



Demersal Trawling Operation

P. Pravin

Central Institute of Fisheries Technology

P.O. Matsyapuri, Cochin-682 029

E mail: pravin@cift.ker.nic.in

Demersal trawls can be operated in a very wide range of depths (from a few metres to more than around 1000 m), mainly at sea, but also, in some cases in inland waters e.g. lakes. The demersal trawl is designed and rigged to have bottom contact during fishing and is, depending on the bottom substrate equipped with different kinds of ground rope. This is for the purpose of shielding lower leading margin of the trawl from ground damage whilst maintaining ground contact and easy move on the bottom.

The trawlers must have sufficient towing force for towing the gear and require a winch or mechanical hauling system. However, in some small-scale operations hauling is done manually. The methods adopted for demersal trawling are: beam trawling, side trawling, stern trawling, double rig trawling, bull trawling and mutli rig trawling. Of these, stern otter trawling is very popular in India.

Stern trawling was first introduced in late 1940s and has become very popular since then. In a stern trawler the towing power is utilized to the maximum and the net can be set in a straight line. The wheel house is usually placed forward leaving the aft deck clear for the fishing gear and fish handling. Gallows with the towing blocks are fixed on either side of aft deck in small trawlers and in case of large stern trawlers, towing blocks are fixed on the stern gantries instead of gallows. A clear view of the aft deck from the bridge is required to provide the fishing master a clear view of the deck and to ensure safety during fishing operations.

Beam trawling

In beam trawls, the horizontal opening of the mouth of the net is dependant on the length of the beam and the vertical opening according to the height of the trawl heads. The size of the net is restricted due to the limitations to the size of the beam. The advantage in beam trawling is that the mouth of the net can be kept constantly open unlike in otter trawling.

On arrival at the fishing ground, the beam trawls are hoisted on the booms which are then swung out. The same method is used for recovery. The operation is undertaken while the fishing vessel sails on a straight course.

When hauling, the net is heaved in until it is at the boom tips. The cod end is taken by the line attached to the cod end strap and the catch is emptied out directly.

Otter trawling

In otter trawling, the otter boards are used to keep the mouth of the trawl horizontally open. Initially otter boards were attached directly to the wings of the net. The Vigneron-Dahl system was introduced during 1920s where the otter boards were attached to the wings by means of sweep lines and bridles. This helped in increasing the effective swept area and thus increased the catch due to the herding effect of sweep lines and otter boards. The vertical height of the net is achieved by the use of weights for the foot rope and floats at the head rope. In larger trawls, in addition to the weight on the foot rope, iron bobbins or rubber discs are attached depending upon the nature of fishing ground. The mouth opening can also be increased by the use of kites, false head rope, hydrodynamic floats and up thruster floats. It is also influenced by the speed of tow and by the length of warp released for towing the net.

The towing warps are provided with markers at distinct intervals for facilitating the release warp as per the depth of operation. The length of warp released in bottom trawling depends on the depth of the fishing ground and nature of sea bottom. The ratio of depth of fishing ground and the warp released is known as scope ratio or in other words, it is the warp-length ratio.

The approximate length of warp to be released would be

- 5-6 times the depth in shallow waters below 50 m
- 4-5 times the depth in off shore waters of 50-100 m
- 3-4 times the depth in deep waters of 100-200 m
- 2-3 times the depth in deep sea of 200 m and more

The speed at which the trawl is towed over the bottom varies, depending on the species being sought, from about 1 ½ to 2 knots upto 4 ½ knots for fast swimming fish. Towing a particular trawl too slowly may cause the otter boards to close together, providing insufficient spreading power to the net which tends to sag on to the bottom. Towing too fast could result in the net lifting off the bottom and floating, quite possibly leading to its turning over and a foul gear.

Winches are used to pay out and haul the warps. The winches have two drums, one for each of the two warps; an additional drum is provided for operation of try net in shrimp trawling. In larger trawlers, single drum split winches are used for each of the warps. Hauling speeds could vary from 30 to 60 m.min⁻¹. Stern ramps are provided in larger stern trawlers, which facilitates the shooting and hauling up of the gear with less manpower. In large trawlers net drums are used to haul up, pay out and store the sweeps, bridles and net with its rigging. The following factors are to be taken into consideration before the commencement of fishing operation.

- a) Availability of fish (by using echo-sounders)
- b) Depth and nature of sea bottom of the fishing ground
- c) Fishery charts and Fishery forecasts,
- d) Current and wind speeds

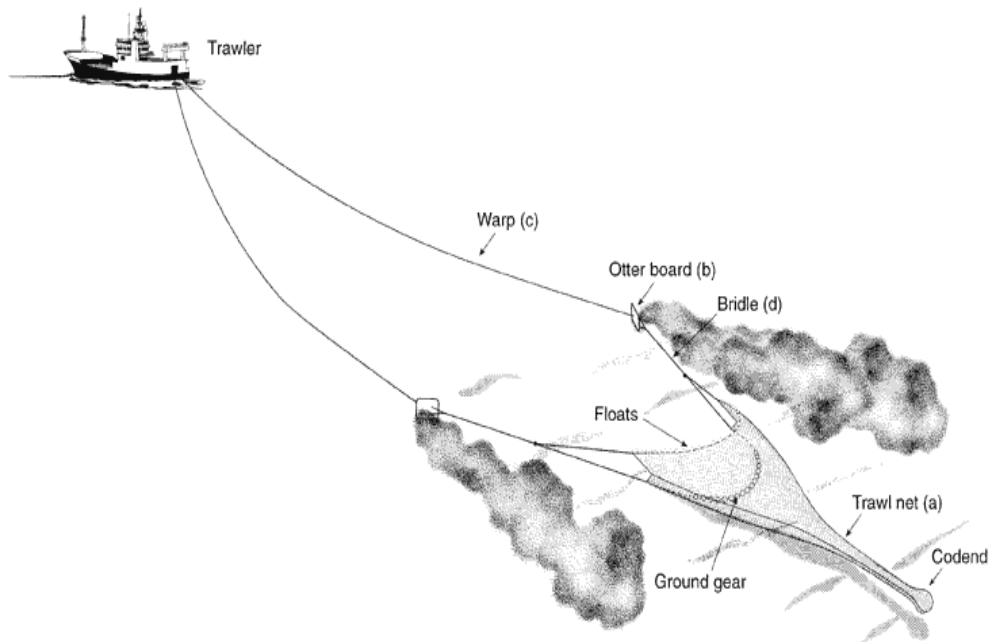
One-boat bottom otter trawling

Shooting the net

The trawl net is kept ready for operation on the fishing deck or in the net drum, as applicable. The warps are attached to the net and the codend is closed properly. The cod end is the first part to be released, followed by the main body of the net. The vessel steams forward slowly releasing the net and the otterboards. The winch is stopped after releasing few meters of the warp to ensure the proper spreading of the bridles and otter boards. The gear is then lowered to the desired fishing depth by releasing sufficient length of warp (scope ratio to be maintained).

Towing the net

The net is dragged for a duration of about 2 to 4 hours depending on the catch.

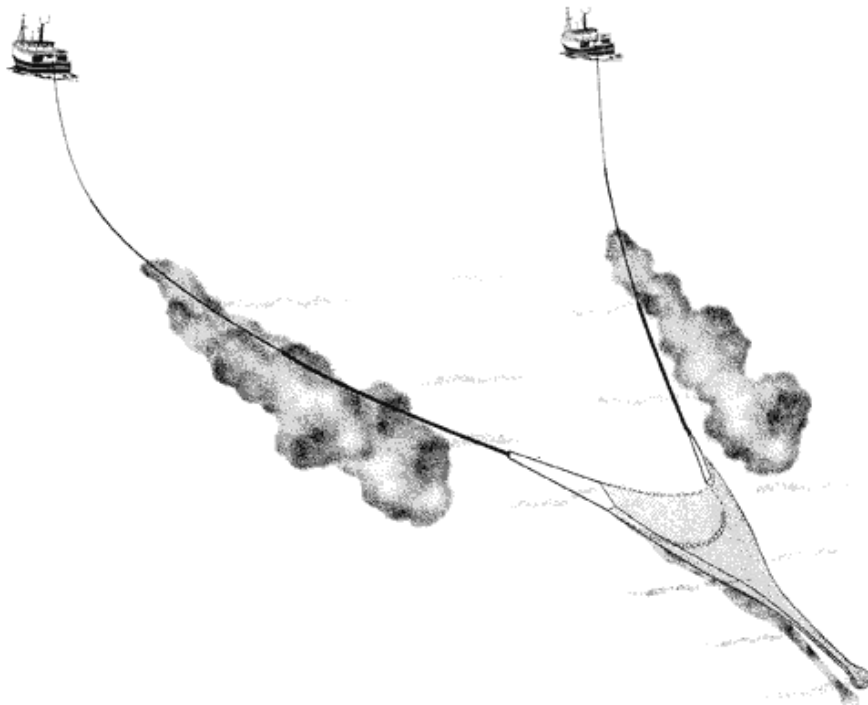


Hauling the net

The net is hauled by heaving in the trawl warps evenly on to the winch drums, until the otter boards reach the gallows. Sweeps and bridles are then hauled up followed by the main body of the net and finally the codend. In small trawlers, the sweeps and the net are shot and hauled in manually and sweeps may remain connected to the otter boards. In large trawlers, a Kelley's eye, independent wire and back strop is used for facilitating the hauling of the sweep lines and net on to the net drum after the otter boards have reached the gallows

Demersal pair trawling operations

It is known as bull trawling or pair trawling. The name itself is derived from the use of two boats for the operation of the net. While pair trawling is perhaps more common for midwater trawling, it is also used for bottom trawling. By utilizing the combined towing pull of the two vessels, a larger net can be worked than would be possible by a single vessel. The two main advantages of pair trawling are: pair trawlers operate trawls without otter boards and they consequently may pull a net which is at least twice, or slightly more, the size of trawls that can be towed by a single vessel. The setting and hauling operations are carried out by one vessel, while the other is used only during the towing sequence; often each will take turns at these operations. As the vessels are operated from a distance from each other scaring effect due to vessel noise is minimal.



Shooting the net

The pair trawl is set out from the stern of the so called "main boat". Once the net is in the water and safely clear of the setting vessel, the "partner boat" come close enough to the main boat and throws a light heaving line to it. The end of the bridles are tied to the heaving line and are pulled quickly aboard the partner vessel and connected to its warp. In general, each of the boat trawling in pair keep a single warp each. At a given signal the winch brakes are released and the two boats shoot their warps taking care of shooting at the same speed. Scope ratio between depth and warp length varies from 1:5 to 1:10 in pair trawling.

Towing the net

When the required length of warp has been set, the trawlers start towing on parallel courses. It is important that the skippers keep permanent contact with each other during all the operations. The vessels move parallel to each other at an equidistance between the two vessels. Generally the distance apart the two vessel is half the length of the warp released.

Hauling the net

When the time comes to haul back, both vessels haul on their warps until the bridles reach the gallows. The vessels then draw nearer, up to a safe distance apart, and a heaving line is used again to transfer a messenger line fastened to the bridle end on one vessel to the other; the partner boat then disconnects the bridle from its warp so that the other, the main boat, may heave in the messenger on the winch through its second gallow block. When the bridles have been hove up all to the gallows, the net is brought aboard and the codend emptied in the usual manner. Either quarter ropes, a drum or ramp arrangement may be used.

The distance between the vessels and the speed of the vessels should be uniform. Further, the skippers of both the vessels should have very good understanding for the smooth fishing operations.

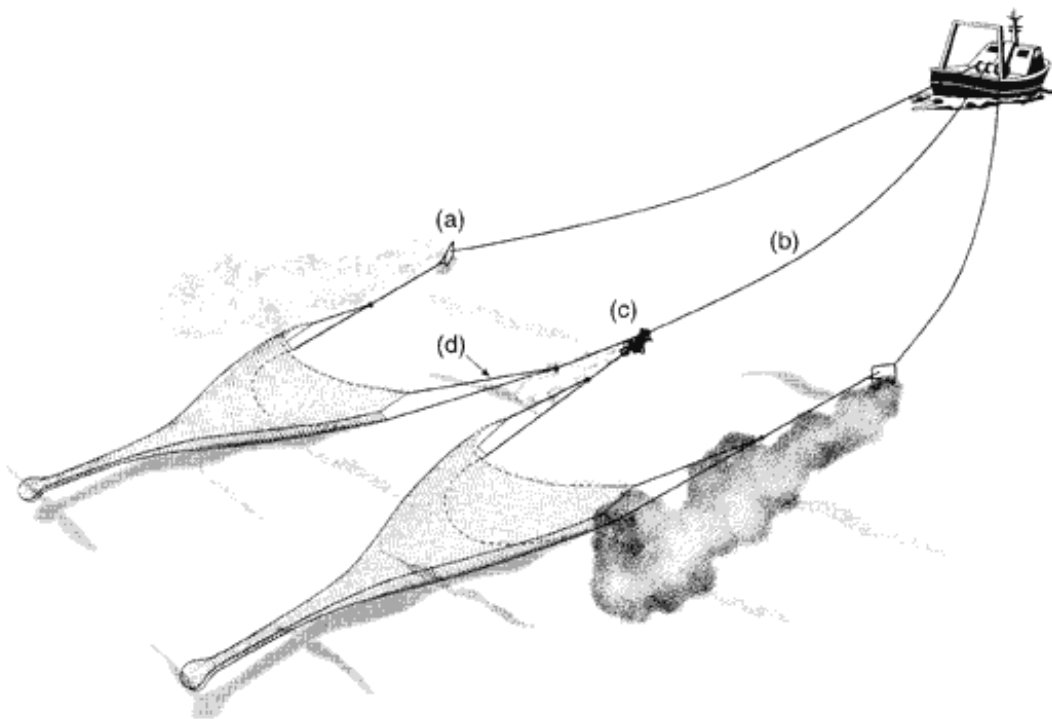
Multi- rig trawling

In general the trawler tow a single trawl. However, recent development is towards multi trawl rigging, where, up to four parallel trawls are towed from the same boat. Twin trawls can be towed from the stern of the vessel or from outriggers. The latter technology is widespread in tropical shrimp fisheries where it is called as quadtrawling. Multi-rig trawling is a widely used trawling practice for shrimps living close to seabed which can be caught by nets with low vertical opening. Advantages of double rig trawling are that two small nets have greater horizontal spread and sweep a wider path than a single net of equal towing resistance with corresponding increase in the catch, lower labour and investment on nets; and lower fuel consumption.

Double-rig trawling

Double rig trawling originated in the Gulf of Mexico in 1950s and now is quite popular in India for harvesting shrimps.

In double rig trawling two smaller trawls are operated instead of using a large and heavy trawl by the same vessel especially for the capture of shrimps. Two booms each of approx, 6-12 m depending on the size of the vessel and size of the net are attached on the port and starboard side of the main mast for towing the net. They are fastened fore and aft vertically and are rigged to operate at an angle of $20 - 30^\circ$ from the horizontal. These booms can be folded upwards when not in use facilitating manoeuvring and berthing of the vessels at the harbour. A long bridle is used for attaching the net to the towing warp. Sweep lines are not used and the otter boards are directly attached. While towing one net, usually the starboard net, is towed slightly ahead of the other. The size of the net and the length of the bridle is so arranged as to have at least 6-8 m clearance between them. A try net is operated every 10-15 min in order to find out the availability of the shrimp catch in the fishing grounds.



Hauling commences simultaneously and the forward net is taken first. A boat hook is used for reaching the lazyline. Lifting the cod end is facilitated by a heavy and strongly staged cross bar arrangement fitted abaft the vessel. The cross bar is provided with several block tackles for lifting the net. Usually a three drum winch is used, two for the two nets and the third for the try net.

The net is rigged by adjusting the weight of chain in the foot rope so as to operate the net 5 to 15 cm above the seabed, in order to avoid mud and non-target finfishes entering the net. A tickler chain is rigged to the front of the ground rope which ploughs through mud and brings the shrimp out of the mud into the path of the trawl. Flat rectangular wood and steel otter boards with an aspect ratio of 0.3 to 0.5 are connected directly to both wings of the net. There are no bridles and sweeps between wing-ends and otter boards.

Bottom trawling and environment

Bottom otter trawls interact physically with the bottom sediment, which might result in removal or damage of sedentary living organisms (including seaweed or coral) and in the case of uneven bottom surface displacement of stones or other larger objects. On flat sandy/muddy bottom the sediments might be whirled up into the water masses and suspended. The short and long-term impact on the bottom environment is still poorly documented. More research on this impact is urgently needed. The major negative impact of bottom otter trawls on the biological environment is related to the capture and frequent discarding of non-target sizes and species of both fish and other aquatic species. Regulation concerning minimum mesh size in the codend is the most commonly used method to limit the capture of non-target fish sizes. In recent years such size selectivity has been improved by the introduction of square mesh codends and selection devices like grids. Non-target species are normally reduced by the use of selective devices, like the Turtle Excluder Device (TED) in shrimp tropical trawls and the Nordmoere grid to reduce capture of fish in the northern shrimp fisheries