Ring seine fishery of Kerala: An overview

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Among the various fishing gears employed for pelagic schooling fishes along the Kerala coast, seines are the most efficient. Contribution of ring seine to total marine fish landings of Kerala has steadily increased since its introduction during the early eighties. It was 21.4 % in the nineties rising to 36.7 % during the period 2000-2004 and contributing more than 50 % since then. In recent years, about 90 % of the oil sardine and about 60 % of the mackerel landed in Kerala were caught in ring seines. Ring seines were introduced during the early eighties by traditional fishers of Alappuzha District which became highly successful. The new fishing method spread to entire Central and Northern Kerala and Kollam District towards south, replacing almost all the prevailing fishing gears for pelagic resources. However, due to consistent opposition to ring seines from traditional fishers they have not been introduced in Thiruvananthapuram district till date.

Craft and gear characters

During the initial phase of introduction, ring seines were operated from small dug-out canoes of 6.5 to 9.8 m overall length (OAL) which were manually propelled using oars. Since more time and energy was required to reach the fishing grounds and search for shoals, the fishing operations were restricted to a distance within 10 nautical miles (nmi). Since 1984 outboard engines were introduced for the propulsion of crafts. Initially 7 hp engines were used which were replaced by 25 hp engines which helped them to reach the fishing grounds and back very quickly. By 1987, almost all country crafts were fitted with out-board (OB) engines. Later, larger vessels with OAL between 13.7-18.3 m known as *Vallom* were widely introduced with fishing activities extending to areas beyond 10 nmi. These were gradually replaced with large sized plank built boats with an OAL of upto 20 m, locally known as *Thanguvallom,* with a crew of 25 or more fishermen.

The capitalization continued in the sector by using three 25 hp OB engines which increased to three 40 hp engines and became commonplace. For this, the fibreglass coated *Kettuvallam* with a transom stem made of marine plywood with facilities to fit 3 outboard engines conveniently was introduced. However, the craft had no fish hold facility and this led to introduction of carrier boat system for quick transport of catch to landing centres, while the main unit continued fishing. In early 2000, the introduction of inboard diesel engines (IB ring seiners) was a significant development and the trend has continued with increase in size of the craft and engine power. Large boats called "*Thanguvallom*" of OAL between 19.8 - 25.9 m, breadth 3.6 - 4.5 m and depth 2.1 - 3.4 m powered by inboard diesel engine became popular. Initially, most of these units used 180-225 hp IB engines. Recently, vessels with 30 m (100 feet) OAL, fitted with Chinese made high speed IB engines of over 400 hp are operating. With the introduction of large nets, purse line winches were fitted in these vessels to facilitate quick closing and hauling of the gear. Medium sized boats of 10.7 - 13.7 m OAL known as *Vallom,* fitted with OB engine of 25 hp and above are being used as carrier vessels by these fishing vessels.

Till the middle of 1960s different kinds of boat seines made up of cotton and hemp fibres, popularly known as *Ayilakollivala / Ayilachalavala / Adakkamkollivala* were used. After that a new boat seine called *Pattenkolli* made of nylon fibre was introduced, with much smaller size mesh, that dominated the fishery till mid 1980s. Ring seines first introduced in 1982 were broadly grouped into two categories, the small meshed *Choodavala*/

Discovala and large meshed *Thanguvala/Ranivala*. The *Choodavala/Discovala* is relatively smaller in size below 250 m in length, 30-70 m depth, with 8-12 mm mesh webbing and targets anchovies and perchlets. The *Thanguvala* that mainly targets oil sardine and mackerel generally is 800 to 1000 m in length, 80 to 100 m in breadth with 22 mm mesh and weighs between 1.5 to 2 tonnes (t). Several modifications have been made by the fishermen in the design of the gear to enhance its performance. However, tempo of gear modifications has been much slower compared to that of crafts.

Ring seine net being loaded on to an IBRS unit

Ring seine nets operated by IBRS units being mended

Ownership Pattern

In the ring seine sector, ownership of the fishing units is either individual or collective. The individual ownership is restricted to smaller crafts up to 40 feet OAL, which are generally non-motorised or fitted with outboard motors (OBM). For larger sized crafts, the ownership is collective with the unit being owned by a group of fishermen (share holders).

Fishing operation

The gear is operated in near shore area within the depth zone of 10-50 m and up to 12 nautical miles (nmi) from shore. Fishing units move to different areas in search of fish shoals based on sea conditions, wind and current patterns, movement of seabirds and/or sea mammals which are used as indicators of presence of fish shoals. Earlier, surface shoals were identified by experienced fishers from the shoal behaviour. Currently, SONAR with digital display is being widely used to locate and identify the shoals. If very big shoals are located, information is communicated to other units at sea or on shore and accordingly more units move to the fishing ground.

Shoals are encircled with the net towed at maximum speed to minimize fish escape. The trapped fishes are concentrated close to the craft at bunt portion and net hauled to mother boat. If the shoal is very big, partial harvest with scoop nets is done. Catch by small vessels is transported directly by the fishing units themselves to the landing centres which may return to the same ground to fish until the shoals are exhausted. Thus in a day, two to three operations are carried out by small vessels, depending on distance to the ground. In the case of larger crafts, while the vessel remains in the fishing ground and continues fishing, one or

Carrier boats landing at Thottappally Fisheries Harbour, Alappuzha District

Carrier boat with catch of anchovies

more carrier vessels associated with it are used to transport catches to the shore.

Attack by dolphins and puffer fishes are common during ring-seining usually during the time of hauling the catch on-board. This leads to heavy loss to the fishers through net damage and fish escape. It also increases labour and causes loss of time. Such incidents are more frequent in recent days, after extension of fishing activities to deeper waters. The issue is being addressed by operating Dolphin Wall Net (DWN) locally known as "*Pannivala*" around the ring seine. Once the fish shoal is encircled by the ring seine, it is surrounded by DWN operated from a dinghy/carrier vessel. DWN is made up of 300-400 mm polyethylene webbing of 1.5 mm twine and 1000 – 1500 m length framed with float line and steel rings hanging from the lower edge. Two types of DWN are in use, one with conventional plastic float with selvedge for reducing entanglement of floats to the webbings, other with thermocol blocks and oil cans as floats and without selvedges.

Trends in fishing effort

Since its introduction in 1982, effort by ring seines have increased steadily. Inboard ring seines (IBRS) first introduced in 1999 became more popular due to high catch rate and return and resulted in its wide adoption subseqently. The upward trend in effort by outboard ring seines units (OBRS) continued till 2008 after which it started declining. Total effort in active fishing time also shows similar trend (Figs.

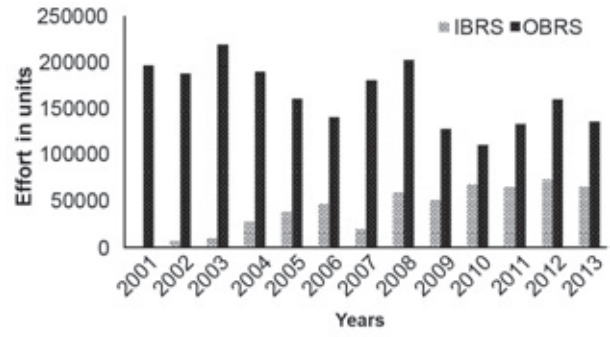

Fig. 1. Fishing effort (in units)by OBRS and IBRS units along the Kerala coast during 2001-2013

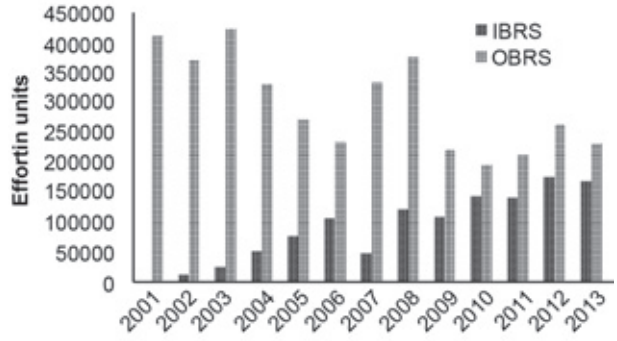

Fig. 2. Fishing effort (in hours) by OBRS and IBRS units along the Kerala coast during 2001-2013

1 & 2). The upward trend in effort from 2002 by inboard ring seines also continued till 2012 and declined thereafter due to low catch and catch rates, which made their operations economically unviable.

Ring seine catch characteristics

Ring seine, which is the major gear operated along Kerala coast contributed about 51 % of the total annual landings of the state during 2008-2014. Since its introduction, there was steady increase in fish landings till early nineties followed by a steep fall in production in 1994 due to the drastic decline of the oil sardine fishery. Following the revival of the oil sardine stock, the production reached an all-time high of nearly 4 lakh t in 2012. Peak landing by outboard sector occurred in 2003 after which it has fluctuated over the years. Landings by inboard sector registered steep increase during 2009-2012 period after which it has declined sharply (Fig. 3).

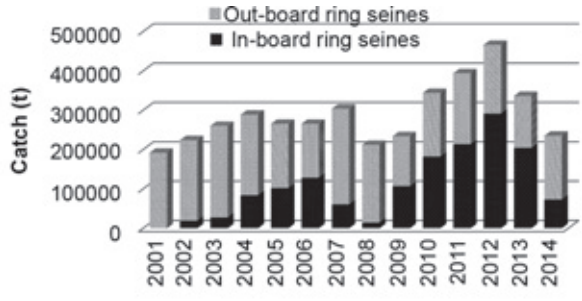

Fig. 3. Catch trend in IBRS and OBRS units off Kerala coast during 2001 - 2014

Oil sardine (*Sardinella longiceps*), Indian mackerel (*Rastrelliger kanagurta*) and white baits (*stolephorus* spp.) are the most dominant resources accounting for about 84% of the ring seine catch. Other resources caught are the lesser sardines, clupeids, coastal tunas, seerfishes, ribbonfishes, carangids and penaeid prawns (Table 1). Oil sardine is the mainstay of the marine fish landings in Kerala with average landings during 2011-2015 being 2.24 lakh t. Ring seine is the major gear used for fishing oil sardine and contributed to 94% of the total oil sardine caught in the state during the period. Oil sardine in the fishery was supported by 45-220 mm size fishes with bulk formed by 100-170 mm size groups. During 2011-2014 period oil sardines below 140 mm total length (TL) which is the Size at First Maturity (L_m-the length at which approximately fifty percent of the fishes are mature) formed about 66% of the estimated numbers landed while juveniles below Minimum Legal Size (MLS) of 100 mm formed only 12 %. Indian mackerel is the second dominant species exploited by ring seine. The average annual landing of mackerel in the ring seine during 2011-2015 was 0.28 lakh t which formed 9.8% of the total ring seine landings of Kerala. The size groups that supported the fishery was 105-260 mm with a mean size of 179 mm.

Anchovies contributed 11.3% of the total ring seine catch during the period. Fishery was supported by more than 10 species of the family Engraulidae. Lesser sardines constituted 3.8 % of the ring seine catch and generally formed a major portion of the

Table 1. Major resources landed by ring seines along the Kerala coast and their percentage contribution during 2010-14

Species/group	Mechanised ring seine (%)	Out board ring seine (%)
Major resources		
Oil sardine	63.77	62.01
Other sardines	5.75	2.89
Mackerel	17.84	6.10
Stolephorus spp.	2.22	10.58
Coastal tunas	2.56	0.02
Scads	2.41	0.52
Minor resources		
Rays	0.003	0
Wolf herring	0	0.05
Thryssa spp.	1.68	4.17
Belonids	0.01	0.32
Croakers	0.15	1.09
Ribbon fishes	0.34	0.01
Horse mackerel	0.23	0.06
Silver bellies	0.01	0.26
Big-jawed jumper	0	0.08
Barracuda	0	0.01
Sliver pomfret	0	0.03
Mullets	0	0.01
Soles	0.04	0.44
Prawns	0.42	3.95
Crabs	0	0.03
Squids	0.04	0
Other clupeids	1.80	3.70
Other perches	0.05	2.05
Other carangids	0.45	1.52

catch by ring seines operated in the southern districts. Among lesser sardines, *Sardinella gibbosa, S. albella* and *S. fimbriata* dominated the catch. Catch of juveniles of other large pelagics like seer fishes, tuna and carangids also occurs occasionally. The juveniles of sardines and anchovies were more predominant during June-September period and that of mackerel throughout the monsoon and post

monsoon months (June-November). Catch of juvenile fishes off Kerala coast has becomes a major concern among the scientific community as well as fishers during recent years.

Summary

Ring seines fishery, since its introduction has registered steady growth both in terms of fishing effort and yield till 2012. Thereafter, due to declining catches, mainly of oil sardine, economic returns were affected adversely. Recently, the seriously dwindled catches of oil sardine along the Kerala coast has rendered the ringseine operations economically unviable. Though the oil sardine catch in the gear was supported mainly by immature fishes, major share of the catch was above the declared MLS of 100 mm total length. Moreover, spawning stock biomass was also high at 30-38% during 2010-2014, which is sufficient to sustain stock and fishery of this resilient species.The *El Nino* which set towards the end of 2012, intensified during successive years with peak impact in 2014 and 2015 as indicated by the Oceanic Nino Index (ONI). The impact of *El Nino* appeared to be highly adverse for oil sardine. The prevailing environmental conditions along the west coast especially along Kerala coast was not conducive for immediate recovery of the oil sardine fishery as indicated by the poorly fed conditions and stunted growth. Apparently unfavorable environmental conditions have resulted in migration of the oil sardine to areas with more favourable ecological conditions. Earlier studies suggest that oil sardine will come back when impact of *El Nino* subsides. The recent crisis in fishery due to drastic decline of the oil sardine fishery off Kerala coast as well as the declaration of the MLS For 14 commercially important species including oil sardine and mackerel through a government notification (GO(P) No. 40/15/F& PD dated 24th July 2015) facilitated by scientific inputs of ICAR-CMFRI has increased awareness among ringseine fishers on the adverse effects of juvenile fishing (Ramachandran and Mohamed, 2015 *Economic & Political Weekly*, Vol. 1., No. 35).

The Central Institute of Fisheries Technology (CIFT) had recommended only about 300 units of ring seines for the Kerala coast but a study by South Indian Federation of Fishermen Societies (SIFFS) in 1998 estimated 1636 ringseine units operating with an estimated 2277 numbers of nets. The overall dimensions of the gear had also grown three to four times from the design introduced by CIFT (Edwin *et al*., 2010, *Proc. National Seminar on Conservation and Sustainability of coastal living resources in India, SOFTI (India), CIFT, Cochin)*. Even now, fishers themselves are continuing to make changes in design and size of the gear according to their vessel capacity to get better catches. Studies have indicated that simple doubling of the gear length increases the effective fishing area by almost 4 fold. A combination of increased gear and vessel size, engine power etc. will therefore enhance the fishing capability several fold leading to high fishing pressure on the stock. Hence, strict measures to regulate the excessive fishing pressure is required.

Depending on the distance to fishing ground and availability of shoals, small ring-seine units are undertaking several fishing trips in a day. Larger vessel units on the other hand remain in the sea and continue fishing till the shoals are fully tapped. These intense fishing practices prevent escape of even a small part of the shoal and raise concerns of sustainability. It is advisable to enforce regulatory measures such as number of fishing trips in a day or season, number of carrier boats and trips, engine horsepower or even quantum of fish that can be caught and landed by the ring seine units to ensure sustainable exploitation of the resources. As a large number of fishermen depend on ring seine fishing for their livelihood, these conservation and regulatory measures need to be developed in consultation with the stakeholders.