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Research Paper

Fishing gears and crafts of the Kashmir Himalayas: a baseline for sustainable fishery management

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ABSTRACT

The present study documents the traditional fishing gears and crafts employed in the Kashmir Himalayas, with a focus on their design, operation, and implications for fishery management. Field surveys and interviews with local fishers revealed seven types of gears, including gill nets, cast nets, scoop nets, bag nets, and double-pronged spears, along with three types of non-mechanized wooden crafts constructed mainly from *Cedrus deodara*. These gears vary in mesh size, material, and operational mode, reflecting adaptations to local hydrological conditions and target species such as *Schizothorax* spp. and carps. While deeply rooted in indigenous knowledge and cultural heritage, several gears, particularly gill nets, pose risks to fish populations due to indiscriminate catch of juveniles. The study highlights the urgent need for regulating mesh sizes, raise awareness among fishing communities, and integrate traditional knowledge into sustainable fishery management strategies. Preservation of these indigenous gears and crafts also carries anthropological value, representing the cultural identity and livelihood resilience of Himalayan fishing communities.

Key words: Crafts, fisheries management, fishing gears, Tulmulla stream, UT of J&K.

The valley of Kashmir, situated in the middle of the Western Himalayas between 33°01′ and 35°00′ N and 73°48′ and 75°30′ E, is located at 1585 m above sea level and has a total area of 4,920 km² (Sarah *et al*., 2011). Around 120 fish species are present in various aquatic habitats in the UT of Jammu and Kashmir; among these, 105 fish species occur in the Jammu region, 23 in the Kashmir Valley, and 15 species inhabit the Ladakh region (Bhat *et al*., 2020). The Tulmulla Stream is located in the Tulmulla jurisdiction of Ganderbal district, Jammu and Kashmir. The elevation of Tulmulla is 1592 meters. The local name for Tulmulla Stream is "*Nagpov* nallah." In addition to the springs at Tehsil Lar, Ganderbal, the stream originates from the Sindh and is also fed by the marshlands of Tulmulla. At Bagidab, Batpora, and Shadipora, the stream joins the Nallah Sindh after passing through various villages. Fishing crafts are devices made of wooden material with varying size and shape, and they are used to catch and transport fish in streams, rivers, and lakes (Sultana *et al*., 2016). Fishing gear is any form of tool, equipment, or device used to catch, collect, and harvest fish resources (Sultana *et al*., 2016)

These fishing gears are made from a variety of materials, such as netting, twine, plastic structures, ropes, steel wire ropes, combination wire ropes, polyethylene, nylon, cotton, polypropylene, mixed fibers, floats and sinkers, and wood (Hameed & Boopendranath, 2000).



Fig. 1: A view of Tulmulla stream at Bagidab Batpora, Ganderbal, Kashmir, India

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The size and shape of a gear are determined by its intended function as well as the environmental conditions of the water body. Depending on the habits and habitats of the fish species present in any water body, a variety of gears are used to capture fish (Tagago & Ahmed, 2011). Seasonal changes in species diversity and abundance have aided in the development of novel fishing gear (Bankole *et al*., 2003). The scientific and efficient management of capture fisheries depends on the thorough documentation of indigenous fishing methods, equipment, and other fishing crafts, which is lacking in India, where fishermen mostly employ traditional fishing methods to capture fish (Kolekar, 2009). Fish of different sizes are caught from water bodies using a variety of fishing nets and equipment that vary in size and shape (Azam *et al*., 2014). Some articles related to fishing crafts and gears from India are Kokate *et al*. (2016), Bhat *et al*. (2016), Syed *et al*. (2020), Biswas *et al*. (2022), Chanu *et al*. (2022), Basumatary *et al*. (2023), Sahu *et al*. (2023), Lekshmi *et al*. (2023), and Wanjari *et al*. (2023). The objective of the study is to provide information about the different kinds of fishing gears and crafts used to exploit the fisheries resources in the Tulmulla Stream in Ganderbal district. This information is crucial for creating a sound management strategy for the judicious use of fish resources in the stream.

MATERIALS AND METHODS

Study area: A detailed study was conducted to assess the fishing gears and crafts along the Tulmulla Stream in Ganderbal district, J&K, India (Fig. 1). Data were collected from five different sampling sites located in the villages of Watalbag Lar, Tulmulla, Rakh Rabitar, Korag Darakpora, and Bagidab (Fig. 2). The sites were selected based on accessibility and similar environmental characteristics.

Data collection: Data were collected from local fishermen, fish landing centres, *aratdars* (brokers), and through direct observation of fishing gears and crafts. Questionnaire interviews (QI) were used to gather information regarding fishing gear, including mesh size, mode of operation, construction materials, fish species caught, season, and shape and size of the crafts. Semi-structured, open-ended questionnaires were used during face-to-face interview sessions.

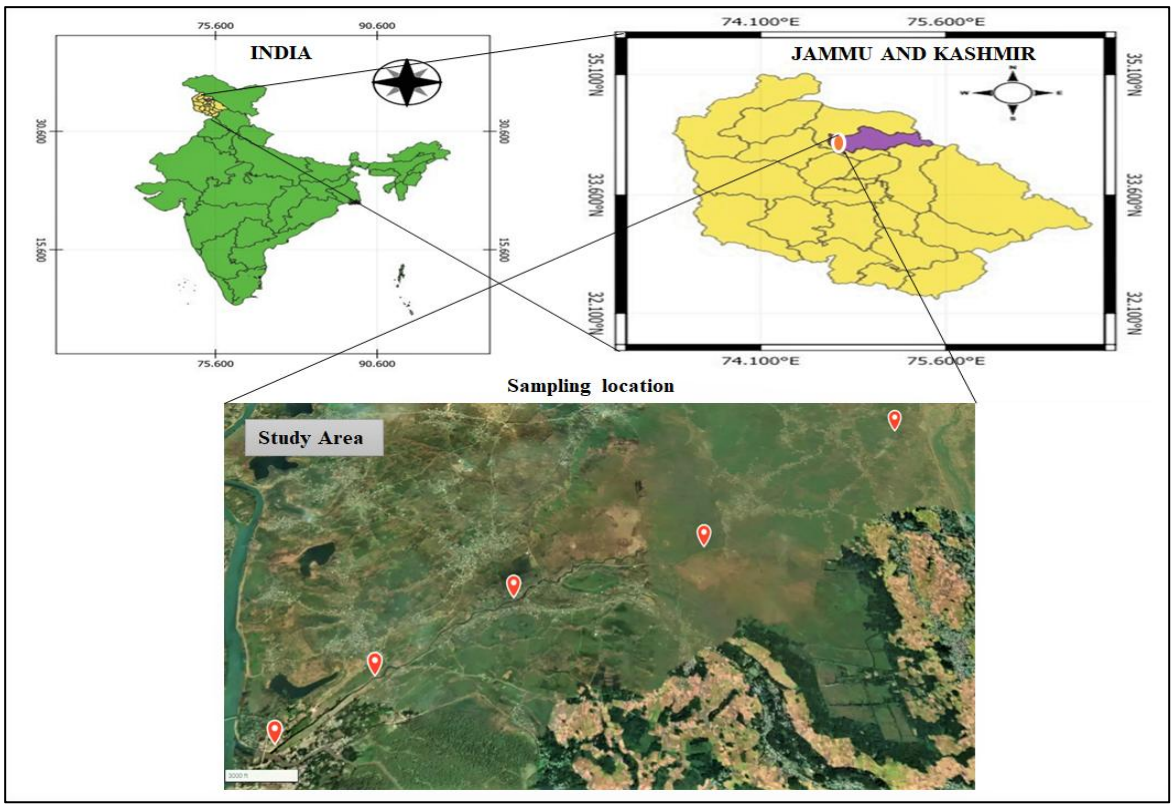


Fig. 2: Study area location along the Tulmulla Stream of Ganderbal, Kashmir, India

RESULTS AND DISCUSSION

The use of gears and crafts is a result of experience gained over time. Each water body has its own pattern for the use of gears and crafts. It provides information about the financial situation of the fisher community, where they catch fish with locally accessible and less expensive fishing implements for the highest possible return (Manna *et al*., 2011).

Fishing gears: The investigation showed that a wide variety of fishing gears were operated throughout the year in the Tulmulla Stream in Ganderbal district for the commercial exploitation of fishery resources. The major categories of fishing gears habitually used in the Tulmulla Stream can be summarized as follows: gill nets, scoop nets, cast nets, bag nets, and single- or double-pronged spears, as shown in Table 1.

Table 1: Different types of net used for fishing in the Tulmulla stream

Gear type	Local name	Operational fishermen	Major species caught	Boat needed	Season
Gill net	*Thani/current zaal Chaal/ Patej*	1-2	Carps, *Schizothorax* Spp.	Yes	All
Scoop net	*Keshop/Gaad khor Gurun khor*	1	*Tryplophysa, Schizothorax* Spp., Carps	Yes	All
Cast net	*Zaal*	1	*Schizothorax* spp.	Yes	Nov to Feb
Bag net	*Khurijal*	1	Carps	Yes	May to Sept
Double Ponged spear	*Narchoo*	1	*Schizothorax* spp.	No boat needed	Oct to Mar

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Gill nets: Gill nets are a common type of net used in the region. They are locally known as *Thani/Current zaal* or *Chaal/Patej*. These are single-walled nets with a mesh size that traps the targeted fishes in the net. The net is made of nylon monofilaments with sinkers attached to the base. This gear is mainly operated during night hours. The nets were used singly or in series. They are vertical walls of netting normally set out in a straight line. Floats and sinkers are attached to plastic ropes and are used as head ropes and foot ropes. The meshes of gill nets are uniform in size and shape. Locally made sinkers are used. The use of these nets has seriously affected the regenerative capacity of the fish fauna. The use of these nets was later banned by the Department of Fisheries. Despite this, gill netting is still being used in this water body. According to the size of the nets and mesh size, gill nets are classified into two types:

Thani/current zaal: This net is rectangular in shape, with a mesh size varying from 40 mm to 50 mm. The length of the net is 3 m to 4 m, and the width is 8 m to 10 m. The net is made of nylon monofilaments. Sinkers are attached to the net (Fig. 3).

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Fig. 3: Gill net with small mesh size (*Thani/current zaal*)

Chaal/ Patej: This net is rectangular in shape, with a mesh size varying from 75 mm to 85 mm. The length of the net is 3 m to 4 m, and the width is 1.5 m to 2 m (Fig. 4). Sultana *et al*. (2016) reported gill nets with floats and sinkers and varying mesh sizes ranging from 17.5 mm to 70 mm, which is similar to our findings.



Fig. 4: Gill net with large mesh size (*Chaal/ Patej*)

Cast net: The cast net is locally known as "*Zaal*". Cast nets are conical-circular nets made of nylon and cotton thread, with the edge weighted with lead, while the conical end is tied to a throwing/hauling rope (Fig. 5). The throwing rope also serves as the hauling rope. The total length of the cast net is 8 feet and it is made of multifilament, similar to the findings of Syed *et al*. (2016).



Fig. 5: Cast net (*Zaal*)

A cast net is made up of three parts: the upper section (net band), the middle section (a conical-shaped net mesh), and the lower section. The upper section is 2 feet long and is commonly known as "*Doashai*"; the middle section is also 2 feet long and is commonly known as "*Coashai*"; and the lower section has two parts, namely "*nav veur*" and "*Paire khar*," both 2 feet long. The lower section of the net has pockets with fixed iron weights. Meshes are locally known as "*gaed*" or "*aesch*" and are 25 mm to 30 mm in size. The use of cast nets having varying lengths from 3.31 m to 4.61 m was reported from a tropical lotic freshwater body in Nigeria (Okoh *et al*., 2007). The cast net is operated during the daytime, with the number of casts ranging from 50 to 60 per day. The sinkers are made of iron, locally known as "*Mani kor*," with a total weight of about 6 to 8 kg around the peripheral cord. These sinkers are cylindrical in shape, with a length of about 30 mm, a diameter of 15 mm, and a distance between sinkers of 60 mm, which is similar to the findings of Syed *et al*. (2016), who reported the design and specifications of cast nets in Dal Lake, Kashmir. The net is thrown from the stern of the boat and then hauled with the help of a pulling cord. The fisher casts the net using both hands and the shoulder, throwing it onto the water surface in an area likely to contain the target fish. When hurled into the air, the net spreads out into a circular shape; as it hits the water surface, the weighted edges descend into the water in a parachute-like form. The fish trapped in the pockets, locally known as "*chand*," are removed manually. Hauling takes 8 to 10 minutes. A long wooden rod, locally called "*Shome*," is used to locate the cast net and is swung around the net so that the fish become trapped in the pockets of the net. Depending on the number of meshes, the cast net is known by different names such as *Guran zaal* (1200 meshes), *Thapthat zaal* (1100 meshes), *Dal zaal* (1000 meshes), *Naushath zaal* (900 meshes), *Nuchkul zaal* (800 meshes), *Pouchkul zaal* (500 meshes), and *Ara zaal* (400 meshes).

Scoop net: This net is also called a "push net" and is made with a triangular wooden frame, to which a net made of nylon is attached and locally known as "*keshop*". The scoop net is an essential piece of fishing equipment commonly used in the Tulmulla Stream in all seasons. It features a circular net attached to a long handle made of poplar or deodar, making it highly effective for certain types of fishing. The scoop net is operated by a single fisherman. The net is submerged in the water, and another rod is used to guide fish toward the net so that they become trapped inside it. The total length of the scoop net is 2 m. This net is both practical and efficient, making it a popular choice among local fishers for harvesting fish in specific areas of the stream. According to the size

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of the nets and mesh size, scoop nets are classified into two types. Syed *et al*. (2016) reported the use of scoop nets in Wular Lake with varying mesh sizes.

Gaad khor: The length of the net is 0.5 m to 0.7 m, and the width is 0.7 m to 0.9 m, while the depth ranges from 0.9 m to 1.1 m. The mesh size varies from 45 mm to 60 mm (Fig. 6).



Fig. 6: Scoop net with large mesh size (*Gaad Khor*)

Gurun khor: The length of the net is 0.4m to 0.5 m and width of 0.6 to 0.7 m while as the depth ranges from 0.8 to 1 m. The mesh size varies from 20 to 40 mm (Fig. 7).



Fig. 7: Scoop net with small mesh size (*Gurun Khor*)

Bag net: A bag net is a type of lift net, locally known as "*khurijal*" or "*boud khurijal*," having a semicircular or triangular mouth (Fig. 8). It is kept lowered in the water below the surface and raised at short intervals with the help of a wooden pole made of poplar or "*Juglans*". A bag net consists of two wooden semicircular poles fixed to each other, with one long central bisecting pole in the centre, so that they are widely separated at opposite ends. A piece of net is attached to these ends. The length of the short pole ranges from 3.5 m to 4 m, and the longer one ranges from 5 m to 5.5 m. These nets involve maneuvering fish over a bag-like piece of netting made of monofilament, which is then caught by lifting the net out of the water in a quick upward movement. Ramesan

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(2009) in northern Kerala reported the use of PE monofilament for webbing in this type of lift net. Yousuf *et al*. (2023) reported a bag net with a mesh size of 30 mm from Anchar Lake.



Fig. 8: Bag net (*Khurijal*)

Doubled pronged spear: The double-pronged spear, locally known as "*Narchoo*", is another type of wounding gear containing 6 to 8 spear heads, with one in the centre arranged in a circular order. It is made of metal (iron) and attached to the main pole made of deodar or poplar, 2.5 m long, with the help of ropes. The length of the spears is 0.3 m, with a weight of 0.5 to 0.75 kg (Fig. 9). Syed and Mohite (2016) reported that a double-pronged spear had 7 to 9 prongs arranged in a circular order and attached with ropes to the main pole, with lengths ranging from 3 m to 3.6 m in Wular Lake and 3.2 m to 3.6 m in Dal Lake, which contrasts with our findings. The equipment is skillfully used to target fish by thrusting or shooting the spear at the moment a fish is spotted. This method is particularly effective for capturing larger fish in shallow waters, where clear visibility allows fishers to observe the movement of their targets.



Fig. 9: Single/double pronged spear (*Narchoo*)

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This technique requires precision and quick reflexes, as it relies on the fisher's ability to strike the fish accurately when it comes within range. This method is not only a practical approach to fishing in certain conditions but also a traditional practice that showcases the ingenuity of local fishing communities. It remains a significant part of subsistence fishing in areas where clear and shallow waters make this approach feasible and efficient.

Fishing crafts: Crafts used in the Tulmulla Stream for fishing purposes are made of *Cedrus deodara*, commonly known as "*deodar*" (Fig. 10 to 12). It is less prone to water absorption due to its high resin content and dense grain structure. It is used in the manufacture of boats because of its special ability to resist rotting and decay and to withstand fungal growth, thus ensuring longevity when exposed to moisture. Oars are used to propel the craft in different directions in the water, and these oars are locally known as "*Khoor*." Mohammed (2012) classified the crafts used in Sudan waters with a flat-bottom hull. Oars were used for propulsion. A wooden plank has a life span of an average of 8 to 12 years, although this can vary depending on maintenance and use. These boats are traditionally handcrafted by regional craftspeople who have been building them through generations. The construction of a wooden plank involves selecting wood and then joining the planks, making the boat sturdy and adaptable enough to navigate the challenging waters of the stream. A similar study by Varun and Kamad (2013) in Dhaura reservoir of Uttarakhand reported non-mechanized, locally constructed wooden crafts used for fishing operations. Caulking materials such as poplar seed paste, made from the poplar plant, are used to fill the gaps between two planks. Shinde (2014) reported the wooden gill-netter with planks, commonly called "*Balav*," operated in Ratnagiri. These boats are an essential part of the local fishermen's livelihood and a long-standing cultural custom that is integral to life in Tulmulla Stream. Wooden planks of 8 m to 10 m in length and 1.5 m in breadth were used by fishermen in the Krishna River, according to Manna *et al*. (2011). Syed *et al*. (2020) reported wooden crafts made of deodar used in Wular Lake. The wooden crafts used for fishing purposes are locally known as "*Shikaer*," while "*Naav*" and "*Waer*" are used mainly for household purposes. These terms have become synonymous among fishermen in the area. The dimensions of the fishing wooden crafts are given in Table 2.

Table 2: Dimensions of fishing craft operating in Tulmulla stream

Craft name	Length (m)	Breadth (m)	Depth (m)	Boat type	Wood type	Bottom shape
Shikaer	5 - 7	1 – 1.5	0.2- 0.3	Non- mechanised	Deodar	Flat bottom
Waer	8 - 9	1.5-2	0.4-0.5	Non- mechanised	Deodar	Flat bottom
Naav	10-12	2-2.5	0.7-2	Non- mechanised	Deodar	Flat bottom



Fig. 10: Wooden craft (*Shikaer*)

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Fig. 11: Wooden craft (*Waer*)



Fig. 12: Wooden craft (*Naav*)

CONCLUSION

Our survey indicated that local fishermen rely on community fishing as a source of income. Fishing activities are carried out using fishing gears and crafts. Therefore, a solid understanding of fishing gear and craft is essential for fishery management. The introduction of fishing gear and techniques to a region can put both people and the aquatic ecosystem at risk, regardless of how new or easy they are technically. In this regard, aquatic conditions, community structure, and economic structure mean that the fishing techniques established in an area are often the most appropriate for the species and sizes sought. Additionally, vessels must match new fishing equipment and techniques. It may be necessary to update the size, power, and design of boats as gears become more complex. It is crucial to determine which equipment can be used without harming the undersized fingerlings stocked under the government plan and which equipment should be regulated, since the operation of all kinds of equipment cannot be immediately prohibited if stocked fingerlings are to be given time to grow. The recommended mesh size, as per fisheries management guidelines, should be used for the fishing gears in this area. At the same time, training and awareness programs should be conducted under the guidance of both governmental and non-governmental groups to educate fishermen about fishing regulations and raise awareness of the long-term impacts of various fishing gear. Traditional fishing gear should be preserved in tribal museums and made available for further anthropological research because of its importance and distinctiveness as a traditional tool that supports the community's livelihood.

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CONFLICT OF INTEREST

All the authors affirm that there is no conflict of interest among them. All research activities comply with relevant legal, institutional and ethical standards.

AUTHOR CONTRIBUTION

All the authors contributed equally in this research article.

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