IX PRAWN FISHING METHODS

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Before 1950 the prawn fishery was exploited only within a narrow coastal strip of 5-20 m depth by various types of indigenous gears. Later, due to the introduction of mechanised fishing vessels the commercially exploited grounds have extended up to 40 m depth. Besides trawling, the conventional gears constitute an important source of prawns landings. There is however no comprehensive account of the different methods of prawn fishing in India except for brief references by Panikkar and Menon (1956) and Venkataraman *et al* (1956). The other available information is related to fishing methods in general or to prawn fishing methods in specified regions (Hornell, 1925 and 1938; Rai, 1933; Chopra, 1939; Naidu, 1942; Jones and Sujansinghani, 1954; Nayar, 1958; George 1961; Menon and Raman, 1962, Thyagarajan and Thomas, 1962; Mani, 1963; Pillai and Ghosh, 1962). It is therefore attempted to deal, in the present account, with the methods adopted for capture of prawns on the Indian coasts, besides those in the backwaters and estuaries which yield a sizable prawn fishery. The types of fishing implements used for catching prawns along the Indian coast depend largely on the physical characteristics of the coast line and the habits of the species.

FISHING CRAFTS

A variety of indigenous crafts is employed in prawn fishing from the simple catamarans of the east coast to the well-built canoes of the Maharashtra coast. The diversity of these crafts calls for a detailed study. Zeiner and Rasmussen (1958) have dealt with the various types of boats of the Indian coast for designing motorised crafts.

The prawn fishing crafts of India can be classified into: (a) *Catamarans*, (b) canoes of the dug-out and plank-built types, (c) carvel type plank-built boats and (d) modern crafts such as pablo boats and large steel trawlers.

Catamarans :- They are non-rigid types of crafts of variable dimensions, used on the surf-beaten coast, for operating boat-seines with a crew of 2-4 men. The primitive one consisting of 4 to 5 logs tied together in a raft fashion is prevalent on the west coast from Quilon southwards till Colachel where from the improved variety *boat-catamarans* appear and continue to occur in the Gulf of Mannar region. The later variety of craft varies little in size (6-7 x 0.75 – 0.9) and is made of 3 logs, the central one being the stoutest, fitting keel-wise at a lower level than the other two which rise sufficiently on each side to form a trough shaped hollow in between. The coromandel type of catamaran is found from point calimere to Krishna Delta. It is constructed either of 3 logs (*chinnamaram* – 6.3 x 0.7 m) or of 4 logs (*Periamaram* – 7.6 x 1,0 m), the middle logs in both projecting aft beyond the outer logs. Another type, *Teppa* or *Teppalu* (6.6 x 1.4 m) is in use north of Krishna and Godavary deltas. It is boat-shaped and consists of 2-3 median logs with two smaller ones on the outer sides. In the Orissa and Ganjam coast, the catamaran (4.2 -5.7 x 0.75 – 1.0 m) has 3 median logs to which two rows of smaller pieces are pegged on the outer sides.

Canoes :- The most common fishing vessel found all along the west coast is the dug-out canoe variously known as *Vallom¸Odam, Hodi, Thoni* etc. in different regions. It is made by hollowing out a single log of wood and is of varying sizes (6.10 x 0.5 – 1.25 x 0.45 – 0.7 m). It is employed for operating boat-seine, shore-seine, gill-net, cast net and occasionally trawl nets with a crew varying from 2 to 8 men. In the backwaters of south-west coast smaller canoes (3.6 – 4.5 m in length) 3.0 m beam and 0.6 to 1.8 m draft) which are essentially dug-out canoes with planks stitched to the sides are in use in the Malabar, Kanara and Konkan coasts for shore-seine operations.

Out-rigger dug-out canoes are employed for cast net fishing in the backwaters near Cuddalore and Porto-Novo. Flat – bottom canoes - *shoe-thoni* of dimensions 9.5 x 1.6 x 0.7 m and the *Malia type* (5.4 – 6.6 x 0.9 – 1.3 x 0.5 – 0.6 m) are in use for stake-net fishing in the Godavary estuary and the creeks of the Gulf of Kutch respectively. In the Chilka and Pulicat lakes and Madras backwaters clinker-built reproductions of dug-out canoes are seen.

Plank-built boats :- They are sturdy boats, prevalent north of Ratnagiri District and Point Calimere on the west and east coasts respectively. The *Hodas* (6.6 – 7.8 x 0.9 – 1.2 x 0.6 – 0.9 m) and *Machwas* type *Wahans* (9.6 – 12 x 2.1 – 3.1 m) of Saurashtra coast and the *Machwas* (9 – 14 x 2.7 3.3 x 0.9 – 1.0 m) of Maharashtra coast coast are employed for bag-net fishing. They are manned by 7 – 9 men and are considered to be the best indigenous fishing boats for mechanisation. Many of them are fitted with 15-30 H.P. engine. The Masula boat known as *Padagu*, *Padava* or *Bar* in different regions is found from point Calimere northwards to Orissa except between Kakinada and masulipatnam and is constructed with planks seen together by coir rope and is without any ribs or frames. It is mainly used for drag-net operations. The length of the boat ranges from 8.5 to 12.2 m. with a beam of 2.4 m. and depth of 1.2 m and the crew consists of 8-12 men.

Between Kakinada and Masulipatnam a rigid type of boat called *Nava* with a frame of strong ribs on which planks are nailed is employed for shore-seine, boat-seine and gill-net operations. The size of these boats is variable. (6.4 – 10.7 m in length, 1.7 – 1.95 m in width and 0.6 – 0.84 m in depth), the bigger ones being used for shore-seine operations. The *Nava* used in the creeks and backwaters for drag-net operations has a smaller draft (0.4 m). The *Dinghi* of North Orissa and *Nauka* of West Bengal are carvel-built boats. The latter has variable dimensions (10.4 to 13.2 x 1.3 to 2.6 x 0.5 to 1.1 m) and is used in the bag-net operations in estuaries.

Modern crafts :- To explore new fishing grounds with improved gear and to increase the range and duration of fishing, mechanisation of some of the conventional boats like the *machwas* with necessary alterations

was accomplished in 1950. Thereafter, new types of fishing boat designs were introduced like the Dan boats (6.6 x 2.2 x 1.0 m), pablo boats (7.4 x 2.1 x 1.05 m) and the shrimp trawlers (9.6 x 3.0 x 1.2 m). The horse power of these boats ranged from 10 to 60. The larger ones are partly of fully decked and have trawling winches. Since 1956 the number of mechanised boats has increased rapidly and it is now estimated that more than 6000 of them are combing the depths of the Indian coasts. Large scale exploratory and commercial fishing operations are also conducted from different bases by a few large steel trawlers (14.3 – 30.9 x 5.1 – 6.3 x 1.6 – 3.3 m) belonging to several organisations like the Govt. of India Deep-sea Fishing Station, Indo-Norwegian Project and the New India fisheries Ltd. They are fitted with engines of 90-300 H.P. and a refrigerated fish hold of 50-70 tonnes capacity.

FISHING GEAR

As in the case of the fishing crafts, a variety of devices from the primitive cover pots (Plunge basket trap) to the modern shrimp trawl is employed for capturing prawns. Taking into consideration their mode of operation and the manner in which prawns are caught they can be classified into the following categories.

1. **Fixed or stationary nets**

These include the bag-nets and stake-nets, which are operated in regions of strong tidal flow and hence the prawn catch is scanty from 7 th to 11th and 22nd to 26th day of the lunar month.

Bag-nets operated on the west coast :- The bag-nets constitute one of the important gears for prawns fishing and are extensively used in Bombay (locally known as *Bokshijal* and *Dol*) and Gujarat coasts (*Gholu jal, Golva, Dor* or *Dol*). In the former region it is operated almost throughout the year while in the latter it is mostly used during the post-monsoon months till the commencement of summer. Prawns are caught along with Bombay duck, Sciaenids, Pomfrets, *Coilia* sp., *Polynemus* spp., seer – fishes etc. In the Bombay waters *Acetes indicus, Palaemon tenuipes, Metapenaeus affinis, Parapenaeopsis stylifera*. *P. hardwickii, Solenocera indica, Hippolysmata*

ensirostris and *Atypopenaeus stenodactylus* are netted in some quantities while in the Gujarat coast the prawn catch comprises mainly of *Metapenaeus kutchensis, M. brevicornis* and *Parapenaeopsis sculptilis*.

The bag nets of Bombay and Gujarat have been described by Setna (1949) and Pillai (1948) and Gokhale (1957) respectively. They are conical in shape, made of cotton or hemp, with a wide rectangular mouth. The size of the net is considerably variable, 12 to 200 m. long from mouth to cod end, mouth being 5 to 90 m. in circumference and mesh 1.0 cm. at the cod end progressively increasing to 4 to 12 cm. near the mouth. The entire net is made of 1 to 5 pieces. The bigger nets are operated in deeper waters. The *dol* net is operated in two different manners known as *Sus fishing* and *Khunt fishing*. The first method is employed in the Saurashtra coast and the second method in Maharashtra coast.The difference in these methods lies in the technique adopted to anchor the net and keep its mouth open. In *sus fishing* the ropes from the four corners of the mouth of the net are tied securely either to two enormous spikes driven 45m. apart into the muddy bottom in shallow regions or to two heaps of stones of 1000-1800 kg each in deeper areas. There are 2 or 3 large wooden floats attached to the upper lip of the mouth. Thus the mouth is kept open by flats and ropes. The net fishes at the bottom. In *khunt fishing* no floats and stone anchors are used. Two stout upright poles each of 40 m length, driven firmly into the muddy sea bottom, are used to set the net. The posts project about 3 m above the surface at flood tide. Two loop-like contraptions are slung on each post, a rope of the depth of the mouth linking them. Through these loops is passed another length of rope which carries a stone weight at its lower end. The upper end of the mouth linking them. Through these loops is passed another length of rope which carries a stone weight an its lower end. The upper and of the rope is wound round the pole projecting above the water surface. Each corner of the mouth is tied to a loop and the mouth of the net can be raised or lowered depending upon the level of the tide or fish movements. Unlike in *sus fishing* the net fishes a few fathoms above the bottom. The net, in either types of fishing is set to face the tide, either ebb or flood. One boat can usually operate a number of nets tied in series – 2 or 3 when they are set to stone anchors and 4 or more in the case of nets tied to stakes. The boat remains tied to the poles or the buoys as the case may be and the catch is periodically removed from the cod end. To avoid predation on the cod end catch, a subsidiary oval bag-net is tied to

the cod end. A light pole attached to the upper edge of the subsidiary net keeps it open in which predators get caught.

In the creeks of Saurashtra-Kutch region a smaller net *Gunja* (5 m long, 2 m wide at mouth with mesh 2.5 cm near the mouth decreasing to 1.0 cm at the cod end) tied to stakes as in the case of *khunt fishing*, is vogue for prawn fisher (*M. kutchensis*) particularly during August- October. In the backwaters of south-west coast of India prawn fishing is conducted almost throughout the year by *Valuvala* or *oonivala* – a conical bag-net of about 15 m long and mouth 18 m in circumference and made of cotton except the part bordering the mouth which is of coir yarn. The mesh size is variable from 1.0 cm at the cod end to 2.5 cm at the mouth (Hornell 1938 and Menon and Raman 1962). The net is set in position on a pair of stakes driven into the bottom mud, before or just after the commencement of ebb tide, and hauled up when the high tide sets in. The species caught are *Metapenaeus dobsoni*, *M. monoceros* and *Penaeus indicus*. During the prawn cultural operations in the extensive paddy fields adjoining the backwaters of Kerala, juvenile prawns are collected by a conical bag-net (5-7 m long, mouth 1.5 to 2.0 m wide and mesh varying from 0.3 to 1.0 cm) tied to the outside of sluice gate, kept open after full tide. Fishing is done at nights and often a powerful light is kept at the gate to attract prawns.

Bag – nets operated on the east coast :- The bag nets constitute by far the most important gear for prawn fishery in the tidal estuaries and creeks. They are operated in the Upputer river leading into the kolleru lake in the Gowthami, Vainetheyam and Vashista estuaries of the Godavary and the innumerable creeks connected with them, in the Kakinada Bay and in the lower reaches of the Hooghly and Matla estuaries.

Those employed in the Godavary and Krishna deltas (*Thokavala or Gidasavala*) resemble the *Valuvala* of Malabar backwaters in construction and mode of operation. The mesh size decreases from 10 cm near the mouth to 1 cm at the cod end. The net is 13.7 m long. The dimensions of the rectangular mouth are as follows: Head-rope 5.08 m, sides 3.8 m and foot-rope 5.9 m. The foot-rope, because it is longer than the head-rope,

forms a shallow bight while fishing which prevents the foot-rope from lifting off the bottom. To withstand the force of the tidal current the head-rope is sometimes moored to an anchor, placed in front of the mouth by two ropes. A number of nets (10-30) is operated in a row across the creek or estuary. The nets are set at the turn of the high tide and the out-going tidal flow is filtered by the stake-nets. The catch is emptied as the ebb-tide slackens. In some parts of the East Godavary district, the bag-nets known as *Thadakakattuvala* have bamboo screens one on either side of the net converging from the banks of the creek towards the mouth of the net, to direct the prawns towards the net. Juveniles of *M. monoceros, M. brevicornis, P. indicus* and *Penaeus monodon* are well represented in the prawn catches of bag nets. In the Gowthami estuary and Upputeru river connected to Collair lake in the Andhra coast, the larger nets 18.3 m long are in use. In the former region the net is operated from anchored boats instead of being tied to fixed stakes. Bamboo poles support the entire length of the head and foot-ropes and help to keep the mouth open and in shape. Heavy stone sinkers are hung from the ends of the pole attached to the foot-rope. Four long ropes tied to the four corners of the mouth of the net are tied to a heavy anchor which is 1.8 m long. Four short ropes are tied to the ends of the bamboo poles and they are held in the boat. While setting the net, the anchor is dropped first and the boat with the net pulls away from the anchor to the maximum distance possible and when the mooring ropes are tight the net is lowered to the desired depth by paying out the short ropes tied to the bamboo poles .The boat stays with the net hanging from it for the entire duration of fishing. A slack rope is tied to the cod end and held in the boat. Huge quantities of *Leander tenuipes* are caught by this method of fishing from August to November.

The bag-nets employed in the estuaries of West Bengal are known as *Behundijal, Behutijal, Bhinjal* or *Thorjal* (Kunju 1956 and Pillai and Ghosh 1962). They differ from other bag-nets in having wings extending forwards from the mouth of the net. The bag portion of *Behundijal* measure 20 m long, mouth 6 m wide and wings 9 m long. Mesh near the mouth is 4.0 cm narrowing to 0.5 cm at the cod end. The mode of operation of the net is similar to the *Sus fishing* of Kathiawar coast. The lower end of the extremity of the wing is tied either to a pair of heavy wooden

anchors or to two wooden spikes driven into the mud, while on the upper side a large drum is attached to serve as a float. The mouth is kept open with the help of two bamboo poles each about 5 m long. There is also a buoy at the cod end. In the lower reaches of the Hooghly and Matla rivers prawns (*M. brevicornis* and *L. styliferus*) are caught in large quantities during October to March.

Stake nets operated on the West coast :- The stake nets, used in the creeks and tidal inshore areas of the Gulf of Kutch are locally known as *Patti*. Prawns (*M. brevicornis, P. indicus* and *M. kutchensis*) and mullets, polynemids and *Sillago* constitute the catch during August to December. The nets and its mode of operation has been described by Gokhale (1963). It is made of cotton and is variable in size (12 to 30m long, 1.5 to 2.5 m high with mesh of 1.0 or 2.0 cm). It is kept stationary with the help of stakes placed at regular intervals. No floats or sinkers are used. At ebb tide the net is laid pleated and concealed in the intertidal regions. With the two ends tied to some mangrove trees or poles specially fixed on the land. When the tide is almost full, the fishermen wade through waist deep water, lift the net part by part and fix it on bamboo or mangrove stakes which are carried in their arms. At the turn of the tide all the prawns and other fishes which had entered with the flood tide get caught in the net. Stake nets are also in use in the tidal estuaries of south Gujarat.

Stake nets operated on the east coast :- The 'barrier' nets employed in the Kakinada Bay and backwaters connected to the Godavary estuary are known as *Moolakattu vala*. They are similar to the stake nets of west coast but longer, extending to over a mile when operated. The net consists of number of rectangular pieces of cotton netting attached to bamboo poles of 2 m in height and is operated where wide stretches of mud flats are exposed at low tide. A team of about 30 men is required for its operation. The net is carried in 2 or 3 *Navas* to the mud flats during high tide and just before the turn of the tide the nets are fixed in about 1.6 m of water by pushing the bamboo poles supporting the net into the soft mud and also by treating the lower edge of the net into the mud so that the net forms an effective barrier through which the ebb-tide flows out. The fish and prawns present within the enclosure are effectively

trapped by the small mesh of the netting. They collect in small pools of water left by the receding tide and are scooped up by the fishermen into the boat. Mullets, catfishes, polynemids, sciaenids, white baits and prawns (*P. monodon, Penaeus merguiensis* and *M. brevicornis*) are caught. The *Char-Pata jal* of West Bengal is a similar net (Jones, 1959). In Pulicat lake, *Kondavalai*, a drag net of coromandel coast, is also used as a stake net to trap prawns. It is fixed upright by a number of sticks in tidal shallows in such a way as to form an imperfect corral trap, one half of the net being in a helicoidal fashion, the other half disposed as a leader to conduct the prawns into a terminal trap (Hornell, 1925). The net is operated at nights.

2. **Seine-nets**.

These are the typical gears for the bulk fishery along the coast. They include the seines without bags and seines with bags (and wings). They are known as boat-seines or shore-seines depending upon whether they are hauled from a boat or from the beach.

Boat-seines of the west coast :- These are the typical marine fishing gear of the Kerala coast and are one of the most important indigenous gears for the capture of prawns, particularly during August to October when the prawns leave the bottom habitat. They are made of cotton or hemp and are locally known as *Paithu vala, kollivala, Sultan vala, Thanguvala* etc. Usually two dug-out canoes with 6-10 men in all are required for this type of fishing. The net may vary in size from region to region. The *kollivala* (Fig.8) operated at Kasargod in North Malabar consists of 3 parts – wide-mouthed conical bag 8.5 m long, a platform 11.5 m long and two wings 53m long, one on either side. The conical bag, made of cotton yarn is made up of 7 sections distally (*Vattom*) each 0.4 m in height and 8 sections proximally (*Melvala*) each 0.7 m in height. The *Melvala* has in addition a 5 layers of 2.5 cm mesh bordering the tip. The platform (*Adivala*), also of cotton yarn, is about 30 m. at its greatest width and 18 sections each of 0.64 m high constitute this part. Each section in the bag and platform portions, is, in turn, formed by a number of smaller pieces. The cod end section of *Vattom* had 9 pieces (0.4 m wide) around while the proximal section of *Adivala* has 60 pieces (0.5 m wide).

The mesh size varies form 1.0 cm at the cod end to 2.0 cm at the platform. The coir wing consists of 5 sections viz. *Kachivala* (14.5 m long) *Kheezhvala* (12.2m) *Kanavala* (9.5 m) *Kadani* (9.0 m) and *Baikadani* (8.0 m). The *kachivala* is attached to the upper lip of the mouth and it carrier floats, whereas the *Kheezhvala* is joined to the lower lip and has a stone anchor hung from the corner on either side. The mesh size of the coir wings varies from 55.0 cm near the mouth end to 115.0 cm at the warp end. A stout coir rope 18 m long is attached to the free end of each wing. The *Sultanvala* described by Hornell (1938) is a smaller net the bag portion measuring only 4.5 long. Both these types of boat-seines are operated in a similar way. The net is carried in two canoes with the bag away from each other in a semicircular fashion, paying out the net. Then they come close and haul up the net after enclosing the shoals in the bag.

In the central zone of Kerala coast, another type of boat-seine *Thanguvala* is commonly used for prawn fishing. It is operated either from a single dug-out or two dug-outs with a total complement of 11-13 men. The net is almost rectangular in shape 50-65 m long and 30-40 m at its greatest width and is provided with a long rope at each of its four corners for hauling. There is a wing on either side which is 5-6 m wide. The head rope carries floats and the ground-rope sinkers. Mesh size is about 2.0 cm. Two other types of boat-seines *Vattavala* and *Koruvala*, differing mainly in size are also used occasionally in this region. *M. dobsoni* constitutes the bulk of the prawn catch in the Central and North Kerala coasts.

The boat-seine of the extreme south-west coast (*Madivala* or *Thattumadi*) are operated by 2 catamarans or dug-out canoes during April to October. A description of this gear has been made by Nayar (1958). It has a wide mouthed cotton bag (*Madi*) 10 m long with mesh varying from 0.6 cm at the cod end to 2.0 cm near the mouth. A coir platform is attached to its lower lip. The platform is formed by 3 sections, the central one being 19 m long, 17m wide and mesh 45 cm and two side pieces 20 x 15.5 m with similar mesh. In front of the platform are two coir wings, one on either side, measuring 27 m long with mesh 270 cm. To the distal extremity of the wings a coir rope 72 m long is attached for hauling the net. The prawn catch consists of *P. stylifera* and *M. monoceros*.

Boat seines of the east coast :- The boat – seines constitute an important gear for capture of prawns from the sea on this coast also and they are similar in shape to those of the west coast but with or without wings or platform (Hornell 1925, Jones 1959) They are operated mainly during April-October by a pair of catamarans or in some regions by a *Nava* and a catamaran. The *Thurivalai* of the coromandel coast, *Iragavala* or *Gosavala* of the Telugu coast and *Irgali* or *Irgal jalo* (*Pedda* or *Bada Irgali* and *Sanna* or *chota Irgali* depending on their size) of the Orissa coast are identical in construction and resemble the *Kollivala* of the west coast except in the absence of a platform. The conical bag is 7-13 m long with mesh varying from 1.0 cm at the cod end to 9.0 cm near the mouth. The wings are 15 to 33 m long. Floats and sinkers are attached to the head and foot ropes respectively. There is also a stone weight at the cod end.

The *Eru valai* and *Sennakunni valai* of the coromandel coast between Madras and Nagapattinam are boat-seines without wings (Hornell 1925). While the *Eru valai* is a true cone in shape the *Sennakunni valai* has a deep crescentific notch above so that the floor of the net projects forwards on the lower aspect. These nets have 10/21 floats on the head-rope and no sinkers on the foot-rope. The *Sennakunni valai* however, has two heavy stone sinkers at the joint between the net and the towing warp.

The *Madivalai* of the Gulf of Mannar region (Thiagarajan and Thomas 1962) is very similar to the *Madivala* of the Kerala coast with coir wings and platform.

Compared to the other boat-seines of this coast, the *Eruvalai* and *Sennakunni valai* fish only in the upper layer of the water column owing to the presence of a larger number if floats on the head-rope and hence the prawn catch is poor. *M. affinis, M. monoceros* and *P. indicus* are the species caught on the east coast.

Shore-seines of the west coast :- These are used mainly for catching inshore pelagic fishes. Prawns (*M. dobsoni, M. affinis, P. indicus* and *P. stylifera*) are also caught occasionally by these nets. Wall nets of enormous length are used in the Konkan and Kanara coasts and are locally known as *Rampan* or *Rampani*. The nets, described in detail by

Pradhan (1956) is made of hemp or cotton and consists of a number of pieces varying from 100 to 600 joined end to end. The size of the pieces is variable, 2 to 6 m long and 5 to 11 m high. The pieces towards the free end of the net have a mesh size of 3.0 to 5.0 cm while the pieces forming the middle of the net have a mesh size of 1.2 to 2.0 cm. Wooden floats and sometimes stone sinkers or lead weights are used on the cork-line and lead-line respectively. A long stout rope is attached to the free end of the net on either side for dragging. The net, operated during the post-monsoon months, requires 3 to 5 boats (outrigger type) and 40 to 80 men, depending on the number of pieces used in the net. The rope at one end is held by men on the shore. The net is paid out from a boat moving in a semi-circular way, enclosing the shoals. The other end of the net is brought ashore to a point 0.4 to 0.6 km apart from the first and is handed over to another party 0.4 to 0.6 km apart from the first and is handed over to another party of men on the shore. The net is then dragged towards the shore. During the monsoon period, a smaller drag net, *Yendi* or *Kairampani* consisting of 20 to 30 pieces, each 4m long and 5 m high is in vogue in the Kanara region. One boat and 8 to 20 men are engaged in this type of fishing. In the estuaries, *Kairampani* with less number of pieces is operated for catching prawns.

The shore-seine of Kerala coast known as *Kambayala* or *Karamadi* is a funnel-shaped net with a coir wing and warp on either side (Nayar 1958). The conical net consist of two sections – *Aravala* 7.5m and *Meluvala* 8.2 m in length. The mesh size decreases from 3.0 cm near the mouth to 0.8 cm in the cod end. The wings are of coir webbing and are about 300 m long with a mesh size of 15.0 to 90.0 cm. The warp length is 200 m or more. The net is operated by one dug-out canoe during October-May in a manner similar to the shore-seine of Mysore coast. A smaller type of shore seine without wings known as Nonavala is also in use in the Cochin-Alleppey coast. Small drag nets, called *Vadivala*, are also used there for prawn fishing during October- February. It is akin to the *Kondavalai* of the coromandel coast (Hornell 1938) and consists of a length of broad net (width 1.8 – 2.7 m and mesh 2.0 to 5.0 cm) partially doubled upon itself length-wise and laced up at each end to form a long thorough shaped bag. The mouth is kept open by sticks tied at intervals. Two men drag it ashore in shallow waters keeping the ground-rope at the bottom with the help of the foot. The *Korubalae*, employed in the estuaries

of North Malabar is also similar to *Kondavalai*. The net consist of 6 pieces each 1.5 m long and 4.5 m broad with a mesh size of 1.0 cm at the centre and 2.0 cm at the end pieces. On the upper and lower margins of the net there is a 2-3 coir mesh (5.0 cm) layer to which the head and ground-ropes are attached. About 13 sticks of 1m height each, kept at 0.75 m apart along the length of the net are tied to the head and footropes only so that the net portion is free and forms a bag when dragged against the current. Two men, one on either ends of the net and one in the middle hold the sticks vertically down to the bed and men come close together gathering the sticks quickly such that the catch is collected in the centre of the bag. The operation which lasts for about 5 minutes is repated several times during ebb tide and small quantities of prawns are caught.

In the Saurashtra coast, a simple drag net *Bari* (5.5 m long, 1.75 m high with 1.0 cm mesh) is used during the monsoon, when it is not possible to go out for fishing. Juvenile fishes and prawns are caught in small quantities. The net is operated in waist deep water by fishermen stretching it between them with a bamboo pole attached to either end of the net. In the inner reaches of the creeks of Kutch the fishermen gather prawns by dragging an open-mouthed gunny bag in less than knee-deep water during August-September (Gokhale 1963).

Shore seines of the east coast :- The *Periavalai* or *Karavalai* of the Madras coast described by Hornell (1925) is the shore-seine *par excellence* of the east coast. It is known as *Peddavala* in the Andhra coast and *Ber jal* in the Orissa coast. They are similar to the *Karamadi* of the Kerala coast except that the wings are in two parts – a proximal 1.5 m long hemp portion and a distal 300 m long coir portion. The funnel-shaped body of the net is 8.5 m long, 18.3 broad at the mouth and 3.0 m abroad at the narrow end. The large detachable truncate cod end is 7.3 m long. The mesh size decreases from 4.5 cm at the mouth to 1.2 cm at the cod end. The wings have 10 cm mesh at the base increasing to 50 cm at the extremities. Hauling rope of nearly a km is attached to the free end of the wings. The head-rope has wooden floats at regular intervals right upto the end of the wing. No sinkens are attached to the foot-rope.

The net is shot in a wide semi-circle from a *Masula* boat and dragged to the shore by about 12 men at either ends. Prawns (*P. monodon* and *M. monoceros*) are occasionally caught in large quantities during (February- March along the Andhra and Orissa coasts when they are believed to be driven close to the shore as a result of upwelling.

The Alivivala or Ayil (also known as *Pedda alivi* and *Chinna alivi* according to size) is a well net akin to *Rampani* of the west coast, having a limited distribution between Pentakota and Kakinada of Andhra coast. It consists of a central portion with 3 to 6 rectangular pieces made of cotton (each piece 7.0 to 10.0 m high and 4 m wide) and a long tapering wing with 20 to 33 sections of cotton netting on either side. The length of each section is 18 m and the height decreases gradually towards the free and when it is only 1.1 m. At the free end of the wing is a stout bamboo pole of 0.55 m height to which is attached a thick hauling rope. At intervals of 3 m, irregularly-shaped wooden floats and stone sinkers are attached to the entire length of the head and foot-ropes respectively. Five large wooden buoys, one on central section and 2 each on the wings are attached to the head-rope to indicate the position of the net. The mesh size varies from 1.2 cm in the centre pieces to 4.0 cm at the extremity of the wings. The net is cast from a *nava* and hauled up by 12 to 30 men (depending on the size of the net) at each end. The *Chinna alivi* is operated throughout the year while the *Pedda alivi* is used only during November-March. As the central section comes near the shore any escaping fish or prawn is caught by *Konti valas* (vide infra) operated just outside the *Alivi.* The high central section folds upon itself as the net is dragged to the shore and forms an effective bag. The prawn catch of these nets is better compared to the *Peddavala* and comprises of *M. brevicornisi, M. affinis, M. dobsoni, M. monoceros, P. merguiensis, Acetes* spp. and *P. tenuipes*.

Among the drag nets employed in the backwaters, *Kondavalai* of the Coromandel coast described by Hornell (1925) has its counter parts all along the east coast. They are called as *Konti vala* or *Eedupu vala* in the Telugu coast, *Khadi jal* in Chilka lake and *Hata jal* in West Bengal. Essentially the net consists of a long broad strip of netting having the upper and lower margins connected and supported by spreader sticks which

are invariably shorter than the width of the strip of netting. Distance between spreader sticks is bout 0.6 m. The larger nets may be 18.3 m or more in length with 30-40 spreader sticks 0.7 to 2.75 m. The smaller nets are about 3.66 to 4.55 m long with a depth of bag of 1.5 to 1.8 m the number of spreader sticks is usually seven, 0.6 to 0.7 m in height. The webbing is of cotton-twine and the meshes are extremely small varying from 0.6 to 1.3 cm. The net is dragged by 2 men wading in the shallow regions and prawns constitute a good portion of the catch. In the Pulicat lake a group of 8 to 10 nets may be operated in a gradually narrowing circle. Another type of drag net known as *Pakkadevu vala* is very popular in the creeks of Godavary delta. It is 7.9 to 9.1 m long, width increasing from 5.9 m at one end to 10.4 m at the other. The mesh decreases from 3.0 cm at the broad end to 1.2 cm at the narrow end. The net is operated in conjuction with a small *nava* with a crew of two men. The narrow end of the net is secured to the gunwale of the boat and the sides of the net are tied to bamboo poles 3.66 m high, fixed at the bow and stem of the boat. Two short bamboo sticks 0.55 m. high, are attached to the corners of the broad end of the net which is dragged along with the boat to the shore by two men (boat crew) wading in waist-deep water. At the shore, the dragged end is lifted up and the catch is manipulated to fall into the boat. The operation which lasts about 10-15 minutes is repeated a number of times. Prawns (juveniles of *M. monoceros, P. indicus, P. monodon* and *Macrobrachium* spp.) form the bulk of the catch.

3. **Cast-nets or Falling nets**

These are primitive devices, limited in their efficacy.

Cast nets of the west coast :- This is very common and primitive gear used all along the coast and is known as *Chogiya, Pag, Beesubale, Vichuvala* etc. in different regions. It is made of cotton or nylon and is conical in shape, the margins having lead weights. There are two varieties, stringed and stringless. In both there is a central line which is held by the hand for hauling the net. In the case of the stringed variety, the central line branches out into several strings before reaching the margin of the net, so that pockets are formed at the

margin and are pulled together as the net is hauled up. In the other variety, the pockets are fixed by turning over the lower rim and fastening it by twines. There is no connection between the central line and these pockets. The size of the net varies from 2.5 to 6.0 m in radius with 1.0 or 2.0 cm mesh. It is hand operated from the shore or from a small boat carrying 2 to 8 men when shoals come very near to the shore. The net is cast with a swinging movement, fully spread. The circumference of the net closes as the lead line sinks fast trapping all the fishes and prawns in the water column below the net. In the Kanara and Kerala coasts during the rainy season of July-September cast net boats operate in concentrations in areas where shoals are sighted near the surface *M. dobsoni* is caught in good quantities at this time. This net is also employed for fishing in creeks and backwaters.

Cast nets of the east coast :- The cast nets (known as *Veechu valai, Vessura vala* or (Kepla jal) are used in the creeks and estuaries all along the east coast. Prawns (species of *Macrobrachium, Metapenaeus* and *Penaeus* are caught in small quantities by this gear.

4. **Scoop-nets or Skimming-nets**

These are employed exclusively in the backwaters, creeks and estuaries. They comprise of the hand-net, push-net and lift-net.

Scoop-nets or skimming-nets of the West coast :- The hand-net (*Arippu vala* or *Vattu vala*)is a small bag- shaped net of 0.6 -1.2 cm mesh with or without handle and is used in the kerala and Kanara coasts to dip out prawns and small fishes (Hornell, 1938). This bamboo or cane bent into an ovate shape forms the mouth of the net. The life nets or the chinese dip-nets (*Cheena vala or Kambu vala* described by Hornell (1938) are large and are extensively used in the backwaters of Cochin and Azhikode in Kerala. A typical net is of 9-10 m square with a mesh of 0.2 cm at the cod end increasing to 5.0 cm at the mouth. The mouth is kept distended by two bamboos each about 2 m or more in length crossing each other at mid lengths and lashed together at right angles. Their distal extremities are attached to the four corners of the mouth of the net. The net is alternately lowered into the water

and raised with the help of a complicated, balanced movable framework. Two men are required to operate this net. Sometimes a light is hung from the apex of the frame to attract fish and prawns during night fishing. Juveniles of *M. dobsoni*, *M. monoceros* and *P. indicus* comprise the prawn catch.

Scoop-nets or skimming nets of the east coast :- The push nets of the east coast are similar to the hand nets of the west coast but are large. They have to be pushed and hence known as push nets. They are characteristic of the creeks and estuaries of Andhra, where they are called *Dhobbudu vala* or *Pakkadevuda vala*. The net is about 1.8 m long with a triangular mouth and truncate cod end. The mouth of the net is supported by a triangular frame whose base is formed of a 1.2 meters long flat wooden plank and the sides (1.4 m long) are formed by two bamboo poles crossing each other at the apex of the net. The portion of the bamboo poles projecting above the apex of the net forms the handle (about 0.5 m long) for pushing the net. The net, made of cotton, is in three sections. The first piece is more or less a square when first fabricated. Three sides of this square are attached to the triangular frame while the fourth side is folded and sewn up to half the distance from the apex of the triangle. The lower unsewn half now forms a circular opening to which is attached a cylindrical net 0.5 m long. To the posterior end of this cylindrical piece is attached the 28 cm long truncate cod end which is 50 cm wide anteriorly and 88 cm wide posteriorly. The mesh size diminishes from 1.0 cm near the mouth to 0.7 cm at the cod end. The net is pushed in front by a man wading through shallow regions and small quantities of prawns (juveniles of *Metapenaeus*) are caught. A smaller net with a uniform mesh-size of 0.7 cm is used in the Kakinada Bay and creeks for catching *Acetes* spp.

In the Kakinada Bay and tidal creeks of the Godavary estuary rectangular dip nets known as *Yettudu Dimpudu*, akin to the *Kambuvala* of the west coast, are operated during the post-monsoon period. The net is 14.2 m long, breadth being unequal 76.9 m at the dipped end and 13.3 m at the opposite end. It is made of cotton and mounted on thick jute ropes. The mesh size decreases from 6 cm near the wide end of the net to 2.0 cm at the narrow end.

The net is fixed in tidal areas with the help of poles and coir ropes and when not in use, looks like a sagging canopy over the water. Usually a *shoe-thoni* with 4 men is used to operate the net. But some times more than one may be found near the net, assisting the operators. The boat is positioned behind the narrow end of the net and the rope on which the net is mounted is held above the surface of the water by two men in the boat. On a triangular wooden platform erected near each corner of the wide end of the net, stands a man holding a 2.5 m long stick, one end of which is tied to the corner of the net. During the incoming tide the two men standing on the platform dip the end of the stick to which the net is tied, right up to the bottom of the creek and thus hold the wide end of the net under the water. Now the net forms a shallow bag through which the tide flows. Every two or three minutes the front end of the net is lifted up far above the head of the men on the platform and the catch pushed to the narrower end of the net from where the men in the boat remove the catch with the help of small hand-nets, sometimes wide meshed screens made of cotton-twine are fixed in a diverging manner from the triangular platforms to the banks of the creek to direct the fish towards the mouth of the net. The net is operated during night or day time but usually when the flow of the tide is strong. Prawn catches are said to be good during night-time when they may form about 50-70% of the catch. Juveniles of *P. indicus, M. dobsoni, M. brevicornis* and *M. monoceros* are generally caught in this net.

5. **Drift-nets**

These are passive fishing net walls of selective nature.

Drift-nets of the West coast :- These are gill-nets made of cotton, hemp or nylon. In the Kanara and North Malabr coasts big-sized prawns (*P. merguiensis, P. indicus M. affinis* etc.) are caught in small quantities in the bottom-drift nets (*Kanthabala* or *Kanthavala*) which are operated by 2-3 men in a dug-out during November-April mainly for catching mackerel-sharks, catfishes, crabs etc. The net consists of 16-25 pieces, each 3-5 m long, 2-3 m high with mesh size of 5 to 6 cm. It is set in position with stone sinkers on the foot-rope and floats on the head-rope, allowed to dirft with the current for sometimes and then lifted

to collect the catch. In the south-west, surface drift nets known as *Vala valai* or *Pattuvala* (40 to 50 pieces each of 5.4 x 1.8 m with mesh size of 3.0 cm) are operated by two men on a catamaran for catching *Chirocentrus* and prawns (*P. indicus*).

Drift-nets of the East coast :- The *Kilevalai* of the Telegu coast is similar to the *Kanthavala* of west coast. It is operated by 4 to 6 men on a *Nava* almost throughout the year. Large-sized prawns (*P. monodon, P. merguiensis, P. indicus. M. affinis* and *M. brevicornis*) are caught in small quantities.

6. Traps

These are of various designs, from the simple basket trap to the complicated weirs or pound weirs which are exclusively used in the estuaries and backwaters.

Traps of the west coast :- Simple devices known as *ottals* are in vogue in kerala (Hornell 1938). They are the basket traps or cover pots used in shallow waters rich in plant growth as well as in the paddy fields. They are sub-conical in form 0.5 – 0.6 m high, open at both the ends the upper one being narrow. They are made of bamboo splints, looped at invervals with split cane or coir cord. The lower end is armed with spikes by sharpening the split ribs to a point. The basket is plunged into the water every few steps, passing the lower end into the mud with one hand and removing the fish and prawns inside the trap with the other, through the opening at the top.

The screen barriers (*Thattuvala*) described by Hornell (1938) are somewhat complicated. They consist of several screens (*Thatties*) arranged as vertical walls supported by strong poles driven into the mud. There are circular, heart-shapped or rectangular trap chambers set at intervals. The traps are also made of vertical screens. The screens are formed of narrow strips of bamboo 1.5 -1.8 m high, laced together with coconut twine transversely about 0.3 m apart. The screen barriers are used in the shallow and tidal backwaters of Malabar. As the tide recedes, the fishes caught within the area are forced to pass into the trap chambers.

Traps of the east coast:- A variety of trapping devices are used on the east coast. In the Chilka lake prawns are caught almost exclusively by bamboo traps which are akin to the bamboo screen traps operated in the estuarine ponds of Philippines. Two types of traps *Daudi* and *Cheengri Baaza* are in use. Their description and mode of operation have been dealt with by Job and Pantulu (1953) and Jones and Sujansinghani (1954). *Daudi* is a prism-shaped and is made of bamboo strips of about 0.6 cm width. Usually strips of 34 bamboo poles each 1.05 m long are required to make one *Daudi* which measures 1.5 x 0.3 x 1.0 m. *Cheengri Baaza* is a rectangular trap made of three parts namely *Patta* or strap 2.2 x 0.55 m forming the four sides and two rectangular pieces each 0.8 x 0.2 m forming the top and bottom. Both the kinds of traps are used in conjunction with bamboo screens known as *Thatta* measuring 12 x 1.2 m. The fishermen construct fences with such screens extending from the shore into the lake to a length of 180 to 275 m and a ring of traps 7 to 8 is placed around the lake end of the fence in waters of 1.0 to 1.5 m depth. The *baaza* type traps are placed at the three corners of the triangular enclosure formed of bamboo screens at the lake end. The traps are set in the evening. Prawns which move along the shore at the night are guided by the screens into the traps. Fishing is carried out almost throughout the year and good quantities of prawns (juveniles of *P. indicus* and *P. monodon*) are caught.

In the deltaic areas of Godavary and Krishna, Bamboo basket traps called *Movu* of the hut-box type described by Job and Pantulu (1953) are operated in the irrigation channels connected to the backwaters during July-October. The trap made of bamboo splints has a rectangular base and the basket is also more or less rectangular in shape up to the middle; above, the bamboo splints converge to a straight line at the top running the length of the trap, leaving a small hole at one end, to empty the catch. The size of the traps is variable. A medium-sized trap measures 1.0 x 0.15 m at the base and 0.7 m high. There is an opening guarded by bamboo splints near the bottom on each of the broader sides. In the larger traps there are two openings on each side. The traps are set across the canals during July-October, either single or in rows depending upon the widths of the canal. *Macrobrachium* spp., *M. monoceros* and *P. monodon* are caught by these traps. In the swamps of Collair lake and

Upputeru river, telescopic two-piece conical bamboo basket cage or traps called *Gampa garre* and rectangular bamboo basket cage or traps called *Mayulu* are extensively used in batteries for the capture of prawns (Venkataraman *et al.*1956).

7. **Miscellaneous devices**

These include *Pachil* of the Kerala brackish water lakes and the pouch trap net of Pulicat Lake.

Miscellaneous fishing devices of the West coast :- In the shallow stretches of the brackish water lakes and canals of Kerala, an interesting method under the name *Pran-junkhar* or *Pachil* (Gopinath, 1953) is adopted for catching praws. In this method, a long heavy iron chain attached to the bows of two canoes which are braced together by cross bars is dragged along the bottom. The chain disturbs the prawns living close to the bottom which jump out of water and fall into the canoe where they are trapped by means of a criss-cross arrangement of bushes or coconut bracts.

Miscellaneous fishing devices of the East coast :- The same principle of dislodging prawns from the bottom is followed in operating the *Kalvalai*, a pouch trap of the Pulicat Lake. It is a huge bowl-like net made of cotton (Hornell 1925). 18.3 m in circumference and 5.5 m deep with a narrow-mouthed bag or cod end and mesh size of 2.5 cm. Two long stout coir ropes weighted with small stones at short intervals are attached to the extremity of mouth one at each end. The net is operated in the deeper stretches of the backwaters. The lower edge of the mouth is firmly fixed to the ground by stakes and the upper edge is held up by two men to keep the mouth open. The two stone laden ropes are paid out by two men so as to diverge widely in front of the mouth. Holding the rope end they cross over to the other side, gradually reducing the area enclosed by the two lines. The moving ropes dislodge the prawns and flatfishes from the bottom and drive them towards the mouth of the net. As the ropes come close to the mouth, the foot-rope is set free and lifted up, thus closing the net.

8. **Trawl nets**

These are modern contraptions to capture prawns near the sea bed.

The marine prawn fishery in India, employing indigenous gears was largely seasonal. However, its value as a dollar earner has provided the impetus for improving the conventional gears to catch prawns in the off-seasons' and explore new grounds. As a result, trawl fishing has developed.

Beam trawling is not done anywhere in India as it imposes certain limit on the length of the beam (maximum 12 m) and consequently on the horizontal opening of the net and the area that could be fished. The most developed method for keeping the towed net open horizontally to the maximum extent is the use of long wings and otter boards. Otter trawling has been found to be very successful for the exploitation of demersal fisheries and is therefore resorted to, on a commercial scale on both the coasts of India. It is operated from a mechanised boat with a crew of 3 – 6 men. In some parts as in Kerala and Kanara coasts it is also operated from a dug-out, close to the shore by two men. The canoes are anchored heavily with a long rope. After rowing the boat away from the anchor to the maximum distance, the trawl net is cast. It is then towed by moving the boat to the original position, holding the anchor rope. The net is then hauled up. Each operation lasts for about 10 minutes.

The otter trawl (Fig. 15) incorporates the features of several of the indigenous devices such as the winged bag and seine nets and *Pachil*. The design of some of the shrimp trawls is given by Satyanarayana and Nair (1962) and Kuriyan *et al*. (1964). The otter boards are shaped in such a way that maximum shearing power and least resistance to towing are obtained. Their size and weight vary from 0.75 x 0.4 to 1.4 x 0.9 m and 11 to 90 kg respectively, depending upon the dimensions of the net and the towing power required. Two or four seam trawl nets, overhang or non-overhang type, with a head line length of 7-27 m between the upper wing ends, are operated. Barrel-shaped thermocole floats or spherical aluminium floats are attached to the head-rope. The foot-rope is longer than the head-rope and varies from 8 to 35 m. It carries spindle-shaped lead sinkers. The mesh size of the net is variable from 5 to 10 cm at the

cod end. The trawling speed ranges from 1.5 to 4.5 knots/hr according to the size of the gear and horse power of the boat. Fewer floats on the head-rope, a heavier ground-rope with a thin tickler chain attached ahead of it and comparatively long wings would seem to make this gear more effective for catching prawns (Kuriyan *et al* 1962 and Deshpande and Kartha 1964).

Considering the different types of gears used for prawn fishing, it is seen that apart from otter trawl, boat-seines of variable design constitute the most important gear for capture of prawns from the sea on both the coasts of India. In addition, bag nets and stake nets are of importance on the north-west coast where the tidal flow is strong. In the Kanara and Kerala coasts cast nets and shore-seines are employed for catching prawns close to the shore. The latter gear is also important in parts of Andhra coast. Compared to the marine fishing gears, a greater variety of devices is in vogue for prawn fishing in the estuaries, backwaters and creeks. In the tidal regions of the east and west coasts bag nets are operated, besides stake nets. Various kinds of drag-nets, scoop-nets and traps are the other gears used in the backwaters.

Although trawl fishing accounts for the bulk of the prawn catch from the sea, its operation is still mostly confined to the inshore waters of 15 to 30 km range from the shore. It would be necessary to extend them into the offshore regions with suitable trawlers to explore the possibility of stepping up our valuable resources. The results of the recent exploratory operations between 300-400 m depth off the south-west coast of India are encouraging in this direction.