



Trawl Designs Used in Small-scale Mechanised Fisheries Sector of Andhra Pradesh, India

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Abstract

Design details of the commercial trawls operated along Andhra Pradesh coast during 2006-2008 are presented. The trawls in Andhra Pradesh are broadly classified into three types based on the target groups, viz., fish trawls targeted for finfish, shrimp trawls for shell fish and cephalopod trawls for exploitation of cuttle fish and squid. This classification shows that the industry has developed into a target fishing sector using resource specific gear. Shrimp trawls have undergone several changes in the course of time with increase in the number of seams from two to six, increase in vertical height and also increase in the length of the net. Mesh size in fish trawls in the fore part of the net increased from 150 to 2000 mm to reduce the drag. Two seam fish trawls, with head rope ranging from 20 to 81 m are widely used for exploitation of finfish in Andhra Pradesh. The codend mesh size of all the trawls were less than those stipulated in the Andhra Pradesh Marine Fishing Regulation Act 1995.

Key words: Trawler, fish trawl, shrimp trawl, cephalopod trawl, Andhra Pradesh, India

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Introduction

Mechanization of fishing craft in the east coast of India was introduced in the late fifties (John et al., 1959). Due to the narrow continental shelf, swift water currents and limited demersal fish schools in the east coast of India, several changes have

undergone in mechanized trawler industry with regard to trawl designs for exploitation of the fishery resources. Initially, trawling was carried out with a beam trawl for assessing the resources and locating suitable trawling grounds. Later on more advanced trawling gears have been designed and developed (Narayanappa, 1968; Sreekrishna & Narayanappa, 1970; Narayanappa & Satyanarayana, 1972; Satyanarayana & Narayanappa, 1976; Satyanarayana et al., 1972; Narayanappa et al., 1985; Rao & Narayanappa, 1994).

Andhra Pradesh with a coastline of 973 km, extending from Srikakulam to Nellore has about five fishing harbours and 271 marine fish landing centres. The state produces 0.15 million t of fish from marine sector contributing 7.5% of the total fish production in India (CMFRI, 2008). About 1802 mechanised trawlers operate trawl nets along the Andhra Pradesh coast. The *sona* boats target the deep water shrimps (*Metapenaeus monoceros*, *Penaeus monodon*, *Solenocera crassicornis*), cephalopods (*Sepia* spp., *Loligo* spp.) and fish (goat fish, croakers, mackerel, nemipterids and ribbonfish), while penaeid prawns were the targeted catch for mini and large trawlers. The trawl shrimp catch fluctuated between 13 433 t in 2001 and 20 446 t in 2006. Ribbon fish was the next dominant resource and the catch varied between 16 359 t in 2002 and 3005 t in 2005 (Rao et al., 2008).

Bottom trawling is known to be a very effective fishing method for exploiting shrimp and demersal fishery resources. Several changes have taken place in the concept of design, construction and operation of trawls over the years. According to the local conditions and availability of fish schools, modifications in design and operations are continuing. Data regarding the designs of trawl nets used in small-scale mechanized sector of Andhra Pradesh are outdated. In the present communication, design

details, technical and operational aspects and comprehensive modifications in commercial trawls being operated in the Andhra Pradesh coast are presented.

Materials and Methods

The study was undertaken in five major fishing harbours *viz.*, Visakhapatnam, Kakinada, Machilipatnam, Nizampatnam and Krishnapatnam of Andhra Pradesh during the period 2006-2008. The commercial trawls were operated from trawlers ranging in size from 13.1 to 28 m L_{OA} at depths ranging from 20 to 150 m. Data with regard to their design details were collected and documented as per FAO (1978). The scale diagrams were drawn using Coral draw software. The data were collected through field visits and interviews with the fishermen onboard vessels, net fabrication centres and fishing harbours.

Results and Discussion

Specifications of different categories of trawlers operated along the east coast are given in Table 1.

The trawlers operating along Andhra Pradesh can be broadly classified into three types based on the length overall (L_{OA}) and horse power namely *sona* boats, mini trawlers and large trawlers.

Sona boats having an L_{OA} of 13.1 m and powered with 102 hp were mechanized and introduced for voyage fishing. *Sona* boats were mostly used to exploit fishery resources up to 100 m depth.

Table 1. Specifications of different categories of trawlers operated along east coast

Specifications	<i>Sona</i> boat	Mini trawler	Large trawler
L_{OA} (m)	13.1	16	21-28
Breadth (m)	4.1	5.08	7.46-7.48
Draught (m)	1.8	2.5	3.4-4.0
Horse power (hp)	102	180	350-624
Type of engine	Ashok Leyland	Ashok Leyland	Caterpillar
Gross tonnage (t)	18	42	156-180
Type of hull	wood	wood	steel
Fish hold capacity (t)	8	10 -15	30
Fuel capacity (l)	5000	12000	40000
Mode of preservation	Ice	Ice	Plate freezing

Mini trawlers have an L_{OA} of 16 m with 145-180 hp engines. They operate two demersal trawl gears simultaneously from 2 out-rigger booms and operate at depth ranging from 50-150 m. Multi-day fishing trips (10-21 days) were undertaken by these trawlers.

Large trawlers of 21-28 m L_{OA} have engines ranging from 350-624 hp. They operate four trawl nets simultaneously, two nets each from each of the outrigger booms and operate at depths ranging from 50-150 m. Multi-day fishing trips (20-40 days) were undertaken by these trawlers.

Based on the target groups, three types of trawl nets were in operation along the coast of Andhra Pradesh *viz.*, finfish trawls targeted for fish, shrimp trawls for shellfish and cephalopod trawls for cuttle fish and squids. Based on the number of seams, three types of nets were identified *viz.*, two seam, four seam and six seam. Finfish and cephalopod trawls were two seam trawls while shrimp trawls had four and six seams.

Generally, the trawls with head rope length ranging from 20-81 m were fabricated with polyethylene monofilament twisted twine and were rigged with 50-55 kg flat rectangular otter boards.

Fish Trawls

All fish trawls were made of two seams. Fish trawls of four different size classes *viz.*, 28, 44 and 46.2 m targeting different finfish groups and 81 m targeting exclusively pomfret were the most common types found. The details of each type are discussed below.

28 m two seam fish trawl

Design details of this net are given in Fig. 1. The wing, square and 1st belly of the net was fabricated with 1.25 mm dia high density polyethylene (HDPE) twine of 200 mm mesh size. The codend was fabricated with 1 mm double twine of 20 -25 mm mesh size. The upper and lower wing panel and square have depths of 62.5, 80.5 and 18 meshes respectively. The head rope and foot rope were made of 14 mm dia polypropylene (PP) rope. Seventeen floats of 15 and 25 mm diameter were mounted on head rope. Eighty rubber bobbins weighing 350 g each were mounted on the foot rope. The net was operated from *sona* boat of 13.1 m L_{OA} fitted with 102 hp engine. This was operated at depth range of 20-90 m targeting mainly ribbonfish, upenoids, sciaenids, lizard fishes and nemipterids.

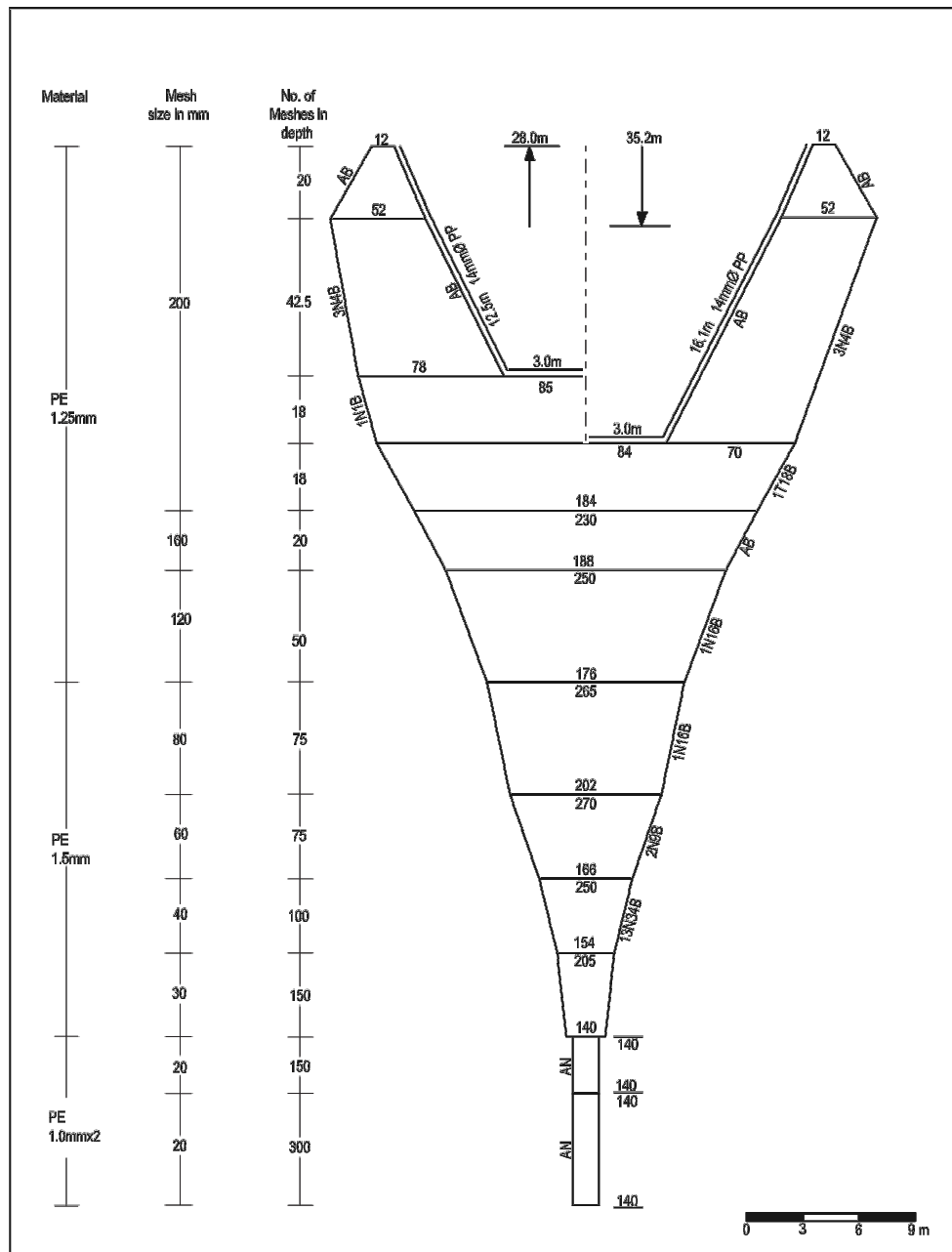


Fig. 1. Design of a typical 28 m two seam fish trawl

44 m two seam fish trawl

The design details of the net are given in Fig. 2. This net was operated from *sona* boat at depths ranging from 20- 90 m. The wing to first belly of the net was fabricated with 1.5 mm dia HDPE webbing having 400 mm mesh size. The 2nd to 4th bellies were fabricated with 1.5 mm dia twine and 5th to 11th bellies with 1.25 mm dia twine. The upper and

lower wing panels had a depth of 51 and 61 meshes. The depth and width of square was 10 x 175 meshes and that of first belly was 20 x 175 meshes. The codend was fabricated with 1.5 mm dia twine having a mesh size of 20 mm. Foot rope and head rope were fabricated with 14 mm dia poly propylene rope. Seven floats of 51 mm dia were mounted on head rope and 12 mm iron chain of 45 kg are

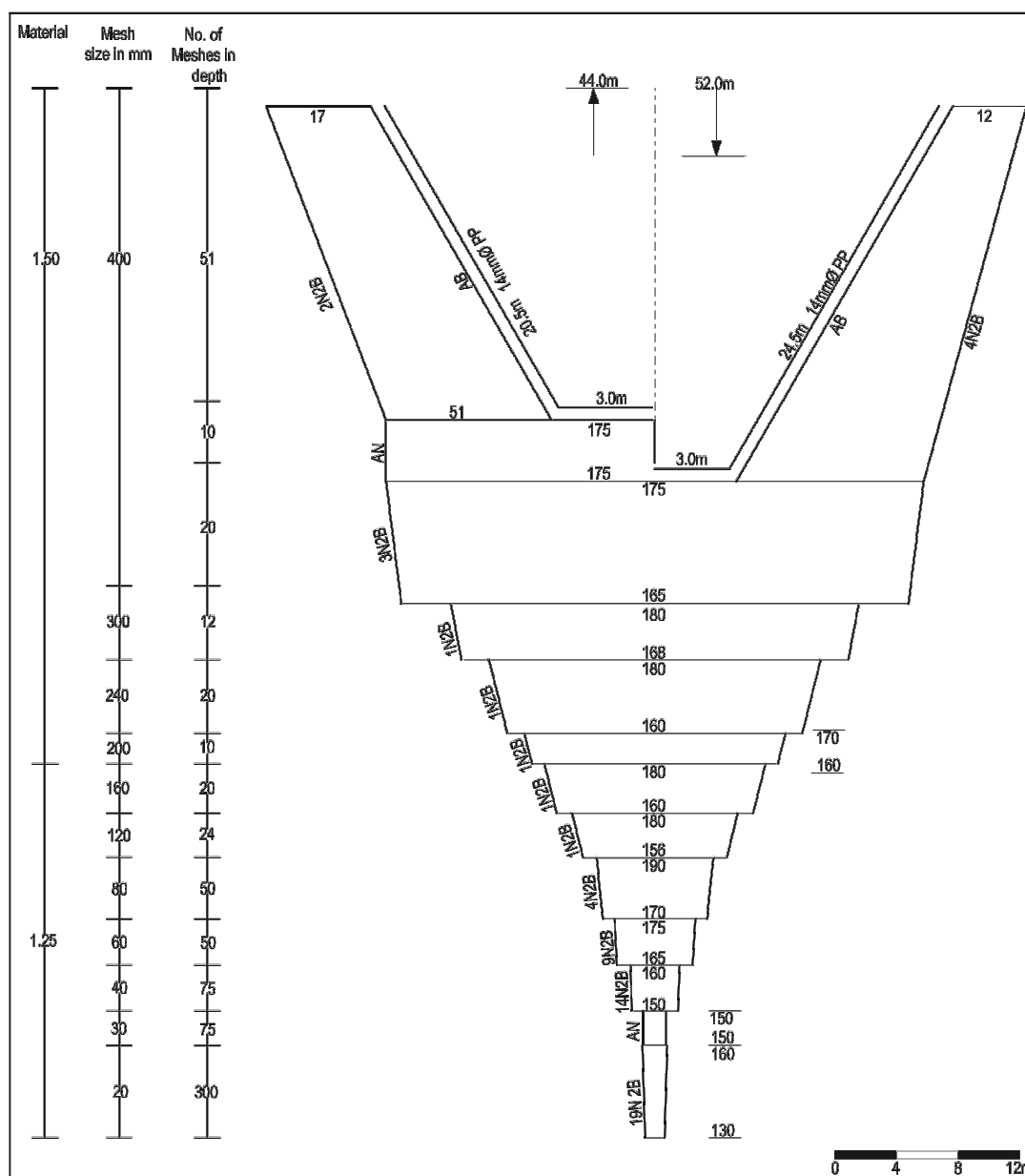


Fig. 2. Design of a typical 44 m two seam fish trawl

rigged on foot rope. The leg of the net was 5 m and the sweep line length was 20 m. The net targeted mainly finfishes like ribbon fish, upenoids, sciaenids, lizard fishes, nemipterids and silver bellies.

46.2 m two seam fish trawl

This net operated from *sona* boat at depth ranging from 20 to 90 m targeted mainly ribbon fish, upenoids, sciaenids, lizard fishes, nemipterids and silver bellies. The wing, square and first belly of

the net were fabricated with 400 mm mesh of 1.25 mm dia twisted HDPE twine (Fig. 3). The upper and lower wing panels had a depth of 64 and 69 meshes respectively. The square had a depth and breadth of 5 x 180 meshes and the first belly was of 9 x 180 meshes. Codend had a mesh size of 20 mm with depth and breadth of 170 x 140 meshes. The codend was covered with a rubline having 150 mm mesh size fabricated with 4 mm rope. Seven 400 mm dia round plastic floats were rigged to head rope of 14

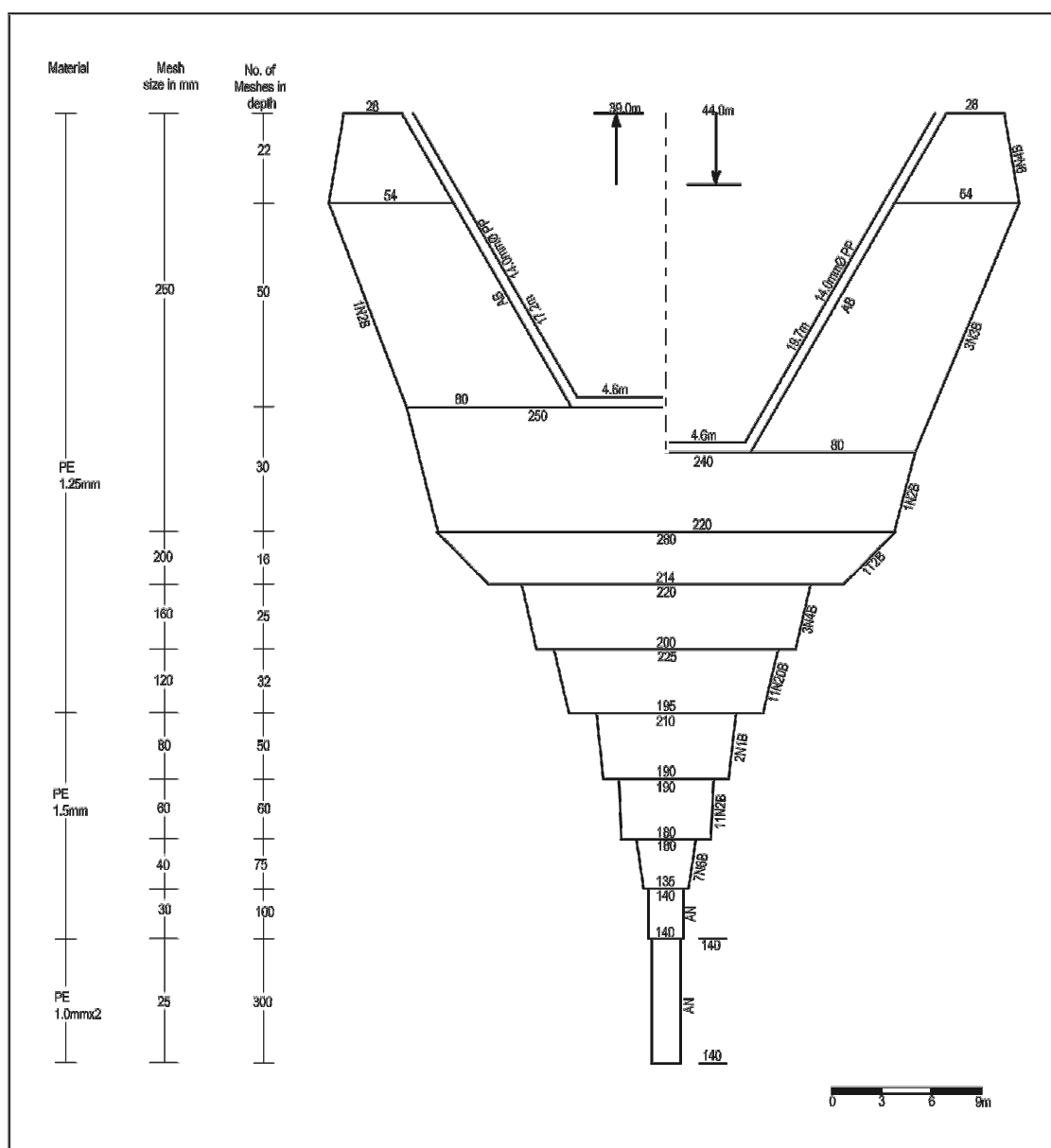


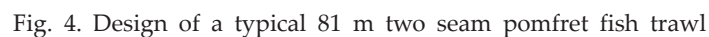
Fig. 3. Design of a typical 46.2 m two seam fish trawl

mm dia and 12 mm dia iron chain of 40 kg was rigged to foot rope of 14 mm diameter.

81 m two seam pomfret fish trawl

This net operated from *sona* boat at depth range of 20- 90 m mainly targeted pomfrets, viz., *Pampus argenteus* and *Parastromateus niger* and other fishes like ribbonfish, upenoids and lizardfish. The wing, square and first belly of the net were fabricated with

2 mm diameter HDPE webbing of 2000 mm mesh size (Fig. 4). The upper and lower wing panels had a depth of 19 and 21 meshes. The depth and width of square was 2 x 114 meshes while that of first belly was 4 x 110 meshes and that of the second belly was 4 x 148 meshes and the mesh size was 1500 mm. The 3rd and 4th bellies were fabricated with 1.5 mm diameter twine and the 5th to 14th bellies with 1.0 mm diameter twine. Codend was fabricated with 1.5



Two shrimp trawls made of four and six seams were in operation.

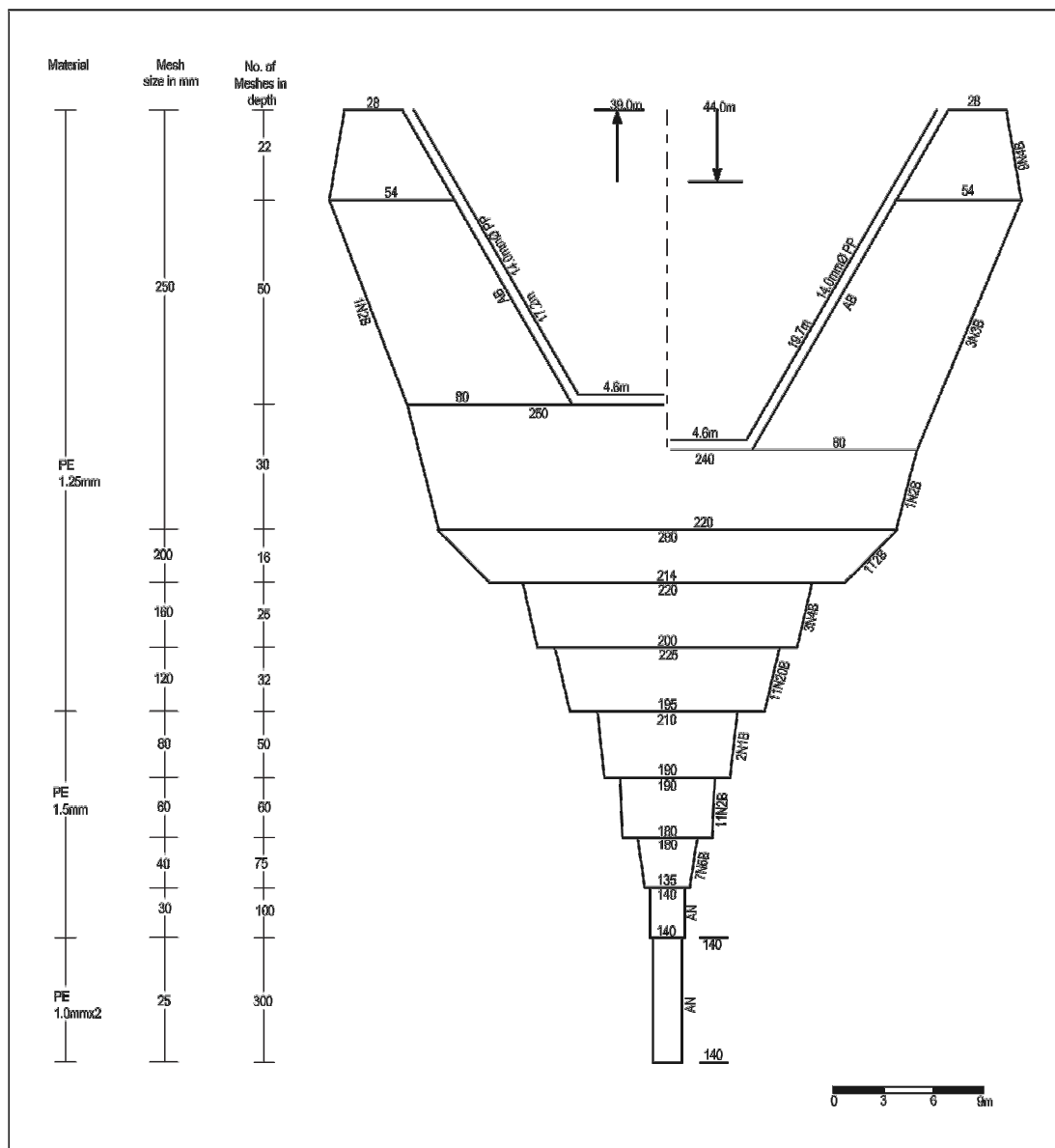


Fig. 5. Design of a typical 39 m two seam cuttle fish trawl

27.4 m two panel six seam shrimp trawl

Design details of a typical 27.4 m two panel six seam shrimp trawl is depicted in Fig.6. The six seam shrimp trawl net used from *sona* boats, was fabricated with two panels and each panel was made with three pieces of webbing. The wings, square and first belly of the net were fabricated with webbing of 0.85 mm twisted polyethylene twine having 60 mm mesh size. The depth, breadth and mesh size of the first belly of upper panel was 63x548x60 mm

and that of the lower panel was 33x510x60 mm (Fig. 6). The net was rigged with flat rectangular wooden otter boards weighing 50-55 kg.

20 m four seam shrimp trawl

A four seam 20 m shrimp trawl was used from mini trawlers of 16 m L_{OA} and large trawlers of 21 m L_{OA} and above. Design details are given in Fig. 7. The net was fabricated with 1.5 mm polyethylene twisted twine. The upper and lower wing panels

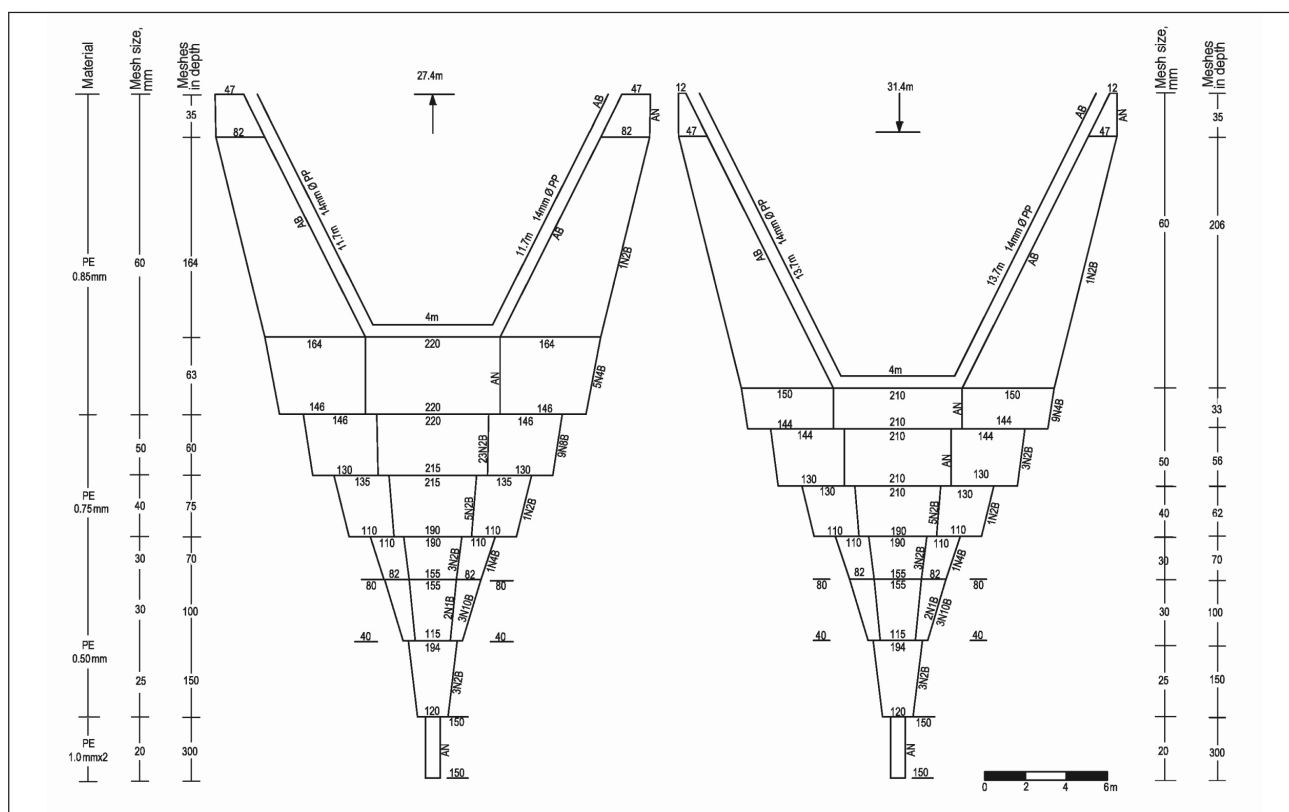


Fig. 6. Design of a typical 27.4 m two panel six seam shrimp trawl

had 80 meshes depth each. The wing, square and bellies were fabricated with webbing of 50 mm mesh size. Mexican otter boards each weighing 225 kg with sled made with iron of 250 kg were used in operation. Four nets of 20 m length each with two nets on each side were operated by a single large steel trawler.

Modifications in the trawl sector

There has been a rapid expansion of both the non mechanized and mechanized fleet over the past four decades. Narayanappa et al. (1985) correlated the catch with increase in the number of fishing boats and observed reduction trend in the CPUE.

Two seam fish trawls dominated the fishing industry until 1950s. During the next two decades, though popularization of trawling brought about a greater use of four seam nets along the west coast, two seam nets continued its popularity along the east coast (Satyanarayana et al., 1972). This trend still continues. It was observed that shrimp trawls have undergone several changes in the course of time like increasing the number of seams from two

to six. Results indicated that the mesh size in the fore part of the net increased from 150 mm to 2000 mm in the fish trawls, the advantage being a reduction in the drag.

Four seam and six seam shrimp trawls gained popularity along the east coast. Satyanarayana et al. (1972) reported that the horizontal opening of conventional two seam trawl was invariably higher than four seam trawl which indirectly indicated that four seam net obtained more vertical spread which accounted for better catch of bottom fishes. Further, no significant difference in the catch rate was reported but a striking difference in the catch composition between two seam and four seam trawls was observed. Satyanarayana & Narayanappa (1976) evaluated the double trawl net and observed that the net was effective in targeting bottom as well as off bottom fishes simultaneously. Rao & Narayanappa (1994) found that the fuel rate was significantly less in rope trawl while catch was significantly more.

Two seam fish trawls are widely used for exploitation of finfish resources. Shrimp trawls have

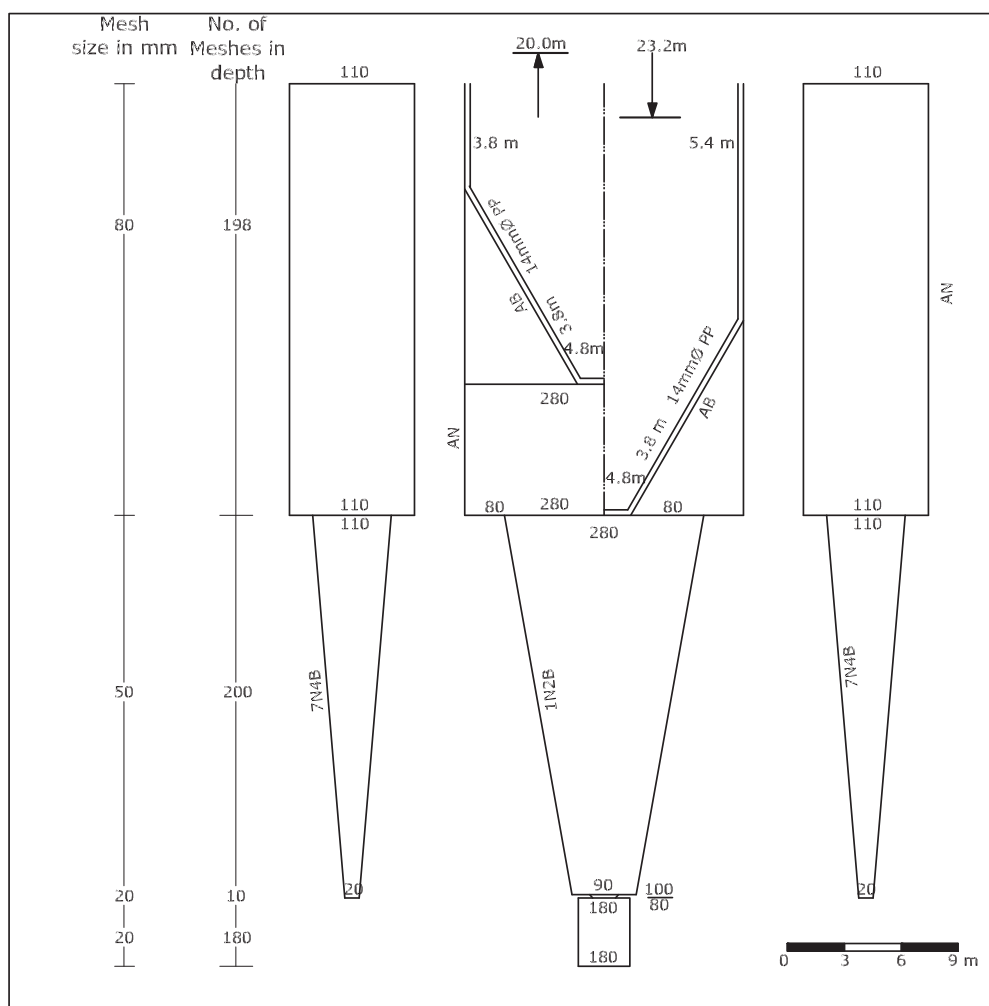


Fig. 7. Design of a typical 20 m four seam shrimp trawl

undergone several changes in the course of time *viz.*, increase in number of seams from two to six, increase in vertical height and length of net. In order to manage our trawl resources efficiently, caution needs to be exercised in the use of trawl nets. Selective fishing practices and mesh size regulation need to be strictly adhered to, for longer sustainability of fishery resources.

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