Chapter 3

Trawling Systems and Bycatch Issues, off South Kerala

3.1 Introduction

In Kerala mechanized fishing was first introduced in 1956 at Sakthikulangara-Neendakara in the Quilon coast, which is by far the most important landing centre of the state and it had extensive effect on the socio-economic aspects of this area. (Devaraj and Smita, 1988; Sathiadhas and Venkataraman, 1981). Currently there are about 850 trawlers operating from Quilon and their number increases to more than 1200 during peak season. The importance of Quilon as a fishing centre is mainly due to its geographic proximity to the Quilon bank which is a highly productive fishing area between 275 and 375 m well-suited for bottom trawling (Rajan et al., 2001). Moreover, Sakthikulangara is a major landing centre for penaeid shrimps especially *Parapenaeopsis stylifera* (*karikkadi*) and deep sea shrimps. About 70-75% of *Parapenaeopsis stylifera* and more than 70% of deep-sea shrimp catch of Kerala are landed at Sakthikulangara and Neendakara (Suseelan et al., 1989; Rajan et al., 2001; Joseph and Jayaprakash, 2003). About 20% of the seafood processing units in Kerala are located here (Ramachandran et al., 1993; MPEDA 2004). All these factors make Quilon an ideal area for conducting the study regarding the trawl systems that contributes 97% of the total catch contributed by the mechanized sector of Kerala (Yohannan et al., 1999).
The design and performance of trawl system have progressed significantly since its introduction during 1950s (George, 1980; Mukundan and Hameed, 1993; Verghese, 1998; Thankappan, 2000). A wide range of designs of small mechanized boats from 7.62 m to 17.52 m fit for commercial trawling were introduced and popularized by the erstwhile Indo-Norwegian Project (INP) and Central Institute of Fisheries Technology (CIFT) (Gnanadoss, 1977; Gulbrandsen, 1984; Gulbrandsen and Anderson, 1992; Verghese, 1998 and Ravindran and Baiju, 1998; Pillai et al., 2000). The trawl nets have also undergone significant changes in course of time in terms of dimensions and design parameters. Over the years, CIFT has introduced several designs of bottom trawls such as two-seam trawl, four-seam trawl, six-seam trawl, long wing trawl, bulged belly trawl and energy saving concepts in trawl design such as large mesh trawl and rope trawl and sheer devices for bottom trawling (George, 1998; Mukundan and Radhalakshmy, 1998; CIFT, 1998; CIFT, 2003).

In this chapter, an attempt is made to assess the present status of trawlers, various trawl net designs and other accessories used for trawling along with bycatch issues in trawl fisheries existing in southern Kerala.

3.2 Materials and Methods

Information on trawlers, trawl nets and accessories, bycatch issues were collected using pre-tested structured schedules prepared for the purpose (Annexures 1 and 2), from important trawl fishing centres off south Kerala. Sakthikulangara, Neendakara, Chavara, Anandavalleswaram and
Kavanad in Quilon district were selected for study (Fig. 2.21). Detailed methodology for the study is given Chapter section 2.6.

3.3 Results and Discussion

3.3.1 Trawler details

3.3.1.1 Vessel classes

Trawlers of both wood and steel construction are prevalent in Quilon. Most of the large vessels are constructed in steel. The trawlers are categorized into four groups, as below, based on size, horsepower, resale value and year of construction.

i. Small-sized trawlers: They are of wooden construction ranging in size from 8.5 m to 9.7 m L\textsubscript{OA}. They are more than 20 years old and have a resale value of Rs. 0.1 to 0.15 million and are deployed for shrimp trawling in peak season.

ii. Medium-sized trawlers-I: They are of both wood and steel construction and range in size from 9.7 m to 12.1 m L\textsubscript{OA}. They are 3-4 years old and have a resale value of Rs. 0.2 to 0.5 million.

iii. Medium-sized trawlers-II: They are mostly of steel construction and range in size from 12.1 m to 16.7 m L\textsubscript{OA}. Most of them are 3-4 years old and have a resale value of Rs. 0.4 to 0.7 million.

iv. Large trawlers: They constitute most of the recent constructions with an investment of Rs. 2.0 to 2.5 million, range in size from 16.7 to 18.2 m L\textsubscript{OA} and are equipped multi-day deep sea fishing.
3.3.1.2 Engine details

Nearly 100% of the engines of trawlers used in this area is Ashok Leyland marine diesel engine. This engine is preferred over other engines by the fishermen and owners, because of its reliable performance and easy availability of spares. Details of the engines widely used in trawlers, operated off south-west coast of India are given in Table 3.1.

3.3.1.3 Crew size and earnings

Crew size in smaller vessels is 5 and for larger vessels 6 to 7, consisting of one skipper (serang), one engine driver and 3 – 5 deckhands. Crew is paid a share of the returns and an allowance (bata) ranging between Rs. 50 and 100 per fishing day. 65% of the net returns goes to the boat owner and the balance 35% is divided among the crew members. Of the crew share, 10% goes to skipper, 7% to engine driver and the balance is equally divided among deckhands.

Table 3.1: Details of engine models, their power and vessel type

<table>
<thead>
<tr>
<th>Engine model</th>
<th>hp @ 2000 rpm</th>
<th>Vessel size L_{OA}</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALM 370</td>
<td>90</td>
<td>&lt; 9.7 m</td>
</tr>
<tr>
<td>ALM 400</td>
<td>100</td>
<td>&lt; 12.1 m</td>
</tr>
<tr>
<td>ALM 402</td>
<td>107.5</td>
<td>&lt; 12.1 m</td>
</tr>
<tr>
<td>ALM 412 (turbo-charged)</td>
<td>124</td>
<td>12.1 m-16.7 m</td>
</tr>
<tr>
<td>ALM 680</td>
<td>158</td>
<td>12.1 m-16.7 m</td>
</tr>
<tr>
<td>ALM 680 (turbo-charged)</td>
<td>177</td>
<td>&gt;16.7 m</td>
</tr>
</tbody>
</table>

3.3.1.4 Fishing area

Area of operation depends upon the season and size of the vessel. Smaller vessels (8.5-9.7 m L_{OA}) restrict their operation in and around Quilon area and operate up to a depth of 20-30 m. Medium size vessels - I (9.7-
12.1 m L\textsubscript{OA}) operate up to 60-70 m. Medium size vessels--II (12.1-16.7 L\textsubscript{OA}) operate up to 250 m depth. Medium vessels operate up to Varkala in south and up to Cochin in north. Larger vessels  (>16.7 m L\textsubscript{OA}) operate up to 300 m depth and fishing grounds range from Thoothukudy in the east coast to Mangalore in the west coast. Most of the vessels particularly larger ones operate from Quilon during August-January and from Kannur or Thalassery during February-April and again from Quilon during May-June.

3.3.1.5 Duration of fishing

Duration of fishing ranges from 9 h to 10 days depending on the size and endurance of the fishing vessel and the species targeted. Small vessels up to 9.7 m L\textsubscript{OA} conduct daily fishing from 3:00 AM to 12:00 PM, during peak season only. Number of hauls of these vessels range between 3 and 4 and duration of haul is 1.5 h. Small vessels mainly target shrimps and anchovies. Medium size vessels up to 12.1 m L\textsubscript{OA} conduct multi-day fishing trips of 2-3 days duration targeting shrimps, squids and fish. They make 4-5 hauls of 1.5-3.0 h duration per day. Medium sized vessels of 12.1-16.7 m L\textsubscript{OA} conduct multi-day fishing trips up to 6 days and carry out 4 - 5 hauls of 1.5-3.0 h duration during day time. Large vessels of >16.7 m L\textsubscript{OA} conduct multi-day fishing trips of 5-12 days, and carry out 4-5 hauls of 1.5-3.0 h duration during day time and up to 4 additional hauls, if there is night fishing. All vessels generally conduct day fishing and night fishing is undertaken according to the availability of shrimps and cephalopods.
3.3.1.6 Diesel consumption

Diesel cost forms the major share in the operational cost of trawlers. The diesel consumption per hour varies from 8 to 18 litres, depending on installed engine power, size and displacement of vessels, tow duration, and other factors. A 16.6 m vessel engaged in 5 days fishing trips typically consumes 200 litres of diesel per day when undertaking day-time fishing and 350 litres per day if night fishing is also conducted. Installing turbo-charged engines and retrofitting turbo-charging in old engines have been popular for realizing increased fuel economy.

3.3.1.7 Otter board

Flat rectangular wooden otter boards with steel reinforcements have been the popular sheer device in majority of trawlers in Quilon area up to late 1990s. During that time about 76% of trawlers used flat rectangular otter boards, 20% used V - form steel otter boards and rest of them used oval slotted steel boards (Shibu and Hameed, 1999). However, during the current study, it was revealed that almost 80% of the trawlers of 9.7 m $L_{OA}$ and above in Quilon area use V-form steel otter boards (Fig. 3.1). Oval slotted boards are currently not in use. The weight of otter board ranges from 50-85 kg each. Table 3.2 gives the details of otter boards commonly used in Quilon area. Small trawlers below 9.7 m $L_{OA}$ use flat rectangular otter boards (15-20%).
### Table 3.2: Details of otter boards used in Quilon area

<table>
<thead>
<tr>
<th>Engine (hp)</th>
<th>Length (mm)</th>
<th>Breadth (mm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>V-form steel otter boards</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALM 370</td>
<td>1320</td>
<td>760</td>
<td>60 -70</td>
</tr>
<tr>
<td>ALM 400</td>
<td>1320</td>
<td>760</td>
<td>70 -75</td>
</tr>
<tr>
<td>ALM 402</td>
<td>1320</td>
<td>760</td>
<td>75</td>
</tr>
<tr>
<td>ALM 412</td>
<td>1370</td>
<td>810</td>
<td>75 -78</td>
</tr>
<tr>
<td>ALM 680</td>
<td>1370</td>
<td>810 - 840</td>
<td>80 -85</td>
</tr>
<tr>
<td><strong>Flat rectangular wood and steel otter boards</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALM 370</td>
<td>1250</td>
<td>625</td>
<td>50</td>
</tr>
<tr>
<td>ALM 370</td>
<td>1370</td>
<td>690</td>
<td>60</td>
</tr>
<tr>
<td>ALM 400</td>
<td>1450</td>
<td>725</td>
<td>65</td>
</tr>
<tr>
<td>ALM 402</td>
<td>1500</td>
<td>750</td>
<td>72</td>
</tr>
<tr>
<td>ALM 412</td>
<td>1520</td>
<td>760</td>
<td>75</td>
</tr>
<tr>
<td>ALM 680</td>
<td>1600</td>
<td>800</td>
<td>80</td>
</tr>
</tbody>
</table>

**Fig. 3.1 V-form otter boards**

#### 3.3.1.8 Trawl winch

Almost all the trawlers in the area used locally manufactured winches of the mechanical type. Small and medium sized trawlers used 8 mm or 9 mm dia steel wire rope (SWR) as warp which costs about Rs. 26-30 per metre and larger vessels used 10-11 mm SWR which costs about Rs. 30-32
per metre. Total warp length used was up to 700 m per winch drum in small vessels and up to 1500-2000 m in large vessels.

3.3.1.9 Fish hold

Smaller boats operating for 9 h were not provided with built-in fish holds. In some cases, 1 or 2 boxes of 500 kg capacity were used. In larger boats, fish hold capacity ranged from 2 to 10 tonnes. The fish hold is insulated using thermocol and more recently using puff insulation which costs around Rs. 0.1 million. Crushed ice is stored separately in this fish hold.

3.3.1.10 Ice and water

Vessels undertaking single day operation did not carry ice. Vessels undertaking multi-day fishing carried ice in large quantities. A 16.7 m vessel carried 20-30 blocks of ice, each weighing 25 kg, for each day of fishing. Large vessels undertaking 5-day trips typically carry 150 blocks of ice per trip. Ice is crushed using crushing machine at the harbour or in ice plant and stored in the fish hold of the vessel. Small vessels carry 500-1000 liters of water and large vessels 1000-4000 liters, depending upon the duration of fishing trip.

3.3.1.11 Electronic equipments

Almost all large vessels and 75-80 % of medium-sized trawlers in the Quilon area were equipped with modern electronic navigation and fish detection equipment such as Global Positioning System (GPS), echosounder and radiotelephone. Echosounder is used for navigation, monitoring the depth of operation, determine the nature of fishing ground and to detect fish. GPS is used for position fixing, precise navigation and
access to potential fishing zones. Radiotelephone helps in communicating with the land stations or with the other boats operating in the sea.

3.3.2 Trawl nets

3.3.2.1 Shrimp trawls

Karikkadi vala

This is a two-seam shrimp trawl with a head rope length of 29.0 m used for harvesting kiddi shrimp (*Parapenaeopsis stylifera*) (Fig. 3.2). It is fabricated with 0.75 mm dia twisted polyethylene (PE) twine except the codend, which is made of 1.25 mm dia netting. Its wings and square were made of 35 mm and the belly sections with 30 and 35 mm mesh netting. Codend was 350 meshes deep and made of 20 mm mesh netting. The head rope and footrope were made of 14.0 mm dia polypropylene (PP). A codend cover of 30 meshes in depth made of 3.0 mm dia twine 100 mm mesh PE netting was provided to protect the codend from wear and tear. An average of 30 kg lead weight and tickler chain were attached to the footrope and about 7-9 numbers of 150 mm or 200 mm floats were attached to the head rope.

Naran vala

*Naran vala* is a two-seam shrimp trawl with a head rope length of 32.4 m, used for harvesting *Fenneropenaeus indicus* (Fig. 3.3). Overall longitudinal length of the trawl was 36.1 m. The wings were fabricated of 50 mm mesh netting. Netting of 40 mm and 30 mm mesh were in the square and belly sections. Codend was 350 meshes with a mesh size of 20 mm. Netting of 0.75 mm dia twisted PE twine were used in all panel sections
except codend, which is made of 1.25 mm dia twine. A codend cover of 30 meshes in depth made of 3.0 mm dia twine 120 mm mesh PE netting was also provided. PP rope of 14.0 mm dia was used for head rope and footrope. Spindle-shaped lead weights of 20-40 g each, were attached to the footrope using 3 mm PP twine. About 30 kg lead weights and tickler chain and 7 numbers of 150 mm or 200 mm floats were used during operations.

**Poovalan vala**

*Poovalan vala* is a two-seam shrimp trawl with head rope length of 28.8 m, used for harvesting *Metapenaeus dobsoni* (Fig. 3.4). Overall longitudinal length of the trawl was 30.5 m. The wings, square and front belly sections were fabricated using 35 mm mesh and hind belly sections using 30 mm mesh netting. Netting material used except for codend was of 0.5 mm dia twisted PE. Codend is 350 meshes deep and made of 20 mm mesh netting of 1.25 mm dia twine. A codend cover of 25 meshes in depth made of 3.0 mm dia wine 120 mm PE netting was also provided. The head rope and footrope were made of 14 mm dia PP rope. About 30 kg of lead weight and tickler chain were attached to the footrope and 11-13 numbers of 150 mm or 200 mm floats were used during operations.

**Pullan vala**

*Pullan vala* is a two-seam shrimp trawl net with head rope length of 32.4 m, used for harvesting deep-sea shrimps (Fig. 3.5). Overall longitudinal length of the trawl was 37.5 m. The wings, square and front belly sections were fabricated out of 40 mm mesh netting and hind belly sections using 30 mm netting. Codend was made of 26 mm mesh netting and 270 meshes in
depth. The net was made of 0.75 mm dia twine twisted PE netting except for codend, which was of 1.25 mm dia twine. A codend cover of 25 meshes in depth made of 3.0 mm dia twine 120 mm PE netting was also provided. The head rope and footrope were made of 14.0 mm dia PP rope. About 35 kg lead weight and tickler chain were attached to the footrope. Floats were not used in this net, during operations. This is to reduce the vertical opening of the trawl, in order to reduce the associated bycatch of finfishes.

**Kai vala**

This is small two-seam shrimp trawl with a head rope length of 21.4 m operated from small-sized trawlers of less than 9.7 m L_{OA} during peak shrimp trawling season, in coastal waters (Fig. 3.6). The net is operated manually without winch. It was 27.4 m in overall longitudinal length and made of netting of 0.75 mm twisted PE twine netting except for codend, which was of 1.25 mm dia twine. The wings and square were fabricated of 30 mm mesh netting, front belly sections using 26 mm mesh netting and hind belly using 24 mm mesh netting. Codend was 350 meshes deep and made of 20 mm mesh netting. A codend cover of 30 meshes in depth made of 100 mm mesh 3.0 mm dia twine netting was provided in the codend, to protect the codend from wear and tear. The head rope and footrope were made of 14.0 mm dia PP. About of 30 kg lead weight and tickler chain were attached to the footrope and 5-7 numbers of 150 mm or 200 mm dia floats were used for operations.
3.3.2.2 Fish Trawls

Chooda vala

*Chooda vala* is a two-seam fish trawl with a head rope length of 32.6 m specially used for harvesting anchovies. It has overall longitudinal length of 46.2 m (Fig. 3.7). The wings were fabricated of 200 mm mesh netting and square using 160 mm mesh netting. Mesh size in the five belly sections ranged from 160 mm to 40 mm. The extension piece between belly and codend was made of 30 mm mesh netting. Codend was made of 20 mm mesh size and 350 meshes deep. The netting used was of 1.25 mm dia twine from wings to the front belly panel sections, and of 0.75 mm dia twine in the hind belly sections and extension piece. Codend was made of 20 mm PE netting and was provided with inner liner of 10 mm knotless polyamide (PA) netting in order to retain the anchovies. The head rope and footrope were made 16.0 mm dia PP rope. About 20 kg of lead weights was attached to the footrope and 11 - 21 numbers of 200 mm floats were attached to head rope, during operations.

Mixture vala

*Mixture vala* is a two-seam fish trawl with a head rope length of 30.6 m newly introduced for harvesting demersal and off-bottom fish resources (Fig. 3.8). The trawl had an overall longitudinal length of 39.6 m. Large mesh netting of 1000 mm mesh was used in the wings and square. Mesh size in the six belly sections ranged from 800 mm to 40 mm. Codend was 350 meshes deep and made of 20 mm mesh netting. Twine size of the netting was 2.0 mm dia in the wings, square and front belly sections, 1.5 mm to 1.25
mm dia in the hind belly sections and codend. A codend cover of 25 meshes in depth made of 3.0 mm dia twine 120 mm mesh size PE netting was provided to protect the codend from wear and tear. The head rope and footrope were made of 16.0 mm dia PP rope. About 5-7 numbers of 350 mm or 300 mm floats and 35 kg of lead weights were used, during operations.

**Meen vala**

*Meen vala* is a popular fish trawl of two-seam construction with a head rope length of 28.2 m used for harvesting demersal fishes (Fig. 3.9). It has overall longitudinal length of 38.2 m. In this trawl, 500 mm mesh netting was used in the wings and square. Belly was constructed of six panel sections of 500 mm, 400 mm, 200 mm, 120 mm, 60 mm and 40 mm mesh nettings. Codend was 350 meshes deep and made of 20 mm mesh netting. Netting with 2.00 mm dia twine was used in wings and square, 1.5 mm dia twine in belly panel sections and 1.25 mm dia twine in codend. A codend cover of 25 meshes in depth made of 3.00 mm dia 120 mm mesh size PE netting was also provided. The head rope and footrope was made of 16.0 mm dia PP. About 5-7 numbers of 350 mm or 300 mm floats and 35 kg of lead weights were used for operations.

**3.3.2.3 Cephalopod trawl**

**Kanava vala**

*Kanava vala* is a two-seam trawl with a head rope length of 37.6 m, used for harvesting cephalopods (Fig. 3.10). It is 51.3 m in longitudinal length and is fabricated of 1.5 mm dia twisted PE twine netting. PE netting of
200 mm mesh size is used in the wings, square and front belly sections. Mesh sizes ranging from 160, 120, 80, 60 to 40 mm were used in the rest of belly sections. Codend is 350 meshes deep and made of 20 mm mesh netting. A codend cover of 25 meshes in depth made of 3.0 mm dia twine 120 mm mesh size PE netting was also provided. 14.0 mm dia PP rope is used for head rope and footrope. About 35 kg lead weights were used in the footrope and up to 11 numbers of 200 mm floats were used, during operations.

3.3.2.4 Whelk trawl

Whelk trawl, known as chanku vala in vernacular, was developed by modification of shrimp trawl design and rigging through local innovation of the net makers, exclusively for whelk fishing. Chanku vala is a two-seam trawl with a head rope length of 24.0 m which is specially used to harvest the whelk resources (Fig 3.11). It has overall longitudinal length of 27.4 m and is fabricated of 1.25 mm dia twisted PE twine netting. Wing and square panels are made of 80 mm mesh netting. Mesh size in the belly sections ranged from 60 mm to 40 mm. Codend is 350 meshes deep with a mesh size of 20 mm. The whelk trawl is fabricated using thicker twines compared to traditional shrimp trawl designs. This is to withstand the abrasion and strain due to operation of the heavily rigged gear close to bottom, especially when there is a heavy load of shell catch. Typical bottom trawls operated in Quilon use only 20 to 35 kg weight in the footrope. The foot rope is provided with about 55 kg of lead weights to tend the bottom closely during operations, to harvest the gastropods lying buried in the mud. 7-9 numbers of 150 mm or 200 mm floats were attached to the head rope.
3.3.3 Netting materials and accessories

Netting material used for fabrication of trawl nets are invariably high density polyethylene netting. Mesh sizes used vary from 1000 mm to 20 mm in fish trawls, 50 mm to 26 mm or 20 mm in shrimp trawls, 200 mm to 20 mm in cephalopod trawl, and 80 mm to 20 mm in *chanku vala*. In *chooda vala* small-meshed polyamide knotless netting is used as a liner inside the codend to retain anchovies. Indigenously manufactured spherical hard plastic floats were used for floatation. Float sizes varied from 150-350 mm (Table 3.3). Sinkers were usually made of lead and were available in 25, 30, 50, 100, 200 g sizes. Cast iron is also used in some cases. Iron link chain was not preferred by most of the net makers as it corrodes rapidly and could stain and damage the net, during stowage. However, it is used to adjust weight during operations depending on requirements. Link chains are also used in deep sea shrimp trawls. More recently, rubber discs of 650 g each have also been in use in bottom trawls, to increase weight and protect the foot rope and net from damage. Polypropylene ropes are the general choice for head rope, footrope, bridles and other ropes used for trawling and rope sizes vary from 14-16 mm dia.
SHRIMP TRAWL (KARIKKADI VALA)
Bottom, Otter trawl
Area: Kollam, Kerala, INDIA
Bottom species (Parapeneausopsis stylifera)

Fig. 3.2 Design of Karikkadi vala
Fig. 3.3 Design of *Naran vala*
Fig. 3.4 Design of Poovalan vala

SHRIMP TRAWL (POOVALAN VALA)
Bottom, Otter trawl
Area: Kollam, Kerala, INDIA
Bottom species (Metapenaeus dobsoni)
Fig. 3.5 Design of *Pullan vala*
SHRIMP TRAWL (KAI VALA)
Bottom, Otter trawl
Area: Kollam, Kerala, INDIA
Bottom species

Fig. 3.6 Design of Kai vala
Fig. 3.7 Design of Chooda vala
FISH TRAWL NET (MIXTURE VALA)
Semi pelagic, otter trawl
Semipelagic fish species
Area: Kollam, Kerala, INDIA

Fig. 3.8 Design of *Mixture vala*
FISH TRAWL (MEEN VALA)
High opening bottom, otter trawl
Fish species
Area: Kollam, Kerala, INDIA

Fig. 3.9 Design of Meen vala
Fig. 3.10 Design of Kanava vala
Fig. 3.11 Design of *Chanku vala*
### Table 3.3: Details of floats used in trawl nets

<table>
<thead>
<tr>
<th>Type of net</th>
<th>Size of float, mm Ø</th>
<th>No. of floats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixture vala</td>
<td>300-350</td>
<td>5 – 7</td>
</tr>
<tr>
<td>Meen vala</td>
<td>250-300</td>
<td>5 – 7</td>
</tr>
<tr>
<td>Chooda vala</td>
<td>200</td>
<td>11 – 21</td>
</tr>
<tr>
<td>Karikkadi vala</td>
<td>150-200</td>
<td>7 – 9</td>
</tr>
<tr>
<td>Poovalan vala</td>
<td>150-200</td>
<td>11 – 13</td>
</tr>
<tr>
<td>Naran vala</td>
<td>150-200</td>
<td>7</td>
</tr>
<tr>
<td>Kai vala</td>
<td>150-200</td>
<td>5 – 7</td>
</tr>
<tr>
<td>Kanava vala</td>
<td>200</td>
<td>11</td>
</tr>
<tr>
<td>Chanku vala</td>
<td>150-200</td>
<td>7 – 9</td>
</tr>
<tr>
<td>Pullan vala</td>
<td>-</td>
<td>No floats</td>
</tr>
</tbody>
</table>

### 3.3.4 Trawl bycatch

Bycatch is that part of a fisher’s catch that is non-targeted and can be defined as discarded catch plus incidental catch (Alverson *et al.*, 1994 and Rao, 1998). Bycatch is a serious ecological issue in trawl fisheries (Alverson *et al.*, 1994; Hameed and Boopendranath., 2000). Bycatch in shrimp trawling in Kerala was estimated at 65-70% (Pillai, 1998). Discarded items in trawling include juveniles and low value components of finfishes, crabs, gastropods, shrimps, cephalopods, jellyfish, stomatopods and snakes and crabs formed the major item of trawl bycatch discards in Quilon. (Kurup *et al.*, 2004).

Survey results on bycatch have indicated that discard rate by trawlers based at Quilon is between 20 and 70%. Fishermen always practice high grading during multi-day fishing and as better valued species comes low value catch previously retained are discarded, in view of limited storage facilities. Field observations during the period study have shown that 50% of the bycatch retained by trawlers was constituted by juveniles and sub-adults of finfishes, shrimps and cephalopods. Finfish juveniles observed during the
study included sciaenids, *Lagocephalus* sp., *Cynoglossus* spp., *Muraenosox* sp., *Conger* sp., *Platycephalus* sp., carangids, cardinal fishes, damsels, leather jackets, sardines, threadfin breams and lizard fishes. Molluscans observed in the bycatch included *Anadara granosa, Babylonisa* spp., *Turritella* spp., *Xancus pyrum*. Commonly found crab species included *Charybdis cruciata, Charybdis feriatus, Charybdis natator, Portunus sanguinolentus, Portunus pelagicus, Calappa lophos and, Porphyra* sp. Other prominent components of bycatch are stomatopods (*Oratosquilla nepa*) and echinoderms (sea urchins, star fishes and brittle stars).

Views of trawlers, landings of shrimp and bycatch, sorting of catch and related activities at Sakthiklangara and Neendakara centres in Quilon, south Kerala are represented in Fig. 3.12 to 3.23.

Bycatch in trawl fisheries contributes a prominent share in the fisherman’s income. In recent times, the demand for bycatch has increased due to the increased utilization of bycatch by the fish drying/curing industries and fishmeal industries outside the state. The low value fishes like Japanese thread fin breams (*Nemipterus japonicus*) and lizard fishes (*Saurida* sp.) that were included in the bycatch discards earlier, have got better demand from *surimi* industry and are now-a-days retained and marketed. Some of the molluscan species such as whelk and chanks are also landed according to market demand, especially when shrimp landings are poor.

The use of Bycatch reduction Devices was not prevalent in trawl fisheries of southern Kerala, during the period of observations.
Fig. 3.12 A view of the Sakthikulangara fishing harbour, Quilon, South Kerala

Fig. 3.13 A scene from Sakthikulangara fishing harbour, Quilon, South Kerala

Fig. 3.14 Kiddy shrimp (Parapeneopsis stylifera) landed by trawler based at Sakthikulangara, Quilon, South Kerala

Fig. 3.15 Squid caught by cephalopod trawl, at Sakthikulangara, Quilon, South Kerala

Fig. 3.16 Sorting of trawl caught landings onboard a small trawler, off Quilon, South Kerala

Fig. 3.17 Squid (Uroteuthis duvauceli) landed by trawlers based at Sakthikulangara, Quilon, South Kerala
Fig. 3.18 A scene from Neendakara fishing harbour, Quilon, South Kerala

Fig. 3.19 A small trawler based at Neendakara, Quilon, South Kerala

Fig. 3.20 Japanese threadfin bream (*Nemipterus japonicus*) landed by trawlers based at Neendakara, Quilon, South Kerala

Fig. 3.21 Sole (*Cynoglossus* sp.) being sorted from bycatch landed by trawlers based at Neendakara, Quilon, South Kerala

Fig. 3.22 Sorting of trawl caught landings at Neendakara fishing harbour, Quilon, South Kerala

Fig. 3.23 Trawl fabrication at Quilon, South Kerala
3.4 Conclusion

The trawl fisheries in Quilon area has expanded over the years. With increase in fishing intensity and diminishing landings from the coastal zone, there has been a shift towards larger and higher powered trawlers with increased fishing range and multi-day fishing. There has been a shift towards steel as the preferred boat building material due to scarcity of good quality wood and its high cost. Most trawlers based at Quilon were engaged in multi-day fishing targeting fish, squids and cuttlefish in addition to shrimps. In view of this multi-species nature of operations, different designs of trawl nets were kept onboard. The large vessels carry between 12 and 15 nets and small vessels carry up to 8 nets, during fishing trips. Ten different designs of trawl nets were observed to be in use in the study area. Among these, five were shrimp trawls, three were fish trawls, one was cephalopod trawl and one was gastropod trawl.

Discard rate by trawlers based at Quilon ranged between 20 and 70% and consisted of 50% of juveniles and sub adults. Bycatch included finfishes such as sciaenids, Lagocephalus sp., Cynoglossus spp., Muraenosox sp., Conger sp., Platyccephalus sp., carangids, cardinal fishes, damsels, leather jackets, sardines, threadfin breams and lizard fishes, Molluscan species such as Anadara granosa, Babylonia spp., Turritella spp., Xancus pyrum and crustaceans such as Charybdis cruciata, Charybdis feriatus, Charybdis natator, Portunus sanguinolentus, Portunus pelagicus, Calappa lophos Porphyra sp., stomatopods and echinoderms. The use of Bycatch Reduction Devices was not found to be prevalent in trawl fisheries of southern Kerala.