



## *Karamadi* - A waning practice of shore seine operation along Kerala, Southwest coast of India

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Shore seines are the age-old fishing gear in all the continents and are operated from the shore to encircle a school of fish in shallow waters. Operation of *Karamadi* or *kambavala* is a waning practice along the southwest coast of Kerala. The structure and design of this traditional gear has been poorly documented. The key aspects covered in this study include the documentation of design, operation and catch composition of shore seines. The presence of cod end with a funnel to prevent the catch escapement is a characteristic feature of this gear. Other significant features of *Karamadi* are the limited use of energy, low discards and bycatch and the use of bio-degradable materials in the fabrication of the gear. Technical improvements and the introduction of measures for the reduction of juvenile catches in shore seine are needed and this can lead to better sustainability and the management of fishery which is a source for livelihood of the traditional fisher folk in the southwest coast of India.

[**Keywords:** Beach seine, Catch composition, Design, Kerala, Operation]

### Introduction

Seine nets are rectangular shaped long nets with or without bag, operated with two long ropes, set either from the shore or from the boat for surrounding a certain area for targeting the coastal shoals. According to Brandt<sup>1</sup>, seine nets were used by Greeks in 3<sup>rd</sup> millennium BC and Romans practiced a large gear '*sagena*' occupied large territories of Europe and *sagena* was later introduced by them to many countries. Tietze *et al.*<sup>2</sup> classified the seine nets into two categories, beach seine/shore seine and boat seine (those with cod end and without cod end). Beach seines have been used for fishing, since several thousand years in all the continents<sup>3</sup>. They are set from the shore to surround a fish shoal in shallow coastal waters, and then hauled onto the shore.

There are reports of shore seines that were used centuries back in the western and eastern coasts of India, encompassing the Malabar, Konkan and the Coromandel coasts. A decline in the use of shore seines have been reported from the Coromandel coast (Tamil Nadu, Andhra Pradesh) and North Orissa<sup>2</sup>. In India, 2,227 numbers of shore seines were reported in different names and operated along east and west coasts of India (Maharashtra, Gujarat, Andhra Pradesh, Karnataka, Goa, Puducherry, Tamil Nadu and Kerala)<sup>4</sup>. FAO-Fisheries and Aquaculture

Department conducted technical, socio-economic and environmental features and impacts of beach seining in India and other developing countries in 2011<sup>(ref. 2)</sup>. Seines like *Ayilakolli vala*, *Arakolli vala*, *Chooda vala*, *Disco vala*, *Deppa vala*, *Ring vala*, *Kudukku vala*, *Thangu vala*, *Kolli vala*, *Koru vala*, *Mathikolli vala*, *Paithu vala* were operational in the southwest coast of India<sup>5</sup>. However, all these gears were totally replaced with the advent of ring seines in this region<sup>6</sup>. The mechanization was a revolt in the history of fisheries in India and this empowered the small scale fishers to go further and deeper in search of fish in the sea<sup>6</sup>. *Karamadi/ kambavala*, a shore seine, is perhaps the only gear in this category which has withstood the test of time<sup>7</sup>. The name signifies that, it is operated from the shore with rope. The continuing use of bio-degradable materials as the parts of the gear through decades is a characteristic feature of this gear. The limited use of fossil fuel adds to the ecofriendliness of this unique gear. There are limited reliable data on traditional seine fishing in India. Salagrama<sup>8</sup> opined that, for focussing and implementing the developmental programmes for shore seine fishing operations there should be a reliable database. The structure and design of this traditional gear has been poorly documented. This communication aims at documenting the design and fabrication of this

traditional gear and the need for management of the fishery.

### Material and Methods

Among the nine coastal districts of Kerala, *Karamadi* is operated along the southern most districts of Kollam and Thiruvananthapuram coasts only (Fig. 1). When selecting the area for the field survey, care was taken to conduct survey in coastal regions where beach seining is predominantly practised. The major aspect covered include design, operation, technological aspects of beach seining and catch composition. Net makers and fishermen provided the required data on the gears. More than 30 fishermen were directly interviewed from Poovar to Kovalam in Thiruvananthapuram and Vaddy to Thangassery in Kollam and focus group discussions were also conducted with pre-structured questionnaire during March-December, 2018. Two typical shore seine designs were selected for the collection of primary data. The materials, method of construction, design details, operational techniques and information on catch were collected. Design drawings were made as per FAO<sup>9</sup> guidelines.

### Results and Discussion

Traditional shore seines were made of natural fibres have been substituted by more catch-efficient

nets made of synthetic fibres with small mesh sizes. Codend and wings are mostly fabricated with polyamide webbings. Coir webbings were also used in the studied sites. Motorised/non motorised wooden/FRP craft are used for the operation of *Karamadi*.

### Design and construction of *Karamadi*

The net consists of three major sections: Warp/hauling rope, wing and the bunt/codend, to where the catch is concentrated (Fig. 2). Motorised and non motorised wooden/FRP craft with 6-12 m LOA were used for the operation of *Karamadi*.

### Cod end/ bunt

The region of the net where the catch is accumulated is called cod end/ bunt and locally known as *madi*. Bunt portion is made of polyamide webbing of 8 to 10 mm mesh size. Total length of the bunt varied from 18 to 25 m in length. Bunt is placed in the center portion of the gear and made with heavier netting to withstand the excess strain during operation. Nayar<sup>7</sup> has documented design details of a *Karamadi* with a length of 15.8 m. During the study, it was observed that, in Vizhinjam region of Thiruvananthapuram, the cod end is divided into two sections based on mesh size and known as *aravala/aramadi* and *melmadi* or *neriyavala*. *Aravala* is the extreme end of the cod end and has a mesh size of 8

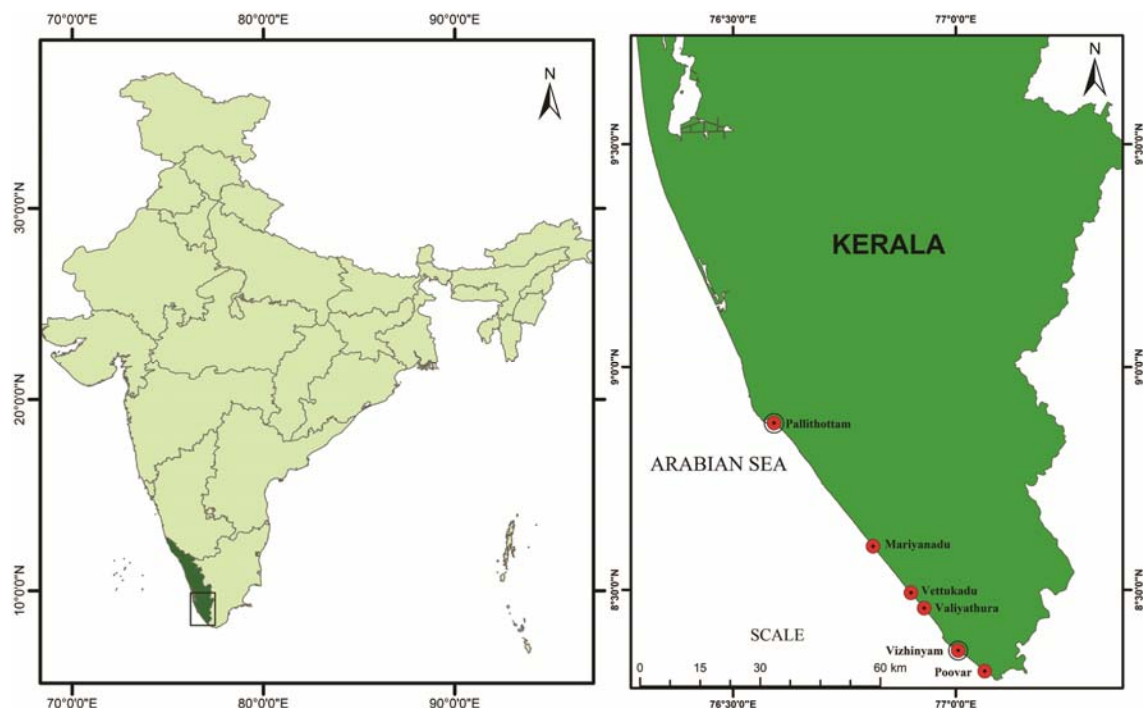


Fig. 1 — Map depicting the study area

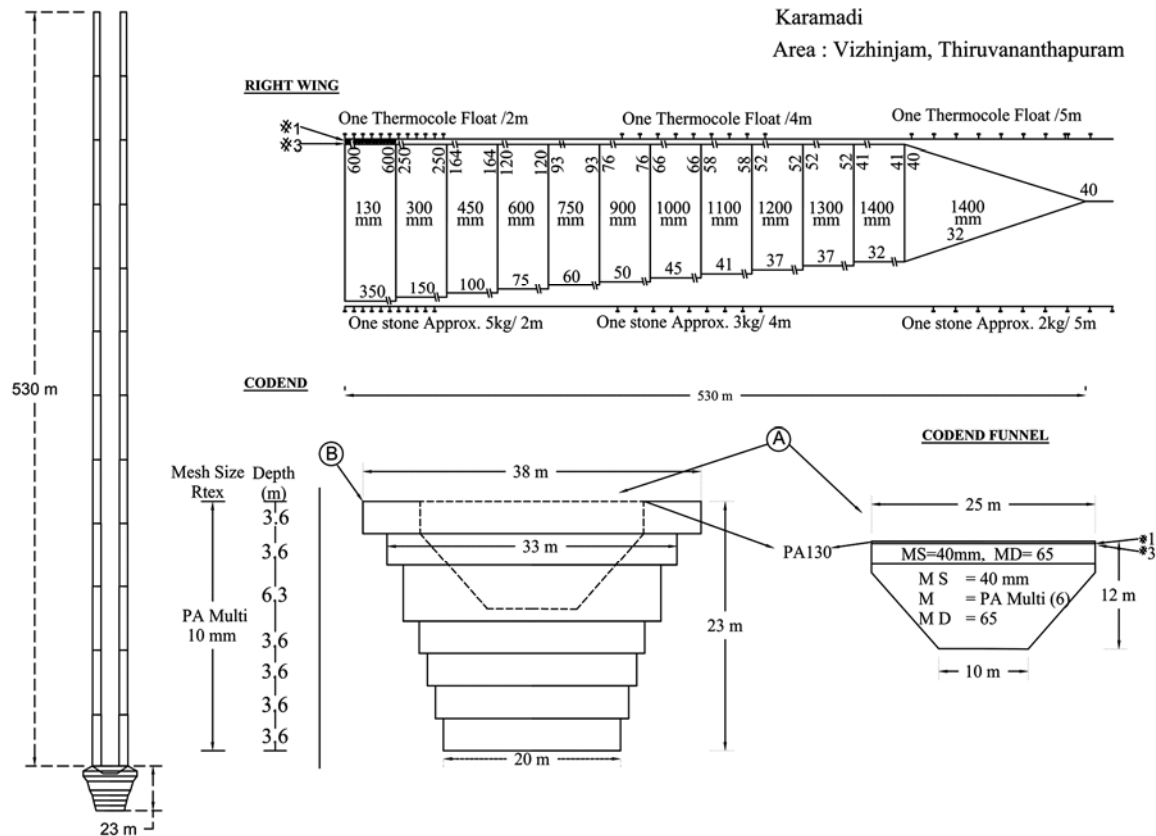


Fig. 2 — Structure and design of a typical *Karamadi*

mm. The 5-7 panels of webbings placed horizontally in front of the *aravala* is termed as *melmadi* or *neriyavala* and has a mesh size of 10 mm. Nayar<sup>7</sup> has reported the same mesh size for *aravala* from the Vizhinjam region. On the contrary, Saleela *et al.*<sup>10</sup> reported 6 mm mesh size for the lower portion of the cod end and she suggested to increase the mesh size to 18-25 mm. Expert Committee for the Registration of Fishing Vessels in Kerala recommended a mesh size of 22 mm in the bunt and main body for sardine mackerel ringseines<sup>11</sup>.

Polyethylene webbings of larger mesh size of 30 to 40 mm were used to connect the wings with the cod end. To prevent the catch escapement, a funnel like structure was attached to the cod end. The length of the funnel extends to one third of the cod end and has 34 - 40 mm mesh size. The funnel mouth begins with the cod end with the same diameter and tapers towards the end with less than 10 m. Narrow end of the funnel and the cod end of the gear is tethered with three ropes to the net body, which enables the funnel opening while in operation. Nayar<sup>7</sup> reported a similar funnel-shaped portion attached to the inner edge towards the mouth side of the cod end to prevent fish escapement. Floats

and sinkers were used to support the horizontal opening of the cod end mouth of the gear.

#### Wings

Wings are locally known as *Vala/ Kayaru*. Two wings extend from the lateral margins of the cod end with a length of 500 – 800 m which herds the fish towards the cod end. It is made by joining polyamide/ coir webbings with 130 mm to 1400 mm in mesh size. Small meshed webbing panels were attached near to the cod end and gradually the mesh size increases towards the warp end. The depth of the wings near cod end ranged from 6.5 to 7.8 m. Rectangular thermocole floats and stone sinkers of 2 to 5 kg are commonly used along the Vaddy and Vizhinjam regions. The number and size of the floats and sinkers increases towards the cod end. Near the cod end the floats are arranged with an interval of 2 m (45x30x30 mm) and gradually increased to 5 m (30x20x10 mm) at the end of the wing and sinkers are also arranged in the same pattern.

#### Warp or Hauling rope

Warp or hauling rope locally called as *Kamba* which is the longest part of the gear with 1000 -1200

m in length. The hauling ropes are stacked as different units and 30-35 units of 80 m length were attached end to end to attain the maximum length as required. Polypropylene or coir ropes of 18-24 mm dia. were used for *karamadi* warp and length of the hauling warp varied with operation, depending on the distance of fish shoal from the shore.

#### Operation of a *Karamadi*

*Karamadi* is operated from wooden/FRP sheathed fishing vessels with or without outboard motor of 9.9 hp. Overall length of the vessels ranged from 6 to 12 m  $L_{OA}$  and operated with in the depth of 25 m. Saleela<sup>10</sup> reported that shore seines were normally operated using non motorised fishing boats with wood, fibre glass etc 8.5 to 11.0 m  $L_{OA}$  from the Poovar region of Thiruvananthapuram. The present study has shown that twenty to forty fishers are involved in the fishing operations depending up on the season. One group of fishermen will remain on shore holding one end of the hauling warp. The second group carrying the gear on a boat along with the other end of the hauling rope, which surrounds the fish shoal/fishing area and set out in a wide semi-circular arc and brought the other end to the shore, which is a certain distance away from the starting point (Fig. 3). The hauling ropes are then hauled simultaneously to the beach by two groups of fishers. Tietze *et al.*<sup>2</sup> reported that, the hauling warps and the wings of the beach seine guide the fish to the bunt part of the gear. When the hauling starts, the two groups of fishermen will come closer (where cod end almost reaches the shore) and the method of operation is common throughout the world.

Beach seine is operated throughout the year and the peak season starts after monsoon and maximum catch was reported during post-monsoon season in the southwest coast of India. The maximum operational time for this gear is varied from 1 to 3 h. Catch per unit effort (CPUE per operation) during the study period was recorded as 50 -100 kg/operation. The dominant groups of fishes include Engraulidae (*Stolephorus indicus*), Clupeidae dominated by *Sardinella longiceps*, Leiognathidae, Scombridae (*Rastrelliger kanagurta*), Carangidae, Hemiramphidae, Sphyraenidae, Sillaginidae, Lactariidae, shrimps etc (Table. 1). Saleela *et al.*<sup>10</sup> reported an annual average fish landing of 22.5 t with a catch per unit of 74.17 kg, from shore seines of the Poovar region of Kerala.

A survey conducted by Tietze *et al.*<sup>2</sup> in selected coastal districts of Andhra Pradesh and Orissa showed a decline in the number of shore seines. Swathi Lekshmi *et al.*<sup>12</sup> reported that *Kairampani*, the traditional shore seine of Karnataka, has almost outdated with the arrival of mechanized crafts and gears. The same trend has been observed during the present study and the number of beach seines has been reducing during the last few decades. The same trend is also reflected globally and Tietze *et al.*<sup>2</sup> reported that during the last few decades, the significance of shore seining has reduced in terms of fisheries production and employment in many of the countries. In Kerala, many of the fishers are operating *Karamadi* as secondary source of livelihood now-a-days.

#### Design variants of *Karamadi*

The design and structure of *Karamadi* vary based on species and region. During the survey, another common design of *Karamadi* has been identified from Kollam region, locally known as *Muralvala* (Fig. 4). The name is based on the targeted group, *Hyporhamphus* spp. (half beaks) and its vernacular name is *Mural*.

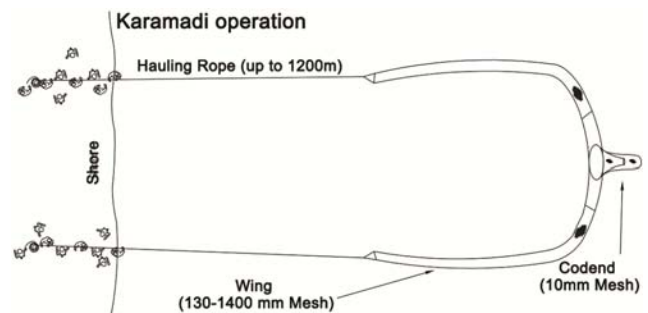


Fig. 3 — Schematic representation of operation of *Karamadi*

Table 1 — Common species identified from the shore seine during the study period

Fish species	Family
<i>Stolephorus indicus</i>	Engraulidae
<i>Stolephorus commersonii</i>	Engraulidae
<i>Sardinella longiceps</i>	Clupeidae
<i>Sardinella gibbosa</i>	Clupeidae
<i>Sardinella fimbriata</i>	Clupeidae
<i>Sphyraena borealis</i>	Sphyraenidae
<i>Sphyraena obtusata</i>	Sphyraenidae
<i>Rastrelliger kanagurta</i>	Scombridae
<i>Megalopsis cordyla</i>	Carangidae
<i>Gazza minuta</i>	Leiognathidae
<i>Leiognathus lineolatus</i>	Leiognathidae
<i>Secutor insidator</i>	Leiognathidae
<i>Sillago sihama</i>	Sillaginidae
<i>Fenneropenaeus indicus</i>	Penaeidae

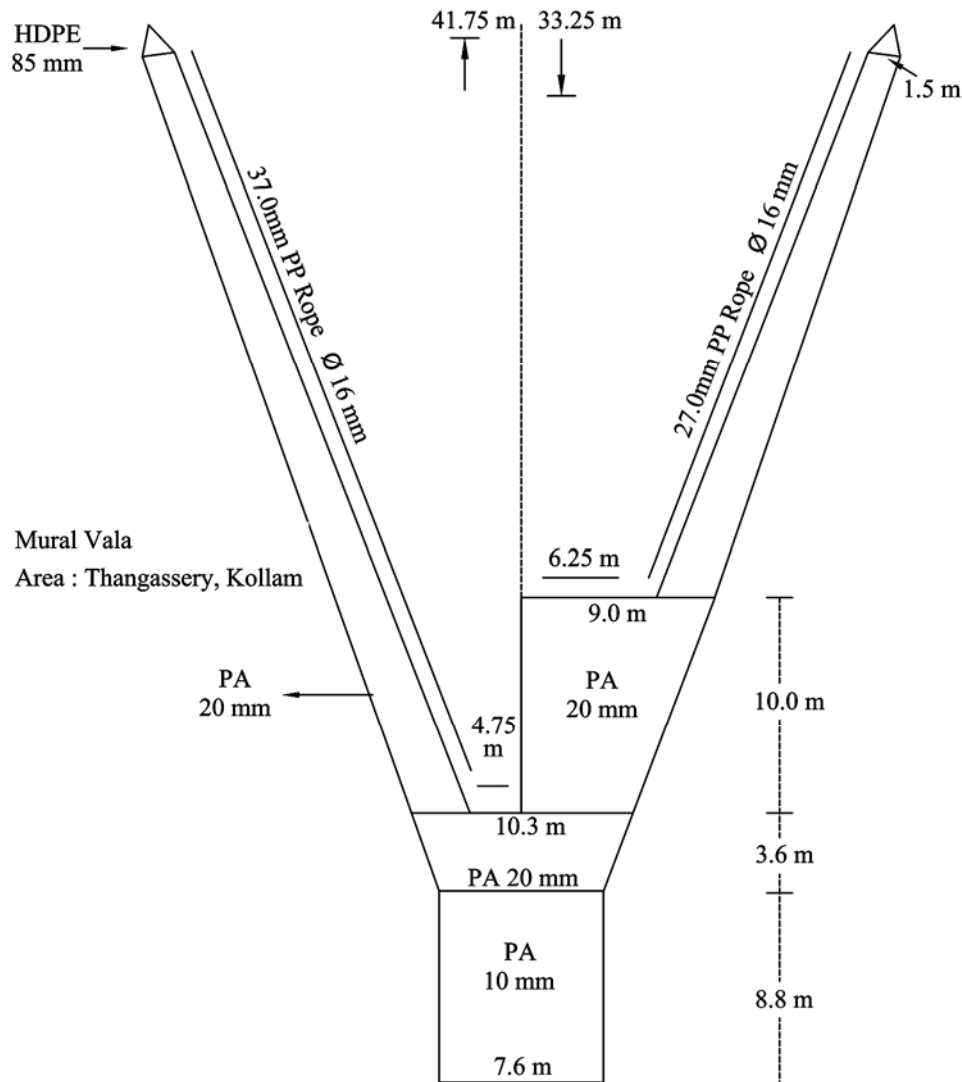


Fig. 4 — Detailed design of the beach seine for *Hyporhamphus*

The total length of this gear is comparatively less than *Karamadi* with 40-55 m length and the cod end is rectangular in shape with a depth of 8.8 m with 10 mm mesh size. Operation is almost similar to the typical *Karamadi*, but at the wing portion plastic strands and coconut leaves were hung to scare the fish towards the cod end. A maximum of 20 fishers are involved in the fishing operations. Nayar<sup>7</sup> reported a slightly modified in *Karamadi*, from Vizhinjam which is locally known as *Churukkumadi* targeting the tuna. The reduction in the number of *Karamadi* in the south coast of India, may be due to the depletion and erosion of shores, intensification of tourism, pollution of the coastal waters, infrastructural developments like the construction of sea walls, ports and harbours, the manual mode of operation of the gear, reduction

of the coastal pelagic resources and due to the introduction of sophisticated and efficient gears like ring seines and purse seines.

### Conclusion

Shore seining is an age old traditional fishing method, practised by the traditional fisher folk and currently this gear is considered only as a secondary option for livelihood in the south coast of India. For the operation of this gear, energy is utilised only for the propulsion of the fishing craft hence, carbon emission is relatively less compared to many fishing operations like ring seining and purse seining. As it is a targeted fishing, bycatch and discards are comparatively very low and in the developing countries traditional shore seines are considered as fisheries with less discard

rates<sup>13</sup>. Gear setting and soaking requires minimum time compared to gillnets or long lines and operation can be completed within 1- 3 h. In the construction of the gear, many natural biodegradable materials like coir, coconut leaves and natural fibres are still in use which retains the ecofriendliness of the gear. Advent of new fishing methods like boat seines, ring seines etc and the beach erosions caused by anthropogenic activities has resulted in the reduction in number of these gears in the region, which was a source of livelihood for the traditional fishermen. The present study points the facts that even though there is reduction in the number of gear, the dimension of gear is increased during the last decades as in the case of other pelagic gears. Technical and operational improvements of the gear and policies for the reduction of juvenile catches in seines need to be developed which would support sustainability of shore seine fisheries.

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#### Conflict of Interest

The authors declare that they have no conflict of interest.

#### Author Contributions

Conceptualization and supervision was done by LE, PHDD was associated with data collection; and compilation and documentation was completed by MLN.

#### References

- 1 Brandt A V, *Fish catching Methods of the world*, 4<sup>th</sup> edn, 2005, pp. 523.
- 2 Tietze U, Lee R, Siar S, Moth-Poulsen T & Båge H E, Fishing with beach seines, *FAO Fisheries and Aquaculture Technical Paper 562*, 2011, pp. 149.
- 3 Gabriel O, Lange K, Dahm E & Wendt T, *Von Brandt's fish catching methods of the world*, (John Wiley & Sons), 2008.
- 4 CMFRI, *Marine Fisheries Census*, (Part 1, India, Govt. of India, Ministry of Agriculture, Dept. of Animal Husbandry, Dairying & Fisheries and Central Marine Fisheries Research Institute, Indian Council of Agricultural Research, New Delhi), 2010, pp. 1-4.
- 5 Pillai P K, Balakrishnan G, Philipose V & Rajendran V, Appraisal on the marine fishing craft and gear of the Indian coast, In: *Marine fisheries research and management*, 2000, pp. 190-221.
- 6 Edwin L & Das D P H, *Technological changes in ring seine fisheries of Kerala and management implications*, (ICAR-Central Institute of Fisheries Technology, Cochin, India) 2015, pp. 104.
- 7 Nayar S G, A preliminary account of the fisheries of Vizhinjam, *Indian J Fish*, 5 (1) (1958) 32-55.
- 8 Salagrama V, A review of fisheries development schemes in three fishing villages in Visakhapatnam district, Andhra Pradesh. Undertaken for the Andhra Pradesh State Fishermen's Cooperative Societies Federation Ltd. (AFCOF), *ICM Integrated Coastal Management*, 2003, pp. 49.
- 9 FAO, *FAO Catalogue of Fishing Gear Designs* (Fishing News Books Ltd., Farnham, Surrey, England), 1978, pp. 160.
- 10 Saleela K N, Dineshababu A P, Santhosh B, Anil M K & Unnikrishnan C, Shore seine fishery along Poovar in Thiruvananthapuram district, southwest coast of India, *J Mar Biol Ass India*, 57 (2) (2015) 113-116.
- 11 Kurup B M, Purushan K S, Pillai N G K, Boopendranath M R, Lathy K M, *et al.*, *Report of the expert committee for the registration of fishing vessels*, Directorate of Fisheries, Govt. of Kerala, Thiruvananthapuram, 2009, pp. 189.
- 12 Swathi Lekshmi P S, Chaniyappa M & Naik A R, Kairampani-The Traditional Shore Seine Fishing of Karnataka, *Asian Agrihist*, 18 (4) (2014) 375-381.
- 13 Kelleher K, Discards in the world's marine fisheries. An update, *FAO Fish Tech Pap*, 470, 2008, pp. 147.