



Chapter 17

Inland Fishing and Resource Conservation

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1.0 Introduction

World freshwater capture fisheries production during 2009 is estimated as 10 323 905 t, which includes fishes, molluscs and crustaceans. Asia alone contributes about 67% of the inland capture fisheries and the top three leading countries are China, Bangladesh and India. India has vast inland resources in the form of rivers and canals, 1,97,024 km; reservoirs, 3.15 million ha; ponds and tanks, 2.35 million ha; oxbow lakes and derelict waters, 1.3 million ha; brackish water, 1.24 million ha and estuaries, 0.29 million ha. Inland water bodies include fresh water and brackish water areas. Out of the 2546 species so far listed 73 (3.32%) belong to the cold freshwater, 544 (24.73%) to the warm fresh waters, 143 (6.50%) to the brackishwaters and 1440 (65.45%) to the marine ecosystem. Lakhs of people directly or indirectly depend on the sector for their livelihood.

In the numerous water bodies inhabiting wide range of species and several types of fishing communities around, various types of fishing gears and methods are employed for fishing in the inland sector. The different fishing craft and gears operated in the inland water bodies are described below.

2.0 Fishing Craft

Fishing craft is a platform which the fishermen negotiate through water for the operation of different types of fishing gears and implements in deeper waters and return after fishing with fish catch. Some fishing gears can be operated without the help of a craft in shallow

waters. The fishing crafts of the inland water bodies are generally, flat bottom for propulsion in shallow waters and are mostly plank built or dugout canoes. They are mainly non motorized/mechanized, propelled by sails, oars and bamboo poles or with OBMs or inboard engine. The overall length of the traditional crafts ranges from 3 to 10 m, breadth of 1 to 1.5 m and depth between 0.20 and 0.60 m.

Dug outs, plank-built boats, FRP boats and tin boats are used in the deltaic regions and middle reaches of rivers and reservoirs. Coracles are used in reservoirs, backwaters and rivers in the southern region of the country. Rafts made of wood or any floating object including foam plastic are used in the periphery of reservoirs and rivers. Mechanized boats are used in certain reservoirs either as carrier or inspection boats.

The fishing crafts are evolved from the cheapest indigenous floating materials available like dry wooden logs, drums, bamboo, banana stems etc. Table.1 shows the major types of crafts used in the inland water bodies in the country.

2.1 Banana raft

Banana raft (Fig.1) is the cheapest and easily made craft by the fishers and are used in some parts of the country. 3 to 5 pieces of banana stem measuring about 1.5 to 2.5 m long are tied together with the help of thin split bamboo strips or strips from the banana stem itself, keeping all the base of the trunk along the stern side. The raft is operated with the help of a long bamboo pole. These are used in small water bodies for operation of gill nets, hook and lines. The life span of this raft is only 3 to 4 weeks



Fig. 1. Banana raft

2.2 Bamboo raft

Bamboo is yet another cheap and easily available material in the region used for raft making (Fig. 2). Bamboo poles are tied together with help of rope keeping all the lower end of the trunk towards the stern side. These rafts are about 10 m in length and 1.5 to 5.0 m wide. It is operated with the help of bamboo poles or oars in the sluggish rivers, floodplain lakes and in some reservoirs. The life span of this raft is about 1 to 2 years



Fig. 2. Bamboo raft

2.3 Wooden raft

Wooden rafts are made by tying up of three to four local cheap wooden logs. These are used in reservoirs and small water bodies. The life span is generally 3-5 years.

2.4 Rubber tubes

Inflated rubber tubes (Fig. 3 & 4) from tyres of trucks and cars are used for fishing in inland in the southern parts of India. These are exclusively used in some reservoirs in Kerala for operation of gill nets and lines. The fishermen sit on the inflated rubber tubes along with the nets and maneuver using their hands and carry out fishing operations.



Fig.3. Rubber tube



Fig.4. Fisherman on rubber tube

2.5 Empty containers

Empty oil containers or plastic buoys are also used as floating devices to carry out fishing.

2.6 Coracle

Coracles (Fig. 5 & 6) are primitive, light, bowl-shaped boats with a frame of woven grasses, reeds, bamboo or saplings covered with sheets. Coracles are mainly used in reservoirs and

backwaters in the southern regions of the country. Coracles are about 2.24 m in diameter with the greatest diameter across the centre. The bottoms of the boats are covered with few layers of plastic gunny bags or with plastic sheets. The bottom of the craft is tarred to make it waterproof. Coracles are steered and propelled using a single paddle.

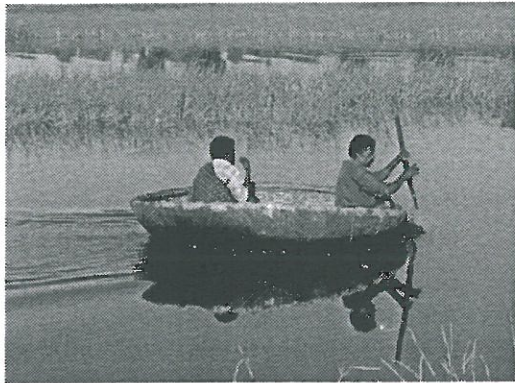


Fig. 5. Coracle



Fig. 6. FRP Coracle

2.7 Dug out canoe

It is mainly made from a single large log by scooping out the wood with the help of a small hand spade. Dug out canoes (Fig. 7 & 8) are seen throughout the inland water bodies of the country, though the numbers have drastically reduced due to shortage of large timbers. The average length of this boat ranges from 4 to 6 m. Coal tar is used as a coating after completion of construction of the dug out canoe to prevent the entry of water in to the wood. In shallow water bodies it is operated either by a bamboo pole or by an oar by 2 to 3 persons. Fishing gears like traps, gill nets and hook and lines are operated from this canoe. The dug out canoes in Manipur have a unique design in the stern part of the canoe. They are extended in to a rectangular wooden platform of 50 to 60 cm in length on which a fisher can sit comfortably and operate his gears. Dug out canoes made by hollowing out the butt and stem of the Palmyra palm of West Bengal and Vallam of Kerala are examples.



Fig.7. Dug out canoe



Fig. 8. Dug out canoe

2.8 Plank built canoe

Plank built canoes are predominantly used in rivers and reservoirs. They are of different types and vary widely in size and shape depending on where they are used and the type of fishing to be carried out.

These types of canoe are operated by oar and in case of shallow water bamboo poles are also used. Sometimes canoes are provided with arch-shaped roofing made of bamboo mat or polythene sheet which provide shelter to the fishermen. Coat tar is applied to make it water proof and protect the hull. Indigenous preservatives are also mixed with coal tar for protection.

The fishermen also give a protective sheathing of FRP to their canoes to extend the life of the canoe. Dinghies of West Bengal, Chhandi nauka, Nava of Chilka Lake, Machua of Gujarat, Dhoni of Karnataka are few examples.

Low cost canoes made with rubber wood and coconut wood by CIFT are in operation in inland water bodies.

2.9 Bamboo canoes

Canoes (Fig. 10) are made up of thin strips of bamboo and covered with plastic sheets or waste plastic gunny bags.



Fig.10. Bamboo canoe

2.10 Canoe made with waste plastic bottles

Canoes have been made with waste plastic bottles indigenously by local fishermen for the inland sector in Kerala.

2.11 Galvanized iron sheathed canoes

Fishing crafts sheathed with galvanized iron (GI) sheets of OAL 6-9 m fitted with 24-37.5 hp inboard diesel engines are used for fishing and quick transportation of the catch in some reservoirs (Fig. 9)



Fig.9. GI Sheathed canoe

2.12 FRP canoes

FRP canoes (Fig. 11 & 12) are also used for fishing in the inland waters. Its smooth finish and light weight enables the fishermen to maneuver easily in the river.

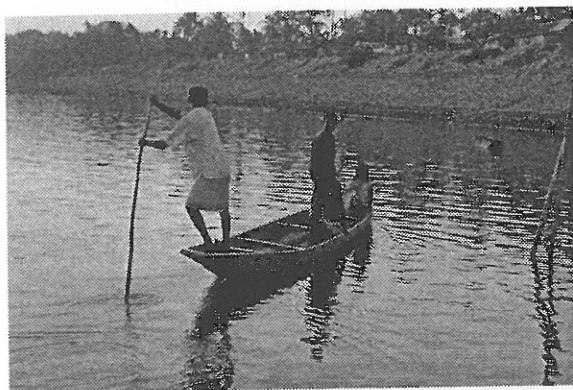


Fig. 11. FRP Sheathed canoe



Fig. 12. FRP Canoe

2.13 Aluminium canoes

A 5.25 m aluminium canoe with 2 hp OBM was designed and fabricated by CIFT for use in inland water bodies. It can be a building material for small crafts.

2.14 Thermocole boat

Thermocole boat made of piece of thermocole of size of about 120x120x30 cm covered with Polyethylene (PE) netting and, plastic sacks and silpaulin sheets are used in Alappuzha region for gill netting in coastal and inland waters

Table 1. Different fishing crafts used in the inland water bodies in India

Sl. No.	Name	Material used/ specification	Main fishing gears operated
1	Banana raft	Banana stem and bamboo L 2-3 m B 0.3-0.4 m	Cast nets, gill nets and hook and lines, cast nets
2	Bamboo raft	Bamboo L 5 - 15 m B 1 - 1.5 m	Hook and lines, cast nets
3	Wooden raft	L - 3-5 m	Hooks and lines, cast nets
4	Rubber tubes	0.50 - 0.75 m dia	Gill nets
5	Coracle		Gill nets, hook and line
6	Dug out canoe	Different types of wood L - 4 - 6 m. B- 0.3 - 0.5 m.	Traps, gill nets, hook and lines, cast nets
7	Plank built canoe	Different types of wood L - 5 - 10 m. B - 1 - 1.5 m	Drag nets, Cast nets, Gill nets and Seine nets
8	Bamboo canoes	Bamboo strips 3 - 5 m	Cast net, gill nets
9	GI sheathed canoes	2 -7 m	Gill nets
10	FRP Canoes	4-10 m	Gill nets, cast nets

3.0 Fishing gear

A wide range of fishing gears are operated in the inland water bodies of the country. Important fishing gears operated in the inland water bodies are given in Table.2. and are described below.

3.1 Surrounding gear

The net is shot around a shoal in a circular fashion in shallow waters, later the area of the circle is reduced and the enclosed fishes are captured. This type of operation is seen in the north eastern states where they carry out fishing around katal, a floating FAD. Surrounding gear (Fig. 13) is a large wall of netting which is surrounded around the katal and slowly the weeds and twigs are removed and finally the fish is surrounded and the fishes are caught using cast nets, or scoop nets



Fig.13. Surrounding gear

3.2 Seine net

Seine nets (Fig. 14) are roughly rectangular in shape without a distinct bag and are set vertically in water; to surround the school of fish, generally pelagic.

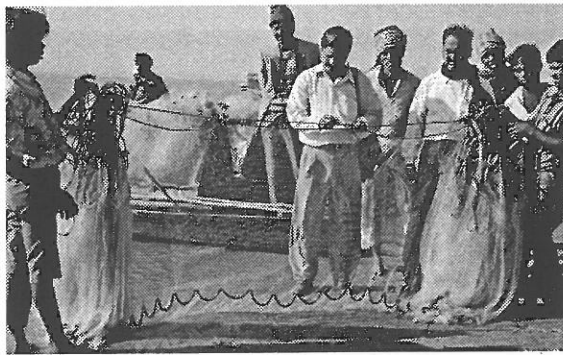


Fig.14. Seine net

3.3 Shore seines

Shore seine is a large net operated near the bank of a river, reservoirs or beels. The net usually has two wings and a middle landing part. The net is payed in the form of an arc from the shore using a boat and a number of fishermen pulls the net from the shore. The foot rope of the net always touches the bottom and the net is pulled towards the shore and the fishes are collected from shore. Few beach seines have peripheral pockets in the lower part of the net for collecting fishes. Small netting with two sticks on each side is operated by encircling and dragging certain area. Do-Dandi of Ganga river, Bori of Gujarat and Gorubale of Karnataka and Pattuvala or Chavittu vala of Kerala. Tana jaal, Ghayala jaal, Raja-rani jaal, Gheesa jaal, Ber jaal, Chati jaal, Ghon jaal, Moshori jaal, Fesi jaal, and Pet-kasi jaal operated in the north eastern regions are some shore seine nets of the country.

3.4 Boat seine

Boat seines are also operated in inland water bodies. Its construction is similar to the bag net and is operated from boats. The net is released from one or two boats to form an arc. After encircling the fish, the net is hauled from the boat. Buro jaal and Koni jaal are single boat seines operated in backwaters of West Bengal. Pesi jaal is another small boat seine

operated in Assam. Patua-jaal is a boat seine operated in Chilika lake for small clupeids and beloniforms.

3.5 Bag net

3.5.1 Stow net on stakes

Stow nets (Fig. 15) are conical bag nets operated in shallow waters and estuaries where tidal current is strong. The mouth of the net is kept open against the current by means of stakes driven into the bottom. Examples are Oonnivala operated in backwaters of Kerala, Behundi jaal of Hooghly estuary Gunja jaal operated in creeks of Kutch region of Gujarat and Gidasavala operated in Krishna and Godavari delta of Andhra Pradesh



Fig.15. Stow net on stakes

3.5.2 Stow net fixed on shore

Stow net (Fig. 16) is a bag net conical in shape similar to a trawl net. It is known by different names in different regions. The mouth of the net is fastened to the opposite river banks against the current using ropes or wire ropes. The upper edge of the net mouth is kept open with the help of bamboo poles fixed at both ends of the wing and near the mouth region of the net. The fishes are collected in the cod end as the current of water takes the fish inside the net. These nets are used only when there is sufficient flow of water. Baghjaal and Bion jaal of Assam are examples of stow nets.



Fig.16. Stow net fixed on shore

3.6 Push net

Push nets (Fig. 17) are operated in shallow water bodies. It has a 'V' shaped bamboo frame to which the webbing is attached. The net is pushed through water by man wading and during operation it scraps the bottom. It is hauled at frequent intervals. Some scoop nets have a cod end to facilitate collection of catch. The net is also operated from boats. Pelni of Narmada, kamjaal and kursung jaal of Assam, Schiki of Hoogly and Kuppu valai of Tamil Nadu are some examples.



Fig.17. Push net

3.7 Skimming net

Skimming net (Fig.18) is a bag net with triangular mouth fixed on bamboo poles. The capture of fish is affected by the forward pushing of the net by the fisherman. From time to time, the net is raised to pick up the catch. These are operated from boat. Ghukuta jaal, kuracharon jaal, and farshkhura jaal of Assam and hela jaal of Ganga are examples.



Fig.18. Skimming net

3.8 Stick held drag net

Stick held drag (Fig. 19) net is operated in Orissa, Madhya Pradesh, Andhra Pradesh and

Kerala. Mesh size of the gear ranges from 10-15mm. Webbing is fixed to bamboo stick of 70cm to 90cm length at regular intervals to form a pouch. The net is dragged by two persons in shallow areas which are devoid of bottom obstruction. While hauling the net fishes are driven into the net from both sides by splashing water with one hand. A drag net thandevala with two poles on either side of the rectangular mouth are operated in backwaters of Kerala.

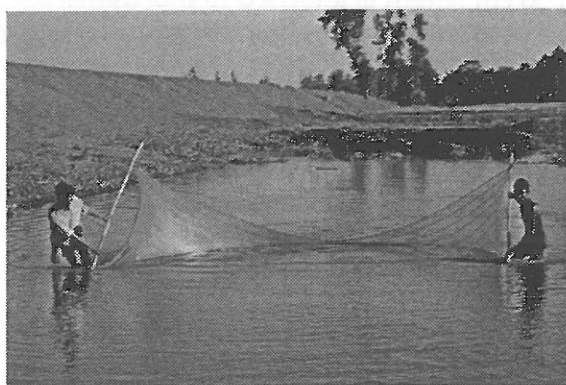


Fig.19. Stick held drag net

3.9 Scoop net

Scoop net or small bag nets (Fig. 20) with rectangular mouth or circular mouth with frame used to scoop fish out of water. Net is operated in beels, backwaters and other inland water bodies. Vadivala and koruvala of Kerala Bachra jaal and hatjaal of Assam are some examples

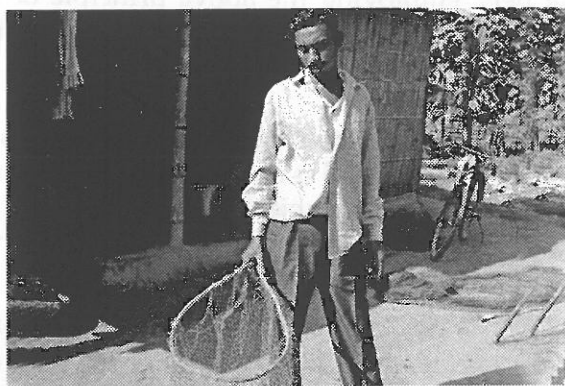


Fig.20. Scoop net

3.10 Trawl nets

Trawl fishing has been carried out on experimental basis in reservoirs and rivers. Otter trawling has been tried in Hoogly estuary, Hirakud reservoir, and in Gandhisagar reservoir. Operations of mini trawl in Kerala has been recommended as an active fishing method in reservoir for the control / capture / elimination of cat fishes, uneconomical fishes and trash fishes. It is not recommended in rivers.

3.11 Dredge

Hand operated dredges (Fig. 21) (kuthi vaaral) are used in backwaters in Kerala to harvest clams. The dredge is made of slightly inwardly curved horizontal plate of about 50 cm length having about 40 spikes pointing downward at the lower edge of the plate. To this curved plate an arch shaped bamboo frame of about 30 cm height at the center is attached. A small bag net of about 50 cm length is attached to this frame. The net and the dredge are attached to a wooden pole of approximately 10 m length. The dredges are operated by two or more fishermen using two canoes.

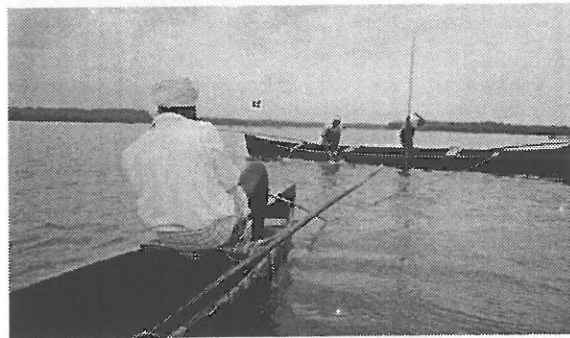


Fig.21. Dredge

3.12 Lift net

Lift net is a sheet of net, usually square, but may sometimes be conical, is stretched either by several rods, ropes, or a frame. The fishing principle is to keep the net submerged for an interval of time and then pull it rapidly out of water so as to catch any fish, which happen to be over it. A variety of nets, employing the above principle of fishing, are operated in inland water bodies. A lure and lift net techniques is practiced in Tamil Nadu.

3.12.1 Hand lift net

Hand lift net (Fig. 22) operated along the shore in shallow waters. Four corners of the net are attached to poles tied at the center and is operated by dipping and quickly lifting the net out of water. Panjaal of Assam khora jai, kabjai and pah jaal are lift nets operated from boat or flat forms built in shallow waters of Brahmaputra. Kacha of Tamil Nadu, kurli of Punjab, arippuvala and hoop nets of Kerala, Maharashtra and Tamil Nadu and jamdajaal of Gujarat are examples.

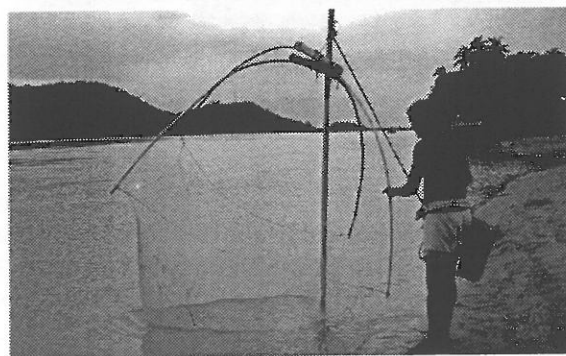


Fig.22. Hand lift net

3.13 Large dip net

These are large stationary dip nets (Fig. 23) operated in the inland waters. It is a square piece of net with a frame work for propping up the net. During night operation a light is kept hanging from the apex of the poles to attract fishes. Dekhi jaal of Assam, khoila jaal of West Bengal and cheenavala or kambavala of Kerala are examples.

Another type of lift net is large net with ropes connected to the four corners and operated by a group of people from four boats by dipping and lifting after the fish shoal entering in the net. Peruvala of Chaliyar estuary in Kerala and marala of Orissa are examples.



Fig. 23 Large lift net

3.14 Falling gear

Falling gear is usually a cone shaped net or other devices, which is dropped to cover aquatic animals and enclose them. Generally they are hand operated in shallow waters, but some are operated from a boat. The stick-held cast net is an example. The principle is to catch the fish by covering from above. The gear is cast over the area where the fish is available and the trapped fish are caught by hand.

3.14.1 Cover pots/ plunge basket

Cover pots or plunge baskets (Fig. 24) which are clapped over the fish. These are made of finely woven bamboo strips; the height of these gears varies from place to place. Polo and juluki of Assam, ottal of Kerala, tapar of Rajasthan, ootha of Mysore and polo of West Bengal are examples of plunge baskets

3.14.2 Lantern net

Lantern net (Fig. 25) consists of six pieces of bamboo, each about 1.8 to 2 m in length. These pieces are tied together at the anterior portion, while at the bottom, these diverse are connected with a polyethylene rope. Round the hoop is sown the free edges of a bag shaped net while the upper closed end of the net is tied to the apex of the frame. The trap thus formed is pushed on the mud of shallow water when fish is detected and the net is untied from the apex. The



Fig.24. Cover pot

gear is operated from boat with two fishermen on board. At first the water is disturbed to understand the presence of fish and their movements. The net is then dropped over the area where the fishes are likely to present. The fisherman jumps into the water and dives down to secure the fish in the net and collects it. The net is operated during day in clear water. Chak jaal of Assam and kuriyar of Allahabad are examples of lantern net.



Fig.25. Lantern net

3.14.3 Cast net

Cast net (Fig. 26) is found throughout India. Cast nets are conical bag shaped net. It is the most widely used gear in the inland sector by single fisherman. Three types of cast nets are operated in inland waters viz. with closing strings, with peripheral pockets and without strings, pockets and hauling rope. Iron sinkers are fixed in the lower periphery of the net. The net is thrown in a circular fashion over the water and due to the presence of sinkers the net sinks to the bottom. It is then hauled up with the help of the hauling rope tied to the apex of the net. Fishes that come within the area covered by the gears enter the pockets while hauling. The cast nets vary in their sizes. Based on the size and different mesh size, the nets are named differently. The cast nets are mostly made of PA multifilament. Khewali jaal of Assam, chakar jaal of Gujarat and veesuvala of Kerala are some examples of cast nets.



Fig.26. Cast net

3.15 Gill nets and entangling nets

Gill nets (Fig. 27 & 28) are long walls of webbing hung vertically in water are either set in one spot or allowed to drift with the current (Fig. 27). Gill nets are used in rivers, reservoirs, beels and other inland water bodies. Gill nets can be operated in the bottom, midwater or surface targeting desired fish. These nets are also used as encircling gear. It is highly selective and can be used judiciously by using the optimum mesh size to capture the right size of the fish. Gill nets are also named by the target fish they capture. Gochail jaal of Allahabad, thangadi of Hoshangabad, kuto jaal of Hoogly, current jaal, langi jaal and phansi jaal of Assam and ozhuku vala of Kerala are examples.

The rampant use of very thin polyamide monofilament materials, discarded and lost nets in the inland water bodies could lead to ghost fishing and can also cause environmental and ecological problems. Proper selection of mesh sizes, hanging ratio, and mode and time of operation can make gill net an eco-friendly, low energy and sustainable fishing method.

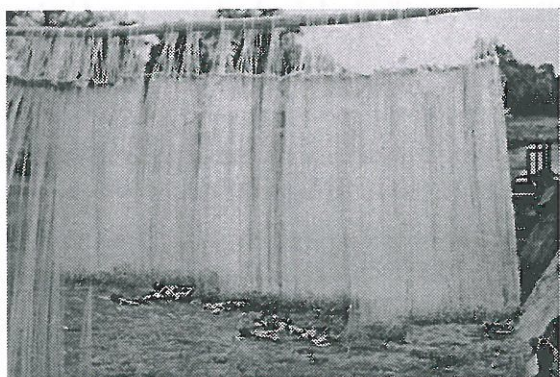


Fig. 27. Drift gill net



Fig. 28. Entangling net

3.16 Traps

Traps (Fig. 29) are passive fishing gears into which the fish can enter voluntarily in such a manner that the entrance then becomes a non-return passage of the device. Trap fishing is

highly fuel efficient both in terms of returns and biomass per unit of fuel consumed. Traps can fish continuously during day and night with periodical checking and the organisms can be retrieved alive without any damage. Traps are mostly made of bamboo, palmyra fibres, coconut tree, coconut leaves etc. Kankada khadia and khonda screen traps in Chilka lake, Orissa chempally koode of Kerala, kumini of Madhya Pradesh, sepa and dingora of Assam are some examples of fishing traps.

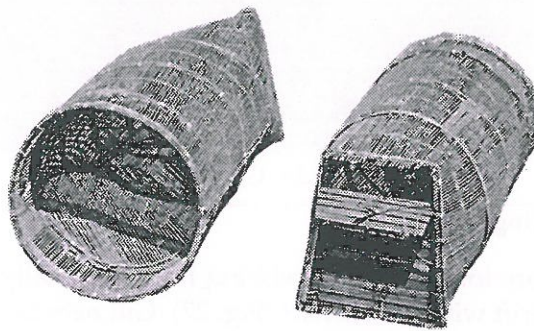


Fig.29. Trap

3.17 Fish barrier

Fish barriers (Fig. 30) are long leaders of converging screens erected in shallow waters to lead the fishes into the chambers fixed in the end. Net barriers are slowly replacing the bamboo barriers as these are cost affective and saves labour and lasts longer than the bamboo screens. The gear consists of leaders, gathering ground, channels and filter platforms. The leaders guide the fish into the trap. The length varies from 10 to 50 m depending on the width of the river stream or canal. Water seep through the platform, leaving the fish. These gears are very effective in capturing nearly all fish moving downstream. The fish reaching inside the barriers are captured by using lift nets. Roak used in river Yamuna in Agra during summer to catch major carps, jano khonda or disco net of Chilka lake, banamara and betamara of northeastern states are some examples.



Fig.30. Barriers

3.18 Aerial traps

Aerial traps are specialized traps to capture fishes that jump when faced with an obstacle

(Fig. 31). These fishes can be caught on the surface in boxes, rafts, boats and nets. The fishes are enticed to jump out of water by placing obstacles and are caught in the air by special devices obstructing their jumps. Sometimes the fish are frightened to get them to jump out of the water. Pachilchangadam of Kerala, choli used in river Ganga for mullets, kattuvilai of Tamil Nadu and letidiya and dolonga of Assam are some examples.

Trap fishing continues to be one of the major fishing methods among the inland fishermen in spite of the technological developments and introduction of other fishing gears over time. However, factors such as thinning out of fish population and reduction in natural shallow water areas, poor returns and attitudinal changes of the fishermen has lead to reduction in the use of fishing traps.

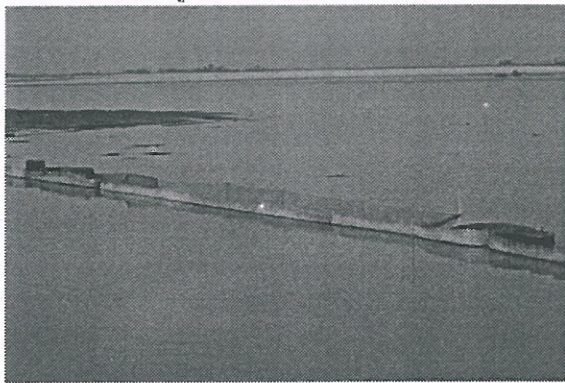


Fig.31. Aerial trap

3.19 Hook and lines

The gear generally consists of line(s) and hook(s) to which edible or artificial baits are attached to attract fish or other aquatic animals. Unbaited hooks or jig may be also used. This is a passive gear where fish are enticed by edible or artificial bait or lure, which stimulates the appearance and movement of the natural prey and are finally held by the hook concealed in the bait or lure. The hook is connected to a line or snood. The hook and lines are also named locally according to the fish species targeted.

3.19.1 Hand lines

As the name indicates these are lines operated by a fishermen by hand. Hand lines are operated with few hooks and a constant attention is required by the fishermen. A fisherman operates 3-4 numbers of lines from a canoe. Nylon monofilaments with different diameter are commonly used. Hook size depends on target species. Earthworms, small frogs, fishes, prawns, polychaetes, etc. are used as bait in live or dead condition. Baits of plant origin are also used. Fish, fresh water prawns, tortoise, and crabs are captured.

3.19.2 Pole and lines

Pole and line has a line fixed to a slender long pole (Fig.32). The line consists of a hook with

bait and may be attached to a sinker. Traditionally bamboo poles are used. A small float made of lightweight wood is used to adjust to the desired depth of the hook in water. An example is chip boroshee of Assam.

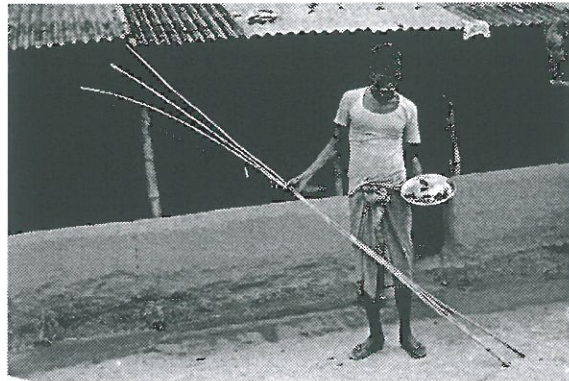


Fig.32. Pole and line

3.19.3 Set lines

Several hooks are set in a fixed position. The main line is tied to bamboo poles fixed on either side of the river. The hooks on the branch line are hanged from the main line at regular intervals. Sometime one end of the main line is tied to a bamboo pole fixed on the riverbank and the other end is set free. The hooks are placed both day and night and the catch are periodically removed. The length of the main line depends on the water body. Branch lines are tied at a distance of 1 to 4 m from each other. The main line is made up of either polyamide or polypropylene twine and the length of the branch line varies from 30 to 50 cm. Hooks No. 2, 3 and 4 are used. Live baits are used to attract the fish. The hooks are placed either just touching the water surface or 30 cm below the surface. Set lines are set in the midwater or in the bottom according to the type of fish targeted.

3.19.4 Long lines

Long lines with small hooks are operated for predatory fishes in estuaries, rivers and reservoirs. It may be surface set or bottom set. Length of the main line ranges up to 1000 m with 50 to 500 branch lines and hooks. Size of the hook and the length of branch lines depend on the target species and place of operation. Small fishes, earth worms, prawns etc. are used as bait. Ayiram choonda (thousand hooks) of Kerala is an example.

3.19.5 Drift lines

Drift long lines are also operated in the inland water bodies. Its construction and mode of operation is similar to the set line except that the lines are allowed to drift in the water. Drift lines with floats made up of pieces of bamboo of 30 cm in length are used as drifting / floating material. A branch line is tied at the center and the hook is allowed to hang. The depth of the line depends on the depth of the water body. Several types of baits like earthworms, small fish, eggs of honeybee and ants and sweet balls are commonly used.

3.19.6 Drop lines

Drop lines have a main line and a number of hooks attached to one end on the line on either side using small piece of lines and is rigged in such a way that it stands vertically in the water. At the upper end of the line a float is attached. Suitable bait is also provided. This type of gear is used during winter for the capture of carps and cat fishes.

3.20 Grappling and wounding gear

Grappling and wounding gears include all types of sharp implements, which can be pushed, thrown or shot to immobilize the fishes by grappling, squeezing, piercing and wounding them.

3.20.1 Spears

Spears are one of the most primitive fishing implement used to catch fishes. Spears are basically made of a bamboo handle and iron barbs. The spear may be single or multi pronged. Various types and sizes of spears are used in inland waters for catching fishes, crabs and tortoises. The metallic sharp end of the spear may be single pronged or multi-pronged. These are mainly used to catch large fishes very close to the bank in shallow waters. The spear is thrown at the fish coming to the shallow marginal areas of a water body. The operation requires special attention and skill on the part of the fishers. The fishermen also carry out this operation using light to attract the fish during night. The fish gets injured in this type of fishing. Three pronged (muppally) and five pronged (ampally) spears of Kerala, Tena of Chilka lake, Pokora and Jathi of Assam are few examples.

3.20.2 Bow and arrow

Fishing using bows and arrows are primitive methods but are still being widely used in hilly areas and shallow clear waters mostly by the tribals. Bow and arrows are normally used to catch fish visible from a distance. The bow is mostly made of pole, bamboo strip or plant creeper, and the two ends are joined with a strong cord (Fig. 33). The arrow is usually made of wood with a metallic pointed tip. A cord is attached to the base of the arrow and is tied to the bow for retrieving the catch. Thettal of Kerala and Dhenukar of Assam are some examples

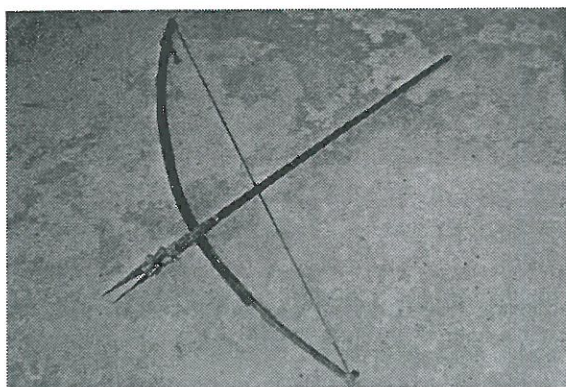


Fig.33. Bow and arrow

3.20.3 Other sharp objects

Sharp projectiles are Implements having sharp edges which are used to catch fish. The fishes caught are usually in damaged condition. Knives and sickle are used in shallow waters to harvest fish. The fishes are attracted towards the bank using torches or a light source and any fish that comes within the striking range is struck heavily with the sharp object injuring the fish.

4.0 Stupefying methods

Fish are caught using Ichthyotoxins, chemicals, explosives and electricity. Ichthyotoxins are extracted from different parts of poisonous trees. Pesticides and chemicals are also used to kill fish in few water bodies in the country. Explosives like dynamites and local made bombs are used in rivers and reservoirs. Thotta of Kerala is an example of explosive. Electrical fishing is also common in the hilly streams and other water bodies in the country. These are destructive fishing methods endangering the environment as well as human life. These destructive fishing practices will harm the resources and the fragile biodiversity of the area.

5.0 Miscellaneous fishing gear

5.1 Fishing without gear

This method is the simplest form of capturing fish and fishes are caught without using any fishing gear generally by hand picking.

5.2 Hand picking

This is a very primitive fishing method and is still being carried out in shallow water bodies in the country (Fig. 34). Fishes submerged in the mud, or hiding in the crevices and in between stones and rocks are caught by hand. Hand picking for fishes, prawns and clams etc are practiced in estuaries, lakes, wetland, low lying water bodies and backwaters in the country. Handpicking is carried out mostly by fisherwomen in Kerala. In ponds the water is totally dewatered and the fish and prawns are picked by hand.

Community fishing is a common practice in north eastern states especially during social or religious festivals. Almost the entire village community takes part in fishing in some community pond or Beel with indigenous fishing gear (e.g. polo, jakoi, porongijaal etc.) As the whole community enters the low waters and move around catching fish, the whole pond gets turbid and muddy very soon and the fishes in the pond start gasping for air and comes to the water surface. Fishers catch the fish with hand and also using various fishing implements.



Fig.34. Hand picking

5.3 Diving

Skin diving (Fig. 35) is being done by fishermen to harvest edible oysters, clams and fishes from backwaters and inter tidal areas. The fisherwomen harvest shrimp by hand even in neck deep water. They detect the shrimps with their foot and then dive down to take the individual shrimp. Commonly known as mungipidikal (catch by diving) in Kerala.

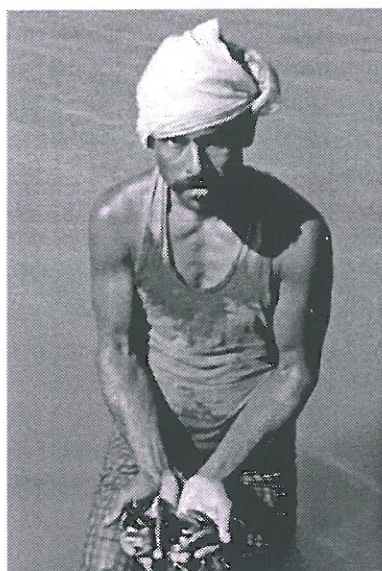


Fig.35. Diving

5.4 Purse net/clap net

It is a semicircular purse net extensively used in catching Hilsa (Fig. 36). The net consists of an elliptical frame by tying two-split bamboo on either side or a bag shaped net attached to it. The net with its mouth opened vertically is towed along the river bottom by 1 to 2 fishers while being steered by 2 more. The frame of the net consists of two long slender arched bamboo strips

about 6 to 7 m long tied together at both the ends in the form of hinges. To this frame is attached a rounded bag shaped net having a mesh of 22 to 70 mm made of PA about 3 to 3.5 m deep. The mouth is kept open by a brick, iron ball or a stone weight of 1.5 to 4.0 kg tied to the center of the lower lip. There is a feeler cord fixed to the upper portion of the net to transmit the disturbance caused by the entrance of fish. The stout haul rope is paid out to the desired depth. This haul rope passes through a ring or Y-shaped piece of wood in the upper lip and attached to the middle of the lower lip immediately above the weight. Net is operated from a boat moving with the current. When any fish enters the net it causes certain jerk which is felt by the fisherman holding the rope, which immediately close the net by pulling the rope and haul the net. Illisha shangala jaal' and karal shangala jaal are very popular purse nets in the lower Brahmaputra, the former for hilsa and the latter for migratory carps. This net is also seen in West Bengal.



Fig.36. Clap nets

5.5 Bush parks

Brush parks are the most common fishing method employed in the beel (Fig. 37). These parks mainly act as shelter areas. Two different types of brush parks locally known as katal / jeng and pit / chek, are erected in the beels of Assam. Katal fishing or katalmara is a method, which is extensively used in the beel fisheries of Assam. Katal are prepared by erecting tree branches in the bottom with a collection of water hyacinth, in the form of a circle. Pit / chek is a very large brush park (0.5 to 2.0 ha) erected in beels heavily infested with floating water hyacinth. Similar type of bush parks known as Phooms are seen in Loktak lake, Manipur. Fishes take shelter in this. During winter when the water level goes down, katal is surrounded using screen or net. Fishes are collected after removing the weeds

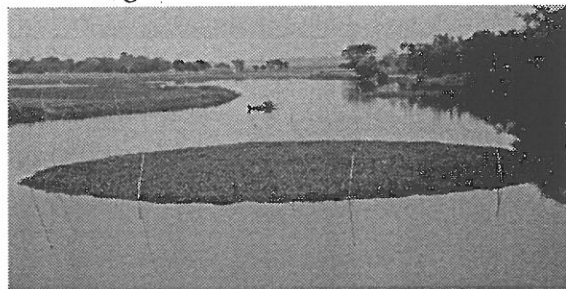


Fig.37. Bush park

5.6 Drive-in nets

In the case of drive-in-nets (Fig. 38), the technique of this fishing method is to drive the fishes into fixed fishing gear from a distance. Sometimes gill nets are used for this purpose. The operation is done in the shallow areas. Scare lines can be made by inserting tender coconut leaves into the twists of a long coir rope or with broken pieces of bricks and thin strips of turtle shell similar to a stick held seine net. The net is fixed in the form of "U" and the fishes are driven into the net using the scare lines. In the final stage of operation of the net two ends are brought together and the confined fishes are captured. Beppevala in rivers of Kerala, gopal jaal in Allahabad, sone jaal and tik tiki khedani of Assam are examples



Fig.38. Drive in net

6.0 Recreational fishing

Mainly hand lines and pole and lines are used for recreational fishing (Fig. 39) to capture game fishes. Artificial baits are also used as lure to attract fish. This is one of the main tourist attractions and has lots of scope for commercialization. Recreational fishing for trouts and mahseers are carried out in several places in our country.



Fig.40. Recreational fishing

Table 2. Different fishing gears used in the inland water bodies in India

Sl. No.	Groups	Examples
1.	Surrounding nets	Ber jaal - Assam
2.	Seine net	Do dandi - Ganga river Bori - Gujarat
	Shore seine	Gorubale - Karnataka Pattuvalla - Kerala Tanajaal - Assam Buro jaal - W. Bengal Pesi jaal - Assam
	Boat seine	
3.	Bag net	Gunja - Gujarat
	Stow net on stakes	Buajaal - Hoogly estuary
	Stow net fixed on shore	Baghjaal - Assam
	Push net	Pelni - Narmada Kamjaal - Assam Schiki - Hoogly Kupu valai - Tamil Nadu Ghukuta jaal - Assam Hela jaal - Ganga Thandevala - Kerala
	Skimming net	
	Stick held drag net	
	Scoop net	Koruvala - Kerala Bachra jaal - Assam
	Trawl nets	Hoogly estuary, Hirakud
	reservoir, Gandisagar reser	voir, Backwaters of Kerala
4.	Dredges	
	Dredge	Kuthivaaral-Kerala
5.	Lift net	
	Hand lift net	Panjaal - Assam Kacha - Tamil Nadu Kurli - Punjab Arippuvalla - Kerala Peruvalla - Kerala Marala - Orissa
	Large lift net	

- | | | |
|-----|---|--|
| 6. | Falling gear
Cover pot. Plunge basket | Polo - Assam
Juluki - Assam
Ottal - Kerala
Otho - Karnataka
Polo - W. Bengal
Tapar - Rajasthan |
| | Lantern net | Chak jaal - Assam
Kuriyar - Allahabad
Khewali jaal - Assam |
| | Cast net | Chakar jaal - Gujarat
Veesuvala - Kerala |
| 7. | Gill nets entangling nets | Current jaal - Assam
Langi jaal - Assam
Gochail jaal - Allahabad
Thangadi - Hoshangabad
Kuto jaal - Hooghly
Kandadi vala - Kerala |
| 8. | Traps | Kankad khadia - Chilka lake
Chempally koode - Kerala
Kunini - Madhya Pradesh
Dingora - Assam |
| | Fish barrier | Banamarea - Assam
Jana khonda - Chilka lake
Pachichangadam - Kerala |
| | Aerial traps | Litidiya - Assam
Kattuvalai - Tamil Nadu |
| 9. | Hooks and line | Suta Boroshee - Assam
Chip boroshee - Assam
Kuti boroshee - Assam
Ayiram choonda - Kerala
Nol boroshee - Assam
Hat boroshee - Assam |
| 10. | Grappling and wounding gear | Ampally - Kerala
Tena - Chilka lake |
| | Spears | |

	Bow and arrow	Pokora - Assam Thettal - Kerala Dhenukar - Assam
	Sharp projectiles	Knife, sickle
	Stupefying methods	Thotta - Kerala
11.	Miscellaneous fishing gear	
	Hand picking	Tappidikal - Kerala
	Diving	Mungipidikal - Kerala
	Purse net	Shangla jaal - Assam
	Bush park	Katal - Assam Phooms - Manipur Padal- Kerala Beppevala - Kerala
	Drive in nets	Gopal jaal - Allahaad Sone jaal - Assam
12.	Recreational fishing gear	
		Pole and lines - Assam, Himachal Pradesh, Uttarakhand

7.0 Conservation

As the fish production from marine sector has almost touched the peak the focus is on inland sector to meet the increasing demand for fish food. Inland water bodies are diverse and complex with mixture of innumerable freshwater and brackishwater areas and fishery resources with multiple stakeholders and legislation. Production from inland capture fisheries also crossed the peak and much importance is given to increase the production from culture fisheries. Introduction of new species like *Litopenaeus vannamei*, pacu (*Piaractus mesopotamicus*), *Pangasius sutchi*, Pompano (*Trachynotus blochii*), Lates calcarifer, *Lutjanus argentimaculatus*, etc. is an example for the emerging emphasis for aquaculture.

Several problems are reported from the inland capture fisheries sector which is affecting the fishery. Habitat degradation due to water pollution, water abstraction, land reclamation, construction of check dams and roads across rivers and canals and blocking the fish passage, clearing mangroves for aquaculture and other purpose, siltation and sand mining. Unscientific and destructive fishing methods and ghost fishing due to abandoned and lost fishing gears are also serious issues. Prawn seed collection from the water bodies for aquaculture purpose is affecting the resources.

A variety of fishing craft and fishing gears and methods including prohibited methods are followed in the inland water bodies. It may be summarized that floating crafts like rafts are still prevalent in inland water bodies. Dug out canoes have reduced considerably due to

shortage of large trees trunks. Coracles are still being widely used in the southern parts of the country mainly in reservoirs and backwaters. Plank built canoes with FRP sheathing has also become popular in the inland sector. FRP crafts can be introduced in many of the inland water bodies for better efficiency and durability of fishing craft. Split bamboo canoes, thermocole boat and canoes made of empty bottles are innovations but only limited number are in use.

Gill nets are the predominant fishing gears in the sector followed by long line, line, shore seine and stick held seine nets and cast nets. In the pond fishery, cast nets, stick held nets, gill nets and lantern nets are common. Most of the indigenous fishing methods in the region are eco-friendly and are sustainable fishing methods.

Destructive fishing methods like use of mosquito netting for fishing, electrical fishing, use of explosives, chemicals and poisoning which are still prevalent in certain pockets of the country may be stopped. Nets with mesh size as small as mosquito nets are being used, will have to be phased out in a systematic manner. Stationary bag nets, drag nets and other filtering devices are capturing huge quantities of juveniles. Harvesting of fingerlings, for aquaculture and other purpose, need to be stopped. Discarding unwanted fishing gears back to the systems should be avoided and the lost and damaged fishing gears are to be retrieved to avoid ghost fishing.

Ecosystem based conservation strategy may be adopted on a participatory mode. Stock enhancement programs and other management strategies like fish sanctuaries and closed areas and seasons may be adopted.

Control on excess capacity, responsible harvesting technologies together with habitat restoration process and stock enhancement programmes will have to be adopted for long term sustained fisheries from the inland waters of India.

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