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Design and General Characteristics of Marine Gill Nets of Kerala

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Gill nets are the most commonly used gear depended upon by the maximum fishermen in all the districts of Kerala. Results of a study on the marine gill nets of Kerala undertaken during May 1999 to June 2000 are reported in this communication. Nets of different mesh sizes ranging from 14 to 250 mm targeted at different groups of fishes are prevalent along the coast. The nets are classified into different groups and the technical specifications of each type are detailed. Polyamide (PA) monofilament has almost completely replaced PA multifilament in all the nets except those targeted for anchovy, white sardine and seer. Fishermen often use nets of different mesh sizes, connected end to end, in a fleet of net landing all size groups of fishes.

Key words: Kerala, gill nets, trammel nets, polyamide monofilament.

In the traditional fishing sector of Kerala, there exists a medium size sector based on motorized and small non-motorized canoes. This sector, operating gill nets, minitrawl and hook and line provide seasonal employment to the fishermen when the ring seine is not in operation. Of these gears, gill nets play an important role. Of the 55 712 artisanal gears operated in the state, 65.6% are gill nets (Anon, 1999). Even though these nets contribute only 9.2% of the total marine fish landings of the state (Yohannan *et al.*, 1999) it is depended upon by 45.74% of the sea going fishermen of the state (Anon, 1996).

Hornell (1938) in his account on the fishing methods of Malabar coast, described two typical gill nets of the area used for mackerel and sardine. Anon (1951) & Nayar (1958) reported different nets and their mode of operation. Satyanarayana & Sadanandan (1962) suggested a classification for gill nets based on mode of operation. Since then, many changes have taken place in gill nets with respect to material used, net dimension, mesh sizes and mode of operation (Vijayan *et al.*, 1993). The present day gill nets are mostly resource specific and hence require reclassification. Therefore, an attempt is made to classify the gill nets based on mesh size and target species. The results of a study made with the objectives of documenting the design and technical specifications of the gill nets of Kerala are communicated here.

Materials and Methods

A study on the marine gill nets of Kerala was undertaken during May 1999 to June 2000 to study the design and technical characteristics of gill nets operated. Sixteen fishing centers along the entire coast of Kerala where gill net fishing is actively done were selected for the study. The selection of centres was as per Anon 1981, 1996 and 1999. The data pertaining to the technical specifications, design details and operation of important gill nets, the craft used, depth of operation and other relevant details were recorded following Miyamoto (1962). Representative sample from each category of gill nets from important fishing centres viz., Marianad, Iravipuram, Moothakkara, Vadi, Chettikadu, Arthinkal, Chellanam, Manassery Cochin Fisheries harbour, Puthuvype, Thalikulam, Chavakkad, Vellayil, Chaliyam, Puthiappa, Dharmadam, New Mahe, Mapla bay and Neeleswaram were examined. The design of the gear was documented following Nedelec (1975).

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Results and Discussion

A variety of nets of different mesh sizes starting from 14 to 250 mm were found to be in operation. The design and technical details of each category of gill nets are given in Table 1 and that of trammel nets in Table 2.

The nets were divided into single-walled and multi-walled, based on construction of nets. Based on mesh size, the single walled gill nets were broadly classified into two groups namely small mesh and large mesh gill nets (Fig.1). Nets with stretched mesh size less than 70 mm were grouped under 'small mesh' and those with mesh size above 70 mm under 'large mesh'. Subsequent classification into drift and set nets was made based on the mode of operation. Further, the nets were classified based on the target fish. In multi-walled nets, only trammel nets were in operation. The study showed that most of the nets were of the drifting type except

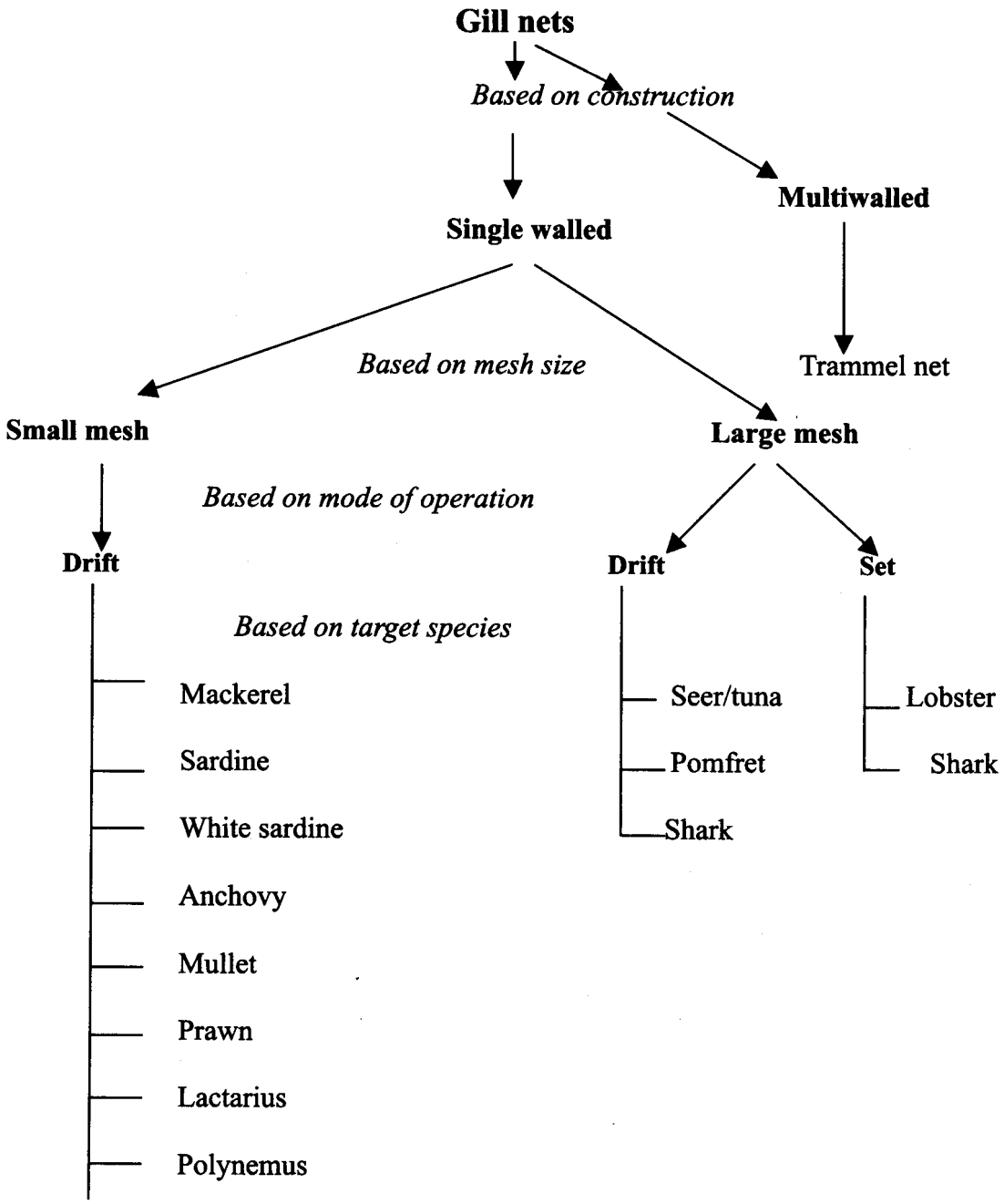


Fig. 1. Classification of gill nets

lobster and shark nets. Shark nets were operated as both drift nets and set nets in different centres. The encircling type of nets were almost absent probably due to the widespread use of efficient nets like ring seines for shoaling fishes. Luther *et al.*, (1997) grouped gill nets of India into small mesh and large mesh keeping 45 mm as the cut off mesh size. In the present study it was observed that most of the fishes caught in mesh size below 70 mm grew upto a maximum length of 30 cm and hence 70 mm was selected as the cut off mesh size considering the size of the target group.

Table 1. Technical specifications of marine gill nets operated off Kerala

Net	Shark	Pomfret	Seer	Lobster	Sardine	Mackerel	Mullet	Anchovy	White sardine	Prawn	Lactarius	Polynemus
Local name	*Sravu vala*	*Avoli vala*	*Ozhukku vala*	*Ral vala*	*Chala vala*	*Aila vala*	*Malan vala*	*Natholi vala*	*Veloori vala*	*Chemmeen vala*	*Parava vala*	*Vazhmeen vala*
Main webb. mesh size (mm)	130 (90-250)	100	100 (90-140)	90	38 (30-40)	52 (38-52)	30 (30-36)	14	16 (16-26)	36 (34-52)	35	65
Twine type	PA multi	PA mono	PA multi	PA mono	PA mono.	PA mono.	PA mono.	PA multi.	PA multi.	PA mono.	PA mult.	PA mono.
Twine spec./ dia (mm)	210x12x3	0.2	210x6x3	0.32	0.16	0.2	0.16	210x1x2	210x1x2	0.16	210x1x2	0.2
Meshes in depth (no.)	85	100	110	70	100	200	100	600	200	100	200	100
Hang.coeff. (E1)	0.49	0.53	0.53	0.63	0.57	0.62	0.56	0.56	0.63	0.53	0.71	0.54
Meshes (no.)/ unit	3948	3000	1000	2100	7380	5000	3829	11400	5333	2897	4560	1800
Hung length (m)	254	160	53	120	160	160	64	90	53	55	114	63
Hung depth (m)	9.6	8.5	9.2	4.87	3.1	8.2	2.5	6.9	2.5	3.0	4.9	5.5
Selvedge twine	PE*	PA	PE	PA	PA	PA	PA	PA	PE	PA	PA	PA
Selv.twine (spec)/dia (mm)	2	210x2x3	2	210x2x3	210x2x3	210x2x3	210x2x3	210x3x3	2	210x2x3	210x3x3	210x2x3
Selv.mesh size (mm)	150	100	100	100	60	60	60	50	60	70	57	65
Selv. meshes (no.)	1	2	1	3	2	3	2	5	4	1.5	3	1
Selv. hung depth (m)	0.13 (upper only)	0.33	0.08 (upper only)	0.46	0.2	0.28	0.19	0.41	0.37	0.17	0.23	0.11
Total hung depth (m)	9.73	8.83	9.28	5.33	3.3	8.48	2.69	7.31	2.87	3.17	5.13	5.61
Head rope	PP	PP	PP	PP	PE	pp	PP	PE	PP	PP	PP	PP
Head rope (mm)	6	4	4	4	4	4	4	3	4	4	4	3
Float type	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC
Floatsize (mm)	100x20	100x20	100x20	100x20	50x20	60x20	60x20	40x20	55x18	60x20	45x18	60x20
Floats/unit	94	33.33	22	15	123	100	54.7	75	66.66	42.6	60	40
Foot rope type	nil	PP	nil	PP	PE	pp	PP	PE	PP	PP	PP	PP
Foot rope (dia)	nil	3	nil	4	4	4	4	3	3	3	4	3
Sinker type	Granite	Concrete	Granite	Granite	Granite	concrete	Lead	Granite	Clay	Lead	Granite	Granite
Sinker wt (g)	50	250	750	150	150	250	26	150	100	26	150	150
Sinkers/unit	94	33.33	2 / fleet	218	50	50	27	37	8	85.2	30	20
Total fleet length (m)	800-1280	640	800-2400	360	480	800-1040	320-800	360	420	480-640	600	480
Depth of operation (m)	19-300	10-32	19-300	40-64	6-8	32-40	10-16	4-8	6-8	3-11	64	6-16
Craft	Ply wood canoe/ Mech wood boat	Ply wood canoe	Ply wood canoe/ Mech wood boat	Kattamaram	Dug out canoe	Plank transom	Plank built canoe	Ply wood canoe	Ply wood canoe	Plank built canoe	Ply wood canoe	Plank canoe
Motor-HP**	9.9-25/90	9.9	9.9/90	nil	nil	9.9	nil	9.9	9.9	nil	8	nil

** Horse power * Polyethylene

The small mesh nets comprised nets for anchovy, white sardine (*Kovala koval*), sardine, mackerel, *Lactarius* (white fish), prawn, mullet and *Polynemus* (thread fish). The large mesh nets include nets for seer and tuna, shark, pomfret and lobster. The length of small mesh nets range from 300 to 1000 m while large mesh nets have a length ranging from 1500 m to 2500 m. Very rarely nets of length above 2500 m viz., upto 2800 m were found operated by mechanized gill-netters. Nets of more than 2.5 km length or those operated outside EEZ are considered as 'large scale drift net fisheries (Northridge, 1991). Therefore, the gill net fishery of Kerala can be considered as coming under the category of 'small scale drift net fisheries'.

Mackerel gill nets are widely used all along Kerala coast. In all the centres, this net was in operation as drifting type either from motorised or non-motorised vessels. Design of a typical mackerel gill net operated in Chellanam area of Ernakulam coast is given in Fig.2. The nets are popularly known as *'aila vala'* in most districts and are similar in design while the *'echavala'* prevalent at Kollam and Thiruvananthapuram coasts targeted for mackerel and small tuna had a slightly different design. The nets are mostly made of polyamide monofilament of diameter 0.16, 0.20 and 0.23 mm while a few fishermen in Kollam and Thiruvananthapuram coasts, use PA 210dx1x2 (Rtex 51) and 210dx1x3 (Rtex 76) also. Mesh

Table 2. Technical specifications of trammel nets operated off Kerala

Parameters			Specifications
Main webbing	Inner layer	Mesh size (mm)	45
		Material type & spec.	PA* 210x1x2
		Meshes in depth (no.)	100
		Hang.coeff. (E1)	0.42
		Meshes (no.)/unit	8465
	Outer layer	Mesh size (mm)	260
		Material type & spec.	PA 210x3x3
		Meshes in depth (no.)	12
		Hang.coeff. (E1)	0.71
		Meshes (no.)/unit	867
	Selvedge	Material type & spec.	PA 210x2x3
		Mesh size (mm)	45
		Meshes (no.)	3
Ropes	Head rope: type and Diameter (mm)		PP** 3
	Foot rope type and Diameter (mm)		PP 3
Floats & sinkers	Float type		PVC***
	Floatsize (mm)		55x20
	Floats/unit		432
	Sinker type		lead
	Sinker wt (g)		23
	Sinkers/unit		390
	Hung length/unit (m)		160
	Total fleet length (m)		640-800
	Total hung depth (m)		3.42
	Depth of operation (m)		16-21
	Target species		Prawn, flat fishes
	Craft		Ply wood canoe & kattamaram
	Motor-Horse Power		9.9

* Polyamide **Polypropylene *** Poly Vinyl Chloride

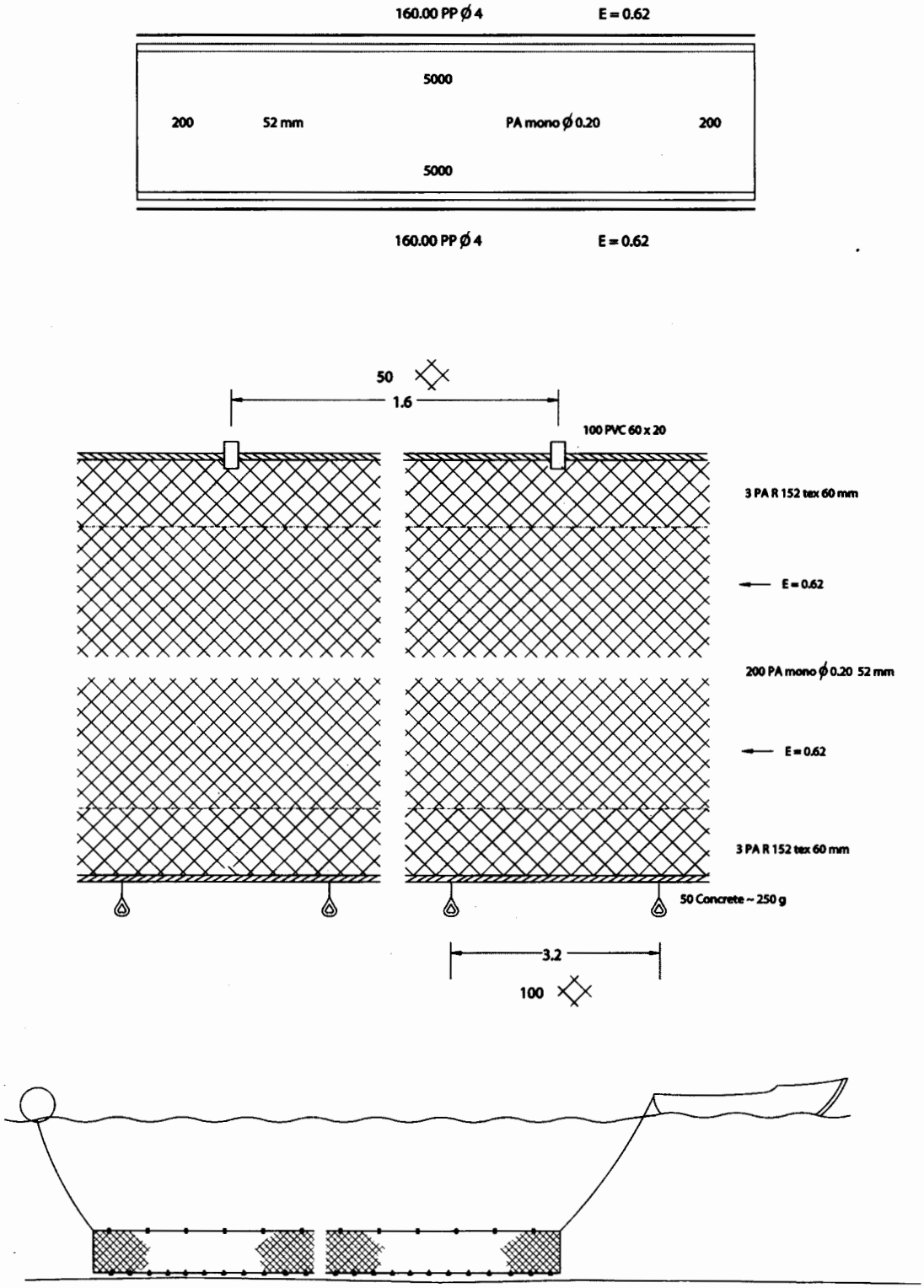


Fig. 2. Design of mackerel gill net from *Chellanam*, Ernakulam

sizes ranged between 40 and 60 mm but 50 to 54 mm were common. The 40 mm was targeted for small sized mackerel in the inshore waters and the 58 to 60 mm for small tuna also. The hanging coefficient of the net ranged between 0.43 and 0.64. The *'echa vala'* of Kollam and Thiruvananthapuram meant for catching fish by entangling had hanging coefficient ranging between 0.43 to 0.44. The hung depth of the net ranged between 4.0 and 12.8 m; those operated from non-motorised vessels had hung depth

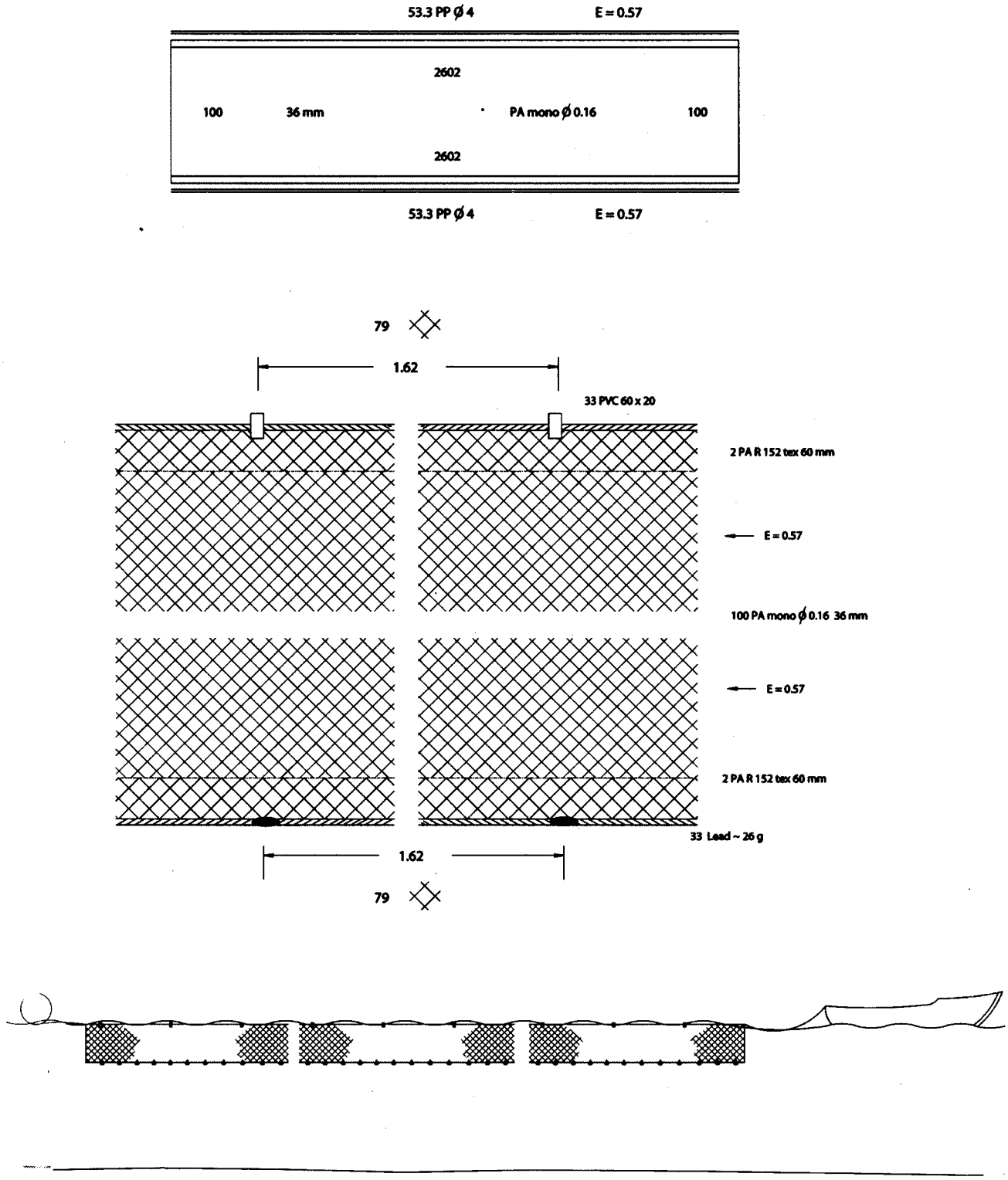


Fig. 3. Design of sardine gill net from *Beachroad*, Ernakulam

ranging from 4.0 to 5.5 m and those from motorised vessels from 4.1 to 12.8 m. The length of nets taken onboard non-motorised vessel was in the range of 320 to 510 m and on motorised vessel it was 650 to 1040 m. The depth of operation of mackerel gill nets ranged from 4.8 to 64 m. In the motorised sector this was from 16 to 64 m and in the non-motorised sector it was from 4.8 to 11.2 m.

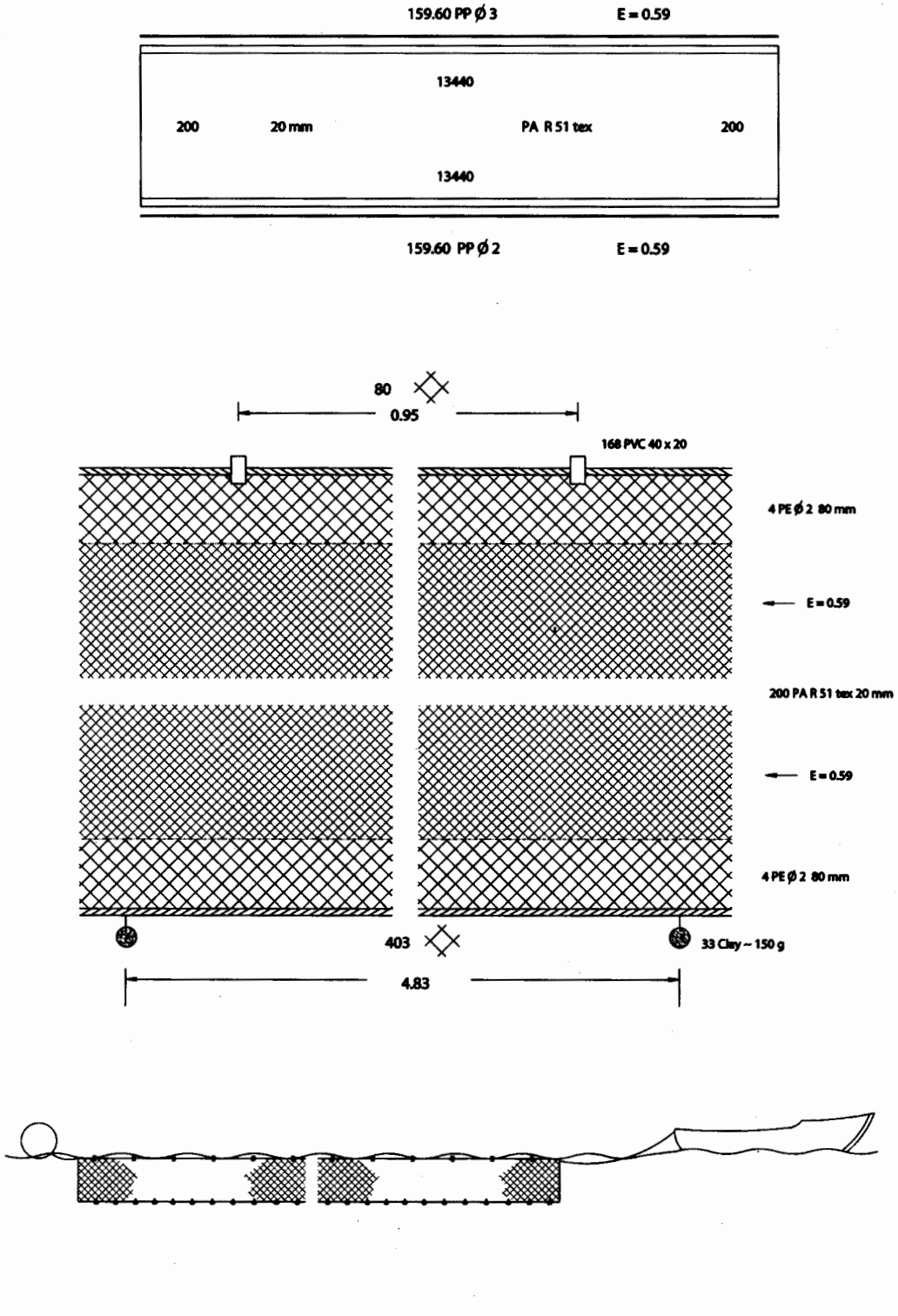


Fig. 4. Design of *veloori* (*Kovala koval*) gill net from *Kannur city*, Kannur

Gill nets for sardine also are distributed through out Kerala coast and are operated both from motorised and non-motorised vessels. This net is usually known as *'chala vala'*. The design of a typical net operated at Beach road, Ernakulam is given in Fig. 3. The nets were exclusively of PA monofilament of diameter 0.16 and 0.20 mm. Mesh size ranged between 30 and 40 mm but mostly between 36 and 40 mm (Table 1). Vijayan *et*

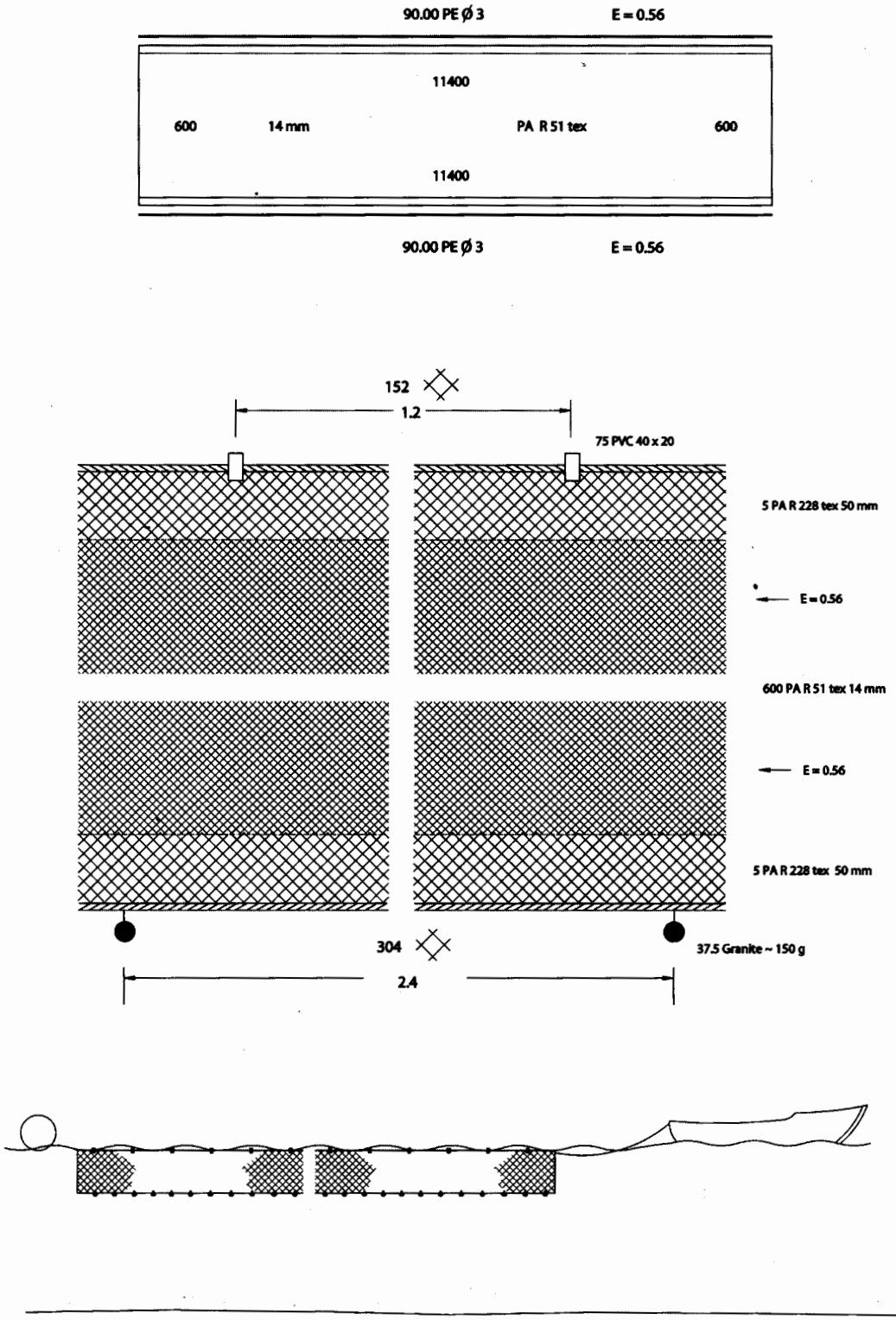


Fig. 5. Design of anchovy gill net from *Marianad*, Thiruvananthapuram

al., (1993) reported 32 to 42 mm mesh sizes from different centres. To facilitate the capture of different species in different size groups, fishermen often used mesh size of 34, 36, and 38 mm in a fleet. The hanging coefficient ranged from 0.53 to 0.70. In general, webbing was rigged in such a way that there was scope for gilling and entangling. Hung depth varied between 3.25 and 7.89 m. (Table 1). Non-motorised units

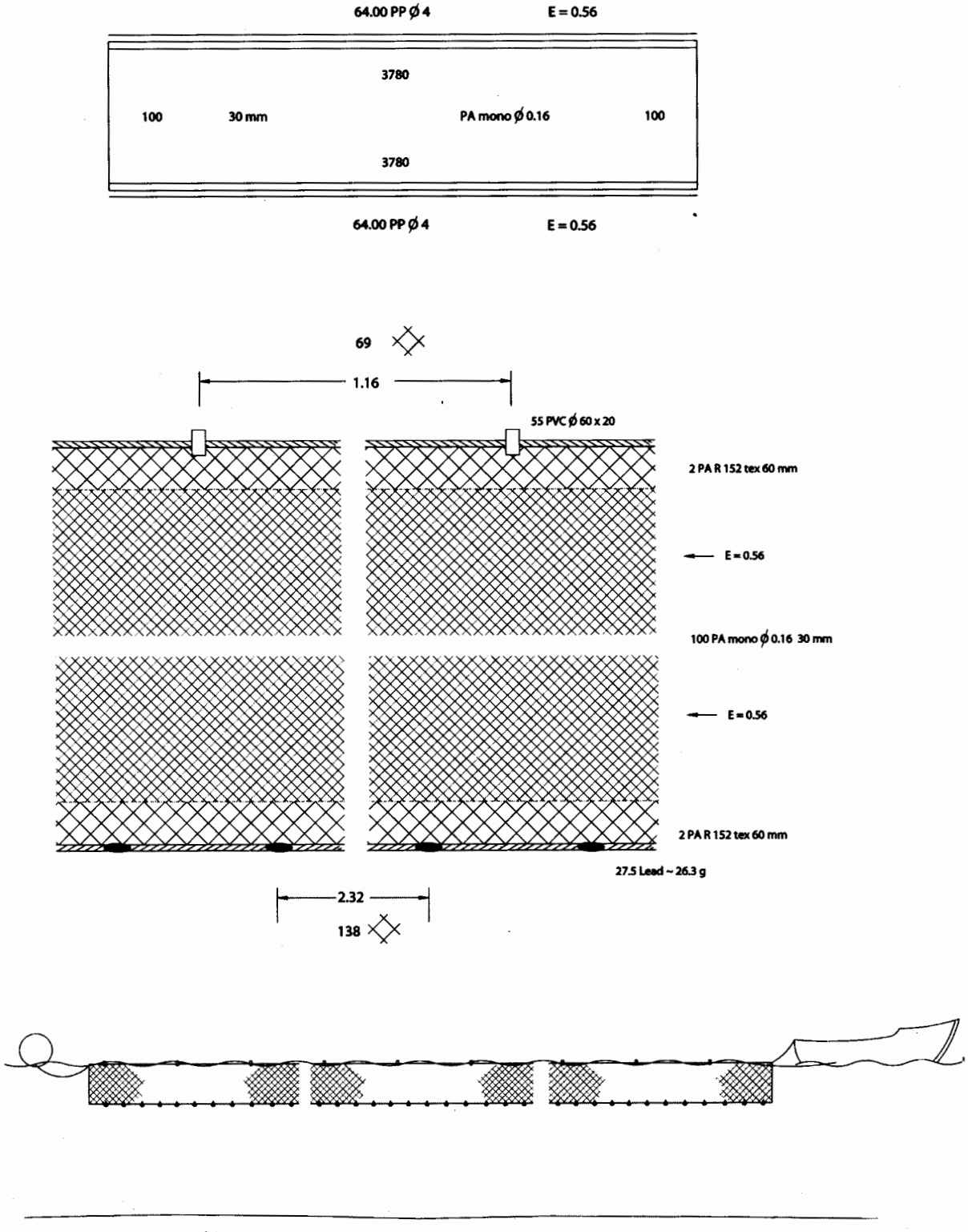
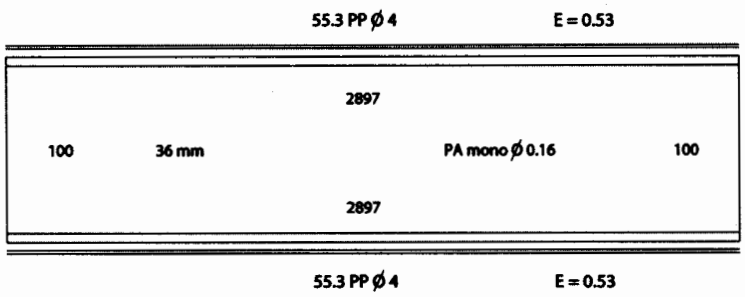
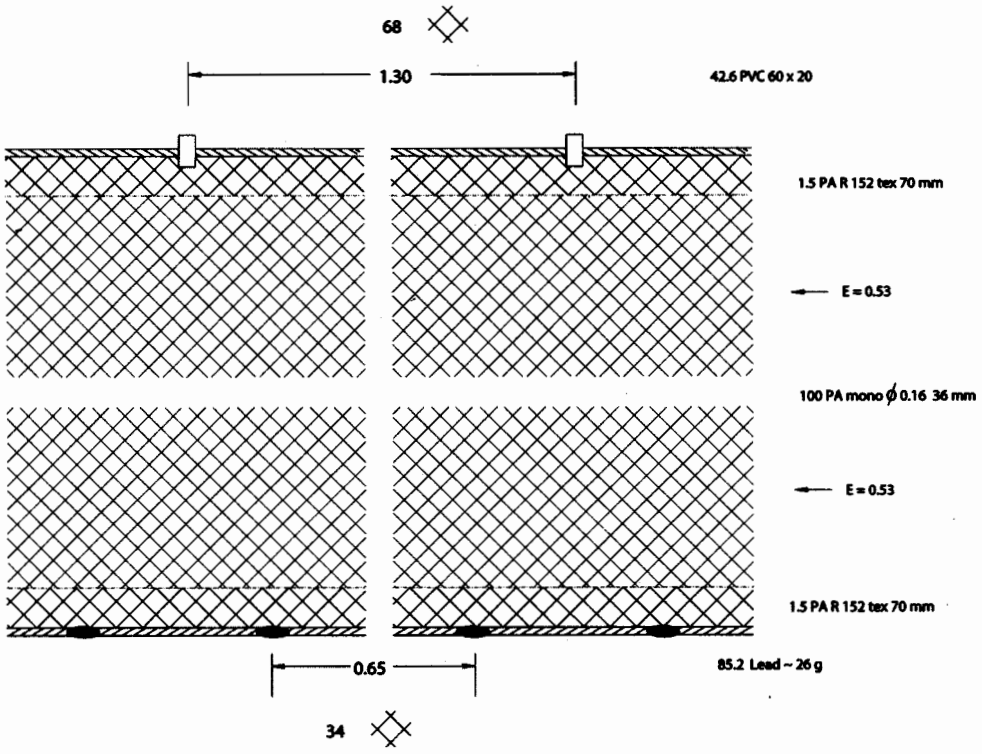


Fig. 6. Design of mullet gill net from *Manassery*, Ernakulam

used nets of depth 3.25 to 5.87 m only whereas in motorised units depth ranged from 3.91 to 7.89 m. The 'total fleet length of the net ranged between 380 and 1000 m in different centres. The difference depended on the type of vessel and method of propulsion. Non-motorised vessels carried nets of total length 380 to 800 m and motorised vessels 480 to 1000 m length. In the case of sardine gill nets, often the





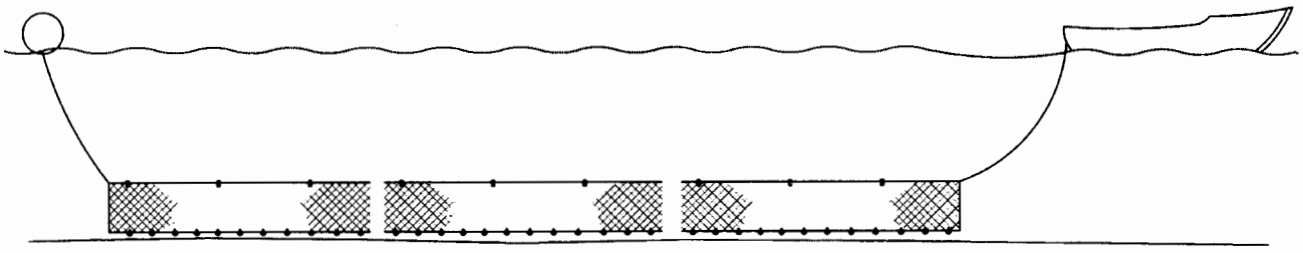
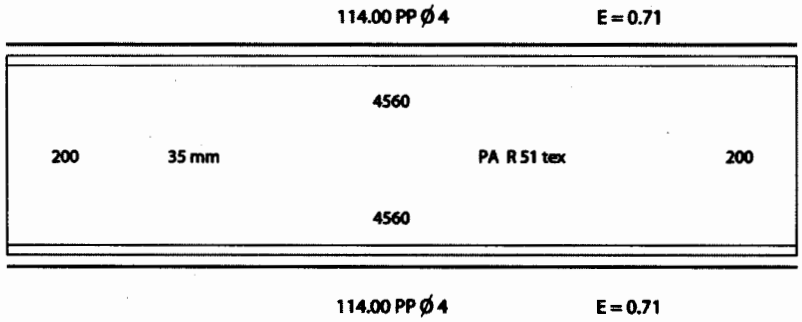


Fig. 7. Design of prawn gill net from *Kannamaly*, Ernakulam

carrying capacity of the vessel was not fully utilized. Depth of operation of non-motorised vessels ranged between 3.2 and 32 m and that of motorised vessels ranged between 16 and 64 m.

Locally known as *'chooda vala'* and *'veloori vala'* the gill nets for white sardine (*Kovala koval*) is concentrated along the northern Kerala coast with mesh sizes ranging from 16 to 26 mm. Design of a typical net



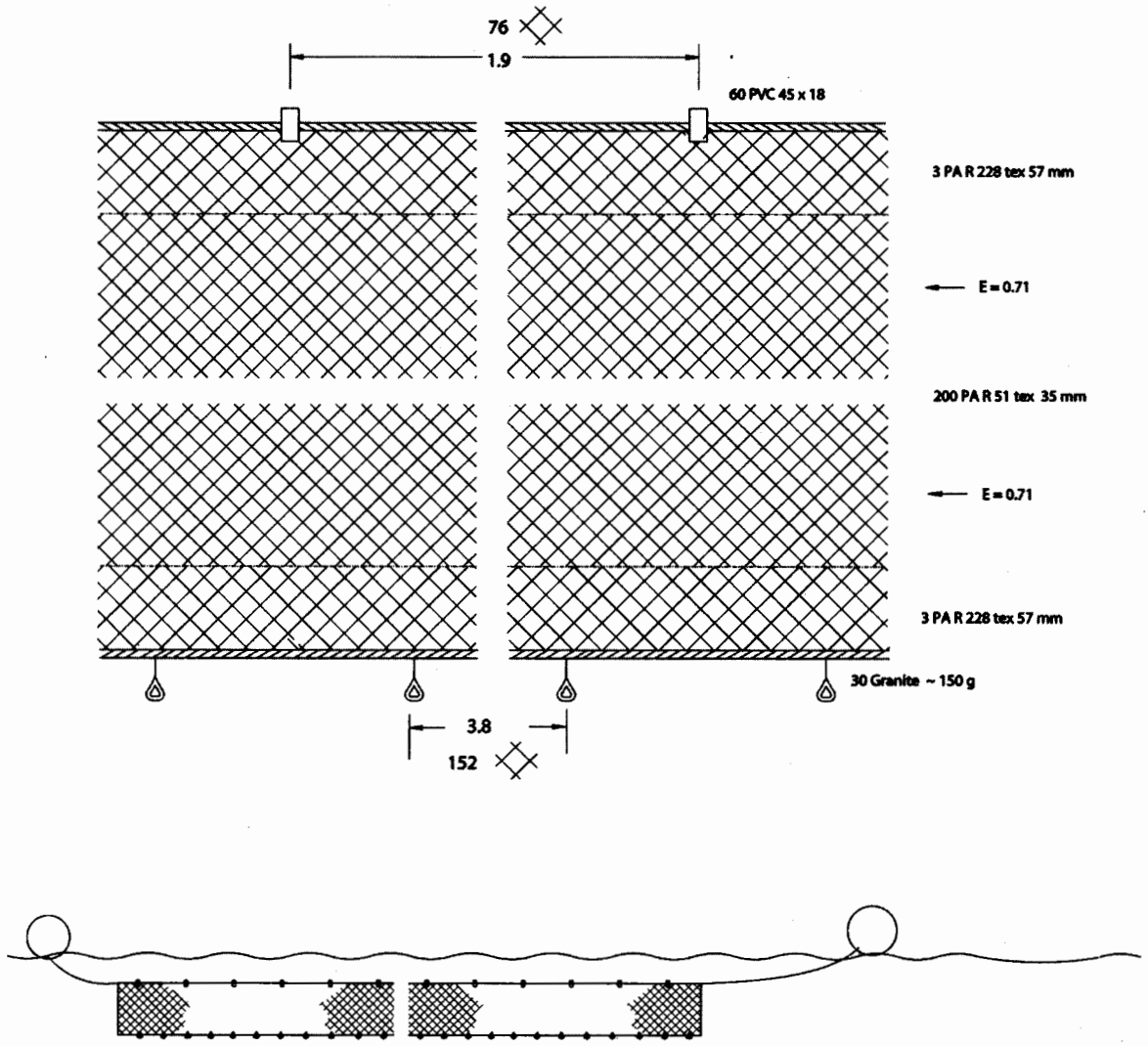


Fig. 8. Design of *parava* (*Lactarius*) gill net from *Iravipuram*, Kollam

in operation at Kannur is depicted in Fig 4. The material used in all the centres is PA 210dx1x2. Mesh sizes in use are 16, 18, 20, 22, 24 and 26 mm but mostly 24 and 26 mm. Hanging coefficient of this net is between 0.58 and 0.63 in different centres. As the species is caught mostly gilled and wedged, the nets are rigged with a hanging coefficient of 0.58 and above for a better mesh opening. Hung depth of the gear operated from motorised vessels varied from 2.87 to 8.20 m and generally nets of 420 to 800 m length are

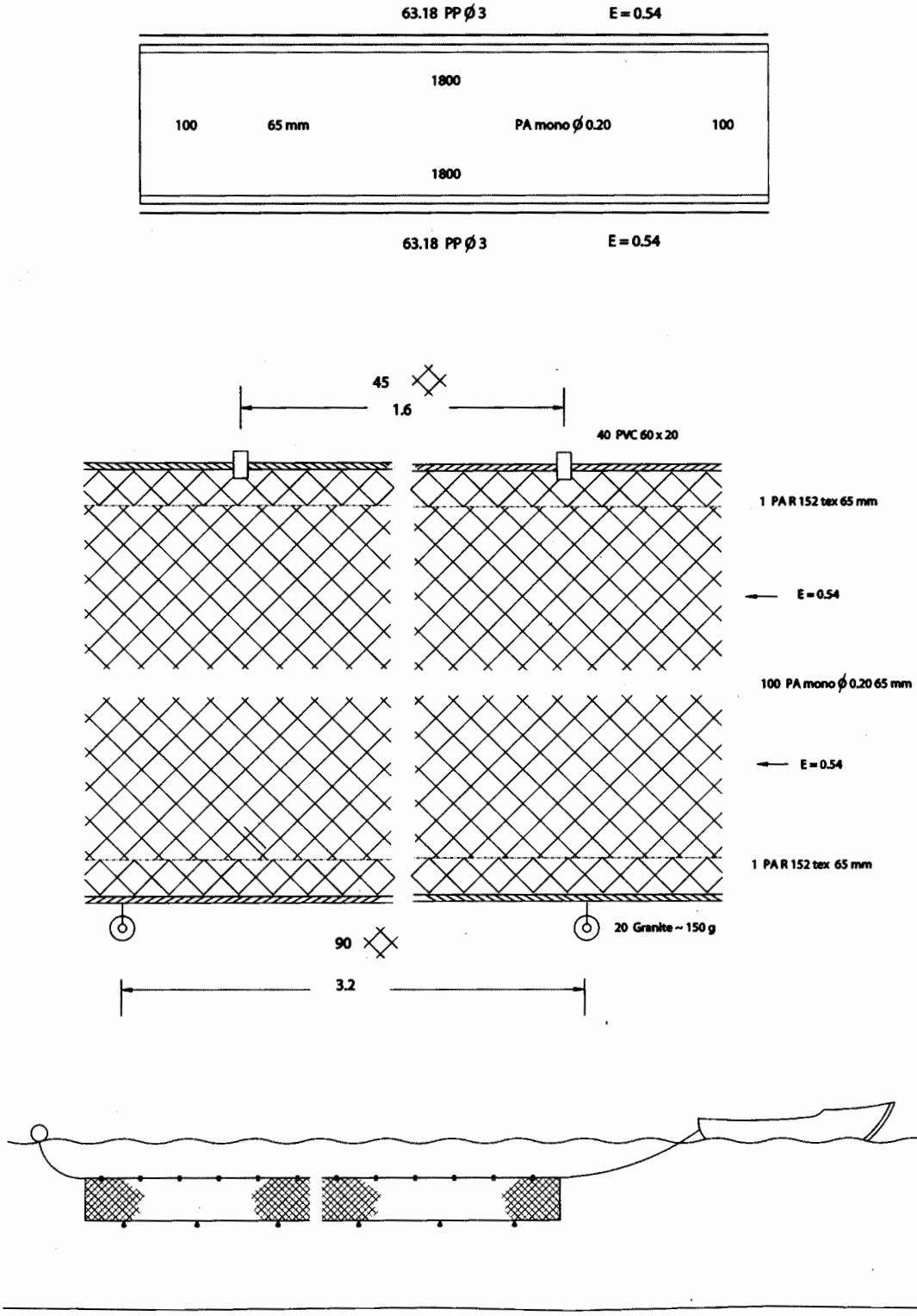


Fig. 9. Design of *vazhmeen* (*Polynemus*) gill net from *Chellanam*, Ernakulam

taken for operation. The depth of operation of the nets ranged between 5 and 10 m.

Locally known as *'natholi vala'*, anchovy gill nets are confined to Kollam and Thiruvananthapuram coasts only. Design details of a typical net operated at Iravipuram, Kollam is depicted in Fig. 5. Net has a mesh size of 14 mm, hanging coefficient of 0.55 to 0.56 and fishing height ranging between 7.29 and 7.39 m. This net is exclusively made of PA 210dx1x2. Fishing season coincided with

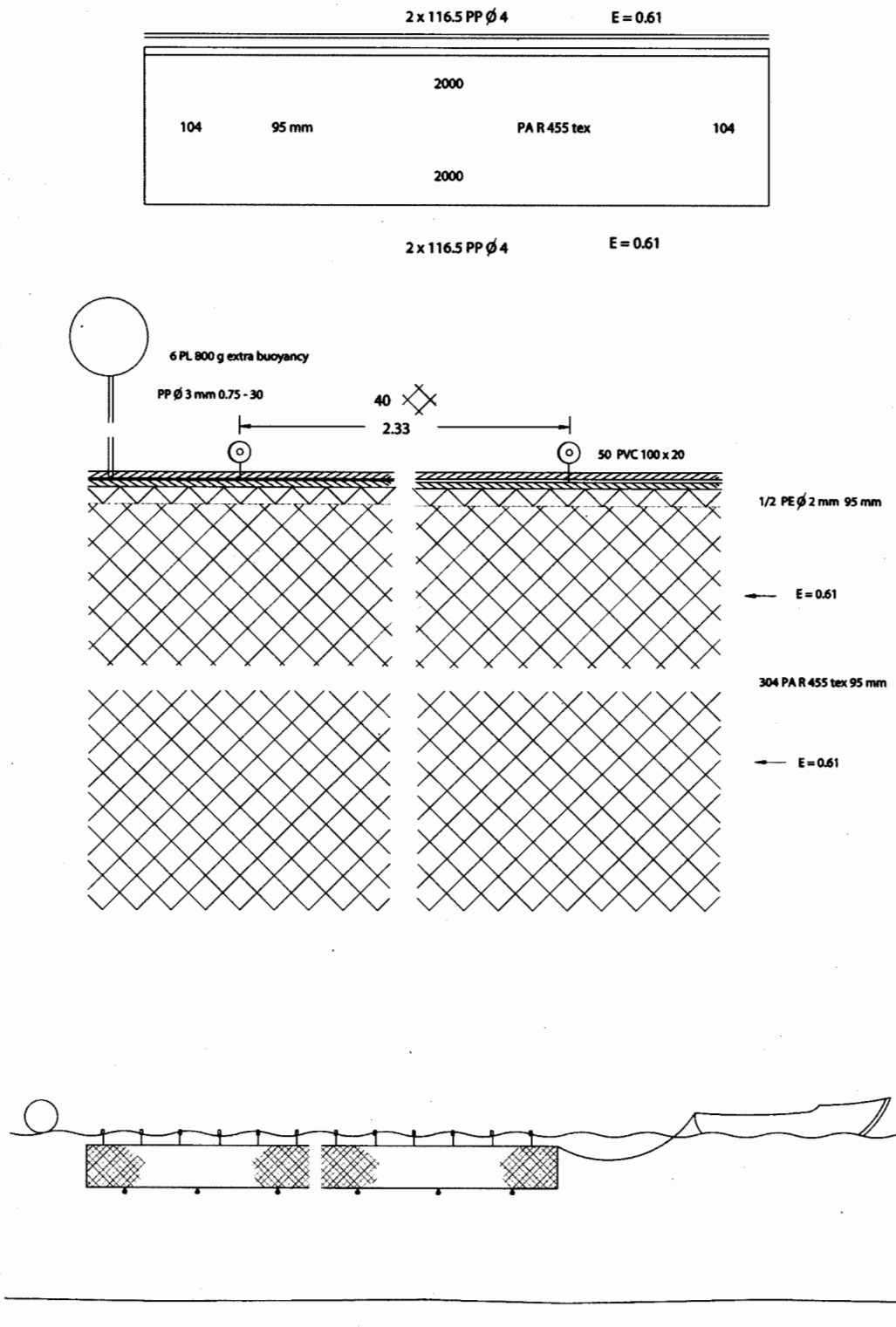
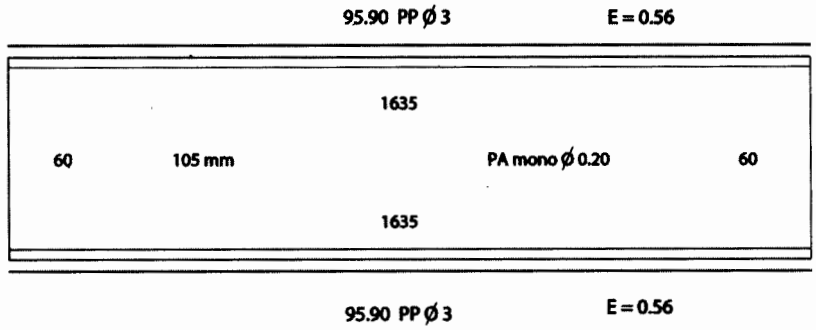


Fig. 10. Design of seer gill net from *Thalikulam*, Thrissur

the start of southwest monsoon in May and continued for five months.

Mullet gill nets, popularly known as '*malan vala*', is a recent addition to the gill net fishing. A typical mullet net is depicted in Fig. 6. PA monofilament of 0.16 mm is the material used. The mesh size varies from 30 to 36 mm and the net is strictly operated as a surface drift net with the float line always touching the surface. The fleet length ranges from 64-300 m. This is operated from non-motorised vessels almost round the year except during monsoon. However, the target



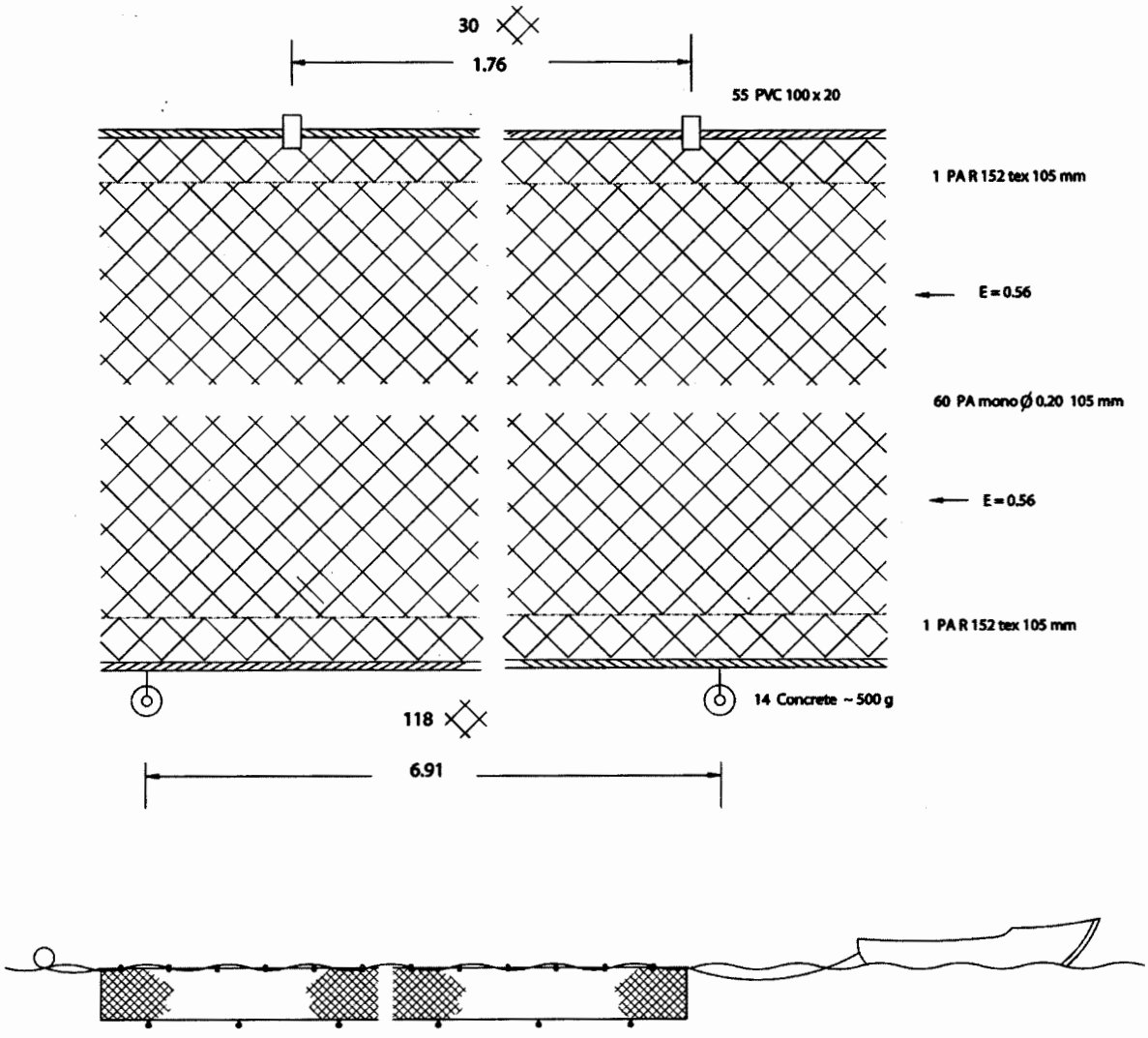


Fig. 11. Design of pomfret gill net from *Chavakkad*, Thrissur

group of fishes is available mainly during August to October.

Gill nets are increasingly used for the exploitation of prawns The design of a typical prawn gill net (*chemmeen vala*) operated at Beach road, Kannamaly, Cochin is depicted in Fig. 7. The material used is exclusively PA monofilament of 0.16 and 0.20 mm diameter. Mesh sizes used are 34, 36, 38, 50 and 52 mm. The hanging coefficient is 0.53. The depth of operation ranges between

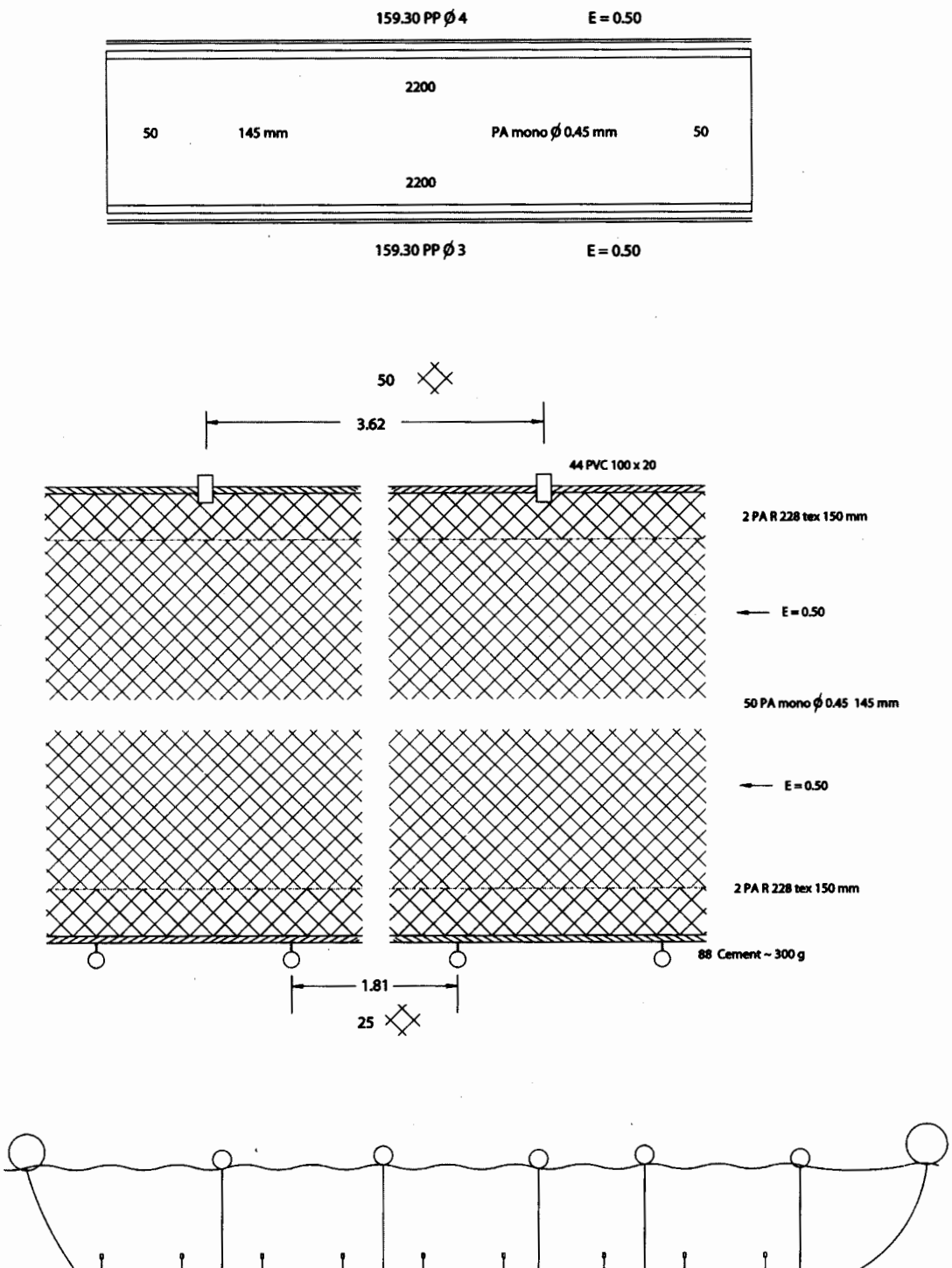


Fig. 12. Design of shark gill net from *Thalikulam*, Thrissur

3.2 and 11.2 m and fleet length varies from 480 to 640 m.

Popularly known as *'parava vala'* and *'edakettu vala'*, this net found to be in operation along Kollam-Thiruvananthapuram coast was targeted at parava (*Lactarius lactarius*). This net has not been reported earlier. The design of a typical net is given in Fig. 8. PA multifilament 210dx1x2 is used and mesh size varied between 33 and 35 mm. The nets were hung with hanging coefficient

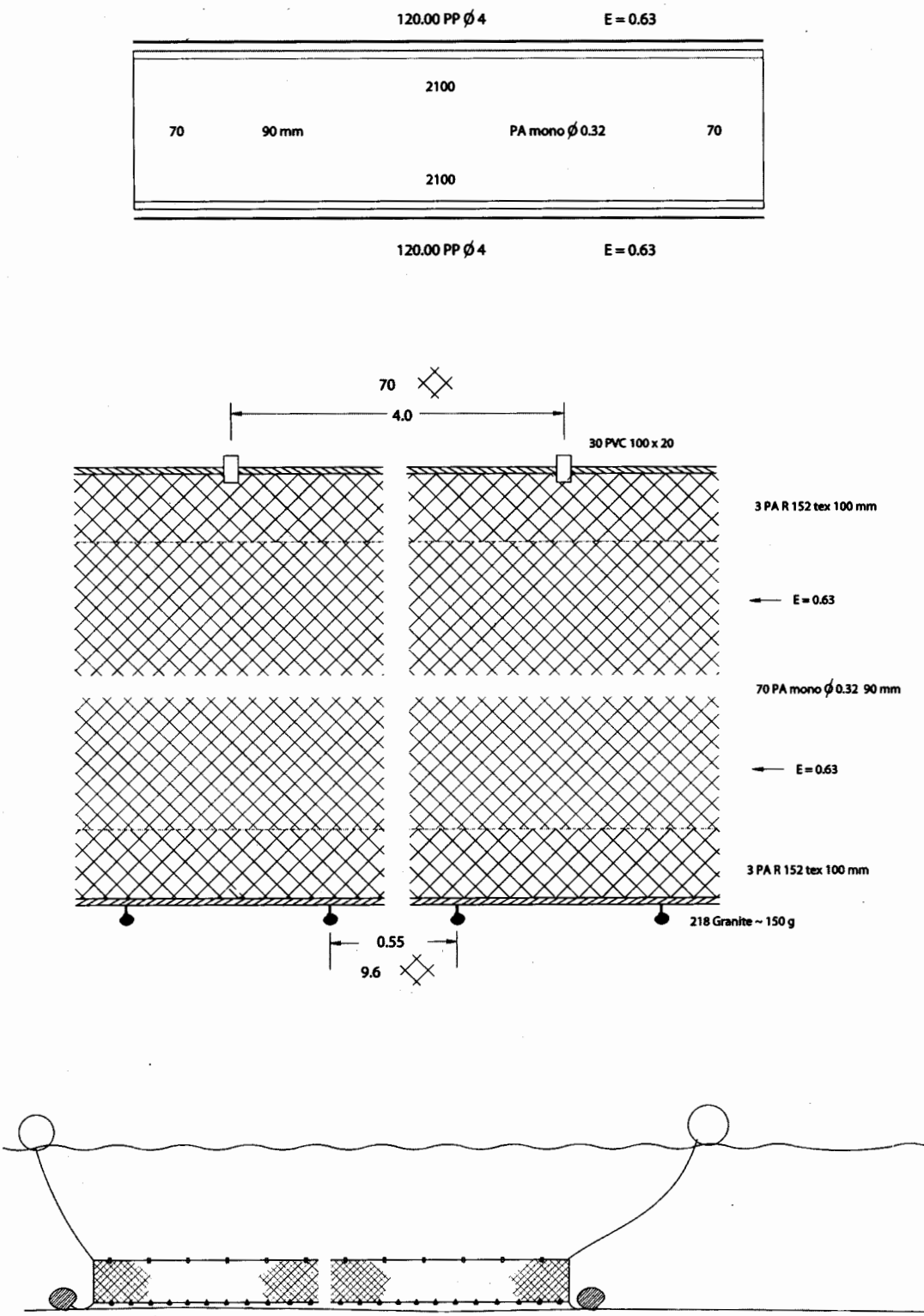


Fig. 13. Design of lobster gill net from *Iravipuram*, Kollam

0.71 for better mesh opening. The operation was carried out from marine plywood boat. The net had a depth of 5.14 m and length upto 600 m.

The fishermen along Cochin coast were extensively using gill nets of mesh size 65 mm for the capture of polynemids. Popularly known as *'vazhmeen vala'*, this net was

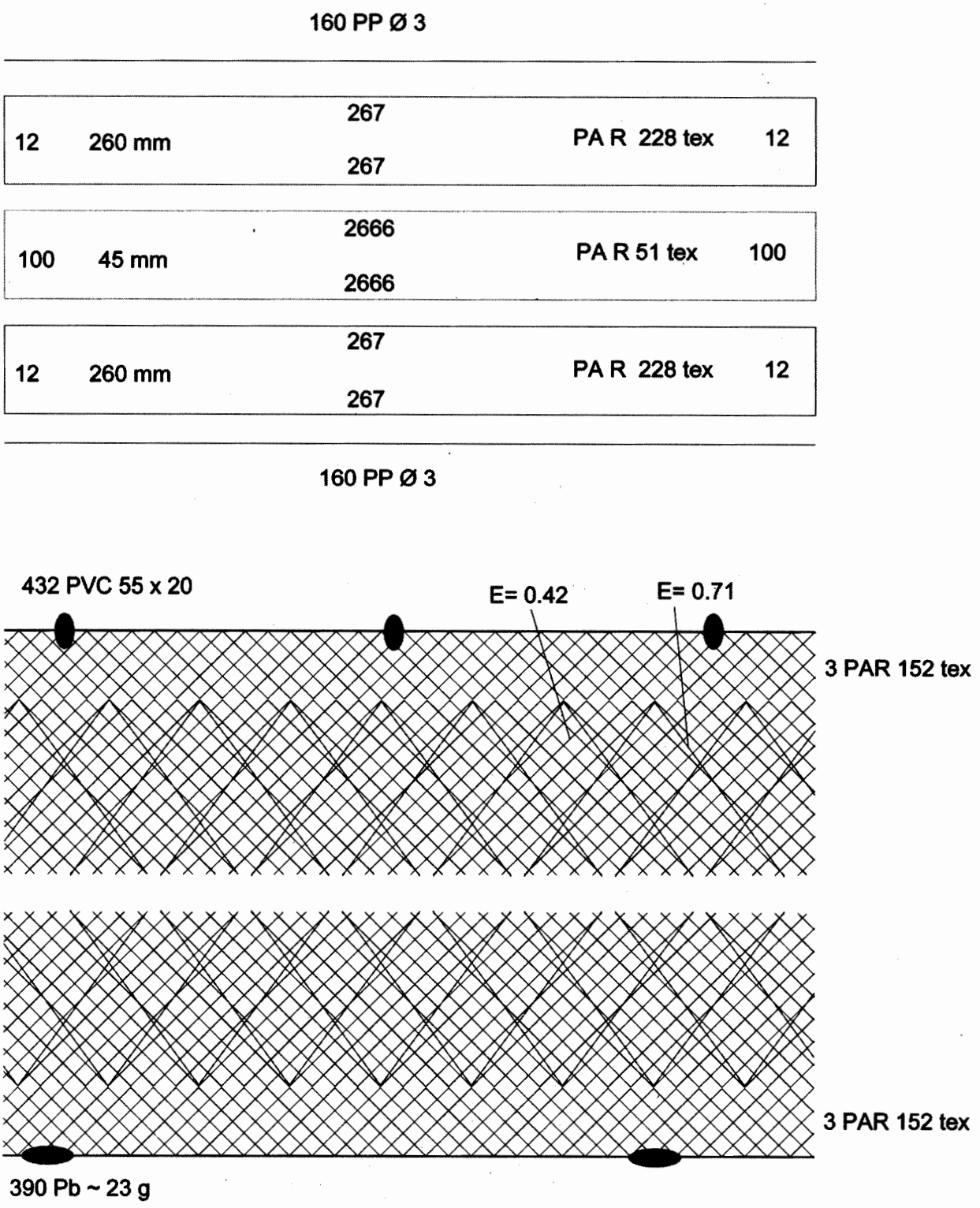


Fig. 14. Design of trammel net from *Moothakkara*, Kollam

operated by traditional fishermen from non-motorised boats. Design of a typical net is given in Fig. 9. The net operated as column drift has a mesh size of 65 mm and the material used is PA monofilament of 0.20 mm diameter rigged at a hanging coefficient of 0.54. It had a depth of 5.57 m and total fleet length of 480 m.

Gill nets for seer and tuna are restricted to certain pockets of the state. These nets are called as *'ozhukkuvala / kanathavala / valayottum*

vala' in different areas. These nets are rigged without sinkers or even footrope. These are operated in column or surface depending on the swimming layer of the fish during different seasons (as surface drift net during June to Sept and column drift during Oct to May). Design of a typical net is given in Fig. 10. The nets are often coloured to camouflage with the background. Brown, green and red are the colours commonly used. Tamarind seed extract was used earlier for dyeing the nets but nowadays-synthetic dyes are used. Throughout the centres PA 210dx6x3 (Rtex 455) was the most common material used. During December – January months when comparatively larger specimens of seer fishes occurred in the fishery, PA 210dx9x3 (Rtex 683) and 210dx12x3 (Rtex 911) were used. The mesh size ranged between 70 and 140 mm, the most common being 90 and 100 mm (Table 1). The hanging coefficient of the gear varied between 0.44 and 0.71 in the different regions. Since the target species are strongly muscled and fast moving fishes, nets with a hanging coefficient of 0.5 and without footrope or sinkers renders effective entangling of the fishes. The net is devoid of footrope or sinkers for effective entangling. The hung depth of the nets ranged from 7.68 to 12.86 m. The fleet length of net ranged between 255 and 2800 m but mostly less than 2500 m. The depth of operation of motorised and mechanised crafts ranged between 16 and 90 m and 19 to more than 300 m respectively.

Gill nets specifically targeted for pomfret were not recorded in Kerala before 1993. Vijayan *et al.*, (1993) reported that gill nets specifically targeted for pomfrets were becoming popular in north Kerala. In the present study pomfret gill nets locally known as *'avoli vala'* were observed in many areas of Kerala especially from north of Alappuzha. Design of a typical pomfret gill net operated at Chavakkad, Thrissur is depicted in Fig. 11. PA monofilament of 0.20 and 0.23 mm diameter was exclusively used as the material for the gear. The mesh size varied from 100 to 118 mm. The hanging coefficient ranged from 0.45 to 0.62 and the depth of operation varied between 6 and 24 m. Panikkar *et al.*, (1978) worked out 126.0 mm as the optimum mesh size for the capture of *Pampus argenteus*. However, the mesh sizes used at present are lower than the optimum.

Gill netting targeted specifically at shark was found only in Thalikulam, Thrissur. In other centres shark gill nets were the same as that of seer gill nets but with thicker PA twine (210dx12x3) and larger mesh size (130 to 140 mm). In Thalikulam a few units of set gill nets of PA monofilament of 0.45 mm dia (Tex 185) with 145 mm mesh size were found in operation for sharks. The design of a typical net is shown in Fig.12. The net having a total length of 320 m is positioned in water by attaching a master float with a flag to the head rope and heavy stones to the footrope on either ends. Every twenty four hours the net is hauled and fishes caught are removed. The net is operated at a depth of 2 to 3 m, very near to the shore. A single man operates the net.

Lobster gill net popularly known, as *'ral vala'* is a set gill net and is found in Kollam district only. Design of a typical gill net is given in Fig. 13. The net is made of PA monofilament of 0.32 mm diameter having a mesh size of 90 mm and hanging coefficient 0.63. Fishermen are of the opinion that even though monofilament is more efficient than multifilament, since the grounds are rocky and the operation is bottom set, the chances of net getting damaged and lost are very high. The net is positioned by attaching a master float to the head rope and a master sinker to the footrope. Nets of around 360 m length are operated at a depth up to 64 m. Operation is carried out throughout the year.

Trammel nets known as *disco valai* that were introduced into the state during mid eighties (Joel & Ebenezer, 1985) are popular only in Thiruvananthapuram and Kollam while a few units are available in Puthuvype of Ernakulam. These are operated specially for prawns during the July-August period. Both motorised and non motorised units operate these nets. The net has a middle layer (lent) of PA 210x1x2 of 40-45 mm mesh size with a hanging coefficient of 0.42-0.49

and two outer layers of thicker material viz., 210x3x3, mesh size 250-260 mm and hanging coefficient of 0.60-0.71. Fig.14 gives the typical design of a trammel net operated at Moothakkara region of Kollam. The design of nets operated in other centres also follows almost the same pattern except for slight variation in hanging coefficient. At Iravipuram, Kollam the hanging coefficient of the inner and outer layers of the net are 0.41 and 0.62, at cochin 0.41 and 0.58 and at Marianad, Thiruvananthapuram it is 0.42 and 0.68 respectively. A few units operated in the Ernakulam district have the inner layer made of PA monofilament of 0.16 mm diameter. Apart from prawns, these nets are operated for the capture of soles also. Operation of trammel nets for prawns also shows the use of resource specific gear. The indication of switching over to specific gear for desired species is a healthy sign as operation of specific gear over space and time would ensure capture of only targeted species and avoid capture of juveniles and unwanted species.

The material has almost completely been changed to PA monofilament and only a few types are made of multifilament. Except nets for anchovy, white sardine, seer and tuna, all are made of nylon monofilament of diameter 0.16, 0.20, 0.23 and 0.32 mm. These nets are generally termed as *'vysali vala/tangese vala'*. The present study indicated almost complete phasing out of PA multifilament by monofilament in the small mesh sector. However, the nets for large pelagics are still made of PA multifilament while in other states high density polyethylene (HDPE) and PA monofilament are extensively used (Pillai, 1989; Pillai *et al.*, 1989; Pravin & Remesan, 2000 and Ramarao *et al.*, 2002). Thomas & Hridayanathan (2002) reported the suitability of HDPE for seer and tuna nets in Kerala.

The practice of operating multimesh gill nets viz., use of 4 to 5 mesh sizes simultaneously in a fleet of net is to be discouraged as it results in the landings of fishes of varying sizes including juveniles. Luther *et al.*, (1994) reported juveniles of lesser sardines in nets of 25-28 mm mesh sizes. Thomas & Hridayanathan (2003) in a study using mesh sizes of 30 to 50 mm reported juveniles of different species of fishes caught in nets of less than 34 mm mesh size. Thus in spite of the known selectivity of gill nets, when operated like this, the gear becomes unselective. Hence, by proper selection of mesh size, hanging ratio and fishing height and the use of mesh sizes in succession as per the availability of the resource may render gill netting a more ecofriendly fishing method. Besides, use of HDPE in large mesh nets for seer and tuna would make it a more cost effective fishing method.

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