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Fishing Methods in Streams of the Kumaon Himalayan Region of India

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Abstract

The Kumaon region of India harbours a rich coldwater fish biodiversity. In the present communication, attempts were made to study the different types of fishing methods employed in the rivers/streams in this region. The study categorized ten conventional fishing methods followed by four each for commercial and destructive methods and three for recreational purposes. The study indicated that the indigenous technical knowledge (ITK) for fishing has been developed by the local fishermen. In some of these methods the fishermen used the behavioral pattern and microhabitat type used by the fish. The present information discusses the species specific and habitat specific methods utilized by the fishermen. The necessary suggestive measures for the sustainable exploitation of coldwater fish in the hilly region have been incorporated in this paper.

Introduction

Kumaon region is situated in the central Himalayan zone in the Uttaranchal state of India and is spread in an area of 21,035 km^2. A network of rivers and tributaries streams drains through the area into the Ganga river system through the snow capped mountains down to the plains of the Terai (the foothills). The two major drainage systems of the region are Ramganga and Mahakali, which includes important tributaries like Dhauliganga, Goriganga, Ramganga (east), Saryu, Panar, Ladhiya, and Kosi. This region is endowed with a rich biodiversity of fishes. The important fish species found in the region are *Tor putitora*, *T. tor*, *Labeo dero*, *L. dyocheillus*, *Mastacembelus armatus*, *Schizothorax kumaonensis*, *S. richardisonii*, *Garra gotyla gotyla*, *Nemacheilus rupecola*, *Psudoecheneis* spp. and *Glyptothorax pectinoperus*. Due to anthropogenic activities and natural disaster, a number of fish species are declining at an alarming rate. The potential threats to the threatened fish *T. putitora*, which is one of the most economically important game fish in the Kumaon region, are environmental degradation of the habitat and various deleterious developmental activities along with poaching, overexploitation of resources, and indiscriminate fishing in the area (Das and Pathani 1978). Since the pattern and regulation of fishing has a great bearing

on the fish population dynamics, it is very important to study the nature of gears and crafts commonly used that may lead to selective fishing, thus putting stress on a particular size group of fishes. The fishing methods used in the different parts of India have been well described by various authors (Jhingran 1975; Jhingran and Sehgal 1978). The fishing methods used in the hill streams of Kumaon are not well documented however, Badola and Singh (1977) have reported the fishing methods in the adjacent Garhwal hill streams.

Materials and Methods

Information on fishing methods was collected through intensive field survey and interaction with the local fishermen of the Kumaon region during the period of 1996 to 2001. The survey covered the streams like Ladhiya, Lohawati, Saryu, Ramganga (east), Ramganga (west), Goriganga, Dhauliganga, Mahakali (Sharda), Kosi, Panar and Gomti in the watershed area of the Ramganga and the Mahakali river system. During data collection, the local fishermen were photographed practicing the methods of catching fish. The information collected in the field was compared with the existing information in the literature; for most of the methods no information was existing. Later, the techniques used in these methods were correlated with fish behavior.

Results and Discussion

Fishing methods

Natives of the Kumaon region use various indigenous techniques to catch fishes. Among the various methods of fishing, only a few are documented (Jhingran and Sehgal 1978; Nautiyal 1994). These methods can be broadly classified as conventional, commercial, destructive, and recreational.

Conventional methods

Local people use various conventional methods to catch fishes mainly for their domestic consumption. Some of these methods are ecofriendly but many of them are destructive, too. These methods are applied according to the behavior, abundance in different seasons, and habitat uses of fish. The intensity of adopting these methods varies with seasons, locations, and species. Most of the methods given below are practiced in small and medium sized streams.

GODA

The *Tor* spp. migrates to small tributaries at the onset of the monsoon (June-July) for spawning; after the breeding season, it goes back (September-October) to big rivers for feeding (Shrestha 1997). During this period, the stream is blocked by stones, gravel, mud, and shrubs with only one drainage

point kept open and at the open end a conical structure locally called "*goda*" (fabricated from locally available spiny/nonspiny shrubs) is placed. The migrating fish are trapped into the structure. The high water velocity along with the structure of the *Goda* prevents the escape of the fish. Mostly, the Goda is used at night and trapped fishes are collected in the next morning. The length of the *goda* ranges from 1.0 to 1.5 m with an opening diameter of 30 to 50 cm and a closing diameter of 0 to 10 cm (Fig. 1). The *goda* is used in fast moving water habitats (i.e. rapid, riffle, and cascade habitats of the stream) where the depth is shallow, water velocity and gradient are high, and the substrate is dominated by boulders. The fish catch includes small as well as big fishes, some fishermen have caught *T. putitora* of up to 40 kg (weight) using this method (pers. comm.).

HAMMERING

The upland stream fishes use the boulders as one of its hiding covers. When a strong blow is given on the boulders using a hammer, the fishes hiding beneath it are injured (Fig. 2). The injured fishes, including the small sized are collected.

WATER DIVERSION

This method is practiced where one or more secondary streams is found within a channel (Fig. 3). The water in one of the secondary streams is diverted to the other by blocking one stream with mud, boulders, and plants. Thereafter, the fishes are collected from the stream. This method is practiced in fast moving water habitats of the stream. Most of the fish collected include small sized bottom dwelling fishes like *Garra* spp., *Nemacheilus* spp., *Barilius* spp., and *Mastacembelus* spp. Locally, the method is called *Dola bujana*.

STICKS

In shallow streams, the stick is often the best instrument to catch the mighty *T. putitora*. During monsoon, the *T. putitora* migrates to small

Fig. 1. The *Goda* structure fixed in the fast moving water (riffle) area of a stream.

Fig. 2. A fisherman using hammer to catch fish

Fig. 3. Channeled stream, ideal place to catch fish using water diversion.

streams flowing through the fragile Himalayas ecosystem. These small streams very often get loaded with mud and boulders, due to this water becomes highly turbid. Under these conditions, the *T. putitora* takes shelter in the small shallow streamlets where it can be easily recognized. The local people beat it with sticks and kill the trapped fish. This method is practiced in shallow streamlets, which are active during the monsoon seasons only.

AXE

Due to high rainfall during the monsoon season, the water level in the stream suddenly rises and as the water suddenly recedes, the big size Goonch (*B. bagarious*) often get trapped in the shallow water area, where it cannot move. Local people use axe, sickle, and spade to kill this fish. This method is used in the shallow areas of the stream.

BAG NET

It is a locally fabricated hand net (locally called *Kadiyali*) used for catching the small fishes. The net is more or less of pyramid shape with two sticks attached to it (Fig. 4). The mesh size of these nets ranges from 1 to 5 cm resulting to the catch of the small fishes. Fishermen use it during night hours with the torchlight. The method is practiced in shallow pools and riffles where the fishermen can move.

HERBS

Various types of plant products such as leafs of Khina (*Madhuka* spp.), Rambans (*Agave americana*), stem bark of Jamun (*Syzygium cumini* L) and oil cake of Cheura (*Sapium* spp.) are used to catch various size of fishes (Fig. 5). These plant products are first well grinded and thereafter, applied to slow moving water area (pool habitat). These herbal products are well mixed with the mud to make the stream water turbid; it is mostly applied during the morning or evening hours. After its application, the fishes come to the surface and exhibit abnormal behavior (nervous breakdown and lack of dissolved oxygen may be the possible causes). The fainted fishes are collected by the fishermen using simple cloth/cast netting or *kadiyali.*

Fig. 4. Two fishermen displaying the different types of bag nets.

Fig. 5. A fisherman showing the seeds of *Sapium* spp. and a view of *Agave americana* plant, both used as herbal toxi cant.

POT AND PAN PROCESS

In this method, a thin cloth covers the mouth of a vessel with a hole at the center; wheat flour is sprinkled around the hole and on the bottom of the pot (Fig. 6). The pot is then put in the shallow slow moving water, therafter, the small fishes start assembling around the pot and while consuming the flour spread on the clothes, the fishes start moving inside the pot through the hole for the flour spread inside the pot. The pots are removed from the river after 30 to 40 min and the trapped live fishes are collected. The catch varies with the size of the pot and comprises of small size fishes only.

CLOTH NETTING

In this method, a fine meshed cloth or mosquito net is held by two or more persons in both sides, while another person disturbs the water using shrubs or sticks to direct the movement of small fishes towards the cloth, which is lifted when sufficient number of fishes are seen. Such method is mostly used for domestic consumption and is practiced in the shallow pool area of the stream.

TRAP FOR JUMPING FISH

The *Tor* and *Schizothorax* species have good jumping ability and move against the stream flow. Some fishermen use this behavior to catch fish. The fishermen make a small pit of about 50 x 50 cm dimensions by removing the substrate (Fig. 7). The pit formed is surrounded with cobbles and gravels in such a way that the fish could not escape from it. While jumping through the cascade or rapid type habitat, the fish often fell into the small pit from where it cannot escape (as it cannot attain the swimming velocity to jump out of the pit). This method is practiced during the morning or evening hours when most of the fishes are seen jumping. Locally this method is known as *khor*. Fishes up to 2 kg size are caught by this method.

Fig. 6. The structure used in the “Pot and Pan" process and the fish assemblage over the structure.

HAND PICKING

In this method, the fishermen move into the stream and chase the small fishes hiding beneath the rocks (Fig. 8). The fishes caught by this method include *Glyptothorax* spp. and other small fishes that utilize boulders as hiding cover. This method is practiced in shallow riffle areas.

FISHING TRAP

This is one of the locally used methods, which is generally operated in the barrage when the barrage gate is partially opened. A simple cage made of nylon cloth and square wooden frame is hung by rope from the upper side and a person follows the fish trap (Fig. 9). In this method, the jumping behavior of the fish is utilized against upstream migration. Fishes up to 2 kg sizes are caught by this method and is practiced near the barrages only.

Commercial methods

Local fishermen use these methods for commercial fishing. These methods are usually confined near the fish markets. However, fishermen often practice these methods in remote areas and the fish are transported to the fish markets. Although most fish farmers try to over exploit the fishing resources, these methods will not pose any threat to the fishes if practiced with limitations.

HOOKS

Most of the fishermen use hooks to catch big fishes specially *Tor* spp., *Schizothorax* spp., *Labeo* spp., and *Mastacembelus* spp. This is used in fast moving as well as slow moving water areas. Generally, 10 to 20 hooks are tied to a nylon rope (1 to 2 cm thick). The nylon rope is then put in the stream water during the evening hours and the hooked fishes are collected the next morning. The hooks are generally put without bait but often the baits of melon seed, small fish, flies, wheat flour, wheat flour mixed with turmeric powder, and cooked rice are put on the hooks (Fig. 10).

Fig. 7. A small pit made to catch jumping fish in the cascade type habitat.

Fig. 8. A local man catching the fish hiding in the rock.

Fig. 9. The trap put near the barrage to catch fish

Fig. 10. Different types of hooks used for fishing.

SURAKA

The *suraka* consists of a nylon rope with several knots at regular intervals. The diameter or the knots ranges from 5 to 15 cm, while the length of the nylon rope ranges from 10 to 25 m (Fig. 11). The nylon rope with knots is fastened to submerged rocks on both ends across the stream. Fishes moving in the streams get trapped in these knots. *Suraka* is often put in riffle and glide habitat type with shallow depth and high water velocity. It is put during night time and fishes are collected the next morning. The sizes of the fishes caught by *suraka* range from 0.5 to 2.5 kg.

CAST NET

The castnet is a widely used fishing gear in India. In the Kumaon region the fishermen cast the net while moving upstream or downstream. In most of the streams, the fishermen catch fishes only after several attempts through out the day. The diameter of the cast net used ranges from 1 to 2 m and the mesh size is from 1 to 5 cm. On the periphery of the castnet metallic sinkers are attached to make the net sink and to withstand the flow of streams (Fig. 12). After throwing the net the fishermen disturb the bouldery substrate so that the fishes hiding behind the rocks come out and get trapped in the net.

GILL NET

The use of the gill nets (locally known as *Mahajaal*) in streams is mostly practiced in the deep pools. The *Mahajaal* is spread into the stream using air filled tubes (bus and truck tires), as boats are not operated in the streams. Two fishermen hold the two ends of the net and move in opposite directions on air filled tubes. The fishermen normally practice this method during the evening and morning hours. The gill net is very effective when the adult *T. putitora* are on migration (both spawning and feeding migration). The net is made up of nylon silk, more than 10 m long and stretched mesh size varying from 5.0 to 8.0 cm. Normally, two gill nets of different mesh sizes are used at a time. They are placed across the stream by means of rope fastened at the banks. Using this method, the fishermen are able to catch up to 10 kg of *Tor* and *Labeo* species.

Fig. 11. A fisherman displaying the *Suraka*

Fig. 12. A fisherman displaying the castnet.

Destructive methods

With the advancement in technology and population increase, efforts are made to over exploit the aquatic resources, that will yield more fishes in less time and with a little effort. In the process, various destructive techniques are introduced for the fishing activities. The destructive methods are indiscriminate killers of the entire aquatic organism including the entire life stages of fishes. These include the use of dynamite, pesticides, electric current and other chemicals. The common features among all the destructive methods are:

- These methods are applied at a place where the probability of catching fish is high.
- They are practiced mostly in the remote areas falling near to cities.
- It affects the entire life stages of all the aquatic fauna.
- In applying these methods the fishes faint and come to the water sur face from where they are collected using hand nets or bag nets.

DYNAMITE

The use of dynamite in the Kumaon hill stream is one of the reasons for the decline in the number of endangered fishes. Groups of fishermen often go to remote areas of streams and use dynamite to catch fishes. The junction of riffles and pools with plenty of fish hiding covers is selected for this method. Fishermen acquire dynamite from road construction organizations working in these areas (Fig. 13). Although a lot of fish is caught in a very short span of time, this method involves lot of risks to the fishermen. In many instances fishermen have lost their body parts, hearing power and even their lives.

PESTICIDES

The most commonly used pesticides are Nuvan, Thiodon, and Malathion. These pesticides are applied in high concentrations to the areas with high probability of catching fishes. The application of pesticides not only damages the ecosystem but also affects the health of human beings.

BLEACHING POWDER AND LIME

Bleaching powder and lime are two chemicals easily available in the Kumaon region, used to kill fishes. Soon after its application the fishes come to the water surface.

ELECTRO FISHING

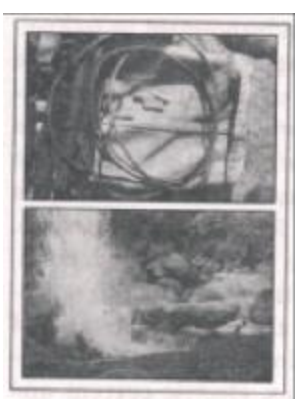

Fig. 13. The materials used in dynamiting and dynamiting in action.

This is another modern technique confined to the urban areas. The main objective of this method is to capture fish by applying electric current to the stream water. In the Kumaon region portable generator sets are used to apply electric current through the stream water. As the electric current is passed to the stream water, all the fishes in the area come to the water surface. This method is performed in the shallow pool area where it is easy to collect the fainted fishes.

Recreational methods

Angling is used for recreational purposes and is universally acknowledged as a thrilling sport. The

Himalayan *T. putitora* is best suited for sport fishing because of its fighting tendency. Local men as well as national and international anglers using different types of natural and artificial baits enjoy angling (Fig. 14). Several national and international anglers come to visit the Kumaon region for sport fishing and often angling competitions are organized in this region (Sarkar et al. 2000). Up to 63 kg of *T. putitora* have been caught in the Pancheshwar area of Kumaon hills by angling (Soni 1998). The methods employed for angling may be classified into three categories, as follows:

FLY-FISHING

The method is called fly-fishing because it uses an artificial fly as a lure to hook the fish using rods and lines. The rods for fly-casting are made up of split bamboos, fiberglass, plastics, etc. The flies used are of two types, dry and wet. The dry flies float on the water surface while the wet sink down into the water (Jhingaran and Sehgal 1978). Fly-fishing is not very effective for big size *Tor* spp. as only the smaller ones are caught. This method is more effective for *Schizothorax* spp as they almost invariably lie with their heads upstream waiting for food to be brought down to them through the current (Dhu 1923).

SPOON FISHING

Spoons are artificial metallic shining lures that make the fishes meet the hooks. This method is more effective for the *Tor* spp. This method can be classified into three groups: small, medium and heavy, depending on the size of the fish. For recreational purposes, heavy fishing (>13.0 kg) is avoided, as extreme skill in handling and playing is required and it is often risky. When spoon and fly-fishing are used together, it is called spinning.

BAIT FISHING

Fig. 14. The different classes of people enjoying angling and the different types of artificial baits used.

In the Kumaon region bait fishing is also practiced. The principle of bait fishing is to offer natural or artificial bait to entice fishes that get hooked and lifted. Big sized *Tor* spp. are often caught with lures, called plugs, spoons and flies. The bait often consists of flour and millet paste, minnows, and worms.

Conclusion

It is pertinent to point that the fishery of mahseer was rich in the past when fishing techniques were primitive. Use of destructive methods like dynamite,

artificial stream barrier, pot and pan process, bleaching and pesticide poisoning has imbalanced the stream biota damaging not only the fishes but also the fish food organism (macrobenthos, periphyton etc.). In view of this, the following suggestions should be given due consideration:

- A total ban on the use of explosives, poisoning should be enforced im mediately.
- Investigations need to be undertaken on the population estimates and the nature and type (mesh size) of nets that need to be regulated. A mesh size of 5.0 cm would be appropriate, as it will catch larger size (>15 cm) fish.
- An awareness program should be organized on the merits and demer its of different fishing methods and the importance of hill stream fish ery conservation vis-a-vis socio-economic upliftment of the fisher folk.
- Suitable rehabilitation strategy should be evolved for the threatened and endangered hill stream fish conservation based on the socioeconomic background of the communities.

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