisheries.

The annual yield from Sardasagar reservoir is about 15 kg/ha. The average yield from all the reservoirs in the Terai region is approximately 35 kg/ha/year, surpassing the national average yield of reservoirs, which typically ranges from 10 to 15 kg/ha. However, economically important fishes like carp and catfishes constitute less than 10% of the total yield from the reservoirs of the Terai region of Kumaun (Kumar 2002).

VI. FISH SPECIES IN UTTARAKHAND

However, the lakes of lesser Himalayas in Kumaun hills support commercial fishery of Chinese carps, Indian major carps, Schizothoracids and Mahseers. All the reservoirs have congenial water qualities supportive to the tropical fishery of Indian major carps, medium carps, Chinese carps and catfish like Wallago sp., Mystus sp., Channa sp. etc. There are 49 species in reservoirs of the Terai region Kumaun. In these reservoirs, the dominant species are Labeo gonius, L. calbasu, Gadusia chapra, Wallago attu, Mystus spp., Channa spp., Oxygaster spp., Puntius spp., Chela spp., Nandus nandus, Mastacembelus. All the reservoirs have a large number of weed fishes such as Gadusia chapra, Puntius spp., Chela laubuca, Chela bacaila, Amblypharyngodon mola, Esomus danricus, Chanda nama, C. ranga and Xenetodon cancila. These weed fishes constitute 75-80% of the total fish yield. Due to the abundance of these trash fishes, several carnivorous species, Wallago attu, Mystus spp., Channa spp., and Mastacembelus spp., thrive in the reservoirs and form more than 10% of the total yield. Some major carp have been introduced into these reservoirs. These are Labeo rohita, Catla catla, Cyprinus carpio and Cirrhinus mrigala to augment fish production (Uniyal, 2021).

VII. FISH SPECIES IN KUMAUN REGION

The Chinese carp and Indian carp mainly dominate the culture fishery in Kumaun in the foothills and lower Himalayan ponds, while in the upper Himalayan region, where the temperature is relatively low, the culture of exotic carp and trout is in practice. The mahseer culture is being done at Bhimtal and Pantnagar fish farms, as well as other carp. In trout culture, two exotic species, brown trout (*Salmo trutta fario*) and rainbow trout (*Oncorhynchus mykiss*) are practised only at Chirapani fish farm in Kumaun.

VIII. FISH SPECIES IN PITHORAGARH

In Pithoragarh, the primary production is Indian carp. Some of the ponds in sub-tropical areas of this area are used for growing snow-trout and mahseer fishes. The culture of Schizothorax sp. is beginning and is being attempted by a few fish farmers in the Pithoragarh district (Verma, 2013). Besides growing brooders, fish seed is produced and distributed by the farms/hatcheries.

IX. FISH FEED

In the study area, farmers were found to use organic fertilizers (compost, cow dung and chicken manure). Fertiliser application is very important for increasing natural food (phytoplankton, zooplankton, and benthic organisms) to augment fish production. Some government organizations provide farmers with fish feed.

X. POND MAINTENANCE

Different pond construction prices (2 lakhs to 20 lakhs, according to size) were found in the study area. The 40000 money spend on maintenance and other expenses. The expenditure on manpower was 15000.

XI. COST PRICE/PROFITABLE CHALLENGES

No pricing policy is fixed by the government and trade associations in the Kumaun region. Different methods, such as open auction and bargaining, set prices. Open auctions are often conducted only in the wholesale market. The price is settled by competition among participating bidders. In the buyer's presence, the bids are loudly announced. The present survey found that auctioneers usually charged 2 to 4% of the sale price from wholesalers. The prices of edible species varied occasionally and fluctuated due to availability in different seasons, as depicted in Table 11.1.

Table 11.1: Price of different edible fish species in Pithoragarh fish markets

S.No	Fish species	Price of fish/kg
1	Labeo rohita	180-220
2	Catla catla	175-190
3	Clarias batracus	120-160
4	Chitala chitala	200-240
5	Hypophthalmichthys molitrix	140-170
6	Tor tor	200-250
7	Wallago attu	140-160
8	Ompak pabda	190-220
9	Channa striata	240-260
10	Carassius auratus	180-220
11	Bangarius yarreli	300-350
12	Mystus tenga	160-190
13	Solea solea	800-850
14	Hilsa ilisha	500-560
15	Pampus argenteus	800-840
Source field survey 2023; Abdurrahman, 2017		

The captured fish are kept in crushed ice thermocoal boxes (with 0-4°C, which retards the microbial action) and transported to the market for their sale. In case of preservation for an extended period (> three days), the captured fishes are processed by the steps that include cleaning, degutting and storage. The preservation of fish uses ice in thermo coal boxes, deep freezers (if the fish demand is large) and sun drying (dehydration). Due to a lack of knowledge, no other preserving techniques (such as salting and canning) are available.

The amount of fish preserved in thermo coal boxes is about 15-18 kg/day and the amount of ice required for preserving the fish is about 3-4 kg/kg of fish. Ice is used to preserve edible fish in almost all the sites, and the quantity of ice required for preservation varies for different fish species. Deep freezing is another essential technique used to preserve edible fish that includes using large refrigerators to preserve fish for a long time at the temperature of -70° C to -1000° C (approximately).

Almost all the shopkeepers at different sites do not use any modern methods/techniques for fish preservation. The profit in terms of Rs/kg of different preserved fish species by different methods adopted by local traders. The maximum profit was observed in the case of Solea solea, whereas the minimum profit was in the case of Hypophthamichthys molitrix, Clarias batracus and Wallago attu. The increasing order of profit by different preservation methods is as follows:

Clarias batracus = Wallago attu = Hypophthamichthys molitrix < Mystus tengara < Carassius auratus < Labeo rohita = Tor tor < Chitala chitala < Channa straita < Bangarius yarreli < Catla catla < Hilsa ilisla < Pampus argenteus < Solea solea.

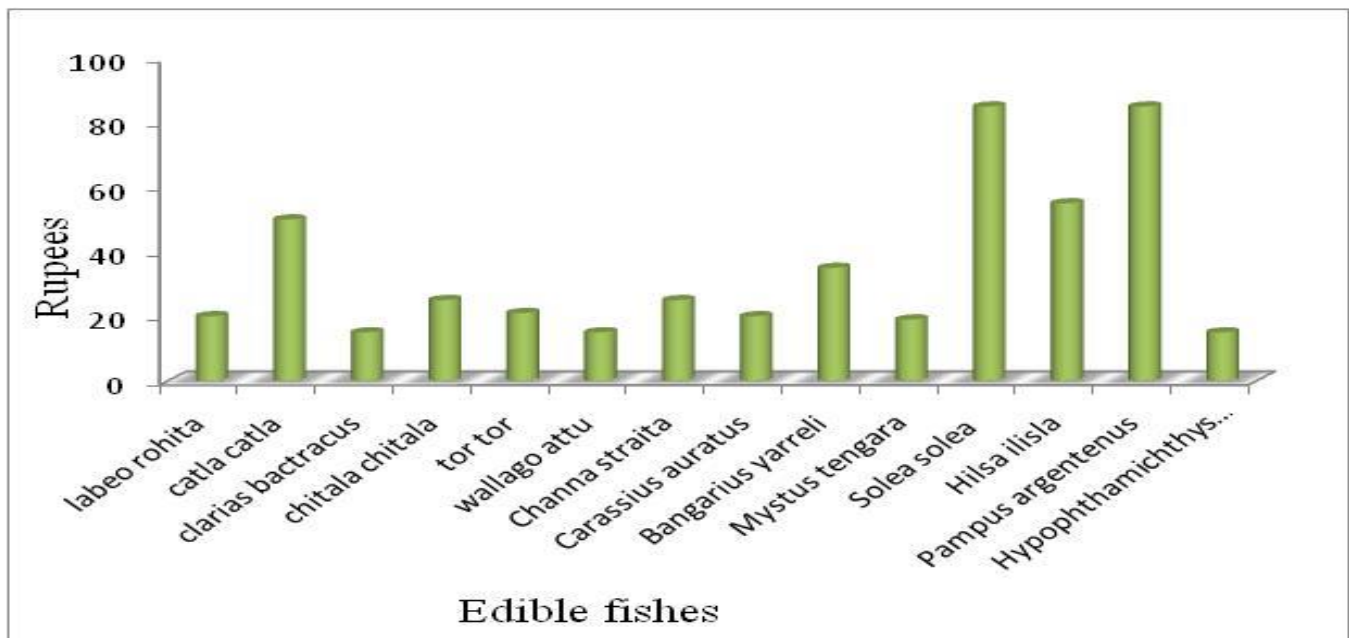


Figure 1: Average profit (Rs/kg) made on different edible fishes by preservation methods

Profit margin: The primary producers hardly get 50-55% of the retail market prices of their products. Fishermen or fish farmers' share of the retail prices varied considerably mainly because of the cost of transportation, icing, and market leaseholders. Mediators got 30-35%, quality or weight loss 5-8%, while the remaining 10-15% was spent on transportation, preservation and other charges (Figure 1). The fish marketing system in the Kumaun region is still highly unorganized and unregulated. It has long been neglected for different reasons, and serious efforts have not been made to improve fish marketing compared to its production. Some specific suggestions for improving existing marketing systems that affect food, nutrition and export earnings are the improvement of transportation and preservation facilities, the introduction of modern wholesaling and retailing facilities, the provision of funding assistance from the government and the improvement of hygienic conditions of landing centres and markets.

XII. FUTURE PROSPECT

Apart from being a recreational activity locals enjoy, fishing can also be viewed as a form of tourism when anglers travel across state borders for fishing adventures. Each state is actively working to boost tourism, including recreational fishing, as part of its economic development initiatives. These efforts often operate separately from fishery management. Fishery managers need to become more attuned to the significance of fishing tourism in their states and forge strong partnerships with state and local tourism promotion agencies. The development of sport fisheries or recreational fisheries will equally help conserve the aquatic flora and fauna by increasing understanding of their mode of propagation and sustainability. Currently, opportunities for angling and recreational fisheries in the state are limited to certain pockets, and a broader preference for sport fisheries with passable investment and awareness campaigns in potential areas is imperative. The availability of popular game fishes adapted to different thermal regimes of this hill state has given the region an enviable reputation in angling and recreation. Anglers come from different corners of the country as well as from abroad. Anglers are provided with a fishing License for rod and line fishing (Baruah, 2022).

One of the best sites in the world for angling golden mahseer is at Pancheshwar, at the confluence of the Saryu and Mahakali rivers. The Mahakali River demarcates the boundary between Nepal and India. Angling fest and competitions are organized yearly in collaboration among angling camps, Kumaon Mandal Vikash Nigam (KMVN), and the Department of Tourism. Hatchery-produced mahseer seeds from Directorate of coldwater fisheries research (ICAR-DCFR) Bhimtal are also occasionally released at Pancheshwar to enhance the stock of endangered species. Many angling camps, such as The Himalayan Outback, Camp the Himalaya, Pancheshwar Fishing Retreat and The Golden Cast, are active in the region to provide logistical support and accommodations during the angling season. Other important angling sites for golden mahseer in Uttarakhand are Vanghat/ Marchula along the Western Ramganga River; Vyasghat at the confluence of Ganga and Nayar rivers; and Ramnagar and Almora along the Kosi River. Vanghat is an excellent mahseer beat located in the Nainital district of Uttarakhand. This promising angling spot lies along the cascading Western Ramganga River that meanders through the verdant forest of Jim Corbett National Park. The mighty golden mahseer and giant devil catfish goonch have drawn avid global anglers to Vanghat. Angling can be done with the permission of the Divisional Forest Officer in those locations where human threat is minimal. Vyasghat can be another excellent option for angling golden mahseer. The search for mahseer starts from Devprayag, the confluence point of the Bhagirathi and Alaknanda rivers, 14 km upstream of Vyasghat. The route follows downstream for a stretch of 36 km over the Ganges. Angling was banned in Uttarakhand, India, in 2018. Angling is an activity that involves catching fish with hooks and releasing them in rivers and streams in forest areas. In 2022, the Uttarakhand Forest Department has decided to allow angling under specific conditions in the state's reserve forest areas, easing a ban imposed in 2018.

XIII. CONCLUSION

Uttarakhand has significant fishing potential, but little evidence shows it is driving the economy. Fisheries are crucial for economic growth, poverty alleviation, and prosperity. The state government should focus on promoting fish farming to alleviate

poverty and improve the state's economy. However, achieving this requires strong political will, infrastructure facilities, better access to Uttarakhand, intra-state connectivity, massive marketing and publicity, developing infrastructure for fish marketing, and promoting the benefits of rural communities. Executing plans with integrity and a forward-thinking strategy is essential for achieving these goals.

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