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Traditional fishing methods used by the fishermen in the Sundarban region, West Bengal

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ABSTRACT: In 2020-2021, 14 Blocks out of 19 Blocks in the Indian Sundarban regions studied fishing methods. According to our study, current socio-economic circumstances in Indian Sundarban regions show that their lifestyle is unsuitable for low family income. This is due to large annual disasters such as cyclones, storms, floods, and the water's salinity. A network of rivers and canals connects the Sundarban. The majority of the population is reliant on fishing activity, and in particular, the livelihood of the local people is supported by capture fisheries, which are in turn reliant on fishing activity. During the study, fishers' homes received knowledge about various crafts and equipment through monthly visits. Fishers have used indigenous fishing techniques and gear in the Indian Sundarban areas to capture fish, increasingly contributing to the local economy and overall fish output. During the research period, five different kinds of crafts and twelve different kinds of gear were found. The study reveals different indigenous fishing gears used in the locality, such as nets, traps, lines and hooks. To catch various fish of various sizes, fishers employ a variety of fishing gears, each with a distinct form and size. Most fishermen in the area collect unripe fruits velvet apple (Diospyros sp.) from the forest and boil them in large pots with sufficient water. Nets and other traps are dried in the sun after being polished with an extract. The purpose of this article is to document fishery-related technical knowledge, particularly traditional fishing techniques and gears utilised in the Indian Sundarban area.

KEYWORDS: Craft, Gear, Sundarban, Fishermen, Traditional techniques

1. INTRODUCTION

The term Sundarbans is believed to have been derived from Sundri or Sundari (Heritiera fomes), the name of the vast mangrove trees that are most abundant in the region. The Sundarbans are home to an exceptionally diverse range of aquatic and terrestrial vegetation and animals. The highly fertile environment of the Sundarbans serves as a natural fish nursery. The Sundarban Mangrove helps decrease the ferocity of cyclonic storms and avoid erosion caused by tidal currents. Millions of people rely on the Sundarban ecosystem for their livelihood and subsistence, including fishing, harvesting fuelwood and lumber, and honey collecting.

The Indian portion of the Sunderbans has 9630 square kilometres and includes several islands and mainland connections (Saha et al., 2018). Fisheries and farming are the primary sources of income for this occupation. Several authors have reported different important fishes and their parasites at various locations (Ray et al., 2016a; Ray et al., 2016b; Dhara et al., 2016). The Sundarbans are an aquatic hotspot where freshwater fish and saltwater fish are found close to one another. The coastal fisheries of eastern India are completely reliant on the Sundarbans for their livelihood (Sen and Mandal, 2019; Ghosh et al., 2017).

Shrimp farms and brackish-water paddy cum prawn culture systems are also becoming major sectors of

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instant cash income for owners of large landholdings in the Sundarbans. The coastal and estuarine fishing and riverside prawn seed collection employ most of the Sunderbans' workforce, including men, women, and children. However, according to the researchers' findings, the majority of these fishing methods are unsustainable from an environmental standpoint and are only focused on the short term (Ray, 1993). A distinction has been made between residents and transients in the fish fauna of the estuary waters of the Indian Sundarbans and the surrounding areas (migrants). The term "resident species" refers to a species that may be found in any estuarine zone throughout the year, with individuals of varying sizes present at all times of the year (Saha et al., 2018; Sharma et al., 2016; Biswas and Ghosh, 2016; Bhattacharjee, 2016).

Many areas in India's freshwater sector have little documentation of crafts and equipment. Several authors have examined the documentation of northeast Indian fishing boats and gear (Upadhyay et al., 2013; Gurumayam and Chaudhary, 2009; Datta and Bhattacharyja, 2009), fishing gear and vessels used in some inland waterways (Gokulkrishnan and Moses, 2014; Manna et al., 2011). Saxena's comprehensive account of fishing vessels and equipment used in the middle section of the Ganga River System (Saxena, 1966). It is widely known that indigenous fishing gear and techniques are used throughout India's southwest coast to catch squids and cuttlefish (Mohan, 1983). However, researchers haven't attempted to record fishing gear or local crafts in the Sundarban area in recent years. Here, an attempt has been made to document the traditional fishing crafts and gears in these regions.

2. MATERIALS AND METHODS

In 2020-2021, the study was repeated in 14 Sundarban Blocks to understand the various fishing techniques better. Different factors including season, area name, materials utilised, technique, typical size and mesh size, and people engaged in the activity were collected using a particular questionnaire. Crafts and gears were measured in the field, and the results were recorded. Data was gathered from a fishing location based on interactions with fishermen, net manufacturers, and shopkeepers. A mobile camera was used to photograph various crafts and gears, and measurements were taken by scale for length, breadth, height (in crafts) and diameter and mesh size (in gears). In addition, other factors such as net type and size, operating mode, and fish captured in the nets were taken.

3. RESULT

Beaches, mudflats, coastal dunes, sand flats, estuaries, creeks, inlets, and mangrove swamps are among the major morphotypes of the deltaic Sundarbans, which have a significant percentage of marine characteristics in the ecosystem. Despite their size, the Indian Sundarbans may be divided into three salinity zones, with intertidal oyster beds sustaining the high saline zone (Saha et al., 2018; Report on Indian Sundarbans, 2003). Partha Pratima, Namkhana, Sagar, Kultali, Gosaba & Basanti are high salinity blocks; Canning-I & II, Kakdwip, Mathurapur-II, Jainagar-II are medium salinity blocks; and Kulpi, Mathurapur-I are low salinity blocks. Generally, heavy salt, heavy metals, and other water pollutants adversely affect aquatic animals' different developmental stages (Mallick et al., 2016; Bhattacharya, 2015; Bhattacharya, 2016; Mandal, 2016; Saha et al., 2017; Samal et al., 2017). Except for salt, other contaminants have come from various human activities and tourism management (Dandapath et al., 2016; Das et al., 2016a; Das et al. 2016b). The conflict between man and nature poses a significant danger to the Sundarban's natural beauty (Sardar et al., 2016).

It's important to remember that the whole Sunderbans region has a wide range of fisheries and aquaculture operations. These include coastal fisheries, brackish water and estuary aquaculture, and riverine and estuarine fisheries. The fishermen live together and perform traditional fishing techniques between the different positive-negative interactions of the biggest Mangrove Sundarban areas. Fishing gear refers to the equipment used to catch aquatic animals. The principles of catch often classify fishing gear and methods and, to a lesser extent, the materials used in gear manufacturing or gear and this approach is common.

3.1 Khepla jal (Cast net)

Fishing gear like khepla jal is widely utilised in all kinds of waterbodies since cast nets are the most common fishing gear. The net has a conical form that looks like an umbrella and comes in various sizes. A typical khepla jal is approximately 13ft. to 20ft long, with a bottom circular ranging in diameter from 20ft. to 30ft. having a mesh size of 1.5 cm. Natural or synthetic twines may be used to weave it. It's a hand-operated net that a single fisherman can throw and control. This kind of equipment requires one person to operate.

3.2 Stake net

Stake nets are fixed conical bag nets that are used in shallow water with strong tidal currents. Stakes pushed to the bottom keep the mouth of the net open against the stream. Variable names are given based on their use, shape and size as Charpata jal, Khalpata jal, Behundi jal etc.

3.2.1 Charpata jal

During low tide, the barrier net known as Charpat jal is used in shallow parts of the Sundarban when the bottom becomes wholly or partly exposed. It's composed of synthetic twines. A typical charpata jal is approximately 100 metres long and 3-4 metres wide, and it is constructed of netting with extremely small meshes. The netting is attached to a thin rope on the top side, while on the bottom side, it is attached to a thick rope. The net's loop size ranges from 1.5 to 1 cm. The net comprises many rectangular pieces of artificial twine

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netting connected to bamboo poles and covers large areas of mudflats during low tide. It will need a crew of approximately 5-6 guys to operate it. Various species of fishes, prawns, shrimp are captured in the flood tide are caught in the net at the turn of the tide.

3.2.2 Khalpata jal

Another kind of barrier net is the Khalpata jal, which is exclusively utilised in the Sundarban khari. The length and breadth of the khalpata jal vary between 50 and 70 metres. The net loops are 1.5 to 1.5 cm in diameter. It's also used to catch Bhetki, parse, datne, prawn, paira, and kain, among other fish species.

3.2.3 Behundi jal (Basal Jal)

The behundi jal catches fish of all sizes. As a consequence, a significant amount of biodiversity is lost. The bag part of the behundi jal is 20 metres long, the mouth is 6 metres wide, and the wings are 10 metres long. The loop is 3.0 cm wide at the mouth and narrows to 0.4 cm at the cod end. It has six loop size settings. The lower end of the wing's extremities is connected to two hefty wooden anchors or two wooden spikes dug into the mud, while the top end is fastened to a huge drum that serves as a float. Two bamboo poles, each approximately 5 metres long, are used to keep the mouth open. At the cod end, there is also a buoy.

3.3 Drag net

Moi jal is a popular name for it. Jal is also known as 'trawl' by certain fishermen. It is a passive gear (except for the floating gill net) in which the mesh size changes according to the target fish's body depth. The gear is designed to stay extended throughout the operation, as the hefty iron weight and floaters are made possible. The operation requires 2-4 persons.

3.4 Gill net (Current jal)

The most frequent fishing gear seen in the river is gill nets. Polyamide (PA) multifilament or monofilament is used to make the net. Gill nets constructed of monofilament are now the most common. It is a passive gear (except for the floating gill net) in which the mesh size changes according to the target fish's body depth. Floats and sinkers keep the gill nets vertically upright in the water column. The actual meshes of the net play an important role in the capture of many fish species, especially Hilsa, when using this kind of equipment.

Fig. 1. Under the preparation procedure of a Khepla jal (Cast net).

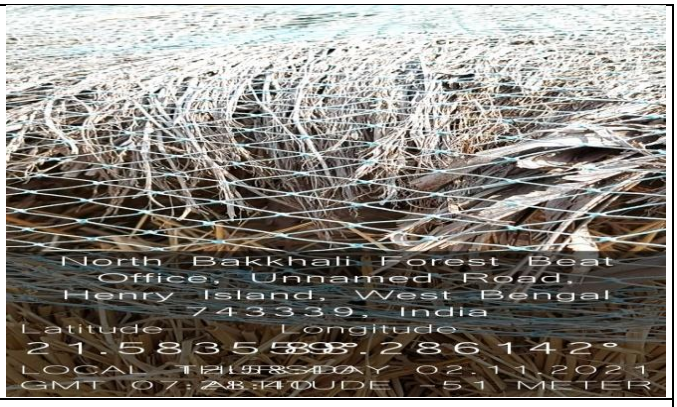

Fig. 2. Khalpata jal

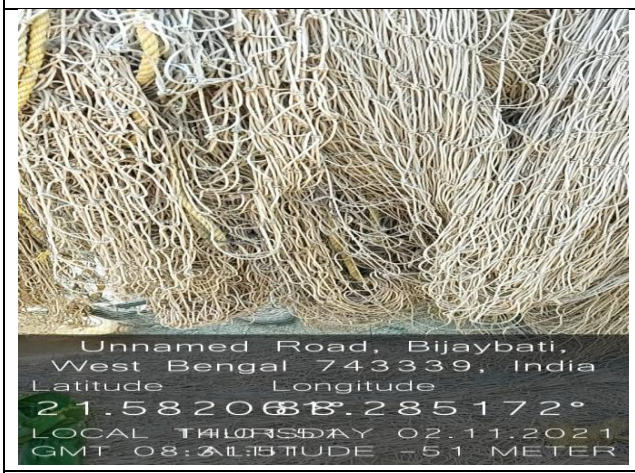

Fig. 3. Drag net

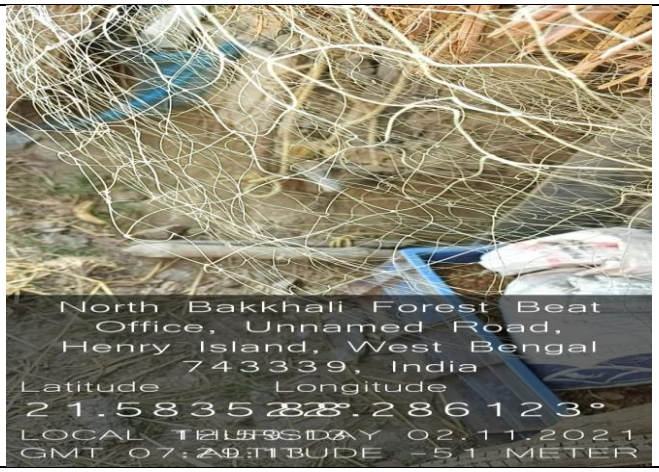

Fig. 4. Gill net (Current jal)

3.5 Scoop net

It is the most often used piece of equipment in the Sundarban region. For example, to capture the larvae of Bagda prawn, many women work together to construct round framing gear and triangle framing gear out of a bamboo frame and mosquito nylon net, which they use to catch the larvae. Additionally, it catches all kinds of tiny fishes of various sizes. The operation requires one person. Sundarban's considerably bigger canal also employs a net in addition to the rectangular scoop. It's a

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shame that this particular kind of scoop net hasn't been documented anywhere yet. Two people are needed to catch the prawn fishes.

Fig. 5. Round Scoop net

Fig. 6. Rectangular Scoop net

Table 1: Some of the selective fishing nets utilised in the Sundarban region and their target species.

Type of Fishing gears	Local Name	Main season	Major species caught	Cost (Rs.)
Cast net	Khepla jal	All-season	All types of common fishes and prawns, shrimps etc.	800-1200/-
Charpata jal (Barrier jal)	Pata jal/ Ghera jal	All-season	Carps, Boal, Pangus, Tangra, Prawns, Shrimps	2000-3000/-
Khalpata jal (Barrier jal)	Pata jal/ Ghera jal	December-April	Bhetki, parse, datne, prawn, paira, and kain	2000-3000/-
Behundi jal (Lift net)	Basal Jal	All-season	Shrimps, small types of fishes, prawns etc	3000-5000/-
Drag net	Moi jal/ trawl Katni jal	All-season	Shrimps, small types of fishes, prawns etc	4000-5000/-
Gill net	Current jal	All-season	Hilsa, Tangra, Carps, Pangus, Datna etc.	8000-10000/-

4. LINE AND HOOK

Typically, the equipment consists of lines and hook(s) with fake or edible apples attached, luring and catching fish. When fishing for various species of fish, different types of hooks and lines are used. If you choose, the lines may be fastened anywhere from the surface to the bottom; they don't have to be anchored.

4.1 A simple hook

A basic hook consists of a head or eye connected to the line, a shank, bend, spike, and barb.

4.2 Barbless hooks

Barbless hooks are used in poles and lines to remove fish from the water as easily as possible.

4.3 Kerbed hooks

The use of twisted hooks in the bent portion makes baiting easier and increases efficiency.

4.4 Double hooks or triple hooks:

In a troll line, double hooks or triple hooks are used to secure fake jackets together. These hooks are less likely to damage fish than a single hook.

4.5 Jig hooks

Jig hooks are made up of a single or a double whorl of barbless hooks wrapped around a spindle that is either colourful, metallic, or plastic in form.

Fig. 7. Line and Hooks

5. TRAP

For fishing, fishermen in Sundarbans utilise a variety of traps. In fishing, traps are fishing equipment into which fish willingly enter and get trapped. Trap fishing is an old passive fishing method with many variants in design, materials, manufacturing, and operation depending on the location and behaviour of the target organism. One or more chambers may be included in a trap, and these chambers are sealed after the fish have entered. Bamboo splits are often used in the construction of traps.

5.1 Square-shaped trap

Locals name this kind of trap a 'Chawra', and they use it to capture a wide variety of fish. In the canal, box-shaped bamboo trap fishing is popular in all seasons. However, several square-shaped nylon-covered bamboo-framed traps have been seen in recent times. The box has a hole through which fish and other aquatic animals may enter, but they cannot leave again via the traditional mechanism.

5.2 Rectangular-shaped trap

Locals name this kind of trap a 'Banga', and they use it to capture a wide variety of small fishes and shrimps. In the canal, rectangular-shaped bamboo trap fishing is popular from winter through summer. The box has 2-3 long channels through which small fish and other aquatic small animals may enter, but they cannot leave again via the interlock mechanism system.

5.3 Round-shaped trap

Locals name this kind of trap a 'Dahari', and they use it to capture a wide variety of fishes and prawns and shrimps. In the canal, round-shaped bamboo trap fishing is popular from winter through summer. The box has One big interlocking hole which fish and other aquatic animals may enter, but they cannot leave again via the interlock mechanism system.

5.4 Polo

This one of the very traditional moderate-size fish capturing equipment is found in the Sundarban regions. One person operates the polo in shallow water by pushing its large rounded area. While going through water, the guy who uses it holds it by its stem and pushes down on the mud with its rim before pulling it back and raising it above or up to the water's level. Then, when he

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catches a fish, he reaches into the stem with his hand to get hold of it.

Fig. 8. Square-shaped trap.

Fig. 9. Square-shaped, Rectangular- shaped, Round-shaped and Polo trap.

6. CRAFT

A fishing Craft is a kind of boat, ship, or other vessel used for fishing. Different kinds of crafts and various sizes and designs are commonly used in Sundarban areas. Floating and movable platforms from which fishermen operate their fishing gear are referred to as fishing craft.

6.1 Dhinghi/ Dingi

The crafts are built on a board that is made locally out of wood and painted. The length and breadth of the boat are varied between 42 and 45 cm, while the height and width are varied between 8 and 10 cm. Boat preservatives, i.e., bitumen paint, serve as water resistants and safeguard artisanal products from deterioration and damage. It also ensures that the vessel has a long-life span and that the boat does not leak. Boat propulsion is accomplished via a long bamboo stick, which enables the boat to move in various directions.

In recent years, fishermen have expanded the size of their boats to sail with a big carrying capacity and have installed a diesel engine to travel quickly from one location to another.

6.2 Nouka

These are constructed of wooden logs and are utilised in low-tide areas with a plain bottom. They travel through the inner canals easily and are employed to capture small fish.

6.3 Built-up boats:

Boats of the carvel design, which have pointed ends on both ends, are currently being built. These boats are employed for the catching of lines and hooks.

6.4 Handline boat:

Manual boats are used in both canals and rivers, and they are operated manually. They are employed to catch all types of demersal fish, including those caught by small, mechanised boats.

6.5 Trawlers

These are very efficient ways to go from the river to the sea. The boats range in length from 32 to 55 feet and maybe fitted with engines ranging from 60 to 120 horsepower. Trawls are fishing nets that are dragged along the seafloor or in midwater at a certain depth.

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Large numbers of smaller trawlers are noticed in the Mohana regions.

Fig. 10. Dinghi (Connected with moto)

Fig. 11. **Built-up boat**

Fig. 12. Nouka

Fig. 13. Smaller Trawler

7. DISCUSSION

Sundarban's canals and rivers are reservoirs of various kinds of fishes, prawns, crabs, and other economic aquatic animals, which may be caught using a variety of gears such as hooks and lines, traps and nets. These are considered the cheapest sources of proteins. Various kinds of digestive protein and enzymes were analyzed on various aquatic animals (Chakrabarti et al., 2006; Gauri et al., 2016; Mallick, 2017). The creation of UV-B protection mechanisms in aquaculture species is critical for the long-term production of healthy aquaculture crops (Chakrabarti et al., 2019; Sharma et al., 2008). Various kinds of gear and craft have been utilised for many generations. Harvesting requires certain tools and skills. Sundarban fishermen have a distinct pattern of gears and crafts. The purpose of this study was to compile a list of the currently accessible fishing boats and gear in the Sundarban area. In this manner, we may get a sense of the various fishing boats and equipment available in West Bengal. Fishermen's traditional fishing methods have a major impact on the surrounding ecosystem. Their traditional fishing methods are more energy-efficient, simple to implement, and environmentally beneficial. In addition, as compared to the mechanised industry, traditional fishing provides considerable opportunity for fair sharing of environmental benefits. Even after modernising fishing boats and gears in other areas of the nation, the current study finds that local fishermen still use traditional fishing methods. It's likely that the abundance of Sundarban forest products such as mangrove wood and other local timber, bamboo, and other basic building materials, such as those used to make these devices, has provided an edge in the design and construction of various crafts and equipment. Various plant extracts that have been dried in the sun are used to preserve instruments and crafts.

Overfishing from spawning grounds, as well as larvae and juveniles, causes severe depletion, according to traditional knowledge of the Sundarban areas. However, according to a recent discussion among local fishermen, they attempt to use a connected engine with a boat to go from one fishing location to another. It will contribute to increased water pollution and should harm fish breeding. The actual mesh size of different kinds of nets is shrinking. As a consequence, tiny fishes get entangled in the net, potentially reducing the fish population.

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