

Purse seining is one of the most efficient advanced fishing methods, and by virtue of its efficiency relatively few vessels are required to harvest the suitable resources exploited by the purse seines. Historically and technologically, purse seines and ring nets have developed from beach seine and lampara fishing methods. Beach seines are inshore dragnets consisting of long wall of netting which are usually deeper than the depth of the water. The Mediterranean origin of the lampara is widely recognized and some ancient Egyptian pictures describe fishing with nets which have a lampara or boat seine shape. In contrast to beach seines, lampara are true surround net have short wings, a deep central bunt and a lead line substantially shorter than the float line. Ring seine is one of the most commonly used gear, hybrids between the purse seines and lampara nets. The ring seines are used in two boat, small scale inshore fishing operations. Two boat ring seining enables small boats and even non-mechanized boats and canoes to use relatively large nets. Ring seines represent a level of purse seining technology which may be very appropriate to small –scale fishermen of the world.

Purse seine

Purse seine is made of a long wall of netting framed with float line and lead line have purse rings hanging from the lower edge of the gear, through which runs a purse line made from steel wire or rope which allow the pursing of the net (FAO, 2019). Purse seine is used to capture of dense, mobile schools of small pelagic fishes. The principle of catching fish in a purse seine involves surrounding a school of fish by a long wall of webbing and subsequently pulling the bottom of the net by means of a purse line. The fish catch from this artificial pond of webbing is then removed either by brailing or pumping, small purse seines can be operated entirely by hand.



Fig. 1. A typical purse seiner of Kerala

Along the Indian coast, purse seine operation is confined to the west coast. A total of 1,213 purse seiners operate in India. The purse seiners operated along coastal states of India are concentrated in Maharashtra (435), Karnataka (422), Goa (294) and Kerala (60) (CMFRI, 2012). Purse seine contribute 22.7%, 82% and 20.3 % of the marine landings of Maharashtra, Goa and Karnataka respectively during 2012-13 (CMFRI, 2013). The purse seiners in India are mainly made of wood and steel and their size ranges from 11 to 23 m L_{OA} . They are equipped with marine diesel engines with power range of 110 to 420 hp. Purse seines are operated from single vessel and skiff assists the fishing operation. Purse seiners generally undertake single day fishing in

Kerala and Karnataka whereas purse seiners from Goa carry out multi-day fishing. Electronic equipments like GPS, echosounder, VHF receiver are mainly used for vessel navigation, fish detection and communication. Mobiles are also used to communicate fishing areas, grounds, catch etc. The crew complement varies from 25 - 35.

Purse seines mainly target fishes like mackerel, sardine, white bait, carangid, tuna, barracuda, seer fish, cat fish, wolf herring, pomfret, lizard fish and croaker. The head rope length of purse seines ranged from 450 to 1500 m and depth of netting range from 60 to 100 m. Purse seines are made of polyamide multifilament webbing with mesh size range from 18 to 46mm. Some vessels carry two purse seines (18 mm and 46 mm mesh size) on board. In artisanal or semi-industrial fisheries, the purse seine handling equipment may include: a purse seine winch, a purse line reel, a brailer and a power block and in some fisheries, a net drum. In industrial purse seine fishery, the basic equipment include : a hydraulic power block, a powerful purse seine winch, a number of derricks, including a brailer or a fish pump, and small winches, an auxiliary boat "skiff" and sometimes, an helicopter. The purse seine can be used by a large range of vessel sizes, ranging from open boats and canoes up to large ocean going vessels. The purse seines can be operated by one or two boats. Most usual is a purse seine operated by a single boat, purse seiner, with or without an auxiliary skiff.

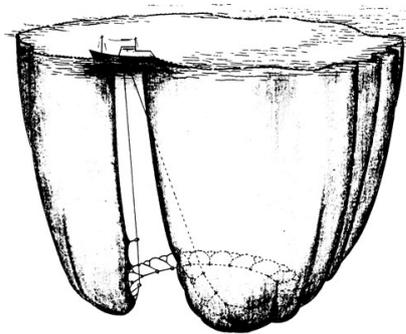


Fig. 2. Purse seine

Source: <http://www.fao.org/fishery/geartype/249/en>

Structure of purse seine

Bunt is a main region of the purse seine where the catch is accumulated and it is made up of thicker twine. The bunt portion is placed in the centre or at the end of the wall of the netting depending on the type of operation. Main body is the largest part of the net extends from one end to the other end of the net except the bunt region and facilitates surrounding of the fish shoal during operations. It is made by joining together large sections of webbing of appropriate mesh sizes to catch the target fish. The material used should have high specific gravity to increase the sinking speed during setting. The lighter type of twisted knotless netting are used for purse seines. Knotted webbing is preferred to compare with knotless webbing because of the damage portion of knotted webbing can be repaired. Selvedges or guarding are strips of strong netting used for strengthening the main webbing to protect it from damage during the time of operation. It is provided in the upper, lower and side edges of the main body of the net. The upper selvedge is attached to the float line (head rope) and the lower selvedge to the lead line (foot rope) and also attached to the side ropes or gavel lines.

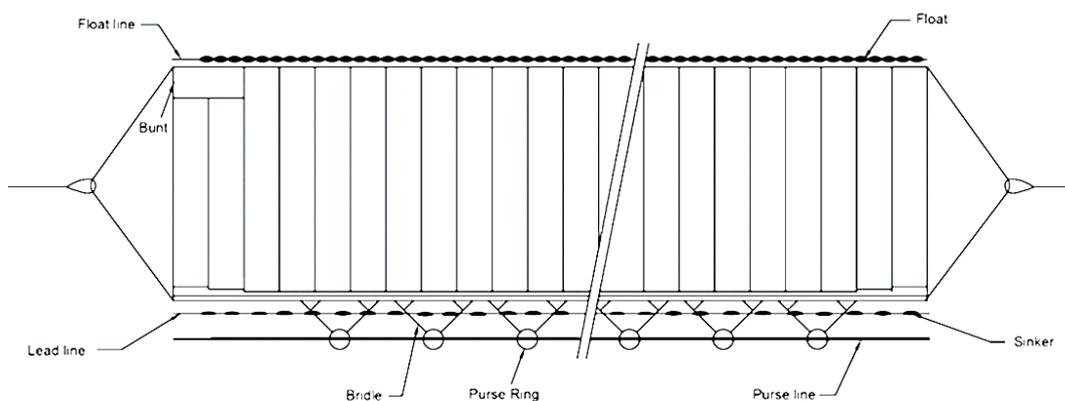


Fig. 3. Structure of typical purse seine

The total buoyancy of float is maintained at 1.5 to 3.5 times the total under water weight of the purse seine net by using cylindrical or spindle shaped floats. Higher buoyancy is provided in the bunt area for counteract the sinking force due to weight of heavier netting in this area. Spindle shaped sinkers are attached to the lead line. Purse rings are made up of steel or brass rings are used with snap type or closed. The size of purse rings depends on the size and weight of the net. For small and light purse seines, purse rings (100 mm -150 mm) made of steel 10 mm in diameter and weighting 1 to 1.5 kg each can be used. For bigger nets rings of 120 mm to 180 mm across of steel 12 mm in diameter and weighing 2 kg to 3 kg each can be used. Tow lines are made up of rope or steel wire and is the last part of the seine. The end of the tow line remains attached to the seiner. It is used to allow a greater circumference of set to be made by using the tow line as an extension of the net.

Factors to be considered in the design of purse seines

The size of the vessel, biological characteristics of the target species and characteristics of the fishing area are considered during the design process. The length, depth and shape of the net depend on the target species. Selection of materials, mesh size and twine thickness for the bunt, body netting, hanging coefficient, determination of weight and floats required for the net are other design parameters for purse seines.

Length and depth of the seine are determined by the size of the vessel, the species, behaviour of the fish and fishing conditions. Depth is between 10 and 15% of the length (BenYami, 1994) is easiest for purse seine operation. In certain cases, the depth goes up to 30-50% of the length in inshore purse seines for sardines, anchovies etc. where the shoal depth is generally high. The depth of the purse seine is more commonly one-tenth of the float line, but may vary from one fourth to one-third for deep swimming and quick diving shoals. The overall size of purse seine is best expressed as length of the float line. Purse seine in water is not a truly vertical wall of webbing but the net is hung so that it is roughly cup-shaped when laid out in a circle. This is accomplished by making the lead line shorter than the float line by 5 to 12% (Ben-Yami, 1994).

The mesh size and twine size are directly related to the size of fish and the quantity of fish caught. To select a small mesh size increases the cost and results in slow sinking. And large a

mesh size results in loss of catch as well as gilling. The mesh size of purse seine must be small enough not to gill the fish in any part of the seine. To select a smaller mesh size in the bunt, compared to the body meshes. Choice of mesh size is a function of the target species and is estimated by the following formula (Fridman, 1986):

$$\text{Mesh opening in the bunt (mm)} = 2/\sqrt{3LK}$$

where L = length (mm) of target fish; K=5 for fish that are long and narrow; 3.5 for average shaped fish; 2.5 for flat, deep bodied or wide fish

The main criterion for determining the twine thickness for netting in a purse seine is to provide sufficient strength for pursuing and hauling when the load due to the fish is maximum. The wing ends and the lower and upper selvages of the seine are subjected to the greatest stresses. Therefore twines of greater thickness are used in these parts. Minimal loads are imposed on the central section of the seine

Sinking speed is found to be proportional to the square root of the apparent lead line weight. Excessive weights results in damage, strain on hauling equipments and handling problems. The normal requirement is 0.5 to 2.0 kg. m of foot rope. The buoyancy requirement is 2-4 times of the weight of the foot rope. The weight of the ballast (in air) normally ranges between one-third and two-third of the weight of the netting in air. The weight in air of the ballast in the foot rope is generally between 1 and 3 kg /m and up to 8 kg/m in large tuna seines (Prado, 1990). The rigging of floats on a purse seine must take into account not only the buoyancy needed to balance the total weight of the gear in water, but also should have additional buoyancy. This additional buoyancy should be of the order of 30% for calm waters and up to 50-60 % in areas of strong currents to compensate for rough sea conditions and other factors related to handling of the gear. Buoyancy should be greater in the area of the bunt and mid-way along the seine, where pulling forces are greater during pursuing (Prado, 1990). In general, the buoyancy of the floats should be equal to about 1.5 to 2 times the weight of the ballast along the bottom of the seine (Prado, 1990). Lead line of the purse seine is usually longer than the float line up to 10 %. However, in some designs, the two lines are equal in length.

Operation

Purse seining operations involves location of fishing grounds, scouting, setting, pursuing and hauling. Searching for fish aggregation, then identifying wherever possible the fish species and evaluating school size and its catchability, prior to surrounding are important aspects of purse seine operation. In artisanal or semi-industrial fisheries, the purse seine handling equipment may include a purse seine winch or a capstan, a purse line reel, a brailer and a power block and in some fisheries, a net drum. In industrial purse seine fishery, the basic equipments include, in general, a hydraulic power block or Triplex roller, a powerful purse line winch, a number of derricks, including a brailer or a fish pump, a skiff and sometimes, a helicopter. The purse seine can be used by a large range of vessel sizes, ranging from open boats and canoes up to large ocean going vessels. The purse seines can be operated by one or two boats. Most common ones are those operated by a single boat, with or without an auxiliary skiff.



Fig. 4. Power block used in purse seiners of Goa

Lampara nets

Lampara nets are a traditional Egyptian fishing gear and were widely used in the Nile Delta sardine fishery. The term lampara stems from the Greek and Latin roots of the word lamp (lampas, lampa), as this net must have been associated with fishing with light attraction for a long time in the Mediterranean. Lampara type nets are also used in other parts of the world. Examples of such nets are the Philippine *sapyaw* which looks like an almost wingless lampara, the Japanese *nuikiri- ami*, the Indian *kolli net* (Von Brandt, 1984) and the *alaman* of the Black Sea (Ben-Yami, 1976).

Structure of Lampara net

The lampara net is a surrounding net, shaped like a dust pan or a spoon (the lead line is much shorter than the float line) with two lateral wings and a central bunt with small meshes to retain the catch (FAO, 2019) without a pursing device. The mesh size varies in different parts. The wing part is made of netting with larger meshes than the centre of the net. The deep central bunt is in middle and hauling is done with both short wings. The ground rope is shorter than the head rope gives the lampara a scoop like shape especially while being hauled. The open front side is lifted after surrounding the fish shoal.

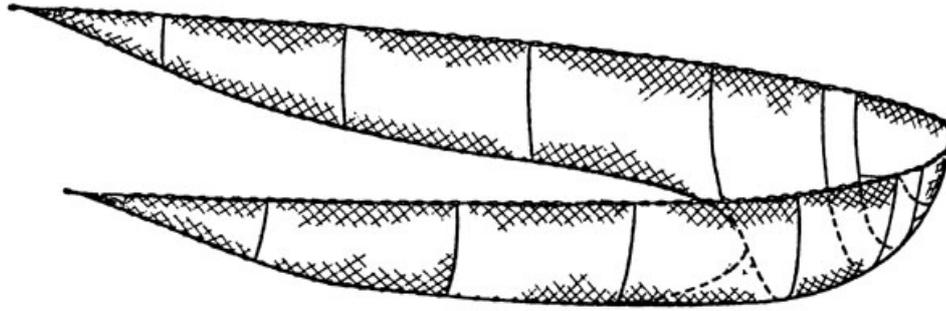


Fig. 5. Lampara net

Source: <http://www.fao.org/fishery/geartype/201/en>

Operation

The net is mostly used with a single vessel, like a boat seine operated by a single vessel. Once the shoal of fish has been surrounded, the two wings are hauled up at the same time. Lampara nets targets pelagic fish species. Lampara nets are mainly operated in the Mediterranean, in the USA and South Africa especially for sardines, in Argentina for anchoveta and mackerels or in Japan, not only for sardines, but also for sea bream and flying fish; sometimes in inland waters. The gear can only be used to catch fish close to the water surface. The principal impact produced by this category of nets may be occasional bycatch/discards, in particular when the lampara is used in association with aggregating devices (FAD).

Ring seine

Ring seines are hybrids between the purse seines and lampara nets. Ring seines are most suitable for small scattered schools like anchovy, mackerel and sardines. They are lighter to handle, cheaper to build and faster in operation. The ring seines are effective in impounding small schools of fish in shallow waters up to 40 m depth from small low powered vessels. The ring seine or mini purse seine gear was first designed and introduced by the Central Institute of Fisheries Technology as a new gear for the traditional craft (Panicker et al., 1985). The mini- purse seine introduced had an overall length of 250m and a depth of 15m and 33m at the wing end and the bunt. Although it originated in Kerala this has spread to all states in the east and west coasts of India.



Fig. 6. A typical Ring seiner of Kerala

Structure of a Ring seine

The structure of the ring seine has many features similar to the purse seine. The ring seine, like the purse seine, has purse rings along its lower edge. Some of the chief structural differences between the original ring seine and the purse seine are that the purse seine is made of comparatively heavy webbing, is practically uniform throughout its entire length, and is square on the ends; while the ring seine, is made of light webbing, is gathered on the ends. It was operated from a plank built canoe of 15 m length propelled by a 9.9 hp engine.

The gear is a wall of nylon knotless webbing and is mainly used to catch sardines, mackerel and small fishes like anchovy. The mini- purse seine introduced by CIFT, which is a modified innovative version of the thanguvala, on the other hand had an overall length of 250 m and a depth of 15 m and 33 m at the wing end and the bunt respectively and pursing was done with the help of rings (Panicker et al., 1985). The size of gear as reported by Edwin and Hridayanathan (1996) in south central Kerala region was 630m and depth 100 m with a mesh 18-20 mm. The ring seine of smaller mesh size (8 - 10 mm) is used to target small fish like anchovy and operate in shallow waters. The report by D'Cruz (1998) showed that the gear had grown in dimensions and due to the large size of the nets, trolleys are used for transportation of the gear. Large ring seines up to 900m length and 90 m depth were reported by Krishna et al. (2004) from Thrissur District of Kerala. Edwin et al. (2010) reported that for a gear with mesh size of 20 mm, length ranged from 600 to 1000 m, depth ranged from 83 to 100 m and weight ranged from 1500 to 2500 kg, which were operated from a fishing vessel of LOA 70-76 feet long powered by inboard engine and hold a crew of 35-45. In the past thirty years the size of the ring seines have grown at least three to four times in proportion to the extent of about 1000 m in length and 100m in depth in Cochin area

Operation

Ring seine is operated from a single boat or a pair of boats. The fishing unit leaves the landing centre at around 5 am. The fishing operation consists of active search, chase and interception of the shoal. One or two experienced fishermen standing at the aft of the craft is responsible for the detection of the shoals. Once the shoal is detected its direction of movement,

direction of current, wind etc., are monitored to determine the mode of operation of the net. If the shoal movement and the water current are in same direction more area has to be encircled as quickly as possible in order to trap the fast moving fish. If the movement of shoal and water current are in opposite direction the chances for successful operations are high. After the shoal identification the crew leader signals for the preparation of shooting of net. After getting the signal one of the crew member (*Chattakaran*) jumps into the water holding one end of the net, the remaining net is carried by the boat around the fish shoal very fast and return to the initial point and usually encircling will take 8-12 minutes. After encircling the shoal, the purse line is pulled mechanically/manually which closes the bottom of the seine (Edwin and Das 2015).

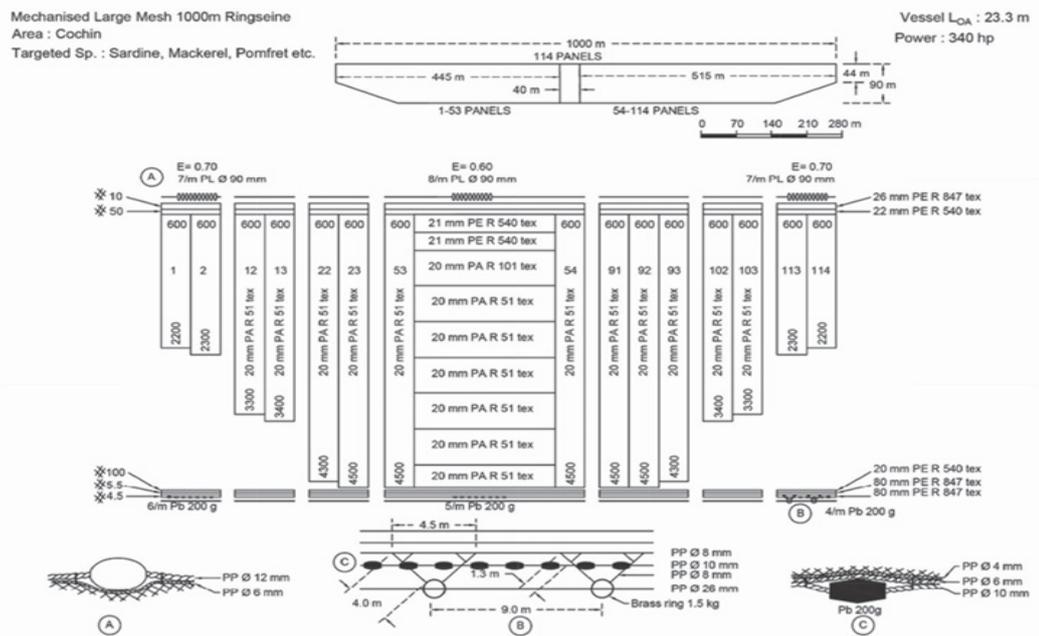


Fig. 7. Design of 1000m Ring seine, Kerala

Pursing may take around 10 to 15 minutes. This is followed by hauling onboard the head rope and netting panels until it reach bunt portion. The entire net now looks like a bag and the fishes are concentrated at the bunt region. Large mechanized ring seiners use large scoop net called the “brailer” for transferring the catch onto the main vessel which is operated with the help of winch operated crane fixed on the deck at the aft part. In a two boat ring seiner one vessel searches for the shoal and on finding the shoal, this vessel signals to the main vessel to start operation by encircling the shoal. Encircling of the shoal is carried out by the valavallam and after this is done the two vessels together haul up the gear either mechanically or manually. Time taken to complete a haul varies from 30 minutes to 3 hours depending upon the size of the catch. Usually after the first catch fishermen will search for one more shoals and start the return trip. The boat usually reaches back at the landing centre by 2 pm. The average time taken for operation in mechanized units is around 12h and for motorized vessel is 8 h (Edwin and Das 2015).

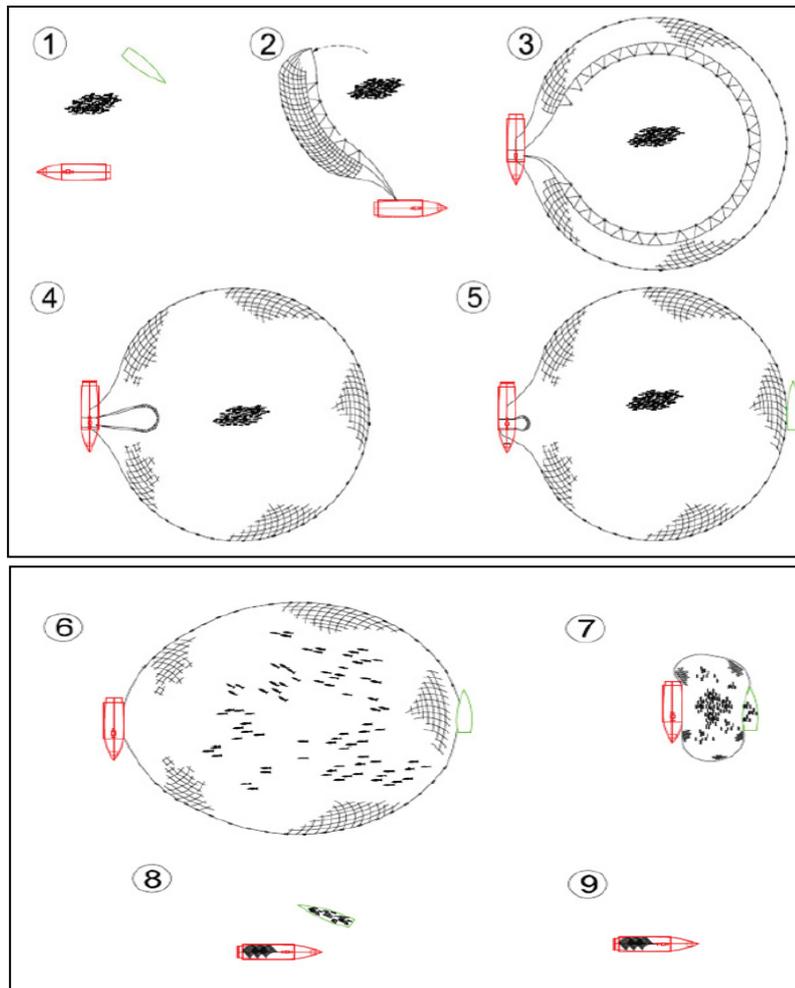


Fig. 8. Operation of Ring seine

Traditional Seines

A seine is a type of surrounding gear which surrounds a certain area and then the gear is towed over this area with both ends to a fixed point either on the shore or vessel. Seines are aimed at catching shoals of fish either at the bottom or in midwater. Seines are broadly classified as beach seine and boat seine.

Beach seine

Beach seine is operated from the beach by means of a boat laying the gear in a semi-circular form, consequent to which both ends of the hauling ropes are pulled simultaneously on to the beach. These are operated in shallow coasts of seas, lakes, rivers and reservoirs. The fishes caught mainly are sardine, mackerels and prawns.

Structure of Beach seine

The gear consists of a long wall of webbing, the depth of which is reduced at the wing portion. Mesh size increases towards the wings. The bag made of thick twine, where the fishes

finally get accumulated, is called bunt. The portion between the bunt and the wing is called shoulder. The net is towed by means of two hauling ropes. The length of beach seine varies between 150 and 2000 m, height 5-40 m and hauling lines between 150 and 6000 m.

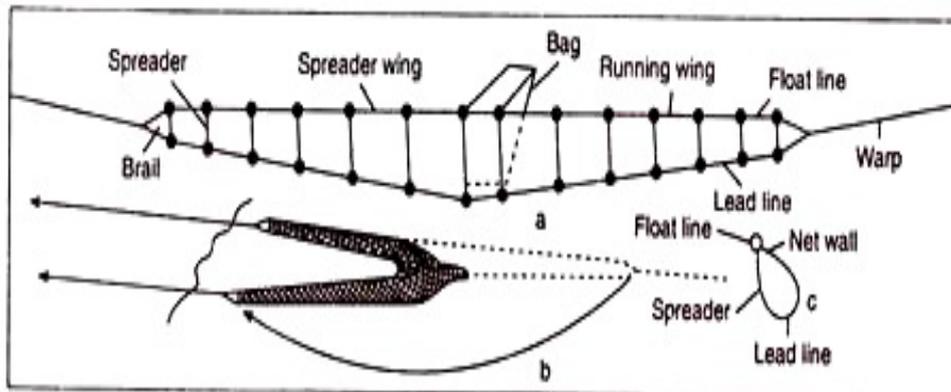


Fig. 9. Structure of typical beach Seine

The net consists of three major sections: Warp/hauling rope, wing and the bunt/codend, to where the catch is concentrated. The region of the net where the catch is accumulated is called bunt. Bunt portion is made of 8 to 10 mm polyamide webbing. Total length of the bunt varied from 18-25 m in length. Bunt is placed in the center portion of the gear and made with heavier netting to withstand the excess strain during operation. Two wings extends from the lateral margins of the codend with a length of 500 – 800 m which herds the fish towards the codend. Small meshed webbing panels were attached near to the codend and gradually the mesh size increases towards the warp end. The wings taper towards the end where is connected to the hauling rope. Warp/hauling rope locally called as *Kamba* in Kerala which is the longest part of the gear with 1000 -1200 m in length as is used for hauling.

Operation

Beach seines are most successfully operated in areas of smooth bottom and calm waters. The entire process of shooting and hauling should be carried out as fast as possible for efficient operation. A large number of people (100-120) persons may be needed for operation of a beach seine. Hauling line of one wing is held by one of the parties on the shore while the boat steams in a semicircle from the shore paying out the bag, wing and hauling rope of the other side. This continues till the net is paid out completely and the boat returns to the shore. The two hauling lines along with wings are then pulled by two groups of fishermen bringing the catch on to the shore. The foot rope is hauled slightly faster than the head rope to prevent escape of fish.

Operation of a beach seine

Twenty to forty fishers are involved in the fishing operations depending up on the season. (Saleela, 2015). One group of fishermen will remain on shore holding one end of the hauling rope. The second group carrying the gear on a boat along with the other end of the hauling rope, which encircles the fish shoal/fishing area and set out in a wide semi-circular arc and brought the other end to the shore, which is a certain distance away from the starting point. The hauling ropes are

then hauled simultaneously to the beach by two groups of fishers. The long hauling ropes and the wings of the beach seine herd fish into the centre part of the gear (Tietze, 2011). When the hauling starts, the two groups of fishermen will come closer (where codend almost reaches the shore) and the method of operation is common throughout the world. Beach seine is operated throughout the year and the peak season starts after monsoon in the south west coast. The maximum operational time for this gear is varied from one to three hours. The dominant groups of fishery includes Clupeidae dominated by *Sardinella longiceps*, Engraulidae (*Stolephorus indicus*), Scombridae (*Rastrelliger kanagurta*), Carangidae, Hemiramphidae, Sphyraenidae, Leiognathidae, Sillagnidae, shrimps etc.

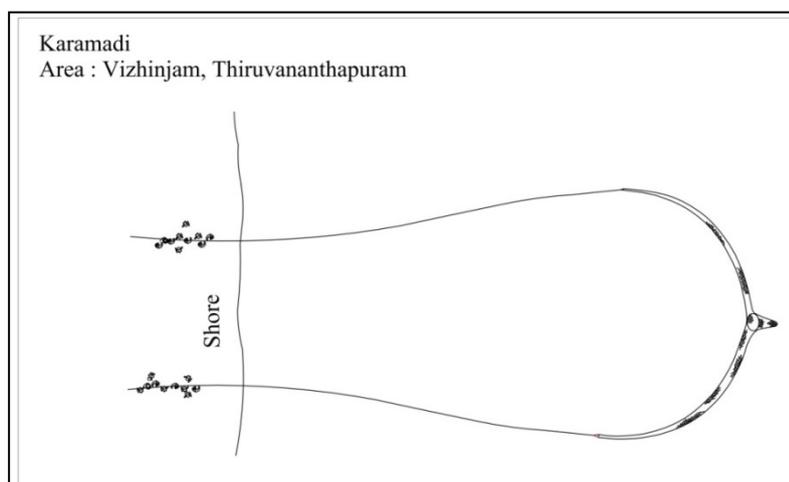


Fig. 10. Beach Seine of Kerala

Boat seine

The boat seines consists basically of a conical netting body, two relatively long wings and a bag. An important component for the capture efficiency of boat seines is the long ropes extending from the wings, which are used to encircle a large area. Many seine nets are very similar in design to trawl nets. Frequently, however, the wings are longer than on trawls. The foot rope is usually a fairly heavy rope weighted with lead rings or hanging lead ropes. The seine ropes are made from synthetic fibre ropes with a lead core or from a combination of ropes.

In medium and large sized vessels special rope hauling (a small but fast winch) and coiling machinery is installed on deck. The long ropes are often coiled in bins (on or below the deck) but on modern seiners these are stored on large hydraulic reels. For hauling the net hydraulically operated power blocks are used. In smaller boats seine nets are manually operated. Seine net boats range in size from relatively small 10 m up to about 30 m in length.

Operation

The whole gear is encircling a large area in more or less a triangular pattern. The net is hauled back by the anchored boat, which is done by hauling the two drag lines simultaneously with the help of the winches, first relatively slowly and increasing to a larger hauling speed when the net is nearly closed. The use of an anchor is often referred to as Danish seining. Fish inside the

ropes are frightened into the forward moving path of the seine net where they are subsequently overtaken by the net and captured. Another boat seine technique is similar, but is not using an anchor. Instead the boat is kept stationary during haul back with the propeller. This technique is often referred to as Scottish seining or Fly dragging. Mainly demersal and pelagic species are targeted by boat seine. Seine nets are operated both in inland and in marine waters. The catching area depends on the length of the ropes; catching depth is shallower than 50 m in lakes and down till 500 m in marine waters. The techniques is most efficient on flat and smooth bottom when long ropes (2 500 m) can be used. Boat seines are also used in rougher grounds, but then with shorter ropes. In some areas are boat seines used to catch schooling fish off the bottom. The impact on living resources are similar to that for trawls as small meshes in the codend may result in capture of undersized fish and sometimes non-target species.

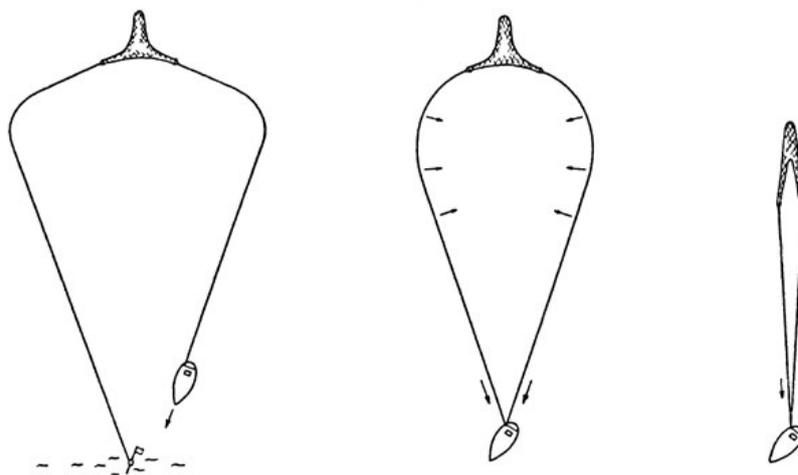


Fig. 11. Operation of beach seine

Source: <http://www.fao.org/fishery/geartype/203/en>

Resource and Energy Conservation in surrounding nets and seines

Selectivity studies of fishing gears around the world have focused mainly on trawls, gill nets, hook and line and traps (Fridman, 1986; Mac Lennan, 1992). A few studies on the selectivity of seine nets have been conducted in South East Asia (Anon, 1995, Dickson, 1987 and Dickson 1995). The experience of the crew makes it possible to judiciously select the presence of juvenile and bycatch species. Bycatch species are commonly present in FAD- assisted purse seining and more than 40 species of fish and cetaceans have been reported from purse seine landings (Romanov, 2002; Pravin et al., 2008). Special escape panels known as Medina panels, which are sections of fine mesh that prevent dolphins from becoming entangled in the gear, and back down maneuver have been deployed to prevent capture of dolphins in purse seines (Ben-Yami, 1994). Selection of mesh size for the purse seine appropriate for the target species. Proper choice of fishing area, Depth and season could also lead to better selectivity of purse seines. Study conducted by Edwin and Hridayanathan (2003) shows that there is a likelihood of fish surviving if released from a purse seine than from a trawl net cod end, larger meshes and filter panels can be used to allow the unwanted fish to escape. The observations made during the study show that there exists a selection after pursing in the large mesh ring seines used on the Kerala coast.

Juveniles are mainly caught in ring seine gears using 8-10mm mesh size and such units are operated at shallow depths touching the bottom in inshore waters. Studies showed that the juvenile incidence in small meshed units is in the range of 32 - 48 % and that of large mesh unit is 5 - 12 %. According to CMFRI (2012) the year 2011 noticed a heavy exploitation of sardine young ones and juveniles and 78.5 % of the landings are contributed by seine net units. Fishermen gain some economic benefit from the juveniles, but the juvenile fish landing causes 65-75% income reduction and results in catch depletion. The reason for surrounding and catching the juvenile shoals as opined by fishers was that the returns from sale of juveniles would cover the operational costs and further there are no restrictions on the sale of juveniles in the market.

The regulation of size and mesh size of seines as recommended by ICAR-CIFT is given below

Name of gear	Minimum mesh size (mm)	Type of mesh	Maximum dimension (hung length and hung depth)
Seine net			
Sardine/ Mackerel seine nets	22	Diamond	600 m x 60 m
Anchovy seine nets	10	Diamond	250 m x 50 m

The fleet size of ring seiners has increase drastically in India. It is observed that there has been a increase in the size of the gear with a commensurate increase in size of the fishing vessel and horsepower of the engine. The dimensions of the gear rose incrementally over the years and the size of the vessels and horsepower increased subsequently. In the past twenty eight years the size of the ring seines have grown at least three to four times in proportion to the extent of about 1000m in length and 100m in depth in Cochin area. In order to accommodate the huge gears the craft also increased two fold in size in these areas and number of craft forming a unit increased as many as four times. Currently mechanised ring seiners are powered by inboard marine diesel engines with power ranging between 98 to 550 hp. The Kerala Marine Fisheries Regulation Act amended through gazette notification, 2018 has stipulated the dimensions of the gear, mesh size and engine horse power of seines to be operated in Kerala.

The recommendations of engine horse power for purse seiners and ring seines by ICAR-CIFT is as below

Sl. No.	Length (m)	Breadth (m)	Depth (m)	Maximum allowable main engine horse power (MCR)
i.	Up to 15.00	Up to 4.60	2.40	190*
ii.	15.00 – 20.00	4.60 – 5.50	2.40 – 3.20	240*
iii.	> 20.00	> 5.25	> 3.00	>240*

*Operation on beyond territorial waters

Sl. No.	Length (m)	Breadth (m)	Depth (m)	Maximum allowable main engine horse power (MCR)
i.	Anchovy < 15.0	Up to 5.0	Up to 2.50	25
ii.	Sardine/ Mackerel Up to 17.5	Up to 5.5	Up to 2.50	65
iii.	17.5 – 20.00	Up to 6.0	Up to 3.0	250*
iv.	> 20.00	> 5.25	> 3.00	> 250**

*Permitted for operation beyond the specified area vide G.O. (P) 29/86/F&PD dated 14.03.1986
 **Operation on beyond territorial waters

Purse seining/ ring seining is one of the most fuel efficient techniques for catching shoaling pelagic fishes. Moreover this gear have no major damaging effects on the sea bed. The carbon emission for one kg of fish production in ring seine unit is 0.37 kg/kg of fish (CIFT, 2013). The fuel consumption for small scale mechanized purse seining was 0.07 kg fuel/kg fish(CIFT, 2008).

As beach and boat seines do targeted fishing, bycatch and discards are comparatively very low and in the developing countries traditional shore seines are listed as fisheries with low to negligible discard rates (Kelleher, 2005). Gear setting and soaking requires minimum time compared to gillnets or long lines and operation can be completed within 1- 3 h. In the construction of the gear, many natural biodegradable materials like coir, coconut leaves and natural fibres are still in use in countries like India. Technical and operational improvements for the reduction of juvenile catches in shore seine need to be developed which would support sustainability of beach seine fisheries.

Conclusion

Surrounding nets take advantage on shoaling behaviour of pelagic species and nets can catch a diverse group of small to large fishes which occupy mainly the surface and column layers of the water mass. Since seines are non selective gear care should be taken by boat operators in ensuring conservation of resources for long term sustainability. The dimensions of the gear have to be kept under check through regulation enforced by the respective governments to prevent over exploitation. The energy use in the seine sector has increased drastically especially in states like Kerala and results in consumption of excess fuel thereby increasing GHG emission. The size of fishing vessel and horse power of engine have to be regulated. In traditional seines the decreasing mesh size of the gear and the increasing size of the net are causes of concern. However, energy expenditure is relatively very low in the sector and therefore judicious use of the surrounding nets and seines can be allowed for exploitation of pelagic resources.

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