

'CHALA VALA' ENCIRCLING GILL NETS FOR SARDINES AND MACKERELS OF THE KERALA COAST WITH SPECIAL REFERENCE TO THEIR DESIGN AND CONSTRUCTION

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INTRODUCTION

PERHAPS the most widely used fishing implement in the country for the capture of pelagic and column fishes are the gill nets. The nets in vogue are designed with the apparent idea to suit the different local fisheries. Bal and Banerji (1951) estimate that 1,82,169 units of gill nets are in use in marine fishing, of which 9,587 units are on the West coast—a zone extending from Cape Comorin to Mangalore. Hornell (1937) in his account on the fishing methods of the Malabar coast includes the descriptions of two varieties of *Chala vala*, typical gill nets of the area, used for *Aila* (Mackerel) and *Mathi* (Sardine). A general description of the nets and mode of their operation are also briefly mentioned in the Agricultural Marketing Series (Anon, 1951) and by Nayar (1958). In all these accounts, the essential technological features pertaining to the design and construction are lacking. In view of the importance of these aspects for determining the relative efficiency of the gear, a survey of the indigenous gill nets of the Kerala coast, with particular reference to *Chala vala* was undertaken and the results of the survey are incorporated in the present communication.

MATERIAL AND METHOD

The fishing centres included in the survey are Chellanam, Southikkal, Jarakkal and Azhikode. Two varieties of *Chala vala* are in operation, namely *Mathi Chala vala* for Sardines and *Aila Chala vala* for Mackerels. The technological data collected were specifications and material used for webbing, details of ropes attached to the net fabric, buoyant material on the head rope and type of sinkers on the foot rope. Constructional details including lacing and joining of different parts of webbing, method of rigging the ropes to the net and distribution of floats and sinkers on the respective ropes were gathered. The ratio of take up and consequent spread of net were estimated. The breaking strength of twine used for the webbing was

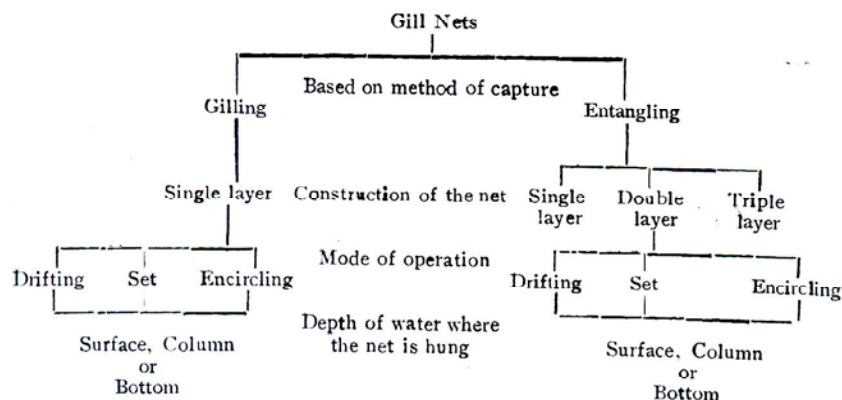
determined. The buoyancy of the wooden floats and the buoyancy and weight per unit length of rope and per unit area of webbing were also calculated.

CLASSIFICATION OF THE GEAR

Charernphol (1951) in his description of indigenous fishing gear of Thailand, groups gill nets as moving and stationary nets. According to Miyamoto (1956), gill nets can be broadly classified into two depending on the way the fishes are caught namely gilling and entangling, having one and one to three layers respectively. These are further grouped based on the method of construction, method of operation and the depth of water. Davis (1958) followed the same principle adopted by Charernphol (*op. cit.*) and divides the gill nets principally into two sections: fixed instruments, including fixed gill nets, tangle and trammels and movable instruments or the drift nets. von Brandt (1959) classifies both gill nets and tangle nets into two main types on the basis of structure and design of the nets. The two classes according to him are (i) single-walled nets and (ii) multi-walled or trammel nets. Since the above indicated classifications do not apparently cover all the different types of gill nets, the present authors, based on the survey, suggest a more comprehensive classification (Table I) for the gill nets.

TABLE I

Suggested classification of gill nets



According to the classification suggested by the authors, *Chala vala* is a surface, encircling single layer, gilling net.

DESIGN AND SPECIFICATIONS

A typical *Chala vala* used for sardines at Narakkal fishing centre is described below in detail:

The net when stretched out is rectangular in shape and composes of a net fabric or webbing, with a headline with floats and a ground rope with sinkers (Fig. 1) along the horizontal extremities. The webbing can be

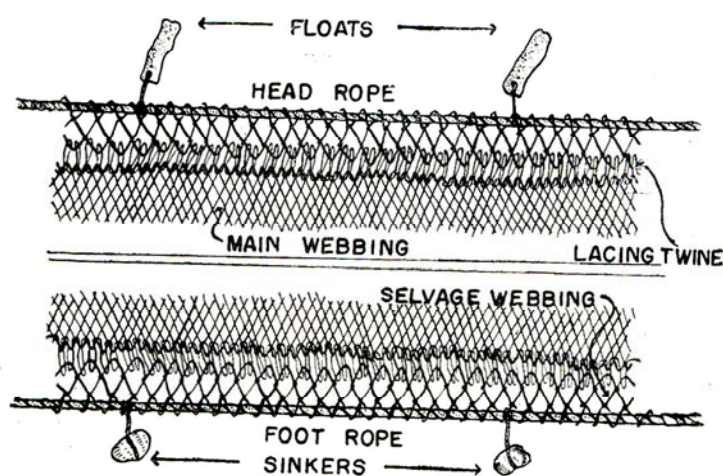


FIG. 1. A typical encircling gill net.

divided into a main webbing (*Kashanam*) of thin twine and selvage webbings (*Changali*) of slightly thicker twine. Ropes (*Peram*) attached to the net are the head and the foot ropes. These extend on both sides to some length sufficient for joining two pieces of nets.

The main webbing of each net consists of 6 horizontal pieces: locally termed *Mal*. The dimensions are 800 meshes in length and 40 meshes in depth. The mesh is uniform throughout and is 1.90 cm. (0.75") bar. The selvage webbing attached to each side of the main webbing is 400 meshes long and 1½ meshes deep, the mesh size being 2.54 cm. (1.0") bar. The different pieces of webbing in the *Chala vala* are arranged as illustrated in the diagram (Fig. 2).

Hand-twisted cotton twines 20/3/1 are used for the main webbing. For selvages, doubling, lacing and looping, cotton twines of specifications 20/4/3 are used. Both the ropes are of coir of 3 strands and 0.68 cm. (0.26") in diameter. The length of each rope is 14.6 metres (47.9') excluding 0.90 metres (3') to be left free on either ends for looping the nets. The

coefficient of hanging is 52% and is identical on both headline and ground rope.

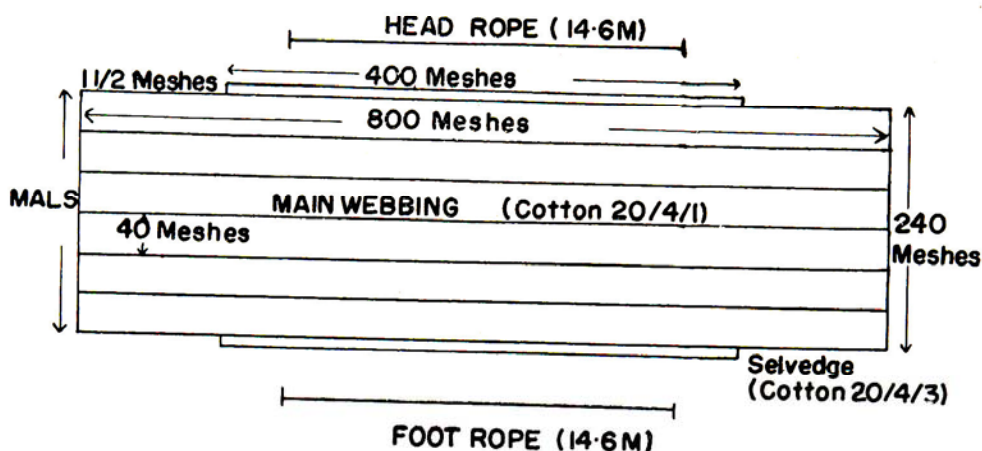


FIG. 2. Arrangement of the webbing in *Mathi Chala vala* at Narakkal Centre.

Cylindrical floats, prepared out of the wood of *Karingotta* tree (*Samadera indica* Gaertn) are used as buoyant material on the head rope. The average length of a float is 55.9 cm. (22"), while its diameter is 3.9 cm. (1.54"). 5-6 such floats are tied at equal intervals on the head rope. The average buoyancy of one float is about 360 gm. Granite stones of weight ranging from 0.68-1.02 kg. (1.50-2.25 lb.) are used as sinkers. 3-4 such weights are attached, to the foot ropes, depending on the oceanographic conditions of water on the fishing days. The floats and sinkers are attached to the respective lines with coir twines [0.31 cm. (0.12")] in diameter.

Construction

Mal is braided by hand using single trawl knot and the horizontal as well as side edges are strengthened. After doubling, loops are made leaving six meshes inside on either side of each of the pieces (Fig. 3 a). Two adjacent *Mals* are joined depthwise by simple lacing in the ratio of mesh to mesh (Fig. 3 b) to form the main webbing. Selvage webbings, which give strength to the net and keep the ratio of take-up constant, are then laced to the upper and lower horizontal edges of the main webbing, by passing the lacing twine in the ratio of a mesh to two meshes. The selvage meshes in turn are directly hung on head and foot ropes and are tied at regular intervals to avoid slippage and consequent changes in the take-up (Fig. 1). Thus the assembled net shots are joined together by passing the lacing twine

through the adjacent loops (Fig. 3 a) on each of them to form a unit for a boat and the number of units operated depend upon the intensity of the shoal.

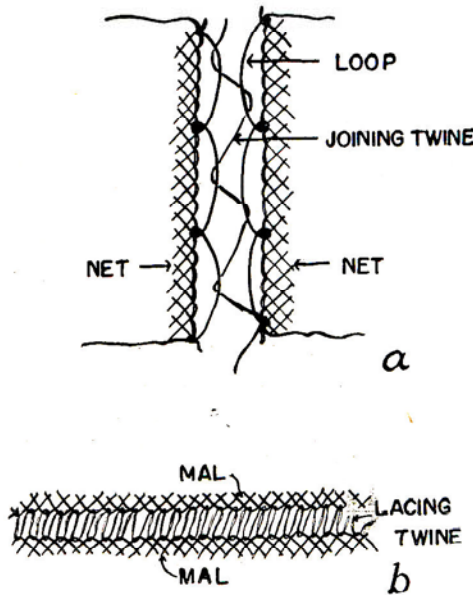


FIG.3(a). Upper: Joining of two net shots. (b) Lower: Joining of adjacent 'Mals'.

Preservation

Tannin solution extracted from either the leaves of *Munja* (*Premna integriflora*) or nuts of *Kadukka* (*Terminalia* sp.) are commonly used for preserving the gear. The solution is obtained by boiling the crushed material in water. Nets are dyed in the hot bath for nearly an hour, and dried in shade after draining the excess preservative. Tanning is repeated once a fortnight depending on the usage.

Method of Operation

Dugout canoes, made of Mango tree (*Mangifera indica* Linn.) or *Ayini* (*Artocarpus hirsuta* Lanc.), are employed for the operation of the gear. Usually five fishermen form the crew, one at tiller, two each for rowing and paying the nets respectively.

Surrounding the school of fish and scaring the fish to gill is the principle behind the operation of the gear. Fishing is usually a combined effort of a few boats operating their nets together; the number of boats depending upon the size of the shoal encountered. After scouting a shoal, a few boats are

rowed well ahead of the moving shoal, which is then encircled from all sides paying the nets from the respective boats. After encircling, fishes are scared either by beating on the sides of the boats or throwing stones into the water.

Variations

Variations in the nets at the different fishing centres are discussed below:

(i) *Main dimensions.*—The general specifications of the *Chala vala* webbings at the respective centres are given in Table II.

TABLE II
The dimensions of the net webbings at different centres

Fishing centre	Specifications of main webbing			Specifications of selvage webbing			No. of net shots forming a unit for a boat	
	No. of meshes in length	Mesh size in depth	Mesh size in cm.	No. of 'Mal'	No. of meshes in length	Mesh size in depth		Mesh size in cm.
Sardine Nets								
Azhikode ..	600	280	3.81	7	300	4.5	7.62	7
Azhikode ..	600	240	3.06	6	300	4.5	7.62	7
Narakkal ..	800	240	3.81	6	400	1.5	5.08	8
Southikkal* (Cochin)	800	250	3.06	7	400	1.5	5.08	7
Southikkal* (Cochin)	800	175	3.81	5	400	1.5	5.08	8
Chellanam ..	800	400	3.18	10	400	1.5	5.08	8
Mackerel Nets								
Azhikode ..	600	300	5.08	10	300	1.5	8.89	8
Narakkal ..	500	240	5.08	8	400	1.5	6.98	9
Southikkal ..	800	240	5.08	8	400	1.5	6.35	8
Chellanam ..	800	270	5.08	9	400	1.5	5.71	9

* Each horizontal piece is called 'Pali' at this centre.

It would be seen from Table II that a single unit for sardine composes on an average 7.5 nets, each having 6.8 *Mal* of 40 meshes depth except at Southikkal, where one *Mal* or *Pali* has 35 meshes in depth. The mackerel unit consists of 8.5 nets and each net has 8.75 parallel parts of 30 meshes depth. In both types of nets generally the lengthwise selvage meshes are half in number of the main webbing meshes, except for the mackerel nets at Narakkal. The selvage meshes at this centre are $\frac{4}{5}$ of the main webbing meshes. The depth of selvage is generally 1.5 meshes, but in the sardine nets of Azhikode they are 4.5 meshes deep. The size of mesh for mackerel nets is uniform at all the centres, while it varies from 3.06–3.81 cm. (1.20–1.50") in sardine nets. Hornell (1937), while describing the general dimensions of the two varieties of *Chala vala* of Malabar Coast, states that in *Aila Chala vala* the mesh size varies from $\frac{7}{8}$ " to 1" bar (1.91–2.54 cm.) and length and depth vary respectively from 8–10 fm. (14.82–18.4 M.) and 5–6 fm. (9.20–11.4 M.). The similar specifications in *Mathi Chala vala* range from $\frac{3}{8}$ – $\frac{5}{8}$ " (0.96–1.60 cm.) for mesh, 6–5 fm. (11.04–27.6 M.) for length and 2–3 fm. (3.68–5.25 M.) for depth.

(ii) *Materials for webbing.*—Cotton cords are used as materials for main and selvage webbings. Their specifications and breaking strength are given in Table III.

(iii) *Ropes and ratio of take-up.*—The details of head and foot ropes attached to the nets are indicated in Table IV.

The ratio of take-up adopted in the two types of nets at the different centres has not been found to be uniform. In general in the sardine nets, this ratio varies according to the size of mesh, *i.e.*, the bigger the mesh size, more is the take up.

DISCUSSION

Depth of net in operation, buoyancy on head line and weight on ground rope were computed from the available data.

(i) *Depth of net in water.*—Usually the depth of this net in operation depends upon the swimming habits, *i.e.*, the layers where the fishes habitually resort and the depth of the fishing area. The foot rope invariably touches the bottom in the encircling gill nets, preventing the escape of fishes through the bottom.

Table V indicates the calculated average depth of net at each of the centres.

TABLE III
Specifications of cotton cords used for webbing

Fishing centre	Size of mesh in cm.	Main webbing		Selvage webbing	
		Specifications of cords	Dry breaking strength in kg.	Specifications of cords	Dry breaking strength in kg.
Sardine Nets					
Azhikode ..	3.81	20/4/1	1.02	20/4/3	3.06
Azhikode ..	3.06	20/3/1	0.70	..	2.28
Narakkal ..	3.81	20/4/1	0.65	..	1.95
Southikkal (Cochin) ..	3.06	20/3/1	0.66	..	3.52
Southikkal (Cochin) ..	3.81	20/4/1	1.22	..	4.88
Chellanam ..	3.18	20/4/1	0.70	..	2.80
Mackerel Nets					
Azhikode ..	5.08	20/4/1	1.02	10/4/3	3.06
Narakkal ..	5.08	..	2.20	..	3.60
Southikkal ..	5.08	..	1.22	..	4.88
Chellanam ..	5.08	..	1.02	..	3.06

TABLE IV
Material and other details of head and foot ropes

Fishing centre	Mesh size in cm.	*Head and foot ropes				Ratio of take-up %
		Material	Ply	Diameter in cm.	Length of ropes in metres	
Sardine Nets						
Azhikode ..	3.81	Coir	3	0.97	10.9	53
Azhikode ..	3.06	..	..	0.97	10.2	44
Narakkal ..	3.81	..	..	0.63	14.6	52
Southikkal (Cochin) ..	3.06	..	..	0.63	14.6	40
Southikkal (Cochin) ..	3.81	..	..	0.63	14.0	54
Chellanam ..	3.18	..	..	0.63	13.9	46
Mackerel Nets						
Azhikode ..	5.08	Coir	3	1.27	15.5	49
Narakkal ..	5.08	..	..	1.27	14.6	52
Southikkal ..	5.08	..	..	1.27	18.1	53
Chellanam ..	5.08	..	..	1.27	18.7	56

* Both ropes are identical in all cases.

TABLE V
The calculated depth of net while in operation

Fishing centre	Size of mesh in cm.	Ratio of take-up %	Depth of net while in operation in metres
Sardine Nets			
Azhikode ..	3.81	53	9.4
Azhikode ..	3.06	44	6.0
Narakkal ..	3.81	52	7.9
Southikkal (Cochin)	3.06	40	6.1
Southikkal (Cochin)	3.81	54	5.9
Chellanam ..	3.18	46	10.6
Mackerel Nets			
Azhikode ..	5.08	49	13.1
Narakkal ..	5.08	42	9.9
Southikkal ..	5.08	53	10.8
Chellanam ..	5.08	56	12.1

It would be evident from the perusal of the Table V, that mackerel nets are operated at comparatively deeper waters than the sardine nets. The average depth of the sardine and the mackerel nets are 7.65 and 11.48 metres (4.20 and 6.3 fm.) respectively.

(ii) *Buoyancy and weight relationship.*—Gill nets in general require more extra-buoyancy on the head rope to prevent the net from falling down when it is loaded with fish. Hence the total buoyancy depends on the weight of the nets with all its accessories and the anticipated catch in water. The calculated buoyancy of floats on the head rope and the weight of granite stone sinkers on the foot rope per metre and per unit area of webbing are indicated in Table VI.

Table VI indicates that the buoyancy of floats and weight of sinkers in air per unit length on head and foot ropes respectively in sardine and mackerel nets, do not show appreciable variation. The buoyancy and weight ratio per unit area of netting is found to be approximately 2; 3 in both the nets.

TABLE VI

Extra-buoyancy and weight per metre of head and foot ropes and per square metre of net

Fishing centre	Length of ropes in metres	Number of floats and their extra-buoyancy in gm.	Number of sinkers and their total weight in air in gm.	Extra-buoyancy in gm. per		Weight in air in gm. per	
				Metre on H.R.	Square metre of net	Metre on F.R.	Square metre of net
Sardine Nets							
Azhikode ..	10.9	4/1500	2-4/2724	137.6	14.64	250.0	26.59
Azhikode ..	10.2	4/1500	2-4/2724	147.0	24.50	267.0	44.50
Narakkal ..	14.6	5-6/1800	3-4/2951	123.2	15.59	202.1	25.58
Southikkal (Cochin)	14.6	6/2130	4/2951	146.0	23.93	202.1	33.13
Southikkal (Cochin)	14.6	6/2130	4/2724	152.1	25.77	195.5	33.13
Chellanam ..	13.9	7/2380	4/2951	171.2	16.15	212.3	20.01
Averages ..				146.2	20.29	221.5	30.49
Mackerel Nets							
Azhikode ..	15.5	5/1975	4-5/3178	127.3	9.71	205.5	15.64
Narakkal ..	14.6	5/2000	3/1724	137.0	13.83	186.6	18.84
Southikkal ..	18.1	8-9/3330	5/4086	183.5	16.98	225.7	20.89
Chellanam ..	18.7	8/2920	5/3632	151.6	12.52	194.2	16.04
Averages ..				149.7	13.26	202.8	17.85

ACKNOWLEDGEMENTS

The authors are grateful to Dr. H. Miyamoto, F.A.O. Gear Technologist, and Shri G. K. Kuriyan, Senior Research Officer (Craft and Gear), for going through the manuscript and offering valuable suggestions for its improvements.

SUMMARY

The findings of the survey of gill nets *Chala vala* used for the capture of sardines and mackerels at a few fishing centres along the coast of Kerala

are reported briefly. The nets were essentially surface, single layer, encircling, gill nets made of hand-twisted cotton, having coir ropes. The details of take-up, spread of net in water, buoyancy and weight per unit length of ropes and variations observed in the nets are discussed in addition to the description, design and construction of gear.

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