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Status of Mechanised Trawl Fishing Fleet of Cochin, Kerala

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Abstract

Trawling is one of the most important fishing methods in India. In response to rising demand for seafood in the worldwide markets, fishermen working in the mechanized trawl fishing sector have been forced to venture into deeper waters in search of new fishing grounds and better catch. There have been significant changes in trawl fishery since its introduction and changes in fleet size and overall capacity of trawlers have increased several times over the past three decades, particularly along southwest coast. In this paper, an attempt has been made to document major shift in length overall (L_{OA}), installed engine power of the trawlers in Cochin, central Kerala. This study reveals that trawler with L_{OA} more than 40m having engine up to 591 hp were recently introduced into the fleet. Similarly, trawls with head rope length ranging from 45.0-122m were seen in operation. The mesh size of the wings in fish and cephalopod trawls showed a clear increasing trend. Square mesh codend were not found to be in use, in spite of the concerted effort of different agencies. This study point out the need for strict implementation of regulations with regard to vessel size, engine power, size of the trawl net, codend type and mesh size. Periodic inspection of fishing units to ensure responsible fishing is highly essential to protect coastal fishery resources in India.

Keywords: Engine horsepower, Length overall, Trawler, Cochin, Kerala

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Introduction

Trawling is one of the most important fishing methods in the marine fisheries around the world. After the introduction, significant changes have been taken place in the design, size and operation of trawl nets (Boopendranath, 2000). Increase in the demand for fish in the domestic and international market resulted in increasing the number and overall capacity of trawlers like size, engine power and size of trawl nets. Ravi et al. (2014) reported that exponential growth of engine horsepower was evident in trawlers with L_{OA} greater than 18 m. Intensive trawling by large trawlers with high-speed engines caused significant harm to the coastal benthic environment through large scale generation of bycatch, destruction of benthic habitat and ultimately it affected the sustainability of Indian marine fisheries output (Dineshbabu et al., 2013). Regulations for responsible trawling operations are not put into practice and as a result bycatch remain as major issue in the trawl landings. There is a need to evaluate and benchmark the existing commercial trawl design to check the level of adoption of various regulations notified by the government and prepare the status report.

There are several studies on commercial trawl designs like Mukundan & Hameed (1993), Neethiselvan & Brucelee (2003), Gibinkumar et al. (2005), Rajeswari et al. (2012), Ravi et al. (2014), and Sayana et al. (2016). Kerala's marine capture fisheries have seen substantial changes, in the number and capacity of fishing vessels, especially in the trawling sector during the last decade. Excess capacity of fleets and excessive fuel consumption by mechanised fisheries have increased over time (Ravi et al., 2014). In the present study, an attempt has been made to document and compare the major changes of

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trawlers and trawl nets of central Kerala during the last three decades.

Materials and Methods

Four harbours in Ernakulam District were selected for the study namely (i) Thoppumpady fishing harbour (Cochin harbour), (ii) Kalamukku fishing harbour, (iii) Murikkumpadam fishing harbour, and (iv) Munambam fishing harbour. To study the present scenario were collected from 40 trawlers from January to June 2021. A pretested questionnaire and template were used for data collection. Data has been supplemented by information gathered from fishermen, net makers and others. The collected data were validated through focus group discussion and interaction with experienced fishermen / net menders. The trawls scaled design drawings were prepared using Auto CAD v2021 software with assistance from the Technical staff of ICAR-CIFT. Secondary data has been collected from published literatures.

Results and Discussion

It is observed that there has been a drastic increase in the size of the trawl which commensurate with increase in the size of the fishing vessel and horsepower of the engine. Trawl fishing started in Kerala in 1955, off the coast of Malabar, on an experimental trawler L_{OA} 6.6 m equipped with a 10hp engine (Kristjonsson, 1967). The maximum L_{OA} of trawlers on the Kerala coast was 10 m in 1980 and 16.8 m in 1995-96, according to John (1996). In Shakthikulangara harbour larger number of trawlers were reported with an L_{OA} of 21.3 m (Kurup & Rajasree, 2007) and Gibinkumar (2008) reported maximum L_{OA} of 21.6 m for trawlers from central Kerala. Ravi et al. (2014) studied the structural changes of trawlers throughout the Kerala coast and reported that the maximum L_{OA} was 23 m. Edwin et al. (2014) reported 28 m as the highest L_{OA}. Sayana et al. (2016) reported the maximum L_{OA} as 33.5 from and during the study period 41.4 m trawlers were also reported. The size of trawlers in the state has increased sixfold or more since its introduction Fig. 1.

Among the different size category of trawlers studied large trawlers (16-24 m) dominated the trawler fleet in all the four harbours. There were no small (<12 m) and medium (<16 m) sized trawlers among the vessels selected for the study in Kalamukku and Munambam harbours. There was no small trawler and only one medium sized trawler found in the Thoppumpady harbour. Similarly, there was only one trawler with less than 12 m size and no medium sized trawler was found from Murrikkumpadam. The growth and domination of large sized trawlers equipped in the central Kerala is evident.

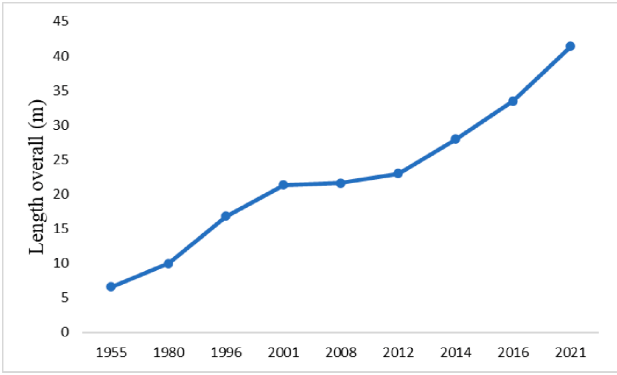

Fig. 1. Growth in size of mechanised trawlers in Kerala

Engine power has been observed to rise in tandem with the size of trawlers or engine power has increased in proportion to the size of trawlers. Changes in engine horsepower of trawlers operating from Kerala from 1955 to 2021 is shown in Fig. 2. The first shrimp trawler had a 10 hp engine (Kristjonsson, 1967). The average engine power of trawlers in Kerala was 7.5 in 1980s (John, 1996) and it was 13 hp during the 1990s (Mukundan & Hameed, 1993). After 1990s, there was a significant increase in the engine power and went up to 148 hp (John, 1996). According to Ravi et al. (2014), the highest engine power recorded by trawlers in the state in 2012 was 495 hp. Sayana et al. (2016) reported the maximum engine power in the trawlers of Kerala as 550 hp.

The trawler with 41.4m size recently constructed at Munambam is with 591 hp engine. It can be stated that the engine power of trawlers in the state has increased 59 times since 1955. In Thoppumpady harbour 37.5% of the trawlers selected for the study had installed engine power of 250-300 hp. Whereas in Kalamukku the dominant class was 400-450 hp (22%) and 12.5% of the trawlers were overpowered with engine capacity of 550-600 hp. Munambam and Murikkumpadam harbour also 400-450 hp engine class dominated the fleet with 62.5% and 34% respectively. Average engine power was highest among the trawlers at Munambam with 381 hp and it was lowest at Thoppumpady harbour (304 hp). Thoppumpady and Murikkumpadam 26% of the

vessels were overpowered and it was 16% and 11% at Kalamukku and Munambam harbour respectively as per KMFRA.

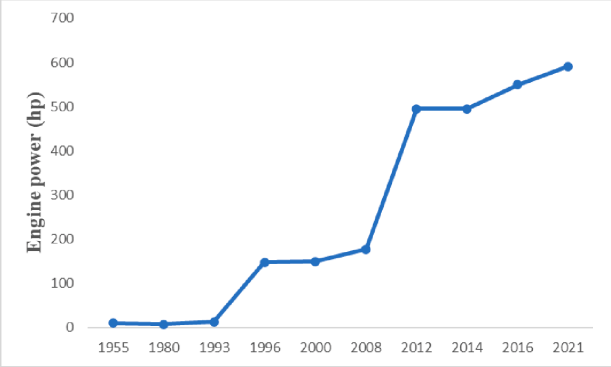

Fig. 2. Growth in engine power of trawlers

Trawl nets have seen significant changes in terms of size, design, rigging, and manner of operation since its introduction. Shrimp trawls were the first trawl nets established in Kerala followed by fish trawls. Resource-specific trawls like fish trawls, shrimp trawls and cephalopod trawls were introduced only after the fish trawl had been popularised. Adoption of 'V' form otter boards and use of steel wire ropes for warps are the two key additions to trawl fishing accessories. Trawl nets have seen obvious modifications over time, such as large mesh trawls, rope trawls, and the use of thinner twines etc.

Fish trawl, shrimp trawl and cephalopod trawls were in operation in all the centres selected for the study and their head rope length varied from 45.0-160.0 m. All the trawls are two seam and are made of HDPE webbing with twine diameter of 0.5 to 3.5 mm. The head rope and footrope were made of poly propylene rope with diameter of 14 to 16 mm dia. Design of trawl nets operated along the Kochi coast and its technical specifications are given in Fig. 3, Table 1 and 2.

The shape of the net, mesh size and twine size, are the important design considerations for trawl nets. Among these parameters, apparent and significant modifications were observed in the mesh size, particularly at the wing end. John (1996) reported a maximum mesh size of 160 mm at the wing end for of fish trawls and 80 mm for shrimp trawls, and in 2008, the maximum mesh size at the wing end reported was 1500 mm for fish trawls and 50 mm for shrimp trawls, along central Kerala (Gibinkumar, 2008). Edwin et al. (2014) reported 5000 mm as mesh size at the wing end for fish trawls and 300 mm for shrimp trawls. Sayana et al. (2016) reported mesh size of 10000 mm for fish trawl, 300mm for shrimp trawl in Kerala. There is a significant increase in the wing panel mesh size of larger-sized fish trawls at present. The concept of large mesh trawls was introduced by CIFT in 1970's for improving the selectivity of the trawl and reducing the drag and

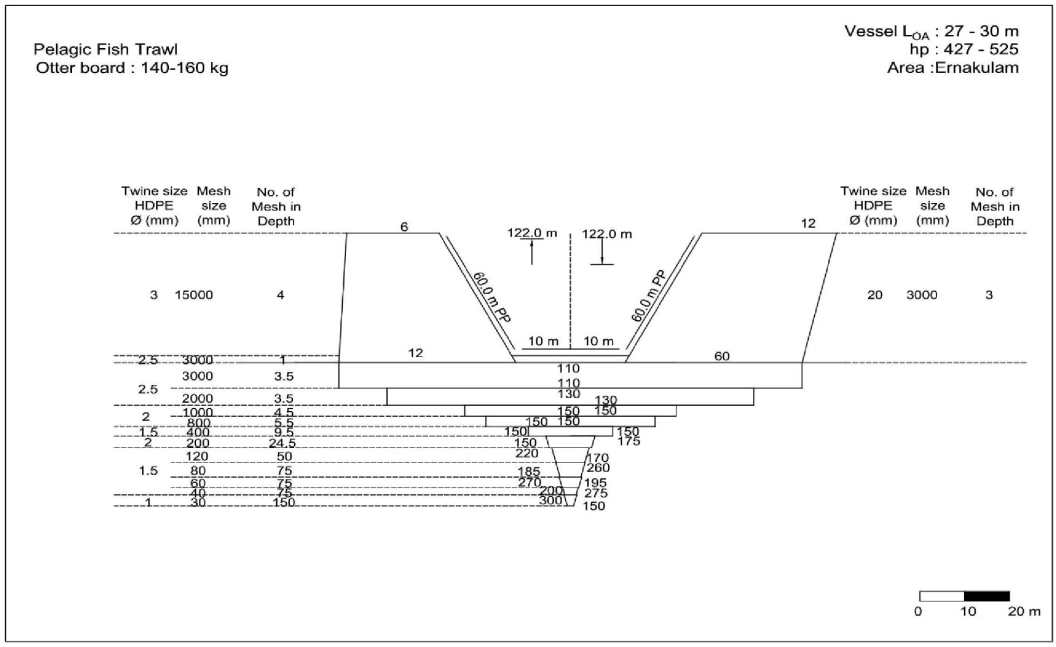

Fig. 3. Typical design of large mesh trawl nets operated along Cochin coast.

Table 1. Technical specifications of different types of trawl nets operated along Cochin coast

Specification	Fish trawl	Shrimp trawl	Cephalopod trawl
Head rope length (m)	45.0 - 160.0	50.0 - 53.5	106.0 - 114.0
Webbing material	High-Density Polyethylene (HDPE)	High-Density Polyethylene (HDPE)	High-Density Polyethylene (HDPE)
Twine size (mm)	1.0 - 3.0	0.5 - 2.5	1.0 - 3.0
Wing end mesh size (mm)	60 - 15000	1000 - 1500	4000 - 15000
Codend mesh size (mm)	20 - 30	18 - 25	20 - 40
Depth of operation (m)	20 - 180	20 - 100	100 - 160
Otter board size (kg)	100 - 160	120 - 160	100 - 160
Shape of otter boards	'V' and wooden flat rectangular	'V' and wooden flat rectangular	'V' and wooden flat rectangular
Rope diameter (mm)	14 - 16	14 - 16	14 - 16
Rope material	Poly Propylene (PP)	Poly Propylene (PP)	Poly Propylene (PP)

Table 2. Trawl craft & gear combinations used along the Cochin coast

S. No.	Trawl net	L_{OA} of trawler (m)	HP of engine	Wing mesh size (mm)	Otter-board size (kg)	Depth of operation (m)
1.	45m Fish trawl	14-17	200-300	60	100-120	20-80
2.	71m Fish trawl	22-25	280-400	300	140-160	20-120
3.	80m Fish trawl	27-30	427-525	6000	140-160	20-120
4.	90m Fish trawl	20-22	350-425	3000	140-160	20-120
5.	122m Fish trawl	27-30	427-525	18000	140-160	20-180
6.	53.5m Shrimp trawl	18-20	350-450	1500	140-160	40-80
7.	50m Shrimp trawl	18-22	250-350	1000	120-130	20-100
8.	106m Cephalopod trawl	25-30	427-525	15000	120-160	100-160
9.	114m Cephalopod trawl	24	427	4000	140-160	100-160
10.	114m Cephalopod trawl	23	350-400	6000	100-120	100-160

fuel consumption (Boopendranath, 2009). For fish trawls, the increase in mesh size was gradual over time, whereas for cephalopod trawls, the growth started in 2016. Sayana et al. (2016) observed increase in the wing panel mesh size reduce the total drag and helps to catch fast swimming pelagic fin fishes. 76% of trawl nets had a codend mesh size of 16-20 mm during the 2000-01, whereas 22% of trawl nets had a codend mesh size of 20-24 mm. (Kurup & Rajasree, 2007). Regardless of the type of trawl nets, 20-25 mm mesh size is used for codend (Sayana et al., 2016). Diamond mesh codends with mesh sizes of 20-30 mm for fish trawls, 18-25 mm for shrimp trawls, and 20-40 mm for cephalopod trawls were found to be in use.

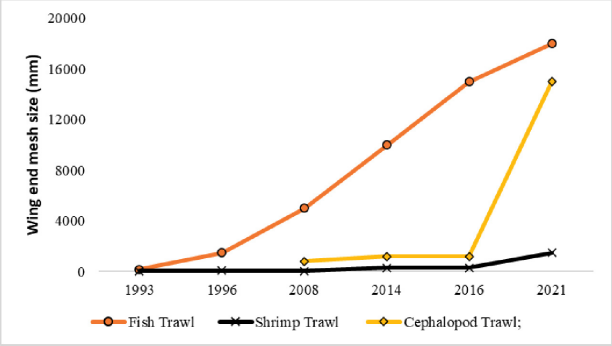

Fig. 4. Increase in wing panel mesh size of the trawl nets

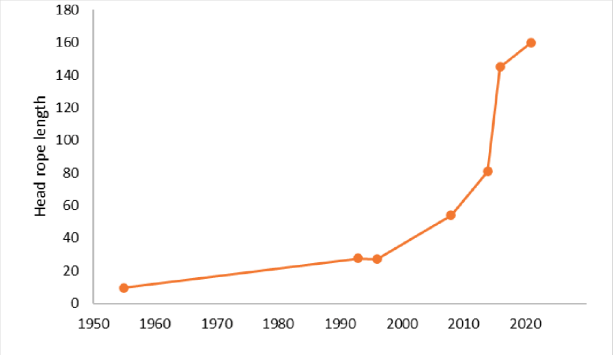

Fig. 5. Growth in head rope length of trawl nets

Fish trawls, shrimp trawls, cephalopod trawls, and gastropod trawls are the four types of trawl nets used in the state. The length of the head rope determines the size of the trawl net. The head rope is made of polypropylene rope with a diameter of 10 to 16 mm. The first trawl net in the state had a head rope length of 9.6 m (Kristjonsson, 1967). Trawl net head rope lengths have now reached up to 160.0 m and varied from 39.0 to 160.0 m (Fig. 5). Diamond mesh codends with mesh sizes of 20-30 mm for fish trawls, 18-25 mm for shrimp trawls, and 20-40 mm for cephalopod trawls are also in use. The statutory requirement of square mesh codend were not found to be use in any were in the study area.

To conserve energy and trawl resources regulations with regard to size and engine power of trawlers and size of trawl nets need to be implemented. Selective fishing practices and mesh size regulation need to be strictly adhered for the longer sustainability of fishery resources. Dimensions of trawl nets for different category of trawlers may be prescribed to stop the practice of making huge size nets and pelagic and pair trawling. The findings of the study will help as a benchmark for determining the changes in the fishing power and also to introduce gear-based technical measures for the conservation of trawl resources.

The results have demonstrated long-term structural changes in the mechanised trawl fishing fleet of Cochin, central Kerala. The study examined the changing trends in Kerala trawl fisheries from 1955 to 2021 in terms of major changes in craft and gear. And also indicated the L_{OA} of vessels and hp, head rope length of the trawls and wing end mesh size were increased significantly as compared to previous studies. There is an urgent need for strict implementation of fisheries regulations to protect the fishery resources for the future. Fuel savings trawl designs and accessories like V-form double slotted otter boards developed at ICAR-CIFT may be adopted by all categories of trawlers to reduce carbon emission.

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