



Fishing gears, catch composition and their effects on aquatic bodies of Barpeta District, Assam, India

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Abstract

Different types of fishing gears used in some localities of Barpeta district, Assam, India were studied. The various fish species caught by the gears and the effects of the gears on habitats of fishes were also studied. It was found that twenty different fishing gears were used by the fishermen of the study area. Among the active gears, there were 3 types of nets, 3 active traps, 3 impaling gears (spears and spikes) and 2 types of hooks and lines. The passive gears included 3 types of gill nets and 2 types of lift nets; 3 types of bamboo traps and 1 barrier. The fishing gears of the study area excluding the surrounding nets and gill nets do not seem to have any detrimental effects on the habitats of fishes or other aquatic organisms.

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Introduction

Human food and nutrition is greatly dependent on fisheries and aquaculture, which is also the fastest growing food production industry in the world (Elvarasan, 2018). Inland fishery has a great contribution towards individuals, society and environment. It contributes over 40% of the total world's finfish production, providing food for millions of people worldwide (Lynch *et al.*, 2016).

It is seen that freshwater habitats of fish are facing adverse effects of overfishing, destruction and pollution (Yin *et al.*, 2022). In addition, use of destructive fishing gears indiscriminate fishing of juvenile and brood fishes during breeding season also pose a threat to fish diversity (Malakar and Boruah, 2017; Sayeed *et al.* 2014). Fishing gears like small mesh gill nets and seine nets are destructive to brood fishes, juveniles, fries and fingerlings may lead to loss of fish population. Indiscriminate capture of wild fish populations also has harmful effects on fish biodiversity. The dragging effect of fishing nets also destroys the river bed (Laxmappa and Bakshi, 2014; Kokate *et al.*, 2016; Mia *et al.*, 2017). Reduction of DO due to decomposition of crops due to flood, turbidity, erosion, progressive siltation, destruction of breeding, nursery, grazing fields are some of the natural causes of decline of fish population (Mia *et al.*, 2017). Anthropogenic activities like changing land use practices, increasing population, agricultural expansion and pollution are also increasingly affecting river basins and riverine ecosystems (Mohite and Samant, 2013). It was found that abandoned, lost or discarded fishing gears may contribute significantly to the plastic pollution of Rivers (Nelms *et al.*, 2021).

Various methods are used by people to catch and aggregate fishes (Sharma *et al.*, 2015). There are many fishing gears which are used in Assam (Pravin *et al.*, 2011; Islam *et al.*, 2013; Baruah, 2014; Purkayastha and Gupta, 2014; Sharma *et al.*, 2017; Jabeen and Soren, 2021; Basumatary and Khangembam, 2023; Borah, *et al.*, 2023).

The study was conducted in Barpeta district of Assam, India. Barpeta district has many fishery resources including natural and culture ponds, beels (lakes), rivers and also many swamps and marshy areas. The fishery sector plays a major role in the local economy of the region (Rajbongshi *et al.*, 2016).

Fishermen use different gears and methods depending on species and environmental and ground conditions. The fishing gears also differ in structure, materials used for construction, capture process and methods of operation. Fishing gears may also have some detrimental effects on the habitats of fishes (Boopendranath, 2009). The present study was done to know the various types of fishing gears used by the fishermen, their local names and the composition of catch and the effects of fishing gears on aquatic water bodies of the study area.

Materials and methods

Ten villages of Barpeta district viz., Ganakpara, Bahari, Kakdhowa, Haripur, Shila, Batikuriha, Oumura, Bhogerbar, Pakabetbari pam and Chutiapara were surveyed. The different types of fishing gears used by fishermen, methods of use and types of fish species caught were studied. Information on use of materials for the construction of fishing gears and methods of use were also gathered through field visit and gathering information from fishermen. The fishing gears were classified according to Boopendranath, 2009 and their effect on the habitats were also studied. The local names of fishing gears are given in parenthesis.

Results and discussion

The active gears included 3 active nets, 3 active traps, 3 impalling gears (spears and spikes) and 2 types of hooks and lines. The passive gears used in the study area included 3 types of gill nets and 2 types of lift nets; 3 types of bamboo traps and one barrier. The characteristics of the gears are given in Table 1.

Table 1. Table showing category, type, characteristics and local names of fishing gears found during the study

Category of fishing gear	Type of fishing gear	Characteristics of gear	Local name
Active gears (nets)	Active nets	Surrounding nets	Bidhanmara jal/ Ber jal
	Lift nets	Scooping nets	Thela jal
	Falling gears	Cast nets	Sewali/ Ashra jal
Active gears (traps)	Scooping gear	Conical scooping gear	Jakoi
	Cover pot	Bamboo made cover pot	Polo
			Juluki
Active gears (Impaling gears)	Spears and spikes	Spear with single spike	Suli/Choli
		Spear with hooks	Koch/Hana
		Spear with multiple spikes	Koch/Hana
Active Gears (Hooks and lines)	Hooks and lines	Hook and line with pole	Barashi
		Hook and line without pole	Doliowa Barashi
Passive gears (nets)	Entangling gears	Gill Nets	Kaoi Langi
			Puthi Langi
			Goroi Langi
Passive gears (traps)	Scooping nets	Lift net	Dharma jal
	Trapping gears	Bamboo traps	Dheki jal/Jata jal
			Sepa (3 types)
	Barriers or fences	Barrier	Dingar
			Darki
			Bana

Description and fishing gears, fish species caught and impact on fish populations

Active nets

Surrounding nets (Bidhanmara jal/ Ber jal): Surrounding nets are used to surround from all sides and catch aggregated fishes. The fishes are prevented from escaping both from the sides and by diving downwards. The net is long and operated by many people (Fig. 1). This gear is used for catching any type of medium to big sized fishes mostly in ponds, rivers.



Fig. 1. Surrounding net (Bidhanmara jal/ Ber jal)

Lift nets

Scooping nets (Thela jal): Thela jal is a scooping net operated by the fisherman actively. It is triangular in shape (Fig. 2). The frame is made of bamboo poles. For these three bamboo poles a net is tied. One bamboo pole is used as a handle for pushing the Thela jal. The fisherman collects the fishes by scooping the net out of water. The fishes remain hidden under the aquatic

plants and are collected by the fisherman. In addition to fish, crabs, prawns etc. are also added to the catch. This net is used in beels and rivers. The size of the triangle and length of the handle varies depending on the necessity of the fisherman.

Fishes caught: *Systemus sarana*, *Puntius sophore*, *Esomus danricus*, *Amblypharyngodon mola*, *Devario devario*, *Botia dario*, *Lepidocephalichthys guntea*, *Channa spp.*, etc



Fig. 2. Scooping net (Thela jal)

Falling gears

Cast nets (Sewali/ Ashra jal): The most popular cast net used is the *Sewali* jal (Fig. 3). The *Sewali* jal is also called *Ashra* jal. This net is conical in shape and when fully open it takes the shape of a circle. A strong jute or plastic rope is tied at its

apex. This rope is used while casting and pulling the net from under water. Several earthen or iron beads are used as sinkers in this net. The fisherman controls the net by tying the extreme end of the rope in his left hand. The net bears several pockets in the perimeter. During hauling the fishes are entangled in these pockets. The fisherman should be skilled in operating this net. The size varies from small, middle to large depending on the area of water bodies where it is operated. This net is used in both natural and culture ponds, beels and rivers.

Species caught: Indian major and minor carps and exotic carps, Murrels like *Channa* spp. and cat fishes like *Mystus* spp. *Clarias magur*, *Heteropneustes fossilis*, etc.



Fig. 3. Cast net (Sewali/ Ashra jal)

Active gears (Traps)

Scooping gear: Conical scooping gear (Jakoi): It is a bamboo made conical fishing gear with a handle (Fig. 4). It is dragged in water like a shovel and lifted up to trap small fishes. It is used in shallow waters of ponds, swamps and marshy areas and operated mostly by women. It is of various sizes. For lifting it has a rope made of jute.

Species caught: *Puntius* spp., *Mystus* spp., *Anabas testudineus*, *Glossogobius giuris*, *Channa* spp., *Macrognathus pancalus*, *Mastacembelus armatus*, *Clarias magur*, *Heteropneustes fossilis*, Cypriniformes fishes like *Botia dario*, *Devario devario*, *Lepidocephalichthys guntea* etc.



Fig. 4. Conical scooping gear (Jakoi)

Cover pot: Bamboo made cover pot (Polo): The Polo is a fishing gear made by tying bamboo strips tied with cane or rope. There are two openings- one small opening at the top and a broad one at the bottom. The fishes are trapped by a sudden dipping of the gear in water in a jerk. The trapped fishes are collected through the small opening at the top. Two types as based on size, shape and gap size between bamboo strips were recorded during the study (Fig. 5 A and B).

Medium to big sized fishes like *Labeo rohita*, *Cirrhinus mrigala*, *Chitala chitala*, *Wallago attu*, *Sperata aor*, *Sperata seenghala*, *Channa marulius*, *Channa striatus*, etc are captured.

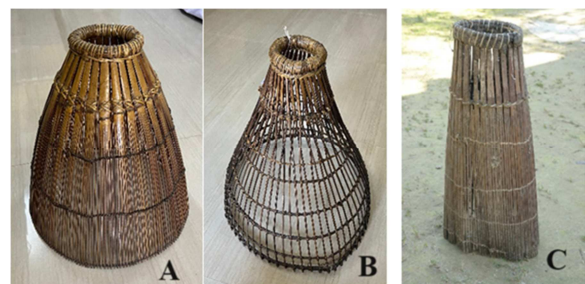


Fig. 5. Cover pot (Polo) (A and B); Juluki (C)

Bamboo made cover pot (Juluki): The Juluki is similar in structure to that of Polo but smaller in size (Fig. 5 C). It has a lesser circumference than Polo. The fishing method is similar to that of Polo.

Medium sized fishes like that of Polo are captured by this gear. Cover pots are used in shallow water bodies having a depth of about two to three feet.

Active gears (Impaling or wounding gears) spears and spikes

Spear with single spike (Suli/Choli): The spear Suli/Choli is an impelling gear (Fig. 6A). Active participation of the fisherman is required for fishing with this Suli. The suli has a handle with a long single spike. The end of the spike is sharp and pointed. The fisherman impels the fish by hurling the gear onto the fish. Fishes especially cuchia (*Monopterus cuchia*) is impaled by this gear.

Spear with hooks (Koch/Hana): The *Koch/Hana* spear is an impelling gear having 5 -10 spokes with hooks (Fig. 6 B). The handle of Koch is much longer than the spokes. The spokes are short, approximately 30 cm. Medium to big sized fishes are impaled by this Koch.

Spear with multiple spikes (Koch/Hana): *Koch/Hana* is also a spear but the number of spikes is more than the spear with hooks (Fig. 6 C). Another difference with the previous one is that it has no hook. The spikes are made of the sticks of an old umbrella. The number of sticks vary, generally upto 15-20 numbers. It is operated in shallow water. Small sized fishes are impaled with this type of Koch.

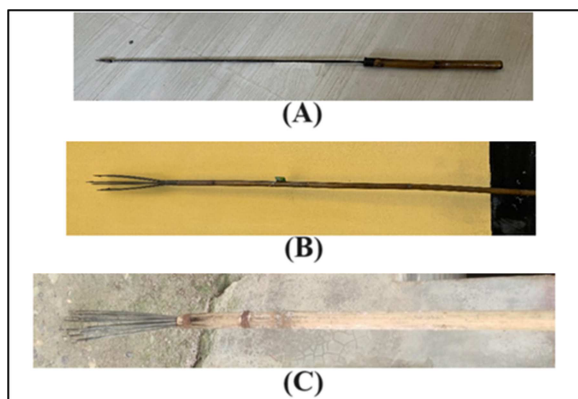


Fig. 6. Spear with single spike (Suli/Choli) (A); Spear with hooks (Koch/Hana) (B); Spear with multiple spikes (Koch/Hana) (C)

Spears and Spikes are used in shallow waters of dried up ponds, canals, beels, along river banks and also swamps and marshy areas.

Active gears (Hooks and lines)

Hook and line with pole (Barashi): Barashi is an active gear which has a hook made of iron and a line. Usually thread is used as a line. The size of the hook varies depending on the size of fishes to be entangled. For alluring the fishes a bait is used. The bait may be of wheat flour ball or earthworm or grasshopper. Long bamboo stick is used as a handle. *Anabas testudineus*, *Trichogaster fasciatus*, *Channa* spp., *Clarias magur*, *Heteropneustes fossilis*, etc are the species of fishes caught by this gear.

Hook and line without pole (Doliowa Barashi): *Doliowa Barashi* also has a hook and a line but without the bamboo stick. The operator used it by throwing, keeping the last end of the line in his hand. Here also a bait is used for alluring the fish. The species caught are same as the gear Barashi. Hooks and lines are used for fishing in any type of water body.

Passive gears (Nets)

Entangling gears

Gill Nets (Kaoi Langi/ Puthi Langi/ Goroj Langi): Gill nets (Fig. 7 A) are rectangular nets of various sizes; These are locally called Langi Jal. The gill nets have different mesh sizes depending on the fish species to be entangled. These nets are kept as barriers against the water current. It has many earthen beads as sinkers attached to its bottom border. Depending on the fish species to be entangled it is named as *Kaoi Langi*, *Puthi Langi*, *Goroj Langi* etc. The gill nets *Kaoi Langi*, *Puthi Langi* and *Goroj Langi* are used for entangling *Anabas testudineus*, *Puntius* fish species and *Channa punctatus* respectively. But in addition to these other fish species are also entangled by these nets whose head size is bigger than the mesh sizes. These types of gears are used to prevent the passage of fishes in water bodies. Usually, these nets are set in calm steady water areas like paddy fields, canals, and swampy areas.

Scooping nets

Lift net (Dheki jal/Jata jal): The lift net *Dheki jal/Jata jal* is a type of scooping net (Fig. 7 C). It is big in size.

The net is square in shape with bamboo frames. The middle portion of the net looks like a bowl where the fishes are caught. It has a handle and a rope for pulling it out from under water. It is set in a river or in the beels. After some time, the fisherman pulls the net by pushing the handle like a lever and pulling the rope. Small to middle sized fishes e.g *Puntius* spp., *Devario* sp., *Anabas* sp. etc. are caught by this net.



Fig. 7. Gill Nets (Langi Jal) (A); Lift net (Dharma jal) (B) and Dheki jal/Jata jal (C)

Dharma jal

The lift net *Dharma jal* (Fig. 7 B) is smaller than the *Dheki jal/Jata jal*. It is set in the rivers, large ponds, swamps or in the beels for catching fish. It is rectangular in shape. Two split bamboo sticks are used for fastening the net. A bamboo pole is tied at the cross point of the split bamboo sticks. This bamboo pole is used as a handle for pulling the net from under water. A long and strong rope is used for lifting the net. The fisherman collects the fishes by scooping the net. Small to medium sized fishes are caught by this trap. It is mostly used in shallow flowing water.

Trapping gears (Bamboo traps)

Sepa (3 types): It is a trap made by weaving bamboo strips. The shape of the gear is broad in the middle and tapering at the ends (Fig. 8). The ends of the trap can be opened to collect fishes. There are two openings at the side of the trap which have fine bamboo strips pointing inwards to prevent the escape of the fishes caught. Based on the size and shape, three different types of such gears were recorded during the study.

The first one has only one opening at the top which is sewed by rope or cane. Its length is 72 cm; breadth 42 cm and gap between bamboo stripes: 0.5 cm. The size

of the mouth with spikes is 11cm × 7 cm. The second one has a mouth size of 10 cm × 10 cm. Diameter of open mouth is 13 cm; circumference at centre is 69cm; circumference at open end: 37cm. The gap between bamboo stripes is 0.5-0.8 cm. The third one has a mesh size of about 1 cm. Small sized fishes are entrapped by these gears.



Fig. 8. Bamboo traps (*Sepa*) of different types

Dingar

Dingar or *Dingora* is a trap made of bamboo, slightly rounded in shape with flat top and bottom (Fig. 9). It is about 80 cm in height and 40 cm in breadth. It has an entry point of fishes at the front which is about 25 cm in width and two openings at the back for taking out the fishes. The entry point has backward-faced bamboo spines of length 18cms. It is placed in flowing water to trap small and medium sized fishes.



Fig. 9. Bamboo traps (*Dingar*)

Darki

This trap is of length 58 cm and breadth: 40 cm. The gap between bamboo stripes is about 7 cm (Fig. 10). It works in the same way as the other bamboo traps and used for trapping small to medium fishes in flowing water.



Fig. 10. Bamboo trap (Darki)

Bamboo traps are used mostly in slow flowing water. Such types of trapping gears are used for catching small to medium sized fishes. The trap is placed in slow running water with side openings facing the current. Generally, they are set in earthen embankments of marshy areas.



Fig. 11. Barrier (Bana)

Passive gears (Barriers or fences)(Bana)

It is a barrier made of bamboo sticks (Fig. 11). It is made of Makal bamboo. It is about 80 to 100 cm in height; the length of the barrier is variable. The bamboo sticks are woven with ropes with a gap of about 2 cm. It is placed as a wall in flowing or stagnant water to block fish movements. The net is placed behind the barrier in a bow-shaped manner in flowing water. Fishes of any size which jump the barrier and get collected in the net placed behind.

Conclusion

All the fishing gears recorded during the study are traditional and are being used since generations. The active traps such as *Jakoi*, *Polo*, *Juluki*, and passive traps such as *Sepa*, *Dingar*, *Darki* and *Bana* were constructed with bamboo. The materials of the nets were synthetic. Most of the fishing gears of the study area do not seem to have any detrimental effects on the habitats of fishes or other aquatic organisms. However surrounding nets and gill nets have some adverse effects on fishes and their habitats.

Surrounding nets (Bidhanmara jal/ Ber jal) is destructive for the fact that this gear has a small mesh size of about 1mm and it entraps almost all aquatic organisms including insects, crustaceans, etc. and small vertebrates. The gill nets sometimes entrap aquatic snakes which is very detrimental for aquatic habitats. People should be made aware of such effects of fishing gears for the protection of aquatic resources.

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