Paper - IX

Fish technology and Processing

Unit - I

Methods of fishing and fishing gear

i) History of fishing

→ fishing has been part of the human experience since the earlist stages of human evolution.

→ Historical texts like Kautilya's Arthashastra (321 - 300 B.C.) and king someswara's Manasollasa (1127 A.D.) refers about fish culture in India.

→ The term fishing may be applied to catching of fishes & other aquatic animals such as shell fish, cephalopods, crustaceans and Echinoderms.

→ The term fishing is not usually applied to catching aquatic mammals such as whales.

→ fishing is an ancient practice that dates back at least to the Upper Paleolitic Period which began about 40,000 years ago.

→ Archaeological features such as shell middens, discarded fish bones and cave painting show that sea foods were important for survival and consumed in significant quantities.

→ Spear fishing of barbed poles was widespread in Paleolithic times.

→ Cosquer cave in Southern France contains cave art over 16000 years old including drawing of seals which appear to have

→ In the Old stone Age about 40000 B.C. peoples practiced shell fish and sea fish.

→ New Stone age about 10000 B.C. has proved evidence of salmon smoking practices.

→ Salting of fish was probably started in Bronze Age about 3500 B.C.

→ The Egyptians invented various implements and methods for fishing and these activity clearly illustrated in tomb scenes, drawings and Paper documents.

→ fishing scenes are represented in Ancient Greek culture that shows a boy on rock with a fishing rod in his right hand and basket in his left hand.

→ The Roman Marcus Terentius, (116-27. B.C.) wrote in his book "De Re Rustica" about two kinds of ponds, freshwater ponds owned by peasants [farmers] for food and profit and salt water ponds owned by wealthy person who used them to entertain their guests.

→ Cassiodorus at AD. 490-585 mentioned that live carps were taken from Danube to the Goth king at Theodoric at Ravenna in Italy.

→ Pierre Belon (1517-1575 AD) described at least 110 fishes from the eastern part of the Europe.

→ H. Salviani (1514-1572 AD) described 92 fishes of Italy in his book.

→ After standard works on Ichthyology Belon, Rondelet, Margrav (1611-1678 AD.) described about 100 fishes from Brazil.

→ In India the interest in fish and fishery dates back to the three thousand years B.C. and evidences of fish being used as food are available from excavations of the Indus Valley Civilization in 1127 AD.

→ The son of King vikramaditya, king someswara composed a book recording the common sport fishes and India and grouped them into marine and freshwater forms.

→ In 1822 Hamilton Buchman gave an excellent taxonomic account of the 'fishes of Gangetic system' and removed various confusions caused by regional names of fishes.

→ Then taxonomic study highlighted by Raibahadur Dr. Sundarlal Hora. former director of Zoological Survey of India.

→ Then Dutta munshi, srivastava, K.H. Alikunhi S.S. Khanna, Dr. V.G. Jhingran studied on Indian fisheries.

→ Dr. V.G. Jhingran was honoured by India's most prestigious national award 'Padma shri' for his work.

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ii) Methods of fishing

a) Traditional methods :— (old methods)

i) Catching By hands :—

→ The simplest methodology by far is hand fishing. This is about as primitive as fishing.

→ When fish Caught by hand grabbing the fish from hands with the help of its rapid lair of outer coverings.

→ So, It has required lot of technique.

→ Catching by hands method can be applied in small flow of water.

→ To make confine the water flow where fishes are available.

→ Then remove the water by hand or any vessel to the side area of water body where is dry land.

→ Then collect the fishes from water body and where thrown the water.

ii) Fishing by hunting (wounding)

→ Fishing can be done by hunting to make a wound by the help of various instruments.

→ Arrow can use to the fishing, arrow penetrate in the fish body. its tapering part split the fish body and hanged fish can collect.

→ The lines and hooks are also used by hunting of fishes.

iii) Fishing by plant poisons

→ Various poisons plants are used for fishing.

→ These are, Tephrosia vogelii, Mundulea sericea, Euphorbia tirucalli, Gnidia kraussiana, Adenia lobat, Balanites aegyptiaca, Swartzia madagascariensis,

→ The Jaggery which is product of sugar-cane also play play a important role in fish poisoning.

→ Mahua oil cake, Derris powder,

→ Saled sirls - Albizea procera,

→ Nogdona - Artemassia vulgaris

→ Dar haid - Barberis aristata

→ Bamula - Dioscorea sp.

→ Chalimarga - Hydnocarpus kurzee

→ Akhrot - Juglans regia

→ Kuchla - Strychonus nuxvomica.

→ Sapphonika - Tephrosia purpuria

→ The hooks generally used in modern fisheries are made of well tempered metal, especially protected from water so that they do not become rusty and blunt.
→ This is done by galvanizing, bronzing, enamelling or simple oiling.
→ The hooks may be straight, bent or reversed, rounded, flattened, angular and may or may not be barbs.
→ The bait is an essential part of line fishing, and has to be carefully selected as to attract the fish by its colour, smell or movement; and depends upon the type of fish or its physiological state.
→ Generally baits are Earthworm, Prawn, Caterpillers, beetles, small fish frog etc.
→ Live bait is most attractive but is not always available, hence dead bait is used.
⇒ Hand lines carry several hooks to increase the chances of bite.
→ These hooks are attached in pairs and these several hooks are used to catch a large number of fish.
→ Long lines are great length and provided with short branch line or snoods bearing hooks at equal distances.
→ They can be operated very easily and are dropped into places where fishes are expected to be in some concentration.

(9) Fishing by baited springs :-

→ A strong but flexible piece of bamboo pointed at both the ends is used as a spring.
→ Its two ends are bent till they nearly meet and are carefully adjusted within the body of a grasshopper, cockroach or a small frog serving as a bait.
→ This is then suspended in water by means of a string to which a float is also attached.
→ When fish seizes the bait, the two ends of the spring sperate in the mouth.
⇒ It is used for catching murrels.

16) Fish screens

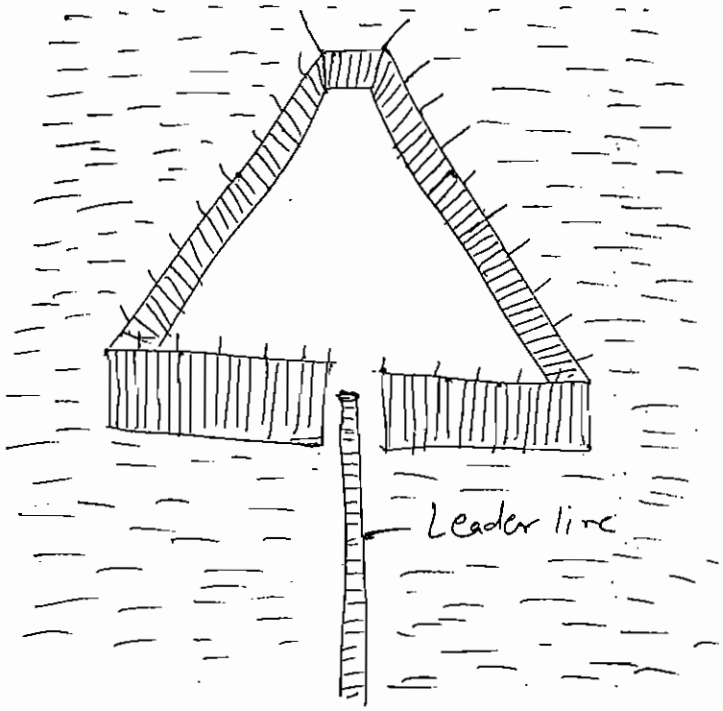


Fig : Fish Screen

→ Slender bamboo sticks are woven to form a screen about 10 meter length and 1 to 1.5 meter width.
→ The screen is set to surround a shallow tidal area at the time of high floods.
→ When the flood water recedes the fish are left behind in the muddy pool and are collected.
→ The screen is also set to mark off shallow areas of rivers.
→ The enclosed space is then divided into smaller enclosures by putting up earthen bunds.
→ The water is then removed out so as to expose the fishes.
→ This method is employed to catch carps, Catfish, murrels. etc.

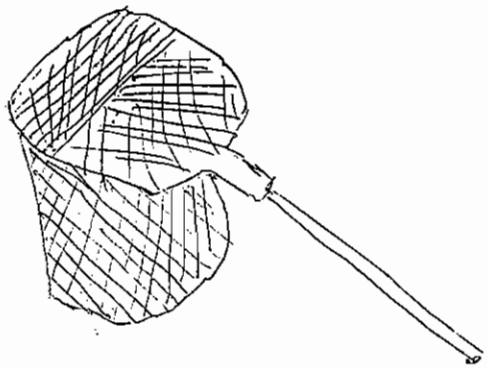
b) Conventional methods [आपचारिक ~~[illegible]~~ पद्धती]

iii) Nets - mode of netting

a) Active netting :— Operated by man or by fishing help-boat

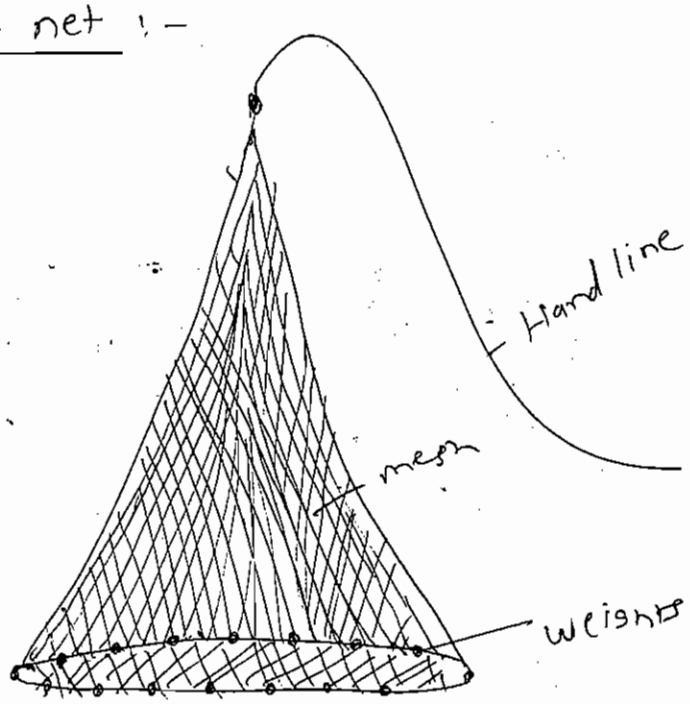
1) Dip net :—

A net attached to the end of a long pole, used to catch fish.



It is called also hand net or scoop net.
It is used for to catch fish near the surface of water.
Its mesh is prepared from wire or nylon rather than cloth.

2) Cast net :—



→ A cast net also called a throw net, and used for fishing.

→ It is a circular net with small weights distributed around its edge.

→ The net is cast or thrown by hand in such a technique that it spreads out while its in the air before it sinks into the water.

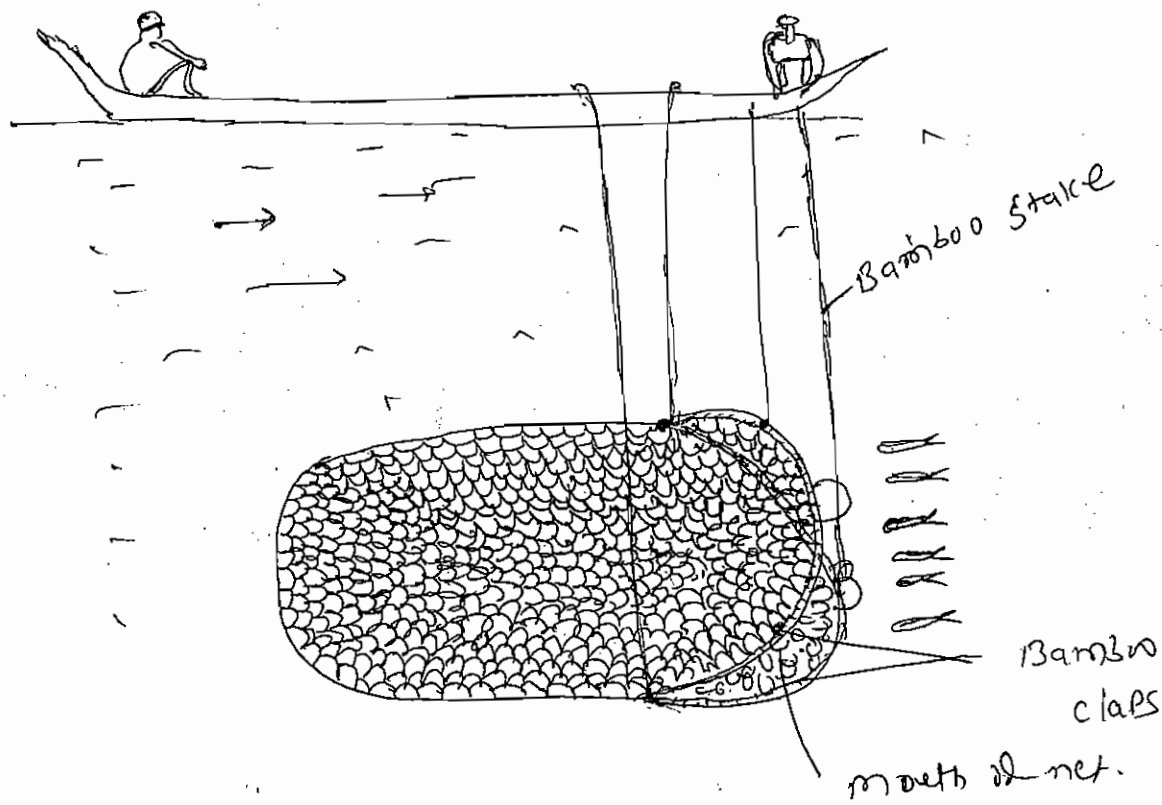
→ This technique is called net casting or net throwing.

→ fish are caught as the net is then net is closed due to bottom side weight.

→ This simple device is particularly effective for catching fishes.

→ It use with various modifications for thousands of years.

B) Purse net



→ The net is suspended from the boat and the mouth is kept open by pressure on the bamboo pole or the weighted rope.

→ Two fisherman with a net sit in a small boat and one rows the boat and the other manipulates the bamboo or strings of the net in such a way that the mouth of the net touches the bottom of the river.

→ The moment any fish enters the net, the fisher man operate the Bamboo stake and rope.

→ Then the net is instantly closed by releasing the ~~indicator~~ rope. and pulling the bamboo.

→ The net is hauled up with the help of the thick rope.

4) Drag net

→ As per the name these nets are operated by dragging using manpower only or man power boats or small ships.

→ These are large sized nets of variable dimensions and mesh sizes, as per the requirements e.g. water level where fishing is to be done, availability of funds, man power etc.

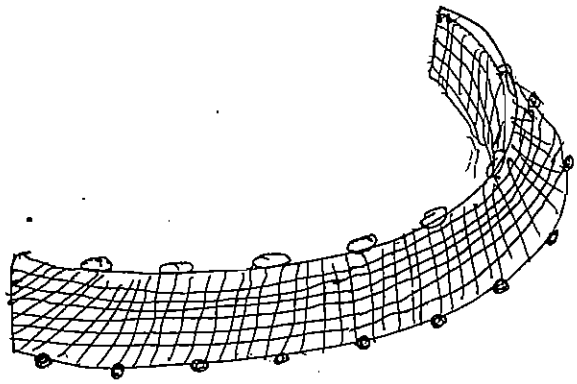
→ The maximum height of the net is in the middle region which tapers towards the two arms.

→ The mesh size, too varies widely, being larger at the outer extremity and smaller towards the mid region of the net.

→ The edge of net is of loose webbing generally twice the length of main webbing, this permits mud and debris to pass through and allows sufficient freedom to the main webbing to retain its shape when the net is drassed.

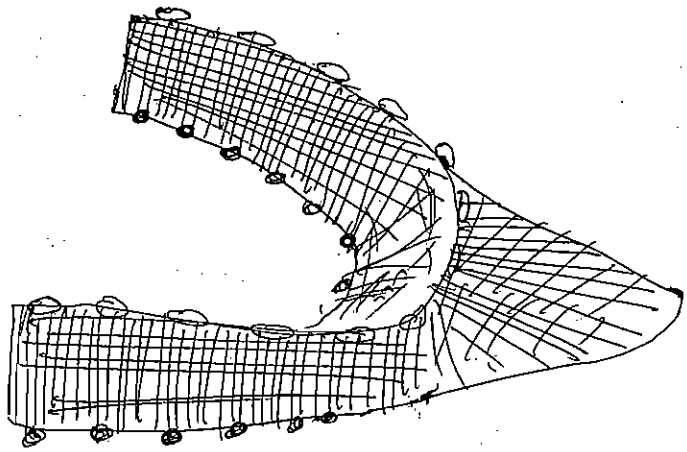
Drag nets are generally of 2 types

a) Dragnet without pocket



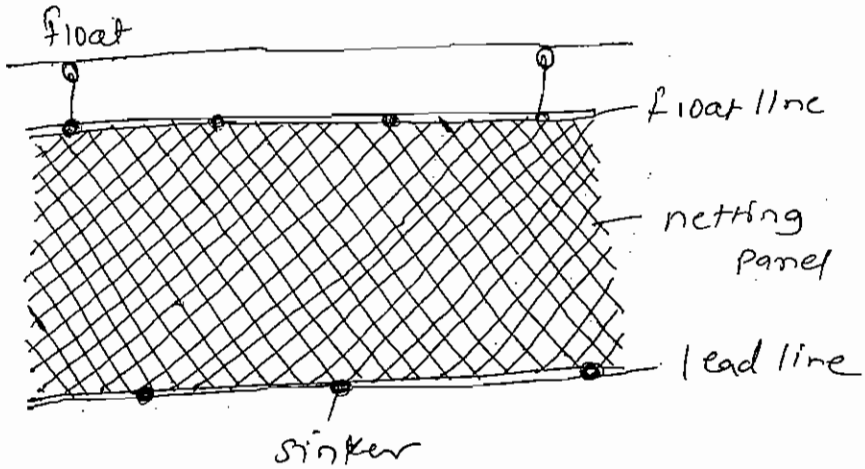
→ These nets are more prevalent and used throughout the year.
→ These are rectangular and made up of one to sixty pieces.

b) Dragnet with pockets



→ This is similar to above mentioned drag net but has rows of pockets at the lower end.
→ Generally there are two rows of pockets and this net is made of cotton mesh.

5) Gill net :-

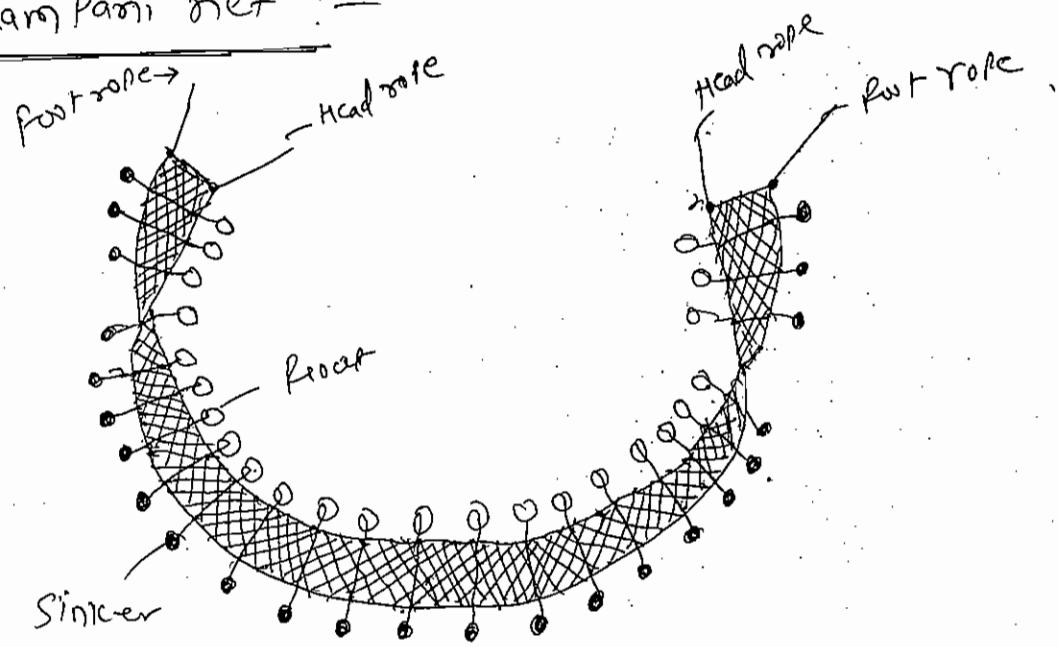


→ A Typical single walled gill net is a rectangular piece of netting.

→ It has float line means head rope, sinker line means foot rope, as well as side rope also present

→ Typical floats are attached to head rope for float the net in water current. and sinkers are attached to the bottom line for sink the bottom line. and prevent from escaping fishes.

6) Ram Pani net :-



→ Rampani net is large sized net made up of 100 - 500 rectangular pieces, joined end to end.
→ Each piece of this net may be 3 - 6 meter long,
→ The side pieces are of larger mesh of 3-5 cm. but the middle pieces have meshes of smaller size (1-2 cm),
→ Floats are fixed to head rope, and sinkers are provided to the foot rope.
→ Long ropes are attached to the both ends for hauling.
→ One end of the net is held on the shore by 20-25 men and remaining net carried on boats.
→ It is laid in a semicircle to enclose a large area, bringing the other end back to the shore, where it is held by a second group of 20-25 men.
→ The two ends are pulled and the net is dragged to the shore.
→ When net is fully drawn, the middle portion of the net forms a large bag entrapping fish and prawns.
→ Dragging is usually stopped when the two ends are 100-150 meter apart, and the drawn out parts of the net are fixed on the shore.
→ fish and prawns surrounded by the middle part of the net are left in water for a few days, and fishing done with smaller net.

✱ 7) Bag net (fixed)

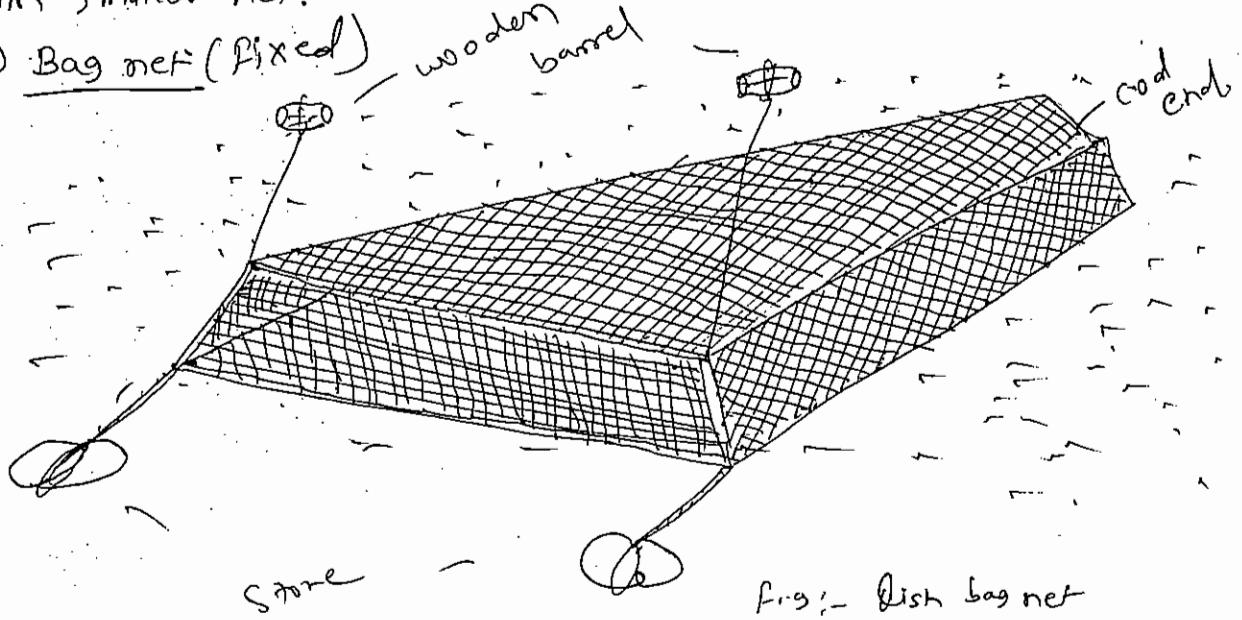
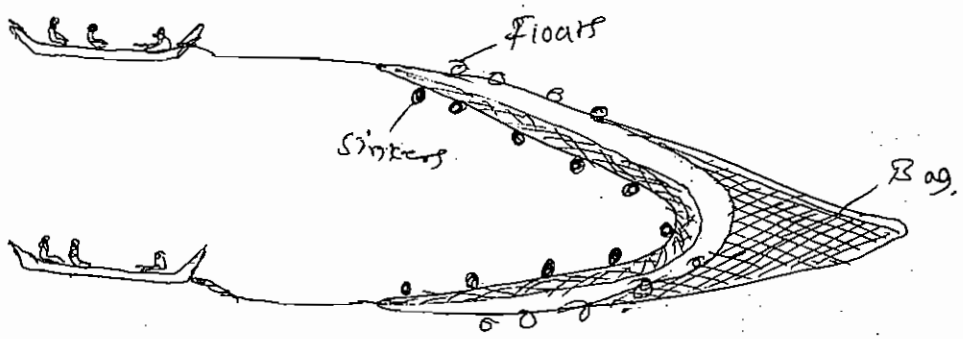


Fig:- Fish bag net
(Ghosh '91)

7) Bag net :-

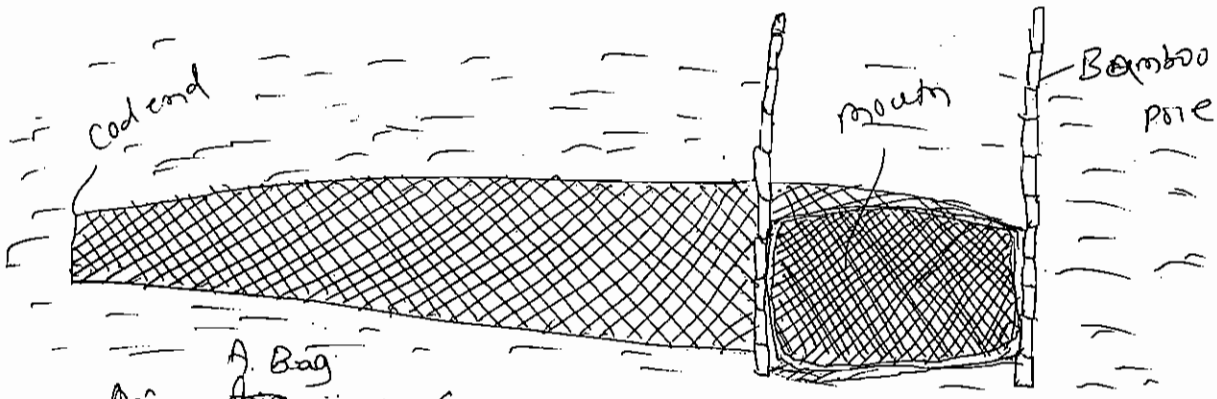


→ This also a kind of dragnet but it consist of a 'bag' at the end and long tapering flanks.

→ These are set against the current and may be operated with the help of heavy sinkers and floats.

→ Particular bag-nets are small sized but long bagnet also available. for speeral fishing of sardines.

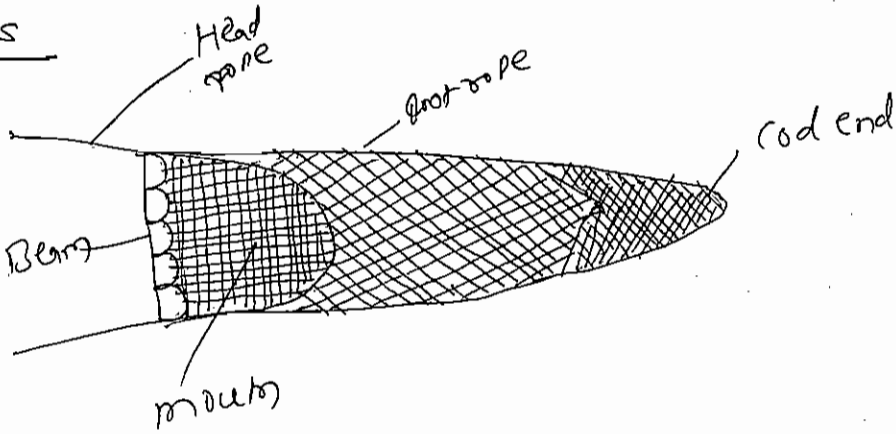
→ It's two end can be dragged by man operated boats.



A. Bag net (Oonivalq)

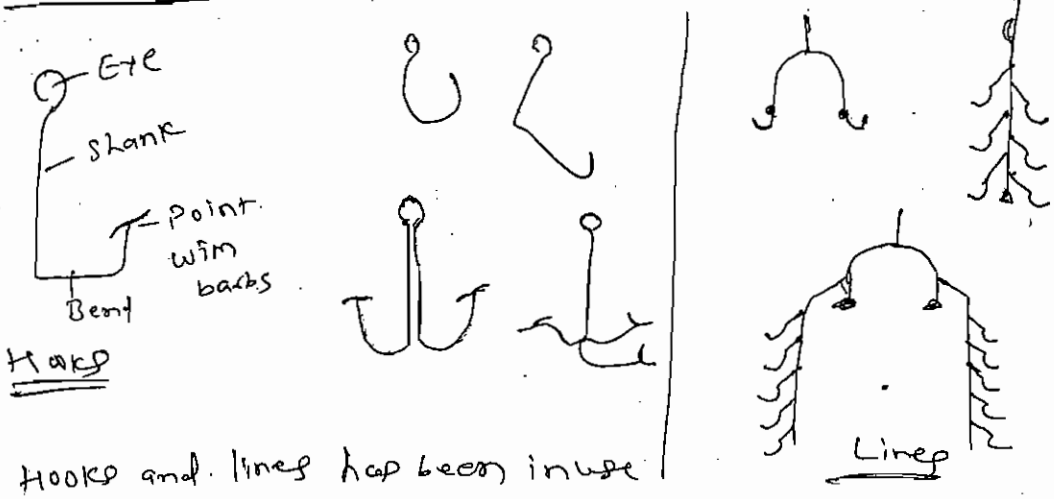
→ The bag nets are conical in shape
→ Its size is vary from 15-200 m in length.
→ meshes are 5-10 cm but gradually become smaller upto 1 cm at the hinder end.
→ The wide mouth is kept open by means of a small pole.
→ The net is fixed in the sea against the current, using bamboo poles. This is called 'Dol'net' in the Mumbai coast.
→ It has not used floats and sinkers.
→ In Gujrat it is called the 'Gholu Jal'
→ The mouth of this net is kept open with the help of two wooden barrels tied to the upper corners of the mouth.
⇒ and stones are tied to the lower corners by ropes.
→ In Kerala, the fixed bag net is called 'Onnivala' and is about 15 m long, fixed with the help of poles.

Trawls



→ It is a very efficient net for capturing bottom living fish and prawns.
→ Conical bag-like net is attached to a moving boat, and the mouth is kept open.
→ The nets are of two types, 'beam trawl' and 'otter trawl' depending upon the method of keeping the mouth open during operation.
→ In beam trawl, the mouth is kept open with the help of a beam fixed to the upper lip, and remains open even if the boat stops.
→ In the otter trawl, there are two solid wood or iron boards, on which the wraps are fixed.
→ The mouth of the net remains open only when the boat is in motion.

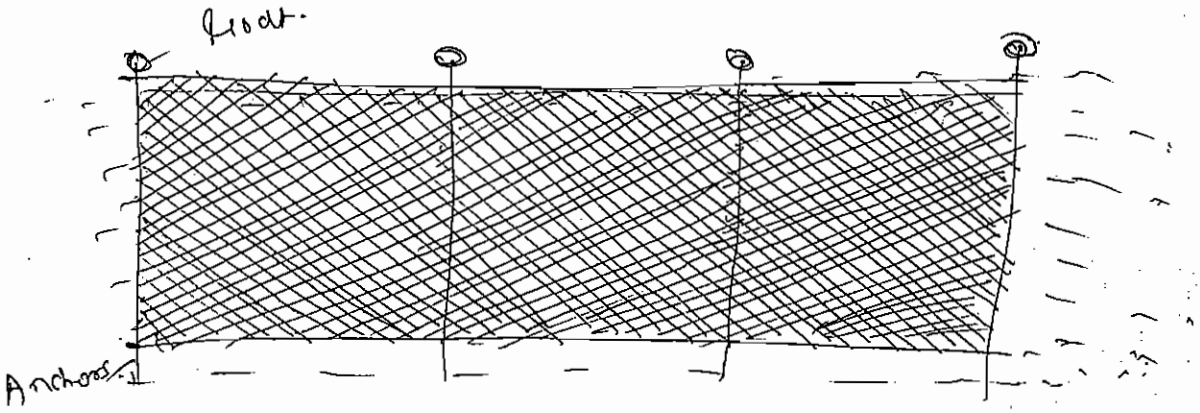
8) Hooks and Lines :—



→ Hooks and lines have been in use for a long time.
→ The principle of line fishing is to offer a real or artificial bait to entice (प्रलोभित) the fish, which is unable to release the bait and is lifted from the water.
→ Previously a thorn was used as a hook, but now metallic hooks of various shape and sizes are used.
→ One or more hooks attach to the end of cotton line and held in hand.
→ Some people use a long bamboo stick at the end of which a thread and hook is tied.
→ The bent hook is useful in keeping the fish captive after it has taken the bait.

b) Passive netting

1) Gill net



→ It is called gill net because the fishes get entangled in the mesh at the opercular region.

→ It is made up of cotton or hemp webbing in various dimensions (20m to 100m × 2 m to 15m).

→ Various dyes (colour) are used to make the net invisible and strong, because large sized fishes are caught with these net.

→ So, the mesh size is vary from 15 cm to 25 cm.

→ The floats are fixed at regular intervals on the 'head rope' and sinkers or anchors to the 'foot rope'

⇒ on the basis of setting gill net divided into three types.

a) Floating type net :-

→ These nets have a wall of net with a float line and a lead line.

→ Floats and weights are adjusted the net is maintained either at the surface or at a desired depth in the mid water.

→ Floating nets specially used in sea fishing to catch Herrings, mackerels, Salmon. etc.

b) Anchored type net :-

→ These are the modification of floating type net.

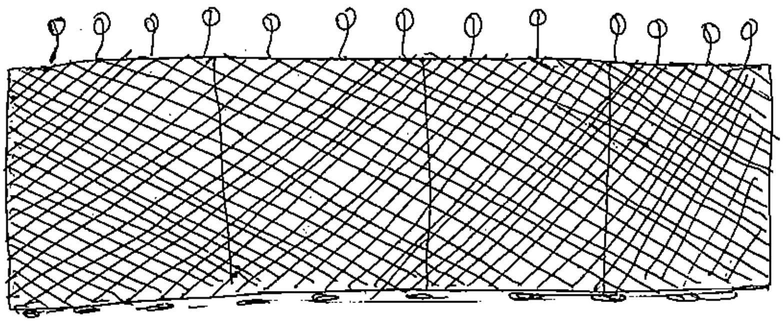
→ It has sinkers at the foot rope 'anchors' are used which do not permit free and held stationary either at the surface or at any depth in column waters. of large lakes or to coastal regions.

c) Staked type net

- In this case the net webbings are fixed with the help of stakes or anchors.
→ several nets may be joined together to form long, straight or curved blocking walls.

⇒ The gill nets are generally laid over night, across the path of fish movement.
→ As a fish tries to swim through a mesh coming in its way, it is able to pass through the mesh by its head but not by its body which is too big to cross.
→ In attempting to withdraw its head, the fish is entangled as the twines slip under the gill cover.
→ The net is hauled the next morning and the gilled fishes are collected

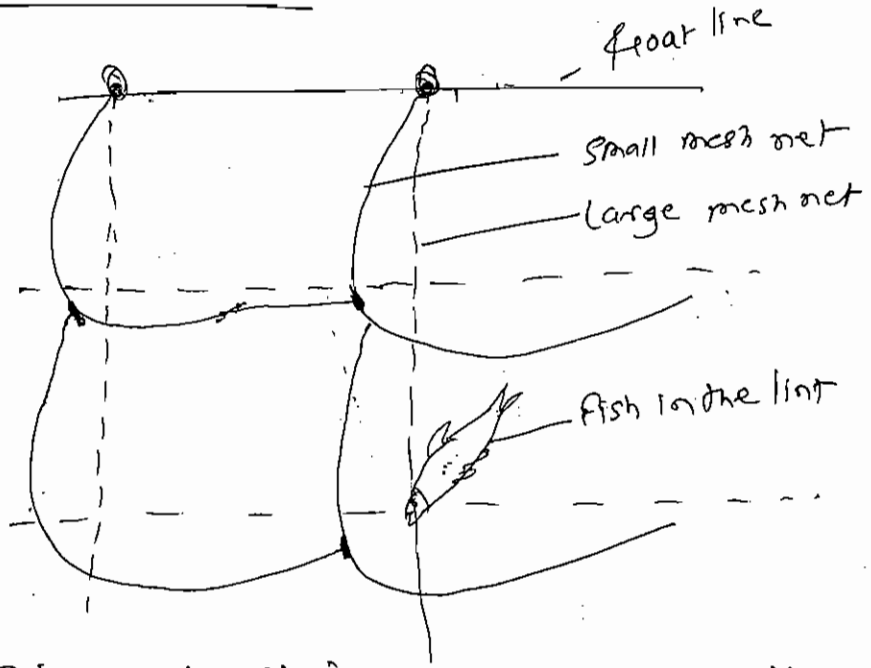
2) Drift net :-



→ Drift netting is fishing technique where nets made hang vertically in the water column without being anchored to the bottom.
→ The nets are kept vertical in the water by floats attached to a rope along the top of the net and weights attached to another rope along the bottom of the net.
→ Its function is like gill net. Fish entangled in net can not escape.
→ The size of the mesh varies depending on the fish being targeted.
→ These nets usually target schools of pelagic fish.

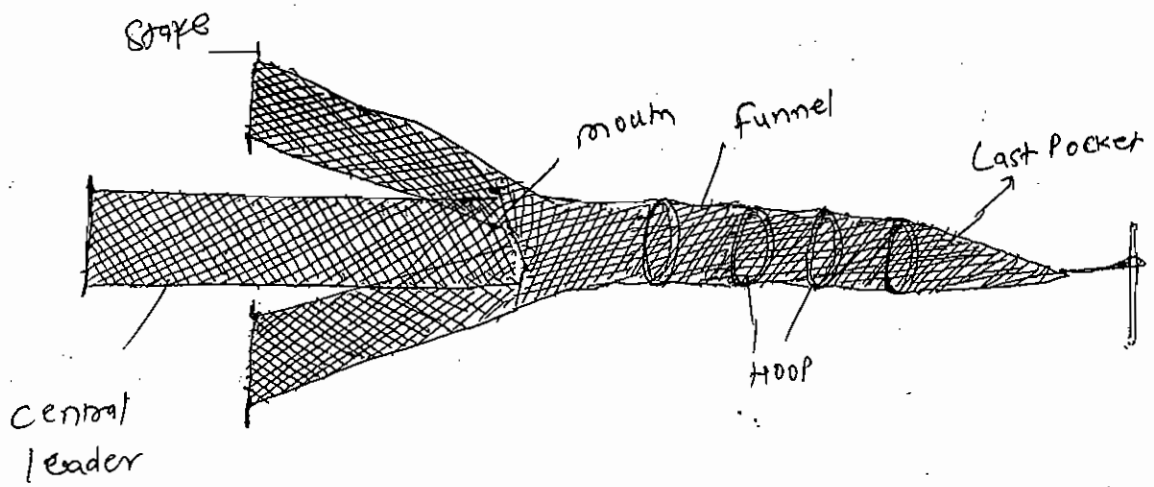
⇒ Traditionally drift nets made from organic materials such as hemp. which is biodegradable.

3) Trammel net :-



→ This net is similar to gill net or drift net in operation but has two or three walls.
→ These walls are joined together above the float line and below the lead line.
→ A small mesh webbing (lint) is loosely hung between the two tightly hung walls of large meshes, [whose mesh size is 4-7 times larger than lint.]
→ Small sized fishes are gilled at the lint where as the large sized ones pass through the first net wall and then proceed to push the loosely hung lint where the fish gets entangled without gilling and are thus unable to escape.

4) fixed trap net



→ fixed trap net is stationary nets and fishes are directed towards an enclosure through guarded entrance.

→ Various indigenous or special nets are used as traps.

→ These nets are particularly use in Ganga and Yamuna river.

→ Locally it is called as 'Bandal'

→ This trap consist of a Barrier of bamboos and a conical bag.

→ About 600 - 800 bamboo poles are fixed firmly at the selected site at an interval.

→ A conical bag is fixed at the end of V- shaped barrier with the help of two stout bamboos.

→ A simple net of cotton mesh about 6.2 cm is fixed to the bamboos.

→ The fishes entered to the conical bag and is entangled.

→ When flood water recedes down the trap is fixed and when water level rise trap is remove.

→ one boat and two men, working in shifts are required for the operation of the trap.

iv) Material used in manufacture of nets :-

a) Natural b) synthetic

a) Natural :- some natural material are used for net manufacture.

At ancient time the tough fibrous inner bark of the PawPaw was used by native americans. for making ropes and fishing nets.

→ Egyptian rope dates back to 4000 to 3500 B.C. was generally made of water reed fibres.

→ Other rope in antiquity was made from the fibres of date palms, flax, grass, papyrus, leather and animal hair.

→ Rope made of hemp fibres was in use in china from about 2800 B.C.

→ Jute is a long, soft, shiny vegetable fibre that can be spun into coarse, strong threads.

→ Jute is one of the most affordable natural fibers and second only to cotton in the amount produced and variety of uses.

→ Natural material of webbing and ropes can be obtained from linen, Remie (chinese grass), Abaca, Sisal and coir plant.

⇒ floats are made from cork, wood, plastic, sponge, rubber, glass or hollow metal.

→ Sinkers are made from lead or iron.

→ Stones can be used as sinkers.

→ Anchors are made from cement concrete.

b) Synthetic

→ Several types of synthetic fibres can be used for the manufacture of net material as.

i) Polyamide - Popularly called nylon.
ii) Polyester - Popularly called Terylene, Decron.
iii) Polyinyl chloride - widely known as Plastic, Tetron, Envilon etc.
iv) Polyinyl alcohol - trade name Vinylon.
v) Polyacrylonitrite - commonly called orlon, Darlon etc.

V) Preservation of the gear

→ If Proper Care of fishing gear are not taken it will definite decompose (Deterioration)
→ Decomposition of gear may be due to mechanical wear and tear caused by rubbing, bending and stretching of the components.
→ It may be caused by moulds (fungus) and bacteria.
→ After fishing, a net is contaminated with fish slime and other organic matter, and these used net should not be left as such overnight.
→ These used net should be cleaned by washing in running water.
→ If washing and drying is not possible, nets may be dipped in brine solution or sufficient quantity of common salt is sprinkled over it.
→ Copper sulphate is also used for cleaning nets.
→ The nets dry in direct sunlight for a long period is also harmful.
→ So, the nets must be washed immediately after use and dried in shade.
→ A wet net is destroyed by bacteria.

→ The best method of net preservation is to suspend the nets loosely in well ventilated sheds.

→ If heaping (ढेर लगाना) is to be done, to sprinkle common salt between all layers.

⇒ Nets will frequently barked for protection from rotting due to bacteria.

→ For this process various tanning materials are used.

→ Bark of certain trees like Karel wood.

→ Mangroves 'Acacia' are used to prepare a decoction by boiling in water. The decoction containing the tanning is cooled and the net is soaked in it for some time. After drying, the net is treated with the decoction a second time. By this impregnation and drying, a thin film of tannic acid is formed in the fibres and prevents bacterial action.

↔ The net is treated with 1% solution of potassium dichromate to fix the dye.

⇒ Nets are protected by tarring, The wood tars and coal tar are equally useful.

→ The net is put in hot tar or tar diluted with kerosene oil for 15 minutes, and is then dried.

→ This treatment of tar is increases the strength of the fibres and makes it water proof also.

→ Preservation of net needs disinfection to kill microorganisms. This is done either by sun drying or by treatment with a 3-5% solution of copper sulphate, copper naphthenate or copper oleate.

Unit – II

Unconventional fishing and fishing crafts

a) Unconventional fishing

⇒ These methods are of recent origin and modern technology oriented. Simultaneously, these ensure better commercial fisheries prospects. Some popular devices include Electro-fishing, light fishing, fish finding etc.

i) Electric fishing - mode of site of electric fishing

Electric fishing :–

→ This modern technique of fishing is being adopted in many countries on commercial level in rivers of well of seas.

→ This method works on the principal of simply congregating the fish in a particular area between the two electrodes where an electric field is created.

→ fishes are then picked up from that area by netting operations. The electric current is weak (about 1.5 Amperes and 150 - 250 volts).

⇒ D.C., A.C. or I.C. (interrupted currents) are used for the said electrofishing on the basis of the behavioural reaction of fish; as depicted below.

Type of current	Behavioural characteristic and effects
1. D.C. [Direct current flows only in one direction. D.C. is often used for low voltage such as batteries]	a) Electrotaxis :– After a certain threshold value of voltage, the fish swimming transversely to the direction of current turn parallel to it with the head is facing anode. b) Galvanotaxis :– All fishes swimming towards anode. c) Blocking (frightening, driving) effect : → This effect is in the margin of the electric field where the fish is frightened away rather than attracted. d) Recovery :– On switching off the current the narcosed fish are able to recover completely.

2. A. C.

[Alternating current referring to the type of flow of electricity where the direction reverses multiple times per second at regular intervals. Mostly seen in the main supply of power.]

a) Oscillotaxis :- After a certain threshold value of voltage is reached, the fishes between the two electrodes take up a transverse position to the direction of current and get narcotised.

b) Recovery :- fishes do not recover immediately after the current is switched off. They may recover after sometime.

3. I. C.

[Interrupted current - A current produced by opening and closing at regular intervals a circuit that would otherwise carry a steady current or one that varied continuously with time]

a) Electrotaxis :- Same as to D.C.

b) Galvanotaxis :- Similar to D.C. The fish undergoes severe vibrations when going towards anode.

c) Cathodic attraction :- If the electric current is gradually increased and then decreased abruptly, the fish turn about and swim towards the cathode.

d) Blocking effect :- Same as explained with D.C.

Mode of site of Electric fishing :-

1) The site :- For commercial purposes A.C. and D.C. are generally used in fresh waters whereas I.C. is used in marine.

2) Fishing gear and Equipment :- A boat, trawler, hoop-net, trawl net, fish pumps, electrodes, cables, Electro-seine, source of electric supply (a battery, generator etc.) etc are required for electrofishing.

3) Fishing :- In case of fresh water two electrodes are immersed in water. The anode and cathode being 2:3 in size. The anode carries a hoop-net (a metal ring from which a net is suspended) at its base. The electrodes are battery operated. The stunned (frightened) fish assembled at the anode are removed by the hoop net. The entire operation is conducted from a boat.

⇒ When fishing in sea, a condenser fed by a D.C. generator supplies the interrupted current. The electrodes are set at the mouth of a trawl-net,

→ As the fish are concentrated at the anode in a stunned state, they are captured in the approaching trawl net. Sometimes, fish pumps are set near the anode to suck up the stunned fish. → (confused)

⇒ Electro-seine consists of a series of alternating positive and negative electrodes hanging like a curtain from float. It is dragged through deep waters followed by netting. (usual)

ii) Light fishing :-

→ The attraction of fish towards artificial lightings has been found fruitful for commercial fishery.

→ It has been observed that fishes living in pelagic zone show positive Phototaxis. When the area is illuminated by electric lamp, search lights etc.

→ The transparency of water will give best results.

→ Yellow light in combination of white light (1000 watt for pelagic marine and 100 - 500 watt for fresh water.) is most effective.

→ Blue light attracts fingerlings.

→ TO catch fishes, both above water and under water lights can be used to attract fishes.

→ After that the attracted fishes are hauled by suitable nets.

iii) Fish finder - Hydro acoustic devices, fishing operations by eco-sounders

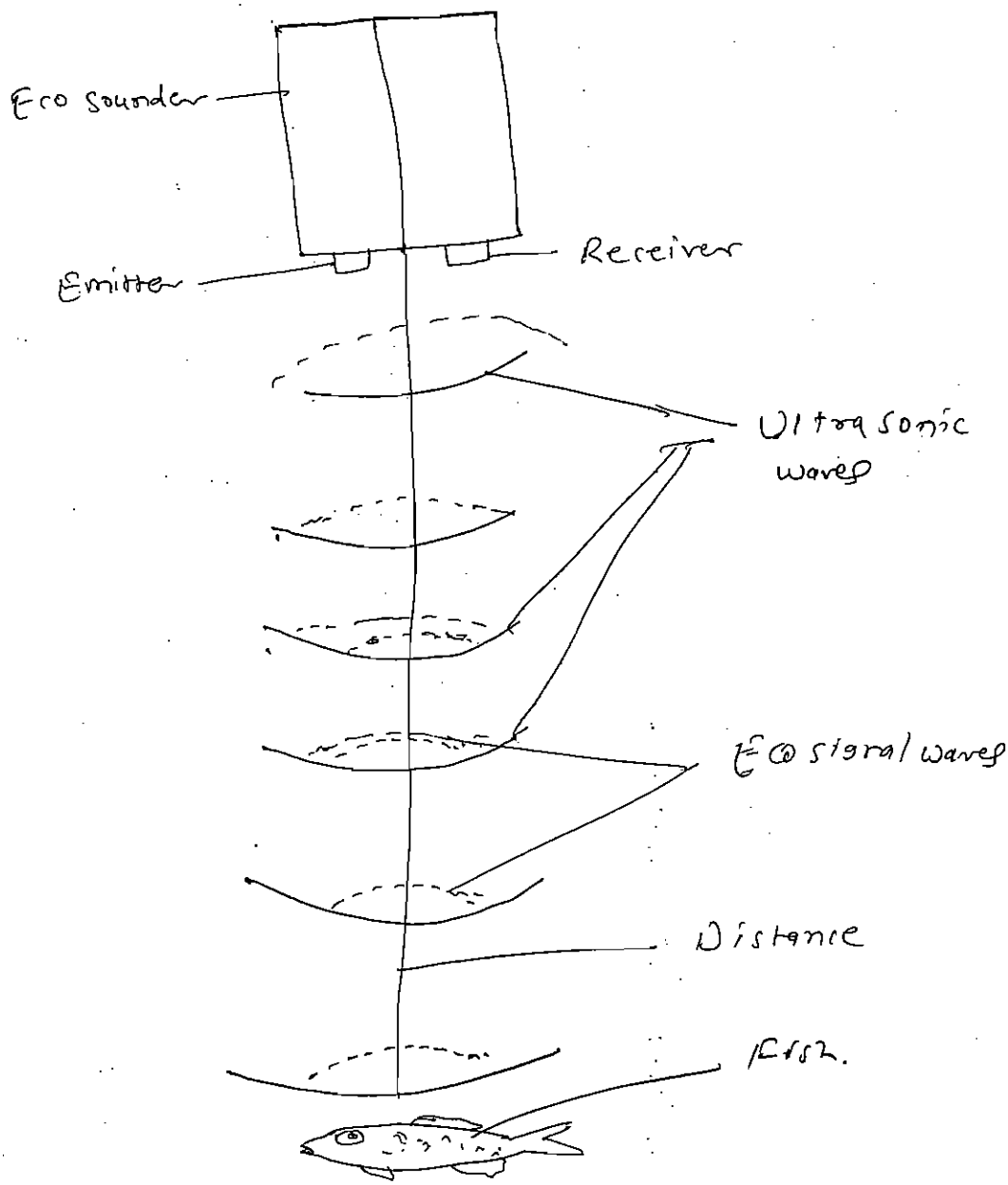


Fig:- A diagramatic presentation of the working of a Hydroacoustic Instrument.

→ Fish finding with hydroacoustic devices is currently used successfully in commercial fishing.

⇒ Generally fish finders are 3 types. i.e. Sonar, Eco sounder and fish magnifier.

→ Sonar and Echo sounders are same working.

→ Fish magnifier is designed for investigation of a very small section in the vertical plane for provide detail information.

A Hydroacoustic device :—

→ This is an echo-sounder or sonar equipment capable of determining the location of fish from ships, rocks, land etc.
→ This instrument emits ultrasonic sound waves in all directions.
→ The waves which strike any underwater object are reflected back just like echo and act as a echo-signal for the instrument.
→ The nature of object and its distance from the instrument are recorded on an automatic recorder.
→ Greater the distance, weaker is the intensity of echo-signal.
→ If the object is fish the signals of varying intensity are detected
→ If fishes are large in numbers echo signals strong.
→ If fishes are in huge shoal the echo signals soft and rolling sound. (group) मिश्रित ध्वनि
→ If fishes are scattered the signals are unclear echo.
⇒ Echo-sounders are smaller and handy. It is widely used getting information in sea and depth about 400m.
→ An echo sounders has two main parts.

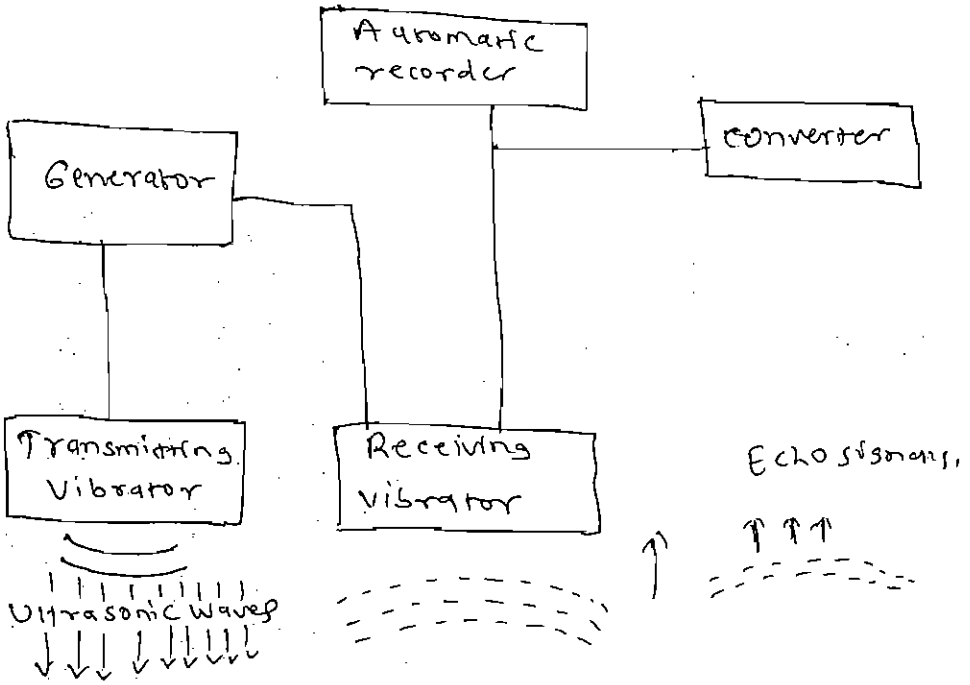
1) Transmitter Vibrator :— which emits ultrasonic pulses.
2) Receiving Recorder :— The reflected ultrasonic waves or echo-signals are converted by the receiver into audio-signal (in the range of 800 - 1000 cps : to be heard by the operator)

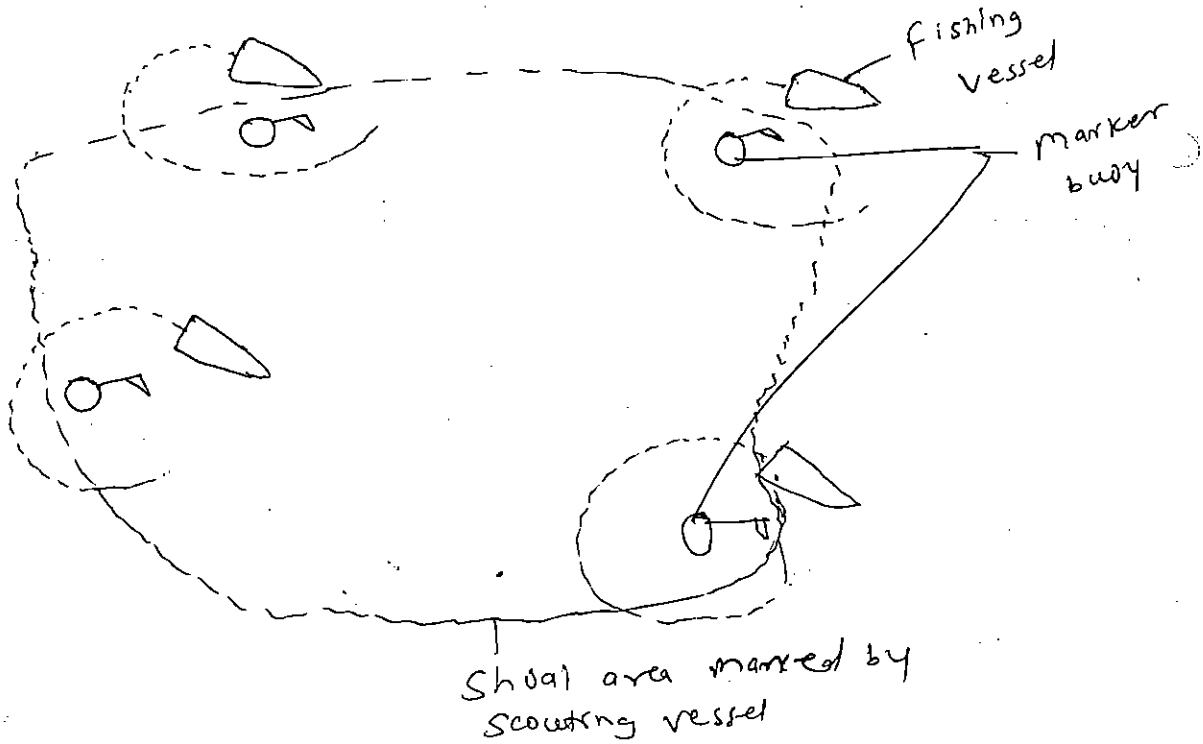
Fishing operations by echo-sounders :—

→ The fishing by Echo-sounders is practised in sea with the help of 2 ships.
→ One is called the scouting vessel fitted with echo-sounders and the other one as the 'fishing vessel' provided with purse net, trawls etc.
→ Both vessels are in communication with each other through radio equipment.

⇒ When echo-signals are recorded regarding the location of large fish shoals, the area are marked by 'marker buoys'.

→ This information is conveyed to fishing vessels on the radio equipment by the scouting vessels.





b) Fishing Crafts

→ The operation of various kinds of gears for commercial fishing requires not only trained manpower but other 'aids' also required which is used for carry the gears, operate the gears and store the collected fishes, which is called as 'craft'.

→ These crafts are rafts, dugout, canoe, large mechanised or non mechanised boats and are indigenous locally built and suitable to local condition.

i) Inland fishing Crafts :-

→ The commonly used crafts in the rivers, ponds, lakes, reservoirs etc. These are following.

i) Raft :- This is the simplest and most primitive type of craft, craft means more or less rigid floating platform made of buoyant material. e.g. barrel, planks, timber etc. tied together for floating on water.

→ Raft made from buffalo skin and used in Ganga river.

→ Raft made from banana stem are used in Bengal and Tanjore district of south india.

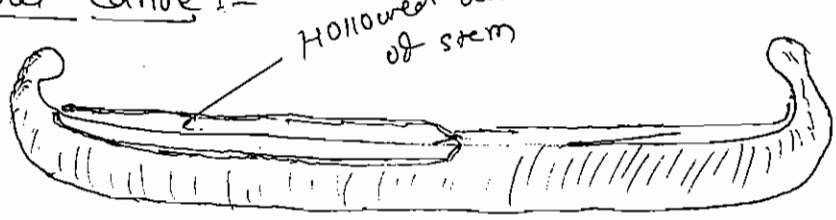
→ The earthern pot raft is seen in Patna, Gaya, and Hazaribagh. It is construted usually 9 earthen pots arranged in rows of three. connecting bamboo ~~[illegible]~~ on either side of the mouths.

→ These pots support a light platform of bamboo, the mouth of each pot being closed with a cover of sal leaves.

→ These raft is used in also Trichinapoly and Tanjore district of South India.

→ At some places in small channels of the Ganga and Yamuna type-tubes are used by poachers to lay spread the gill-net.

ii) Dugout Canoe :-

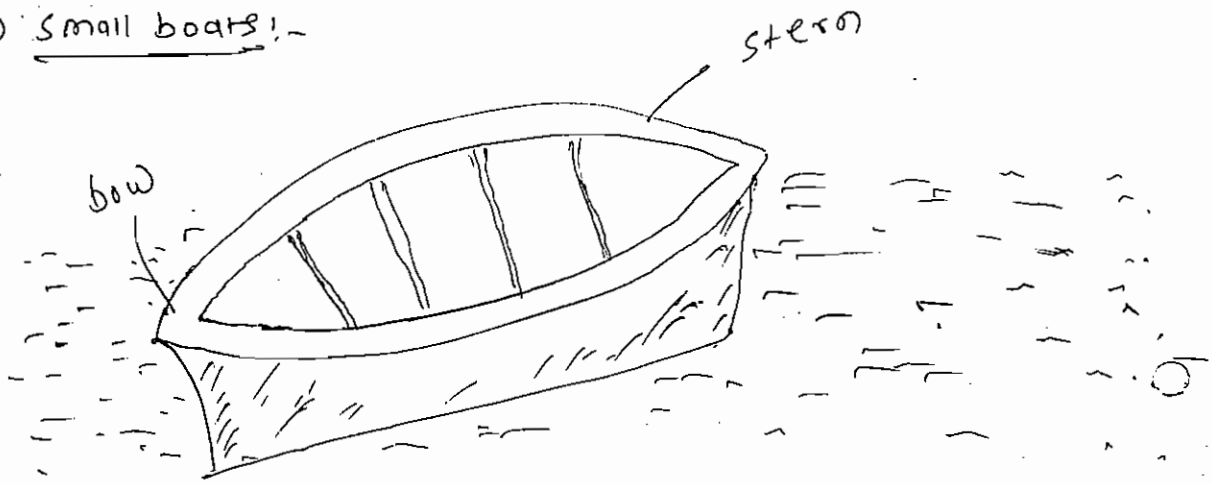


→ This is also a primitive type of craft also known as 'donga' made by hollowing out the butt and stem of palmyra palm.

→ It is very commonly used in west bengal for angling and operate for cast net.

iii) Boats :-

a) Small boats :-



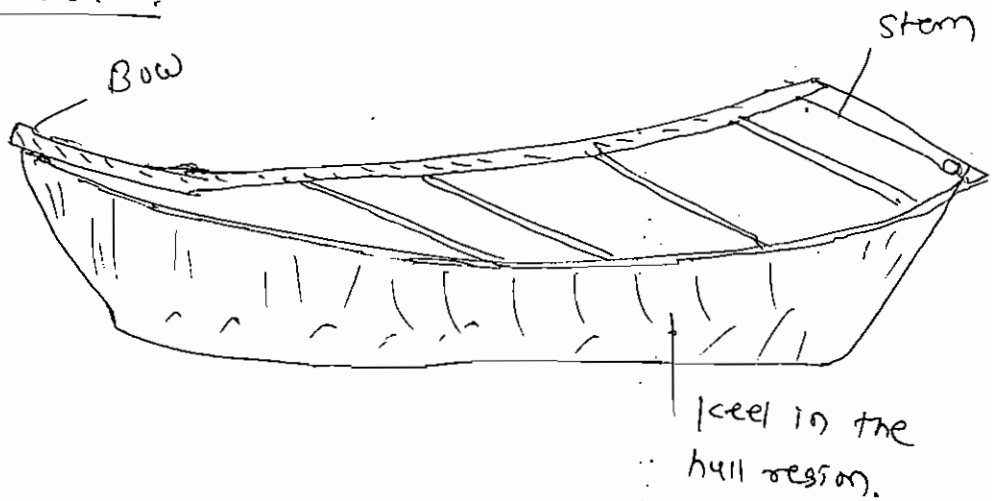
→ These are locally called as 'dinghis'. It is made from wooden planks.

→ It is used in rivers and esturies for operating purse nets and dip nets.

→ These boat have narrow tapering bows (fore part) and sterns (rear part of boat).

→ Usually its size about 6.0 m × 1.5 m × 0.45 m in dimensions.

b) Large boats :-



→ These boat size upto 18 m × 3 m in dimensions and used for operating gill nets, drift nets, and large sized dragnets.

→ The boats used in the Ganges are generally upto 10 m length. With one tapering where as the other one flat about

(3 m wide).

→ They are about 90 cm. deep and there are about three or four raised platforms of about 15 cm width where the nets are placed.

→ These boats may be flat-bottomed or keeled.

→ In chilka lake and mahanadi river flat ~~boat~~ bottomed plank-built boats known as 'Naval' are used.

→ Where 'Masthawal' type boats are used in Gujrat for operating large nets in the estuaries.

ii) Sea fishing crafts :-

→ fishing crafts for sea are not vary of inland fishing crafts.

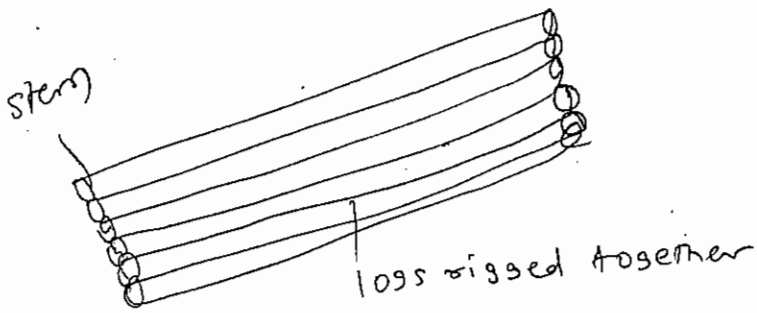
→ They do vary according to the physiography or topographical features. ~~as~~ along the east and west coasts of India.

→ ~~On~~ The east coast sea is rough caused by loamy water.

→ The west coast is usually clear.

1) Craft used along East Coast :-

i) Catamarans :-



→ This is raft formed by rigging together several logs i.e 3 to 7 pieces which are curved and shaped like canoe.

→ The posterior end of the craft is cone shaped, projects above the water and used for changing direction.

⇒ The Catamarans vary in designs in different parts along the East coast and ~~as~~ such of 4 types.

a) Orrisa type :- boat shaped, made up of 5 logs fixed with wood.

b) Andhra type :- upto 5-7 m, made of heavy wood, planks used in fitting.

c) Coromandal type :- made up of 3-5 logs, used in Chennai.

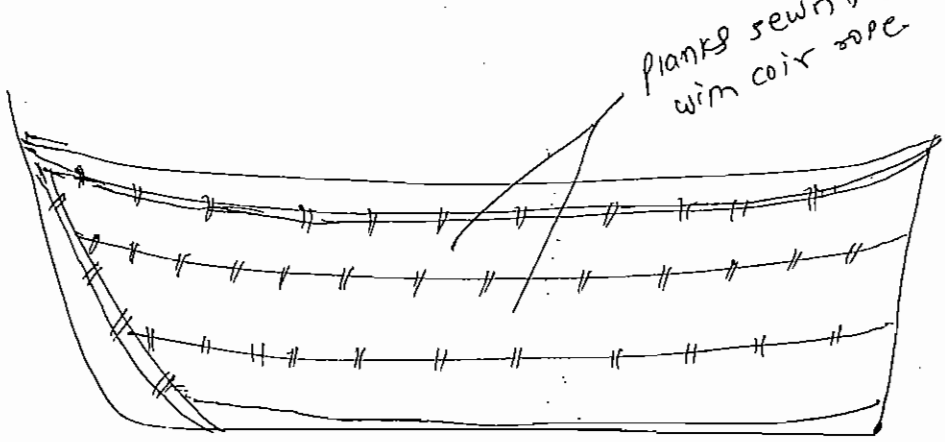
d)

d) Boat - Catamaran :- boat shaped, made up of 3 logs, used in Mandapam, Mukkuv, Tuticorin, Cape Camorin etc.

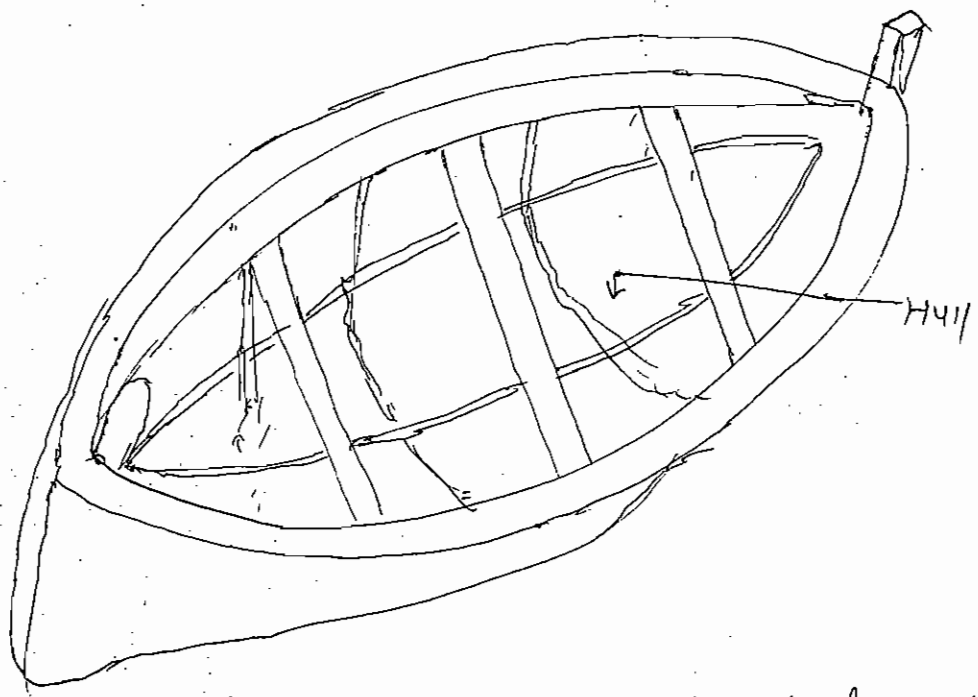
ii) Boats :

a) Non-rigid masula type boat :-

→ upto 9 meter, made up of planks, sewn together by coir rope. Without frames or ribs.



b) Caravel or Carvel boat :-



→ These boat have a 'hull' whose shell is formed of planking or plating in which each strake, overlaps the next one below and is overlapped by the next one above. or the plating laid close together on the frames so as to present a smooth exterior.

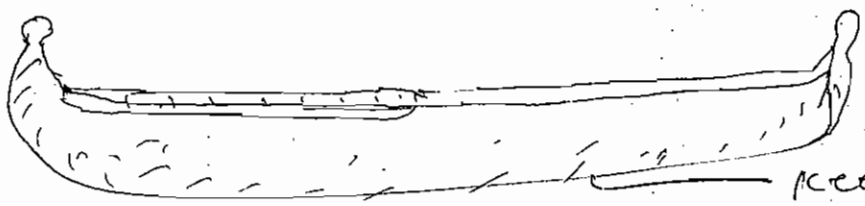
→ Locally called as 'Dinghi' or 'Naukas' in Orissa and West Bengal.

→ They are strongly built and quite spacious boats.

2) Crafts used along west-coast

Canoes :- Various types of 'canoes' have been found in different parts. e.g.

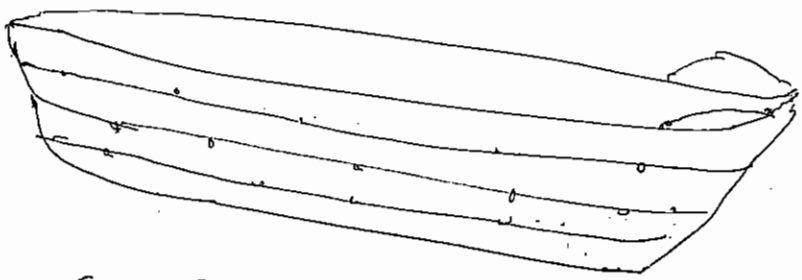
Dugout canoes



→ It is made by scooping out the inner part of the trunk of 'aini' or 'cheeni' wood.
→ The keel is thicker than the sides.
→ It is used in Kerala.
→ Larger dugout is used for operating a variety nets.
→ Small dugout used for operating gillnet or driftnet.

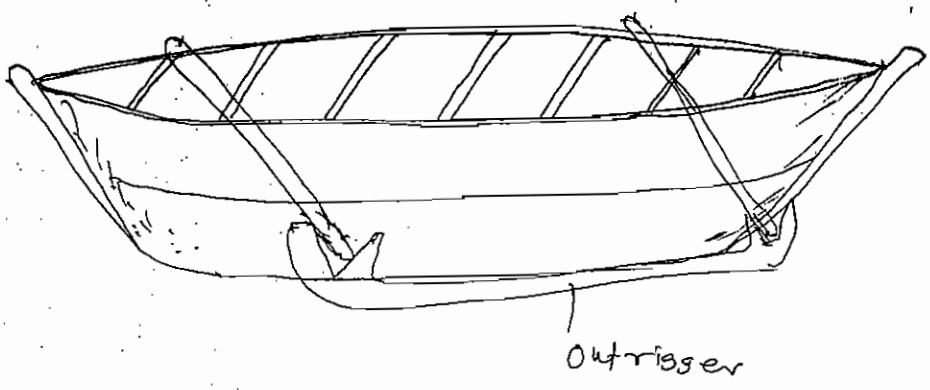
Plank built canoes :-

→ The dugouts further enlarged with planks on the sides used largerly in Kerala, and North Mumbai
→ Planks of cedar wood are seemed together instead of single log. These boats are similar to dugout



Outrigger canoes :-

→ The 'outrigger' is a framework extended out from the sides of a boat supporting a float which gives stability or it is a bracket extending outward from the sides.
→ The boats (15m x 3m) with single outrigger are used on the Konkan coasts for mackeral fishing.
→ They are built-up canoes with a narrow keel and the planks are more spread out.



The boats :-

→ The sea fishing boats are strongly-built and extensively used in norm of Ratnagiri and along mumbai coast.

→ They are designed and named differently in different parts, these are.

i) Ratnagiri Type :- With pointed 'bow' straight but narrow keel and low Gunwale.

ii) Bassein Type :- (Machawa) - It-bow is pointed straight keel and broad hull.

iii) Broach Type :- Flat bottomed used in inshore and estuarine waters.

iv) The 'galbat' or 'satpati' type :- It is medium pointed bow, broad beam, straight keel, and high 'gunwale'. These boats have become popular in Mumbai and further south because they can be easily mechanized without any changes in the design.

iii) Mechanised crafts :-

→ To enhance the rate of the fish landing, some fishing crafts are installed with engines for ~~use of~~ propulsion and to use mechanical devices for handling gears.

→ This is refered to as mechanisation of crafts.

→ Large sized boats exp. Tuticorin type, machwa type, satpati type etc are found suitable for motorization.

→ Mechanization of boats has also been done for inland fishing particularly in large rivers. e.g. the Ganga, the Brahmaputra, the Hoogly, Krishna, Godavary, Mahanadi etc.

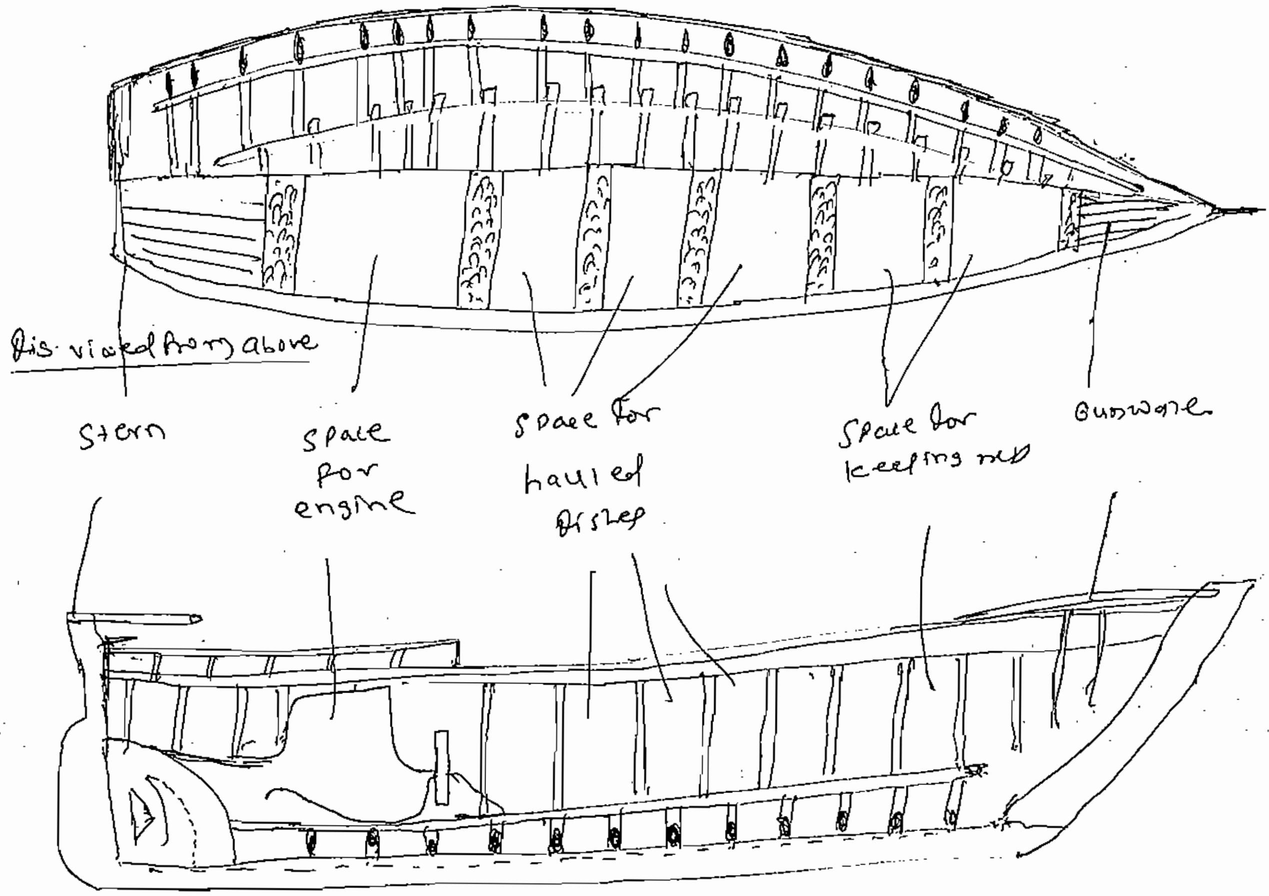


fig. viewed from above

fig. side sectional view

fig: Sat Pati type mechanised boat.

→ Central Fisheries Technological Research Station (Craft and gear wing) cochin is a Government of India establishment for looking after the improvement and mechanization aspects of the crafts and gears, so as to ensure better commercial fishery prospects.

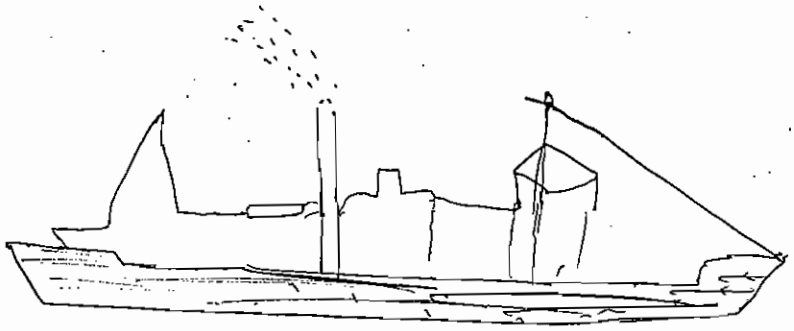
→ This institute has evolved more than dozen fishing vessels in the size & range of 7.6 – 15.24 meter. for Fishing operations

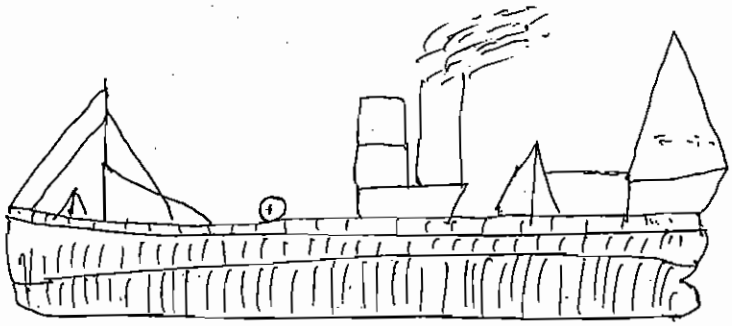
→ About that's total invention 50% mechanised vessels operating in different parts of country.

→ Technological research has also proved useful in the manufacture of marine engines for fishing boats.

→ marine engines for vessels upto 18 meter length are now manufactured in our Country.

→





iv) Material used in Boat / craft Construction

→ several construction materials are available for fishing vessels.
→ Each material has its own construction method.
→ Following are the some materials available for construction of fishing vessels, i.e.
→ Wood, steel, Aluminium, Glass fibre reinforced plastic, ferro cement, composite.
→ material will be select depend on where it is used, its factors are following.
→ Type of vessels, size of vessels, speed of vessels, Shape of the vessels, Availability of material, suitability, Economic viability, Environment in which the vessel is going to operate.

Wood

Advantage:-

- Traditional boat building material, widely popular
- Except exotic kinds, easily widely available
- Resonable price.
- Relatively light for its strength.
- widely available designs.
- Non magnetic, non conductive.
- Pleasent to touch in natural form.
- Absorbs moisture.
- easy to repair.

Disadvantage:-

- Need of Protect by Painting / varnishing.
- regular maintaince or repainting required.
- It may be cracked / damage
- easy accept fire

Steel

Advantage

- Largely available everywhere
- Resonable price lower than aluminum
- It is strong much harder than aluminum.
- Easy to shape into any form.
- The cheapest widely available welding equipment used

Disadvantage:-

- magnetic so, effect to compass, and highly conductive.
- Its main problem is rust.

→ Due to its heavy weight boat become larger wetsurf

Ferrocement

- cheap material
- When Properly use immensely strong.
- Suitable only for heaver displacement boats.

Aluminum :-

Advantage :-

- Great boat building material.
- Availability every where.
- Light weight and Strong.
- Non magnetic does not affect to compass.
- Easy to shape into any form.
- No painting required for protection
- minimum maintaine required.

Disadvantage

- Highly conductive.
-

Glass fibre reinforced plastic (fibre glass)

→ Advantage

→ Non magnetic does not affect to compass. & non conductive
→ Availability ~~from~~ from population centre.
→ very easy to shape into any form.
→ No painting required.

Disadvantage

→ High price for high quality material.
→ It will cracked.