

Innovations in inland capture fisheries for sustaining the contribution of small scale fisheries

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Profile of inland fisheries in India

- Inland capture fisheries are dynamic in nature.
- Extracting fish or other aquatic organisms from inland waters is known as inland fisheries
- Inland fisheries sector in India is largely comes under small-scale fisheries can be defined as an easy, individual or household(family) venture, entail low levels of technology

- Inland fishers are usually socio-economically backward, belong to the traditional fishers' community
- Small crafts, mainly non-motorized boats and simple gears are used to harvest the fish or other aquatic organisms
- Fishers largely work as share-workers or operate individually.
- The fishers do have traditional knowledge on fishing activities, biodiversity, resources
- The activities of small-scale fisheries usually comprise supplying fish and fishery products to local and domestic markets as well as for subsistence consumption

India's Inland Fisheries Sector- Key Indicators

India having 7.73% of Global Share of Fish Production

3rd Largest Fish Producer

2nd Largest Aquaculture Producer

4th Largest Capture Fish Producer

Fisheries has 1.24% contribution in National GVA

Classification of Inland fisheries resources

Riverine Fisheries

Wetland fisheries

Reservoir fisheries

**Fisheries canal/
Derelict waters**



Inland fisheries resources of India and their modes of management

Resources	Resource size	Mode of management
Inland		
Rivers (km)*	164118	Capture fisheries
Canals (km)	64972	Capture fisheries
Mangroves (ha)	356 000	Subsistence
Estuaries (ha)	485185	Capture fisheries
Freshwater ponds (ha)*	9 200 327	Aquaculture
Brackishwater ponds (ha)*	1 065 500	Aquaculture
Secondary Saline soil areas (ha)	9 000 000	Aquaculture (Potential)*
Estuarine Wetlands (ha)	40 000	Aquaculture
Lagoons (ha)	141 129	Capture fisheries
Reservoirs (ha)	3 460 301	Culture-based fisheries & Enhanced capture fisheries
Floodplain Wetlands (ha)	564 286	Culture-based fisheries, Enhanced capture fisheries
Lakes (ha)	30551	Capture fisheries
Upland lakes (ha)	96 900	Capture fisheries
Others**	146 730	-

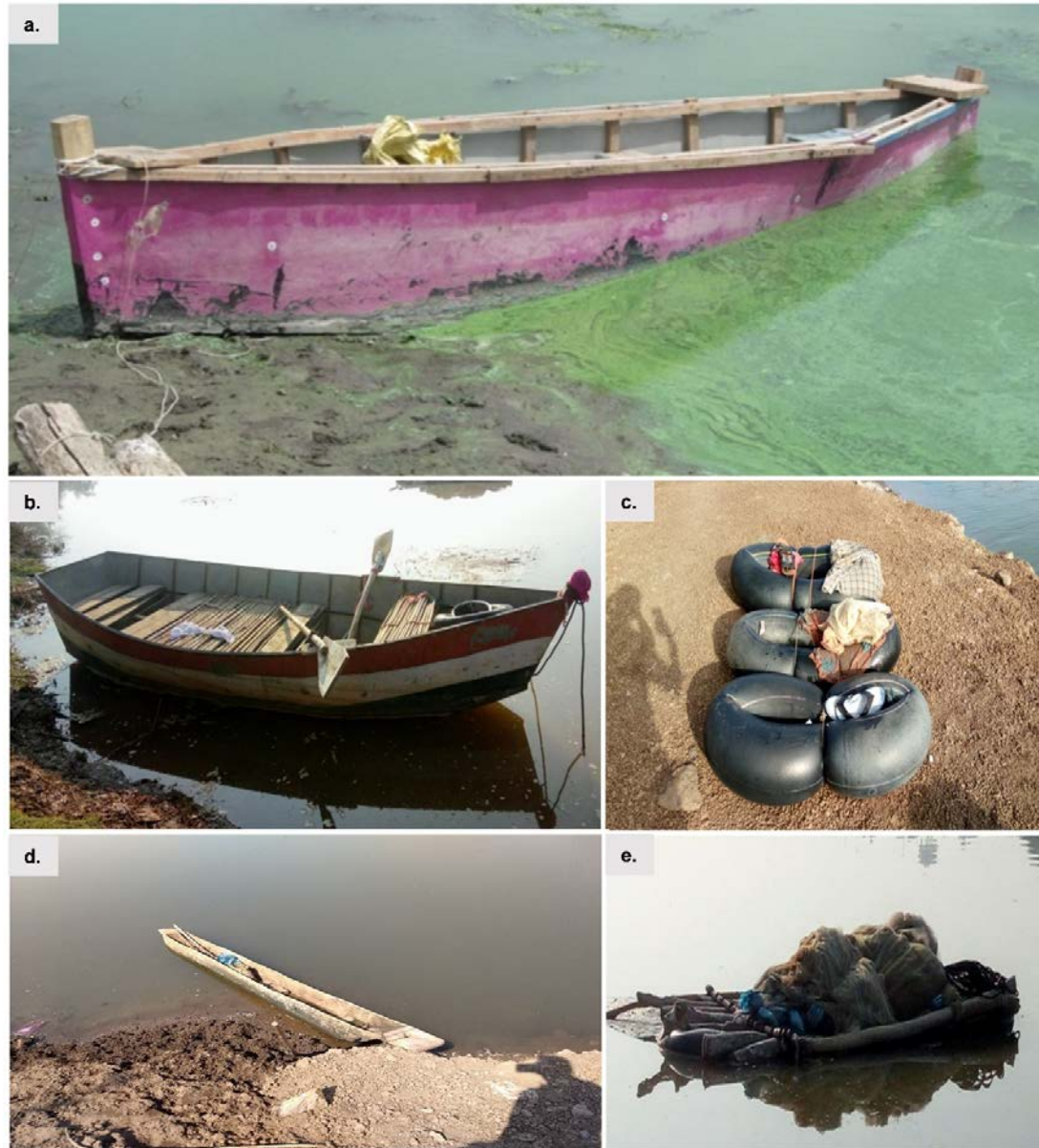
Fishing crafts used in India

- Fishing practices, crafts and gear used in inland fisheries are still traditional, design of which are generally based on traditional knowledge of fish behaviour and hydrodynamics of water bodies.
- In rivers, coracles, country boats, and motorized boats are used for fishing.
- Coracles are the traditional saucer-shaped small boats, generally up to 2 m diameter, made of bamboo frame covered with buffalo hide. These are used extensively in the small inland water bodies of southern states.
- The next popular craft is wooden boat.
- The sturdy and large 'plank-built boats' are used for fishing in rivers with strong tides and currents. These include *dinghi*, *chandi nauka* and *mechho bachari* of West Bengal, *vallam* of Kerala, and *nava* of Chilika lake, Odisha.
- *Kulnawa* is a specialized boat used in the river Ganga for fishing of minnows in calm waters.
- However, many other local variants are fabricated by using locally available wood such as dug-out canoes (usually made of palm tree trunk in southern states).

Types of crafts found in Tapi river

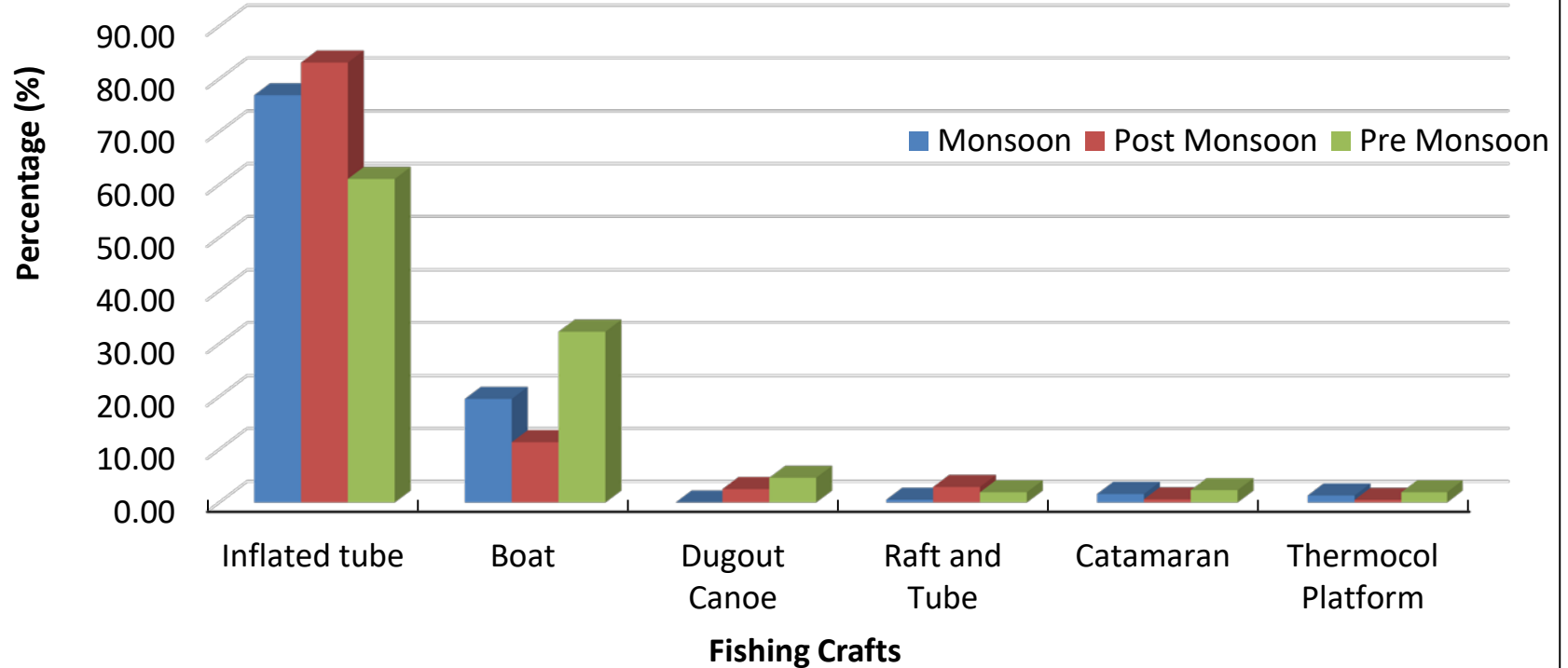
In Tapi rivers fishers are using

1. Wooden boat
2. *Dugout canoe*
3. *Inflated tube*
4. *Raft on tube*
5. *Catamaran*
6. *Thermocol platform*



Different crafts used for fishing in the river Tapti: (a) Boat made-up of tin; (b) Boat made-up of wood; (c) Inflated tube; (d) Dugout canoe; (e) Catamaran

Different types of crafts used in Tapi rivers(Season wise)



Fishing Crafts in the river Cauvery

- Fishing crafts of Cauvery river are rather primitive in nature as the river flow and depth is highly controlled and entirely dependent on water release from dams and barrages across the river.
- Bamboo made coracle was the major fishing gear which has been slowly replaced with fiber-made coracle.
- Large wooden fishing boats which are common in many Indian rivers like river Ganga or river Krishna has not been observed here. Only for a limited period of heavy discharge during monsoon, fishers find difficult to operate coracles; rest of the year those fishing crafts are good enough for fishing in the river.
- A total of five types of fishing crafts have been recorded from river Cauvery as discussed below. Distribution of the crafts is given in Table

Local name	VLN	KDG	TNP	SSM	HGL	BVN	MYN	GAN	LAN	KLD	PZR	PMR
Wooden raft												
Catamaran												
Bamboo coracle												
Fiber coracle												
Wooden canoe												
Fibre canoe												
Fibre boat												

VLN: Valnoor KDG: Kudige TNP: T. Narasipura

SSM: Sivanasamudra

HGL: Hogenakkal

BVN: Bhavani MYN: Mayanoor

GAN: Grand anicut

LAN: Lower anicut

KLD: Kollidam

PZR: Pazhayar

PMR: Poompuhar

Fishing crafts of Bramhaputra

- The fishing crafts used are generally, flat bottomed for propulsion in shallow waters. They are locally known as Nawka, Bhel and Dingi.
- All these crafts are non-motorized and propulsion is by rowing with oar.
- The overall length of the traditional crafts ranges from 5 to 10 m with breadth of 1 to 1.5 m and depth between 20 and 60 cm.
- The fishing craft have evolved from the cheapest indigenous floating materials available like dry wooden logs, drums, bamboo, banana stems etc. The materials used for making the fishing craft depend mainly on the availability of low cost and durable materials locally in the region.
- Among the available timbers, the fishermen consider *Shorea robusta* (sal) to be the best quality wood for the construction of boat due to its long durability in water.
- Due to its high cost the poor fishermen make canoes from the locally available low cost wood like *Pitheclopium monabelbum* (moz) and *Lagerstromia flosreginae* (ajhar), *Chukrassia tabularis* (poma) and *Magnefera indica* (mango). Rafts of banana stems and bamboo are also made by the fishermen for fishing in the rivers and beels.



Plank built canoe in Brahmaputra River

Crafts in reservoirs

- Mechanized boats are used for fishing only in few reservoirs like Hirakud (Odisha), Gobindsagar (Himachal Pradesh), Gandhisagar (Madhya Pradesh), Rihand (Uttar Pradesh), Vallabhsagar (Gujarat) and Malampuzha (Kerala).
- In Vallabhsagar and Hirakud, fishers could get their boats with the help of financial assistance provided by government funding agencies. Flat bottomed, locally fabricated boats 2-3 m in length are used in Hirakud, Malampuzha, Gobindsagar, Gandhisagar and Rihand.
- In vast majority of reservoirs, including some large ones that produce big quantity of fish, like Nagarjunasagar (Telangana), Tungabhadra and Krishnarajasagar (both Karnataka) fishing is still carried out by using traditional crafts and mechanized boats, if used, are only for transportation of fish.

Innovations in fishing crafts

- The only innovation that happened in inland fishing crafts through research institutes is the introduction of fibre glass to replace the wood in boats and buffalo hide & bamboo in coracles.
- The modified version of coracle has an internal diameter two and half to three meters and an inner depth of about 0.5 m.
- Similarly, the Central Institute of Fisheries Technology (CIFT) has designed a fibre-reinforced boat for use in reservoirs.
- However, these modified versions of coracle and boat are not adopted widely at a country scale.



Gears in inland waters

- Inland fishing is carried out by using traditional gear.
- The gill nets, seines, cast nets, drag nets and several miscellaneous types of gear are used in inland water bodies of India.
- Gill nets are the most common and ubiquitous gear in reservoirs of all categories.
- In most of the reservoirs, gillnets are made of polyamide (PA) monofilaments (0.16 mm to 0.4 mm diameter) while multi-filaments are also in use.
- Mesh size ranges from 20 mm to 310 mm. Floats are either of thermocol or expanded polystyrene and plastic. Nowadays, empty plastic bottles are widely used as floats in gillnets.
- Lead is the most common sinker material used in gillnets, the size, shape and weight of them vary according to the type of net and mode of operation. Clay, concrete or pieces of stones are also used as sinkers.

Categorization of fishing methods of river Ganga

Sl.	Category	Sl.	Category
1.	Without gear (1 type)	7.	Gill netting (26 types)
2.	Grappling and wounding gear (4 types)	8.	Drive-in net (2 types)
3.	Stupefying devices (1 type)	9.	Falling gear (2 types)
4.	Line fishing (7 types)	10.	Lift nets (3 types)
5.	Fishing trap (18 types)	11.	Bag nets (12 types)
6.	Arial Fishing trap (1 type)	12.	Dragged gear (5 types)

Different categories of Fishing gear in entire stretch of river Ganga

**Fishing
without gear**



Fishing by hand

Grappling and wounding device

Curved metal rod
to catch mud crab



Multi-pronged
bamboo spear



Bamboo-
made tongs
to catch
mud crab



Multi-pronged
metallic spear



Line fishing



Line without hooks



Hand line without pole



Line without pole, 7 hooks



Multiple set line



Pole and line, 2 hooks



Set line from small twigs

Fishing with Fishing traps



Brush park



Ghuni



Jhangi



Chaurpata Jaal



Pizara



Dhol Duar



Duar



Dhol



Britti



Aanta



Chak Jaal for crab fishing



Woka



Duari Britti



Gogh jaal



Woka



Pinjra



Chak Jaal targeting catfish



Jhinga Jaal

Arial Fishing trap



Thoopa Jaal

Gill nets



Cot Jaal/Sele jaal



Pangas Jaal



Current jaal targeting crab



Hilsa Jaal targeting Hilsa



Phasa Jaal



Bhola Jaal



Vacha /Ghoura Jaal



Tilantare Jaal



Topsey Jaal



Chela Jaal



Khoira Jaal



Puntí Jaal/Piyali Jaal



Gule Jaal



Kukri Jaal



Jaal (15-20 mm)

Drive-in gears



Chilwan



Khunchni Jaal

Falling gears



Khepla Jaal



Chabi Jaal

Lift nets



Jhatka
Jaal



Gyanra
vessal/S
arail



Nouka
vessal

Drag nets



Choti
Jaal



Ber
Jaal



Chot
Jaal



Ghaar
Jaal



Katni/
Moi
Jaal

Bag nets



Guri Jaal



Chhekuni Jaal



Thela Jaal



Hatu Jaal



Dhebti Jaal



Chingri Jaal



Meen Jaal



Kona Jaal



Thor Jaal



Beenti Jaal



Patan Jaal



Sangla Jaal

Common fishing gears used in the Cauvery river

Gear	Time of operation	Cost of material/gear	Number of fishers involved	Catch/operation	Major species caught
Ghana	Day time	Line: Rs. 50/90 m (50-60 No.) Rs. 100/90 m (100 No.) Hook: Rs. 5-10 per piece	one	0.5-2 kg/hr	<i>Wallago attu</i> , Carps
Aaral thoondil					<i>Mastacembelus armatus</i>
Panthi thoondil	Night (Sept.-Nov.)		Two	2-20 kg	<i>Channa sp.</i>
Kodave	Night (Monsoon)	400/gear	One	0.25 -5 kg	Small Prawns
Koondu		Rs. 2000/gear		5 kg	<i>Oreochromis spp.</i> , <i>Channa spp.</i>
Pari	Night	Rs. 300/gear	One	1-7 kg	<i>Anguilla bengalensis</i>
Butty/Komma		Rs. 500-600/gear	One		<i>Mastacembelus sp.</i> , <i>Puntius sp.</i> and other small indigenous fishes

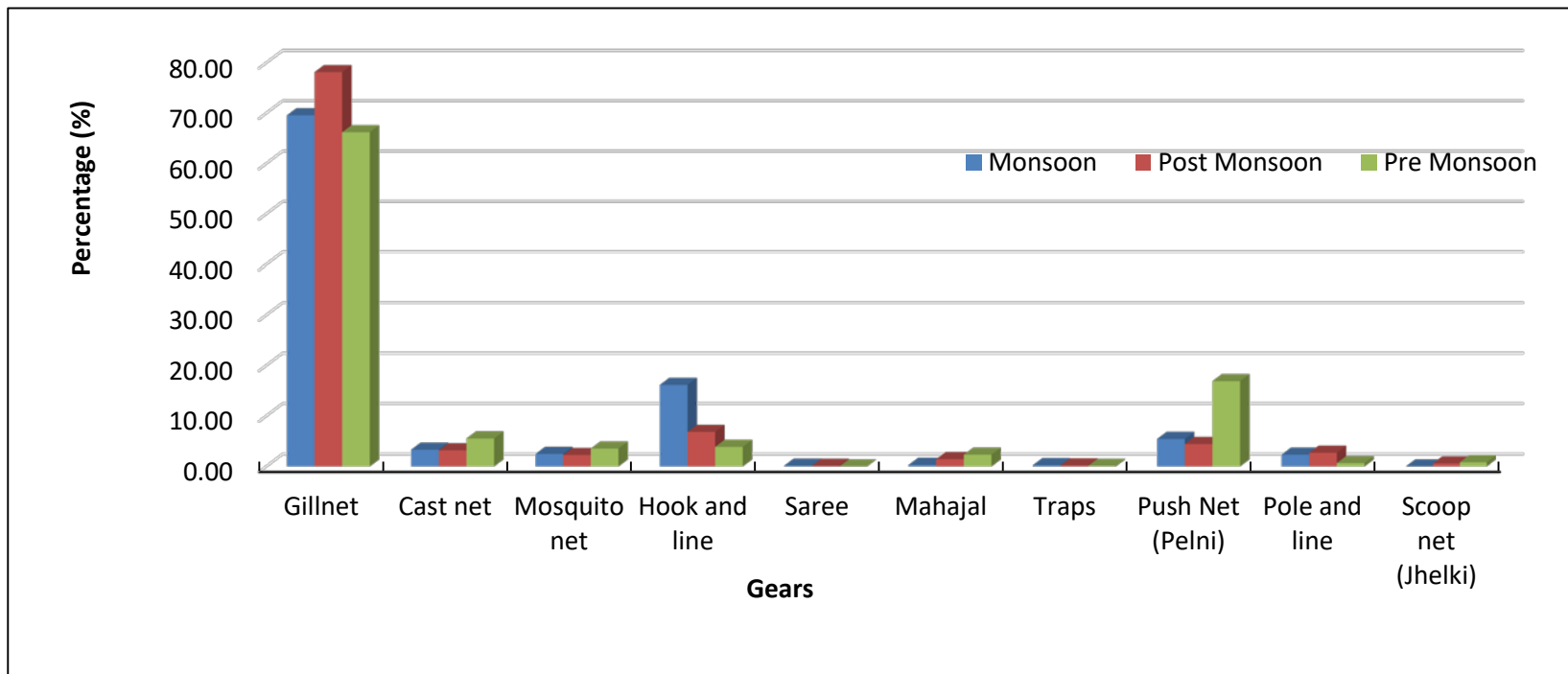
Gear	Time of operation	Cost of material/ gear	Number of fishers involved	Catch/operation	Major species caught
Bidubale	09:00-12:00 hrs.	Monofilament: 500-900/kg	One/Two	2-10 kg	16 mm: Half and full beaks 25 mm: <i>Garra spp.</i>
	17:30 -06:00 hrs.	1500-4000/gear			30 mm: <i>Mastacembelus sp.</i> , <i>Mystus cavasius</i> 45-60 mm: <i>Oreochromis niloticus</i> , <i>Labeo calbasu</i> , minor carps 75-105 mm: <i>L. catla</i> , <i>L. rohita</i> , <i>Cirrhinus mrigala</i> and <i>Cyprinus carpio</i> >110 mm: >1 kg sized fish
Periyavala	01:00 hrs. and 05:00 hrs.	Rs. 9000	Two	2-10 kg	<i>Mugil cephalus</i> , <i>Elops machnata</i> , <i>Megalops cyprinoides</i> , <i>Etroplus suratensis</i> , <i>E. maculatus</i> , <i>O. niloticus</i> , <i>O. mossambicus</i> , <i>Chanos chanos</i> , <i>Sillago sihama</i> , <i>Gerres filamentosus</i> , <i>Scatophagus spp.</i> , <i>Terapon spp.</i>
Manibale	Day time	Rs. 3000	Four	10-20 kg	<i>Channa spp.</i>
Kalluvalai	Day time	Rs. 3500	One/Two	1-2 kg	<i>Mastacembelus armatus</i>

Fishing gear of river Tapti

- Entire stretch of river Tapti exhibited 10 fishing gears
- Gill net - Gill net was found to be the most commonly used gear operated throughout the year.
- Cast net - Cast net is known as Feck jal in Madhya Pradesh and Maharashtra and Chhogiain Gujarat
- Mahajal - Mahajal is a drag net, operated mostly during pre-monsoon or summer season throughout the length of the river while its operation was less in the monsoon season
- Mosquito net – A type of drag net locally known as Macchardani made of mosquito net was noticed in all seasons at middle stretch of the river. This gear is mostly used for subsistence fishing by the poor fishermen in the area.
- Push net - Push net is traditional fishing gear locally known as Pelniand mostly employed in prawn fishing..
- Scoop net - Scoop net with a long handle locally known as Jhelki is a trendy and cost-effective fishing gear used by the rural fishers of the lower stretch of river Tapti for catching small fishes.
- Hook and line - Hook and line is another commonly used gear locally called Galand is in use in river Tapti at all the three states viz. Madhya Pradesh, Maharashtra and Gujarat.

- Pole and line - Pole and line was the other traditional fishing gear identified during the study. Basically, this is a modification of the gear hook and line. It is known Gal in both Madhya Pradesh and Maharashtra.
- Traps - Traps for crabs and prawns were observed in operation in the lower stretch of the river during monsoon and post-monsoon seasons.
- Saree - Traditional fishing using saree was observed in sampling station Dedhatalai (Madhya Pradesh) in the river Tapti during monsoon season. Saree with a length of about 5 m and breadth 1.2 m is dragged by 2-4 fisherwomen, especially in weed-infested shallow areas of the river to catch small fishes and prawns. It is a subsistence fishing method, which contributes to the livelihood of the poor fishers.

Percentage (%) use of different fishing gears in river Tapti.



Different gears used for fishing in the Tapti River



a) Gill net; b) Cast net; c) Mosquito net; d) Drag net; e) Hook and line; f) Pole and line; g) Push net; h) Saree; i) Scoop netJhelki; j) Crab trap and k) Prawn trap



Fishing crafts and gears in Reservoirs of India

Common fishing crafts used in reservoirs

Crafts	Material	Dimension	Durability
Coracle	Split bamboo frame	2 to 2.5m	4-5 Years
Rubber tube platform	Rubber and Wood	1 to 1.5Sq.m.	4-6 Years
Plank boat	Wood of Tectone grandis or Terminalia arjuna	1-2 ft width, 7-11ft length	10 Years
Thermocol raft	Thermocol sheets	0.5-0.7m with a diameter of 0.3-0.4m	2-3 Years
Engine boat	Wood covered with plastic and attached with engine	3.4 ft width 12-14ft length	12-15 Years
Fibre glass boat	Tin material, fiber glass sheet	11-14 ft length and 3-6ft wide and 2-3.5ft depth.	7-8 Years

Details of gill nets used in reservoirs in India

Centre	Twine size	Mesh bar (mm)	Length of shot (mm)	Depth (m)	No.of shots.	Fish caught
Tungabhadra	210/1/3	52	45	5.7	10	Major carps and catfishes
Tungabhadra	210/1/3	35	40	0.34	5-6	Small fish
Bhavanisagar	210/1/3	100	20	-	6	Barbus dubious
Mettur	210/2/3	20	40	-	2-3	Small fish
Hirakud	210/2/3	75	50	6	20	Major carps and catfishes
Gobindasagar	210/2/3	50	50	3	10	
Gandhisagar	210/2/3	50	30	3	9	kalbasu





Motorized FRP boats
(6-9m OAL, 35HP)





Common fishing gears used in reservoirs

Gear	Mesh Size	Durability (in years)
Gill net	20-150mm	4-5
Cast net	10-100mm	3-4
Seine	10-100mm	5-6
Hook and line	Hook size 1-4 cm	1-2
Drag net	10mm	3-4
Scoop net	5mm	3-4

Monofilament gill nets are the most common fishing gears





Drag net/shore seine



Purse seine



Cast net



Hook and Line



Purse seine



Scoop net

Fish aggerating devices

Jhupi: a traditional and ecofriendly fish-aggregating device

- Eco-friendly and highly efficient indigenous fish-aggregating device for catching prawn and SIF.
- Operated during winter and summer
- At a time, 100-300 jhupi are place together at a distance of 15-20ft in row supported by bamboo pole.
- Harvesting is done after interval of 3-4 days of operation with the help of push net or scissors net.
- On an average around 250 grams of live prawn are caught from each jhupi along with small fishes and mollusks.



Cage as FAD

- Waste feed pellets are the major cause of wild fish aggregations at open cage farms.
- The cage farm acts as shelter
- Large fishes easily caught by the fisherman using hook and line with
- Catching wild fish is an additional activity for the members of society maintaining the cage farm
- Chandil: About 20 to 30 beneficiary catch about 100 to 150kg of fish on daily basis in peak season which are sold live in the market or as brooders to hatcheries
- Wild fishes are also trapped using a spare net under the cage.



Sustainability issues

- Compared to marine fisheries, far less attention has been paid over the years towards improvement of fishing technologies in inland fisheries.
- Lack of research support on fishing technologies is one of the main constraints in inland capture fisheries as well as stock-enhanced fisheries.
- This has resulted in not only sub-optimal utilization of production potential of the inland water bodies and low income to fishers, but also led to irrational fishing practices that are harmful to the long-time sustainability of the fish stocks.
- Many states have mesh size regulations for fishing nets to prevent catching of juveniles, but enforcement of such rules is poor.
- In the lower stretches of Ganga, the juveniles of hilsa are extensively caught using fine-meshed nets.
- Considering that hilsa comes to the rivers for breeding and the offspring must migrate back to the sea for replenishing the parent marine stock, such fishing is highly harmful to recruitment and long-term capture fisheries.
- Highly destructive practices like poisoning and electrical fishing are prevalent, especially in remote areas of the Northeaster States.
- Central Institute of Fisheries Technology (CIFT) conducted experimental trawling in large reservoirs like Hirakud and Gobindsagar, but no tangible solutions came out of this (Sugunan, 1995) as the operations were found not feasible economically.