INTERNATIONAL COLLECTIVE IN SUPPORT OF FISHWORKERS (ICSF)
2015-16, DRAFT REPORT FOR COMMENTS
INDIA STUDY: CONTEXTUALIZATION OF SSF Guidelines

Pros and Cons of High Catch Fishing in Traditional Fisheries since 90's:

Village Level Cases of South, Central and North Kerala

STUDY BY PROTSAHAN FOR ICSF

INTERNATIONAL COLLECTIVE IN SUPPORT OF FISHWORKERS (ICSF)
2015-16, DRAFT REPORT FOR COMMENTS
INDIA STUDY: CONTEXTUALIZATION OF SSF Guidelines

INTRODUCTION

Innovations and changes in fishing practices became inevitable in the competitive fishing scenario particularly of the limited and open access resources. In Kerala it is quite often triggered by increase in demand of fish, external capital and the consequent competition. The current scenario is that the different categories of players in the fish production system of the State are arming for grabbing the maximum, quite often leads to overfishing, juvenile fishing and ecosystem damage. Time line analysis on change in fishing practices of traditional sector before and after 80's revealed that prior to motorization (before 80's), the entire coast of Kerala was classified into three major craft zones based on fishing craft prevailed, such as catamaran zone (Kollamkode to Sakthikulnagara), plank built zone (Neendakara to Thrissur) and dugout canoe zone (Malappuram to Kasargod). To compete with the mechanized boats which was introduced through Indo-Norwegian project in 50's — motorization has been adapted to the above mentioned three categories of traditional craft since early 80's. Changes were also reflected in many of the traditional fishing gears in response to the motorization of crafts in which the innovation on boat seine of central Kerala into ring seine in mid 80's was the significant one (See D'Cruz T, 1988 for details). It enabled the traditional sector to acquire a higher catching fishing method which is more close to purses seining. As a result the practice of passive fishing method in boat-seining has been changed to an active ring-seining in which the fishermen started chasing the fish shoals and shot the gear with the aid of OBM propulsion which was otherwise not possible by the earlier means of manual effort alone.

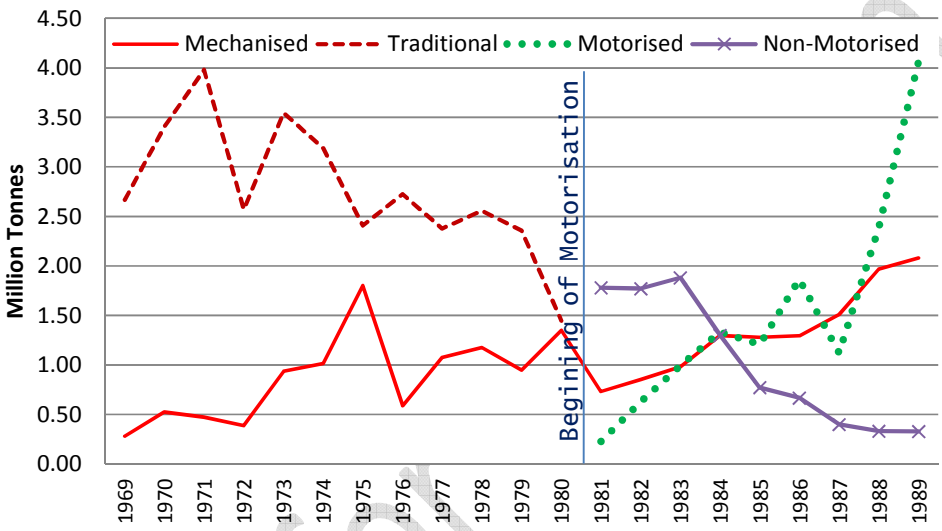
The ring seining method of fishing is more or less similar to the mechanized method of purse-seining. All the operation in purse seining particularly shooting and hauling of the bulk net is aided by the IBM machine and that enabled a proportionate reduction in manpower. The catching efficiency of purse seine is comparatively much higher and the proportional investment and return is also at a higher scale. This better income attracted the external capital and therefore the ownership is vested with the investors. At the time of introduction of ring-seine, shooting and hauling was done manually which accommodated larger number of labor fishermen of 30 to 40 in a unit. The other features of ring seine such as liberal approach in sharing of income to many, coupled with the decentralized ownership, mostly on group basis, enabled channelizing institutional credit, particularly of the State's fishermen co-operatives. However, the middlemen and money lenders maintained their parasitic role to run the system by identifying loopholes such as insufficient, untimely and procedure oriented credit packages that run on the inherent sluggish method of management.

Motorization and the introduction of ring-seine made a total sea change within the traditional sector of Kerala. The success in ring-seining at Kochi accelerated its promotion on either side of this district and reached up to Neendakara in South and Malappuram in North. Parallel to this, another kind of ring-seine, very much closer to the design of purse-seine of that locality was introduced in Kasaragode from the neighboring fishing harbor of Malpe in Karnataka and was spread up to Kannur. The two ring seines locally known as *thangu-vala* (Kochi origin) and *rani-vala* (introduced from Malpe) had been co-existed at Kozhikode, Malappuram and Thrissur districts till the 90's. In the Malabar Coast this gear was operated on dug–out craft which was naturally smaller in size that necessitated the usage of four craft per unit to carry the bulk net and the catch. Thus the two kinds of motorized ring seines spread on the entire Malabar and Cochin Coasts of the State and ring seining become synonyms to traditional fisheries of Kerala. It also reduces the importance of other practices of fishing in the traditional sector in terms of quantity as well as value of the fish produced.

Impact of motorization and ring seine in fish production scenario of Kerala

Fig ( ) given below revealed the fact that since the inception of mechanization it pull down the fish production share of traditional fishers from 4 lakhs tones in 1970 to 1.5 in 1980. This was continued till the traditional fishers acquired better mobility on sea at greater depths through the intermediate technology option of OBM, since 80's. It also enabled innovations in the traditional fishing gears that supported chasing the fish shoal and fishing at deeper waters. The fig ( ) also revealed the fact that since the motorization the traditional fishers regained its old status of fish production from 1.5 lakhs tones in 1980 to 4 in 1989. Since then, gradually they improved the fish catching capability on a progressive manner by innovations mostly on three components of fishing such as craft, propulsion and gear. In addition electronic devices for fish finding and communication are also added to improve the efficiency.

Fig - Impact of motorization and ring seine



Source: CMFRI catch data adopted from PCO SIFFS study 1991

Since 2000, the competition among ring seiners extended to little deep waters for larger and fast moving shoals of fish. Instead of chasing the slower moving pelagic shoals like anchovy, sardine, mackerel and sedentary demersal prawns that mostly available during monsoon — at present, the ring-seiners gear up for the total fishing. Distant water fast moving high value tuna, horse mackerel, and carangid species were also targeted occasionally that fetches higher returns. This necessitates the increase in depth of net, size of the craft and horse power (hp) of engine. The hp of OBM increased from 9.9, 25, 40 and pairs of 40 and finally reached to a situation that OBMs became not enough to carry the larger craft with the bulk net. A competition for reaching the fishing ground for catching the first shoal, at greater depths, in a day, also necessitates high speed propulsion means. Gradually OBM is replaced by IBM of Leyland brand diesel engine of 200, 350, 400 and 450 hp. The hauling of heavier net and pulling out the ring particularly when it entangled at muddy sea bottom also demanded manual effort of more than 40 crew which will not only create more crowd onboard and but also difficulty in mobilizing such a big crew size every day. No option other than installation of winch to solve the problem and that was started since late 90's in Thrissur districts.

Similarly wood, plywood and FRP is also replacing by steel as the boat building material. This adoption was primarily to ensure enough strength for the increasing size of craft and also necessitated a harbor for safe landing of such a heavy craft with the bulk net and catch. It

changed decentralized village level beach landings to centralized harbor based landing that badly affected the marketing system of fish as mentioned elsewhere. The harbor dependent fishing also added inconvenience for the mobilization of larger crew from the remote fishing villages to the harbors. A bus became necessary to transport the crew from one place to the other that added Rs 10 to 12 lakhs to the capital cost of the fishing unit. The total investment also increased tremendously from about Rs 30 to 40 lakhs in 2000 to Rs more than one crore in 2015 which is an enormous as well as risky scaling-up as far as the traditional fishermen are concerned. The contradiction is that though the investments are in terms of crores, no such proportional improvement has been noticed in the quality of life of these outliers.

Usage of mobile phone, wireless, GPS and echo-sounder reveals the technological advancements in the traditional fisheries of Kerala particularly in ring seining. The searches of pelagic shoals are inevitable for shooting the net. In the case of industrial purse-seining search of shoal is aided by helicopter. In its absence a person stand on the top of the mast known as 'monkey's bridge' and watch the distant shoal on the open sea with the aid of binoculars. Ring seiners followed the later without the aid of binoculars. Later, usage of the echo-sounders by ring seiners enables, tracing the column as well as bottom dwelling shoals. The searches of shoals by eye, as well as electronic equipment, widen the opportunity of bumper catches. That comprises low value pelagic shoals detected with eye-watch and high value column as well as bottom shoals with the echo sounder. Mobile phone and wireless also aided the location of lucrative fishing ground through the instant information exchanges between friends and relatives while fishing.

The instant return on investment acquired by a handful of newly introduced, high catching ring seines, which involve capital intensive innovations, in a village, are always set ahead in the competition. Such fishing group has been gaining confidence and leverage to invest more and more on the capital as well as operational costs and win the major chunk of fish shoal appears in their village/harbor vicinity. Certainly that will provoke the others and with no other option, the others also took part in the competition by investing more in the risky venture. Now a day's fishing is like winning lottery, a few may flourish and a majority will perish depend on the competitive provisions in each of the crafts that aided to reach early at the fishing ground, ability in instant detection of fish shoals and skill for quick shooting and hauling of net and finally the fishing season of that year. It was observed during this enquiry period (January to April 2015) that many units run on loss due to the high operational cost and repayment due, on installment of loan, primarily of poor season and this situation has been noticed throughout the coast of Kerala.

The increase in investment for larger units, introduction of winch and proportionate reduction in manpower due to 'efficiency' of fishing has reduced the acceptance of ring seines among the fisheries management personnel and that also created a situation that the fishery co-operatives not in a position to lend out loan to that scale. This competitive situation is really capitalized by the merchant money lender nexus, multinational companies of OBMS and IBMs. The other beneficiaries are net makers, boat builders, kerosene merchants and the Government (as fuel tax @ 25%). The contradiction is that the fishermen still living in huts and at same time own assets worth millions of rupees — it may also pull down the ring seine fishers out of the considerations of the small scale fishers. Though fishing ban have insisted in other States of India to the higher catch fishing methods of traditional sector, during monsoon, this 'traditional purse-seiners' of Kerala in other words the ring fitted thangu-vala is excluded by the State Government due to the political lobbying.

Methodology

In order to document the micro level changes in the fishing practices of Kerala, three village level cases has documented from the three locations such as south, central and northern zones of Kerala. The selection is based on the secondary sources of information gathered from similar nature of enquires done earlier in 1995 and 2000 by the author and also from the secondary sources such as censuses of SIFFS (1991, 98) and CMFRI (2005, 20101). Field visits in selected zones and villages, observation methods on noticing the changing fishing practices in these zones and information gathering by open ended interview with the master fishermen and their groups are the methodologies adopted for this study. The features of fishing practices collected earlier from a particular village or zone has taken as the bench mark to compare and contrast the cumulative changes that have taken place since the last 15 to 20 years. Such changes in the fishing practices are documented to draw the changes over time in fishing practices and recent trend in investment. Changes in fishing practices other than ring seine is also narrated in each of the three cases and is further discussed as category-wise such as mechanized, motorized and non-motorized. Achuthengu panchayat in Trivandrum district, Valappad panchayat in Thrissur, Kasaba in Kasargode are the three locations selected for the case analysis to depict changes in fishing practices and its impact in the fishing scenario of Kerala.

Changes in Fishing Practices: Anchuthengu belt of South zone

In non- ring seine belt, particularly in Trivandrum, not much change on propulsion has been noticed in Southern Trivandrum where week long deep-sea fishing has developed on plywood FRP boats with OBM. Introduction of IBM ring seine has started recently in a few pockets at Northern Trivandrum and was introduced from northern districts of Kerala. The number shows a progressing trend started from 3 and reached >25 (information obtained through field enquiry). Catamaran and shore seining continuing its decline whereas gillnetting and lining on motorized craft is maintaining its domination all over in this deep water zone of Kerala.

It is interesting to note the unique change that have taken place in the fishing practices of the Poothura Thazhampally fishing villages in Anchuthengu of Trivandrum. The Anchuthengu fisherman have the strong hold on fishing in Trivandrum district and is the second highest village in terms of motorized craft population (12%) next after Vizhinjem South (CMFRI Census 2010). The changes in craft population revealed that catamaran declined to almost half and it is proportionally replaced by the motorized plywood and FRP by doubling its number during period of 7 years (1991 to 98 census of CIFFS). The declining pace of catamaran population is slow down to 20% by taking comparatively a longer period of 12 years (1998 to 2010) and the proportionate increase of FRP during this period was 10%. Though beach seine remain the same (16 numbers) in 91 and 98, now it becomes less than 10. Gillnets, hook & line and boat seine are the predominant fishing units in Anchuthengu.

The neighboring southern villages of Anchuthengu such as Poothura and Thazhampally are situated in a narrow strip of land lying in between backwater and the sea. Beach-seine was one of the major gears in these villages which are normally operated by unskilled and old fishermen. Setting up of Muthalppozhi breakwater recently made a sea change in these two villages. The sandy beach completely eroded by 'end erosion' phenomenon of breakwater. The sea swallowed the beaches of these two villages and accreted to the south of the breakwater and the width of beach is progressively reducing every year. Many houses were partially damaged and a few completely destroyed by the sea erosion. These two villages became without beach which created a situation that no more beach-sine operation is possible. Fisher folk loss their land, house, accessibility to sea and occupation, and they responded to this situation by many ways. It includes agitation against the breakwater, adoption of high catching fishing method, demand for

sea-wall as well as river wall, and adequate compensation and rehabilitation package from Government.

They weere rehabilitated in the nearest island that lost their direct accessibility to sea and occupation. Later, sea wall was set up to reduce the erosion and to save the narrow strip of land in between the backwater and the sea. According to Irrigation Department the cost of construction for sea wall is Rs 7crore per kilometer and further it required the maintenance cost of Rs 3 to 4 crore per km from time to time. Sea walls have inherent disadvantages and are generally considered as barrier and dangerous knell for fishing craft. Though these fishers have adopted ring-seine from Alappuzha but the capital money mobilized through external means mostly from gulf returnees. Though it enabled a shift from shore based seine fishing to sea based ring seining this high catching gear created threat to the neighbor's selective fishing methods such as gillnetting, lining and shore seining. The newly introduced ring seiners competing for the same fishery of the neighboring beach seiners, gillnetters and liners - that created tension between the fisher groups.

Gillnet and line fishermen of Ancthuthengu who are numerically strong used to encroach the ring seine catches at sea while fishing. Whenever the ring seines operates close to shore the neighbors more often stopped the operation by force – which is similar to the earlier stoppage of trawler operation in the coastal sea of Anchuthengu that have done with unity and co-operation by all these neighbors. Now they are divided very much and the Poothura-Thazhampally ring-seiners started agitation against the encroachment of Anchuthengu fishermen. The District Collector intervened to prevent further violation in the law and order both at sea and on the land. The customary practices normally tackled these kinds of issues become ineffective and finally the formal authority declared a decision after various consultations with the parties that ring-seine operation is permitted in this area but only after a distance of 3 Nautical Mile and is prohibited in the vicinity of coastal sea. The unfortunate situation that no arrangement has made for the MCS (monitoring control and surveillance) measures and therefore the tension and chances of further conflict is prevailing between these traditional fishers.

This larger ring seine craft locally known as *kappal vallam* (= craft have size of a ship) while moving through the back waters create waves that hit on soft embankment led to another kind of river erosion. The fisher folk live close to the embankments demands hard river-wall to prevent the erosion and safe guard their land and houses. On the sea side the end erosion due to the break water is extending towards north and the northern villagers started demanding sea walls to protect their land and households too - though they aware that it will have bad impact on the beach, the space for fishing activities and their free movement at sea as well on land. This is one of classical stories reveal a tragedy that took place in the name of 'development' that adversely affected the very existence of the fisher folk: their inhabitance, the ecosystem and livelihood of this deprived.

The change in fishing practice in Trivandrum district as a whole reveals that introduction of ring-seine is the major change and is a thread to non-ring seine fishers. It is mainly introduced in villages where fishing is poor and the prime reason is the poor skill of fishermen in those villages. The new gear introduced has the features of high catching and required a vast majority of unskilled fishers with a handful of skilled master fishermen. It is the responsibility of master fishermen to operate the IBM, winches, detection of fish shoal and provide timely command for the shooting and hauling of the net. For the execution of this vital activity required hardly two to three master fishermen in a larger group of 25 to 40. The hard work of hauling the net along with catch is performed by the vast majority. This features of ring seine operation is more or less

similar in beach seine operation where the larger number of about 40 in a unit mostly pulling the towing warp to haul the bag with or without catch on land in which majority of them are old and unskilled fishermen. Vizhinjem North, Santhipuram, Thazhampally, Poothura and Vettor are the areas where ring seine has been introduced recently in Trivandrum in which at Vizhinjem north, due to the strong opposition of the gillnetters and liners from Vizhinjam south, it remains idle on land - yet another conflict between the fisher groups due to the inroad of high catching fishing method.

Introduction of long stay fishing units for deep sea fishing on FRP boat is another development in southern Trivandrum border. The Neerodi village of Kanyakumari district which is one of the nearest neighboring villages of Trivandrum operates about 250 long stay FRP - OBM fishing units, all over Kerala and Malpe. Five to ten units each are also operating from Poovar and Vizhinjem, and one each from Kannanthura and Veli. The other changes in fishing practices in Trivandrum include; the popularly known *klangil* fishery targeting cuttlefish is still prominent in Trivandrum. This has been banned in Karnataka due to the over fishing of brood stock of cuttlefish where it used to adhere its egg around the twigs of *klangil*. The boat seine locally known as *thattumadi* become developed as high catching fishing method in Trivandrum by enlarging its bag size two to three times of its earlier version which operated on catamaran. The fish is being attracted towards the bag using high power light of LED. Usage of OBM in beach seine operation and wide spread usage of 'use and throw' monofilament as bottom set gillnets targeted for export item of flat fishes is another recent addition to the change in fishing practices of Trivandrum.

Nattika and Valappad in Trissur of Central zone

Rupees one crore five lakhs was invested in one of the recently (2013) set up ring-seine units named *Guru-dhakshina* at Nattika fishing village in Thrissur district. The craft is made of steel with OAL of 65 foot, installed winches, propelled with high speed China made IBM run on diesel, operating with crew size of 30 to 40. A carrier crafts made of FRP fitted with OBM and big size net of about 2 tones, a bus to transport the crew are the major constituent in the unit. To protect the net from dolphin's attack while hauling the net with fish, another net locally called as *panni- vala* (=dolhhin net) made with HDPE of larger meshed 120 mm used to encircle it as an outer layer around the ring seine net, if detected the presence of dolphin while fishing – is another new addition. According to fishermen the population of dolphin has been increasing due to the conservative measures adopted by the MoEF to protect the endangered animals including dolphin.

The main feature of ring seine fishing is that it has more resemblance to hunting in the forest in which detection of prey and chasing is a must for shooting the net. Echo sounder as a fish finder introduced recently in the craft enables the shoal detection under water and that was otherwise difficult earlier. Prior to the application echo sunder, expert fishermen used their traditional knowledge and skill for underwater shoal detection by noticing the bubble coming up to sea surface and turbidity due to the movement of shoal underneath. The earlier method of pelagic shoal detection by-eye remains the same without aid of any electronic device like the binocular. Mobile phones may not be that effective at sea due to the poor access of mobile range at distant waters and therefore it is replaced by wireless. Secret information gathering on the location of fruitful fishing ground from relatives and friends, at sea, by private frequency mode of wireless is a common practice for every days fishing. It also enables gathering information on selling price of fish from various landing centers and harbors and now a day is becoming very much part of selling the fish. The heavy steel craft mostly move in between the two adjacent harbors in South

and North of Nattika in Trichur district such as Azhikode and Chettuva and rarely lands at the village based lading centers, except at times, when the sea is very calm and the situations of disposal of little catches.

The income and expenditure of *Guru-dhakshina* ring seine unit revealed that surprisingly in that same year of the introduction of this unit it has earned a net income that was enough to remit all the borrowed capital. This high investment and the success story certainly will trigger the competition in the village but the success may not be replicated, if all the units adopt such a big scale of investment and improved fishing capacity in that locality. According to master fishermen of this locality "there are about 60 IBM ring seiners are operating in between the two estuaries which are the boundaries of Thrissur district such as Azhikod in South and Chettuva in north. Out of this 60 about 20 are owned by the money lenders 40 by the fishermen groups. Another 30 ring seine units of smaller size operated by OBMs locally called as *daba-vala* installed with winch are also operating in this district. Echo sounder in a few, wireless set in many and mobile phone in all crafts is the usage pattern of electronic device in these OBM ring seine units. More or less the same pattern of fishing is followed in Ernakulam district also by making use of the Munambam harbor in north and Fort Cochin harbor in south. These two bar mouths are the passage for large number of mechanized, motorized and non-mortised fishing units including the commercial cargo ships which used anchored inside of the back waters at various landing points set up throughout the Vembanad lake which is the largest backwater - inland water body net work of Kerala.

Kasaba in Kasargode of North Zone

Kasaba is one of the fishing villages where the temple *kadalkodi* (=community decision making body) and customary practices are still maintaining its influence in managing the community affairs. It includes the fisheries management issues with emphasis on equitable sharing of benefit from fisheries and related activities. Kasaba coastal sea is being overfished by the purse-seiners and trawlers from the neighboring Malpe fishing harbor of Kranataka and therefore the fishing effort is already at a higher level. As a result the ring seine population in the village shows a declining trend since the last 15 years. The population of *rani-vala* (=ring seine for sardine) and *mandu-vala* (=ring seine for anchovy) was *21 each of both the categories, in late 90's* (SIFFS Census 1988) and now the *mandu-vala* has been disappeared, and the left out is only 10 *rani-vala* units. According to the *kadalkodi* members men and women of the village, particularly the youth, moving out of fishing and seeking employment in non-fishing areas, such as construction of building and textile shops.

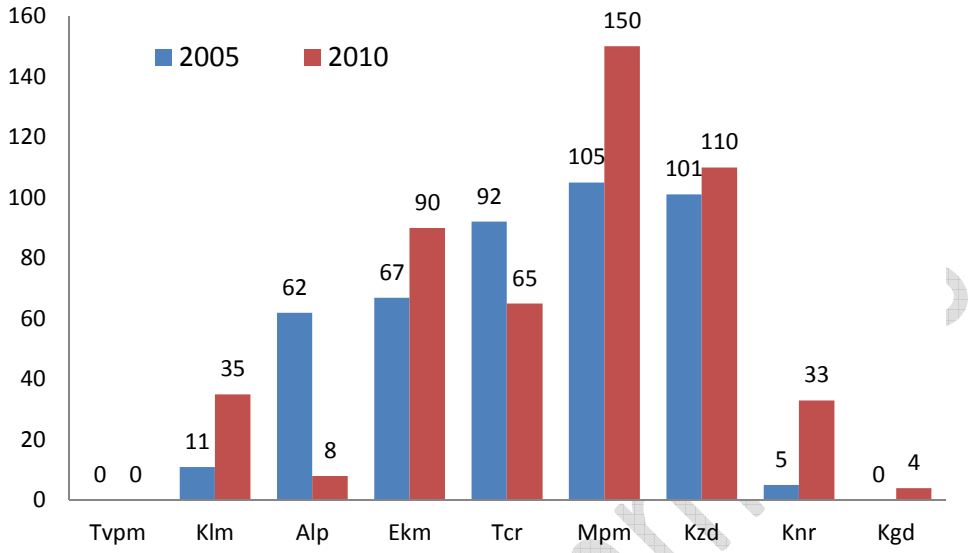
IBM units of ring seine are also started its entry in Kasaragod like in Trivandrum, however the old *rani-vala* ring seine run on OBM targeted for sardine and mackerel (mesh size 18-20mm) are still operating in the districts. In Kasaba, out of the 10 units of *rani-vala* only two are supported by Matsyafed. Last year these two units caught fish worth Rs 1.2 crore in which sardine was the predominant catch. The investment of the unit which was operated earlier on dugout canoe was around 10 to 15 lakhs in 1988 has been almost doubled since 2000 in which the dugouts were replaced with FRP plywood boats that increased the carrying capacity which is utilized by more bulk net and that necessitated higher hp OBMs. Even then the investment remains at a lower level of one third of the IBM ring seine.

A macro picture on distribution of Mechanized ring seine in Kerala

There are 443 mechanized ring sine units enumerated by CMFRI in 2005 and has been increased to 495 in 2010 census. The ring sine operating with OBM is clubbed together with the census of motorized units and therefore its status on spatial distribution is not clear. The status of IBM

ring seine in 20005 and 10 is compared and contrasted with the CMFRI census and is given in Fig .

Spatial distribution of Mechanized Ring seine in Kerala



Source: CMFRI Marine Fisheries Census Kerala - 2010 and 2005 [3&4]

Malappuram and Kozhikode are two major districts where the IBM ring seines are predominant in Kerala. Sale of old and smaller IBM units from Alappuza (62 become 8) and Thrissur (92 become 65) to other districts particularly to Trivandrum has been noticed during the field enquiry. Setting up of new and larger units has also been noticed in other districts such as Kollam (11 to 35) Ernakulum (67 to 90), Malappuram (105 to 150), Kohikode (101 to 110) and Kannur (5 to 33) from 2005 to 2010. New addition of 52 units also takes place during this period in which the ring seiner made of steel are mostly built at Cochin where as the FRP from Malpe.

Alappuzha have the highly skilled fishermen for designing and setting the ring net in Kerala and they are the key players in selling the old IBM units to other district and train that local fishermen for the operation of ring seine. However the motorized version of ring seine locally known as *dappa-vala* is still continuing in this district which cost about only one fourth of the IBM unit (Rs 25 lakhs only). The fishermen in Northern part of Alappuzha claiming that they are following the traditional method of ring-seining locally known as *dappa-vala* in which about 80% of the units operating in this area are not using winch and the craft is propelled with OBM only. The shooting and hauling is still continuing manually that accommodate more man power. However, they still prefer larger IBM units, but in the absence of safer berth place like backwater and harbor, and also the poor net income of IBM, they compelled to dispose the IBM units and continuing with the smaller units run on OBMs.

In Malappuram and Kozhikode the usage of both ring nets such as smaller meshed anchovy (8-10mm) and higher meshed sardine (18-20 mm) nets at a time onboard of a single boat is a unique situation in Kerala. The same kind of IBM unit equipped with two types net arranged on the left and right side of the craft ready to operate either one, at any time, depends on the kind of shoal appeared — has also noticed in Neerodi fishing village of Kanayakumari district. Hear the shore seiners of the locality brought the second hand IBM units from Ponndcheri and it has no connection with the ring seine business of Kerala. This kind of unit with the unique presence of

both gear onboard in Malappuram and Kozhikode locally known as *double pad* is exhibited in the photograph given below.

Arrangement of *thangu-vala* and *chooda-vala* at a time onboard

The investment cost of *double pad* unit of Malapuuram and Kozhikode incurred an additional cost of one anchovy ring net and is operated with craft made of FRP or steel. The presence of this fine meshed chooda-vala was not noticed in other districts though it was used earlier throughout ring seine belt, since its introduction in mid 80's. The usage of bus to transport the workers is not noticed hear in these two districts may be because of the proximity of harbor at Quilandy in Kozhikode and Thanur in Malappuram. The investment for OBM ring seine was about 18 to 23 lakhs in 2000 has been drastically increased to 4 to 5 times due to the adoption of IBM ring seine and is a risky investment on the limited and seasonal ring seine fishery. The investment estimated for one of the IBM *double pad* ring seine unit named *Amme-Bahagavathy* at Quilandy in Kozhikode is given in Tab -.

Investment trend in Malabar (Malappuram to Kozhikode)

Components	Specification	Investments (Rs in lakhs)
		2015
FRP Craft, IBM & Winch	65 to 72ft	53
Carrier craft 2	35 to 40ft	12
OBM 4	40 hp	7.36
Thanguvala 18-20 mm	400x55 fm 2000 kg	10
Chooda vala 8-10 mm	400x55 fm 2000 kg	12
Dolphin net	120 mm	0.5
*Bus		0
Miscellaneous		1
		95.86

* Not yet introduced

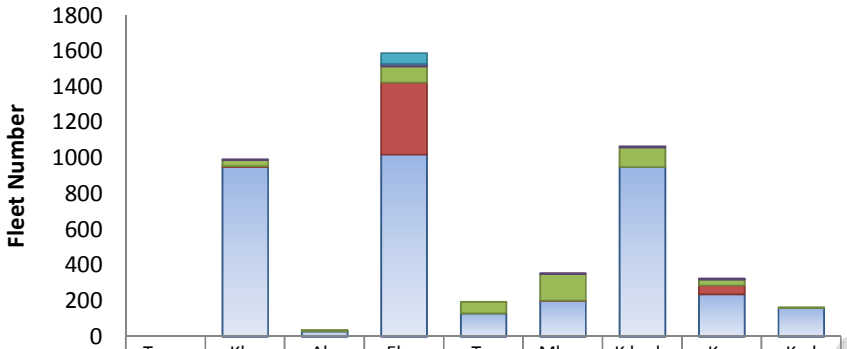
In Kannur district more or less same investment trend has been noticed at the Moplabay fishing harbor. No steel boat has been introduced in this harbor and anchovy ring net is also not in operation in this district and the crowed of IBM units in Moplabay is shown in the Exhibit - .

DEPICTION OF MACRO LEVEL CHANGES

Mechanized sector – Strength of fishing fleets

Mechanized fishing fleets of the State are mainly based in three major fishing harbors of Kerala, namely Neendakara at Kollam, Thoppumpadi at Ccohin and Baypore at Kozhikode. Occasionally they also anchored at other smaller and medium harbors which were built recently. Trawlers, Ring-seiners, Gill-netters Purse seiners, and Liners are the major fishing fleets in the order of abundance. The trawlers which are abundant (78%) and concentrated in the three major harbors mentioned above and mechanized ring-seiners (10%) are widely scattered in all the districts except a few in Trivandrum and Kasaragode. The mechanized gillnetters (10%) and liners (1%) are mostly based at Cochin and a few at the neighboring districts of it. The purse-seiners (1%) are exclusively harbored at Cochin port and are detailed in the Figure given below.

Mechanized fishing fleets of Kerala



	Tvpm	Klm	Alp	Ekm	Tsr	Mlpm	K.kode	Knr	Kgd
P. Seiners	0	0	0	60	0	0	0	0	0
Liners	0	3	0	15	0	1	5	5	0
R. Siners	0	35	8	90	65	150	110	33	4
Gillnetters	0	5	0	403	0	2	0	50	0
Trawlers	0	950	30	1020	130	200	950	237	161

Source: Marine Fisheries Census of 2010 Kerala - CMFRI

The noticing changes among the mechanized fleets include stagnation of numbers of purse seine around 60 but the capital cost per unit cost has increased by 1 to 2 corers. Similarly the trawlers which are abundant in number (3678) comprise the old models of 32 to 40 footer sizes and are replaced by larger size 60 to 90 footer. However the smaller trawlers are still operating in some pockets such as Kollam, Azheekal Moplaybay etc. The wooden boats mostly replaced by steel and installation of higher hp IBM enabled the operation of this dragged gear at greater depths. The Yanmar and Cummins of 450 hp are the costlier (30 lakhs) brands but stable and are not preferred due to the poor accessibility on after sale services. Sinotruk and Weichai of China 280 and 415 hp is the preferred brands mainly due to high speed and half the price of German brand, but as usual has less life. The competitive threat posed by China brand provoked the Leyland and they also starts the production of high speed engine at lower cost. In the context of the deep sea fishing policy, the new trend is that the size of mechanized boat has set at a higher size range. These vessels are sophisticated with the electronic equipments such as echo sounder, wireless and GPS. A brand new 90 footer trawler with all the sophistication is costing more than 3 corers. Most of these bigger vessels switched on to weekly fishing that incurred an operational cost Rs 40,000 to 60,000 for a weekly trip. The major expenditure is for fuel, ice and food. The fuel cost is the major item of expenditure and is vary considerably depend on the number of fishing days per trip, distance of fishing ground, size of the boat and hp of engine. 60:40 is the sharing pattering between the owner and crew respectively after deducting the operational cost.

Traditional Sector

I. Ring seine in Central and North Zone

Three categories of ring seines are identified in terms of size of the net, propulsion means and usage of winch and are discussed below one after the other.

1a. *Mechanized Ring seine - with winch

At the time of the introduction of ring seine in mid 80's the overall length of a ring net was between 100-140 fm (600-840 feet) when it was operated on OBM units. Now this has been increased to 300 to 500fm (1800 to 3000 feet) which is 3 to 5 times more, in the case of ring net that operates on IBM units. The hung depth in mid 80's was 18-20 fm (108-120 feet) and now it has been proportionally increased to 45 to 55 fm (270 to 330 feet). The higher length and hung depth enabling ring seine operations at farther depths of about 40 fathom and it was only up to

15 to 18 fathom at the time of its introduction (mid 80's). The table given below attempted a comparison of IBM ring seine with the purse seine which revealed that IBM ring seine is very closer to purse seine in many ways.

Size of ring seine and purse seine – A comparison

Ring Seine IBM		***Purse seine**	
Length of head rope (in fathom)	Hung depth of net (in fathom)	Length of head rope (in fathom)	Hung depth of net (in fathom)
300 to 500	**45-55**	**250-800**	**30-60**
Ring Seine OBM			
250 to 350	**20-35**		

*Source: CIFT 2015

There are two types of ring seine nets such as the larger meshed (18-20 mm) *thangu -vala* targeted for sardine made of PA 310/1/3 (twine number 1 and $1^{1/2}$) is one category. *Chooda-vala* targeted anchovy has smaller mesh size (8-10mm) made of PA 310/1/2 (twine number half) is another category. Whereas the purse net it is made with thicker twine of *PA 210x2x2 to 210x6x3 and mesh size ranging from 18 to 46 mm* (CIFT 2015). The length of IBM ring seine boat varies from 60 to 75 feet and of *purse seiner is 50 to 90 feet* (CIFT 2015). The comparison revealed that IBM ring seine and purse seine is very much similar — however, the purse net is stronger and bulky because it is made of thicker twine and larger meshed net.

1b. **Motorized Ring seine - with winch

This particular unit is the transition item in the course of development from OBM ring seine without winch to IBM ring seine. The size of the craft and net is comparatively smaller than that of the IBM units. The smaller size enables shallow water fishing because of the lower hung depth of the net and is operating all along the coast. The craft is made of FRP of OAL ranges between 40-45 ft and is propelled with two 40 hp OBMs for chasing the fast moving shoals. A separate diesel engine also installed only for the operation of winch to haul the rings quickly into the craft. The winch enables quick closing of the net from underneath faster than manual pulling and thus reduces the chances of the escape of encircled fish through beneath. The winch also reduced the manpower requirement considerably (from 30 - 40 to 15 – 20) and is a relief to the owners in the current situations of shortage in crew. Manpower from other maritime States of India such as Bengal, Orissa and other NE States who have seaworthiness and experience in fishing is engaged as crew on board of ring seiner.

1c. Motorized Ring seine - without winch

This unit is more or less similar to the ring seine at the time of its introduction in mid 80's except little bigger craft than the original size. Here no winch is using for hauling the rings and is doing manually. This kind of units is predominant in Alappuzha district where the skilled fishermen are available for the operation of ring seine. Alappuzha is famous for the master fishermen in designing and setting the ring seines and is considered as a respected profession which required very specialized skills. Therefore they were locally called as Asans (=Master) and only this masters can design and fabricate this gear. They have good demand all over Kerala and a service charge is fixed for setting one ring net depends on the overall size of the net.

*__Mechanized craft__: Any craft with engine permanently fitted to the hull, which uses machine power for propulsion/fishing operation like casting and pulling the net, operating lines etc. is identified as mechanized craft" (CMFRI marine census 2010) .

Motorized craft: Any craft that has an engine fitted temporarily outside the craft which is used only for propulsion and for fishing operation is identified as motorized craft" (CMFRI marine census 2010).

2. Intermediary motorized units

Plank and dugout canoes motorized since 80's have been replaces by the plywood boats. Non-availability of larger single wood causes the decline of dugouts particularly in Malabar Coast. The intermediary plywood and FRP are continuing fishing with a combination of fishing gears at seasons that includes as a verity of gillnets targeting pomfrets, locally known as *avoli-vala*, tuna and seer gillnets as *pattuvala*, mullet gillnet net *malan-vala*, and mackerel net *kanatha-vala*. The major changes are that except the tuna and seer gillnets, monofilament is largely adopted as gear material in rest of other small mesh gillnets.

Mini trawl net operated on transom plank canoe is the most destructive gear operated earlier — shown a declining trend and is replaced by the banned traditional pair trawling locally known as *vali-vala*. Still they are in use because this is the source of subsistence fishing during lean season.

3. Non-motorized units

The smaller non-motorized units are on fast declining, but continuing in a few pockets, mostly confined at certain seasons in shallow waters. In estuaries and backwaters waters non-motorized monofilament gillnetting is continuing as the important fishing method. Replacement of nylon by monofilaments is total in the case of low meshed gillnets throughout the Kerala. Usage of monofilament as a bottom set gillnet is the recent development in ring seine as well as non-ring seine belts. Higher depreciation, more difficulty in repair and mending of thinner and smaller meshed nets of nylon, non-availability of skilled personnel for repair and mending of net – led a preferred option of 'use and throw' monofilament, as the netting material, but litter the sea as well as land, very badly. Non-motorized units mostly fishing close to shore using low meshed monofilament gillnets net such as gillnets for white sardine locally known as *veluri-vala*, sardine net (*mathi-vala*) and mackerel net (*ayala-vala*). Fishing with hook and line operating at the rocky patches and natural reefs in shallow waters are the locations where a good number of non-motorized units thrive upon.

II. Non-Ring seine Zone

This zone in the south of Kerala can be otherwise known as the catamaran belt where a variety of fishing gears are operating for targeting a variety of fishes at seasons. The steep slopping continental shelf and the consequent deeper coastal sea, and surf-ridden beach naturally selected the usage of four-log and three-log catamarans. One of the major changes in this zone is that fishing has been restricted naturally in 7 villages such as **Vizhinjem S, Anchuthengu, Maryianad Poonthura, Puthiathura Poovar** and **Pulluvila due to a variety of reasons. O**ut of the 46 villages in Trivandrum districts 67% of the total motorized crafts of the districts are operating from these 7 villages and the remaining 23% is widely scattered in the remaining 39 villages (Compiled from CMFRI census 2010). The major fishing units which are dominated in certain pockets of this zone are discussed below.

1. Catamaran units

Motorization of catamaran with 2 hp OBMs is still in low scale and is less than 1% of the total catamaran population and therefore this craft shown an overall decaling trend throughout this zone. A combination of fishing gears such as gillnets for anchovy, sardine, mackerel and hook and line are operated on catamaran. Hook and lining on catamaran is still remaining in a few major fishing villages in the districts such as Puthiathura, Poonthura, and Valiathura where the

fishers mostly depend on natural and artificial reef fishery. The wooden *albisia* is mostly replaced by the FRP catamarans.

In Maryanadu and Anchuthengu, the temporary FADs locally known as *klanjil* fishery accommodate a good number of motorized and non-motorized hook and line units. An unhealthy fishing practice is that the Maryanad fishermen replaced *klanjils* by used plastic bottles packed in a bag made of PE rope and deploying at sea as FADs. These are the bio-non-degradable material littering the sea bottom very badly. Trammel net on catamaran targeting prawns during monsoon has been more or less disappeared and is operating on plywood boats and that also shows a declining trend.

2. Beach seine

This gear remains as such without much change, however the towing warp and wing made with coir earlier had been completely replaced by synthetic polypropylene. The bag made with cotton is totally replaced by the nylon. The latest development is that motorized FRP boats are using for the shooting the net half round shape quickly at sea for chasing fast moving fish like tuna, and landing is aided by pulling the towing rope and wings by about 20 crew each at the two ends - on the land.

This is the main source of income of the old and unskilled fishermen. Sharing is 60:40, the higher share portion of 60 dividends goes to the larger size of crew and the single owner will be the prime beneficiary because it involves little or no operational cost.

3. Motorized Plywood boats

Gillnets and hook and line are the predominant gears operated on motorized plywood boats. It totally displaced the dugouts and plank transom boats from non-ring seine belt. The left out plank canoes are beach seining craft and in certain pockets this has also partly displaced by FRP boats. Widening of daily fishing operations at greater depths up to 40 fathom with OBM in South, and migration from south to north enabled fishing throughout the year by using a combination of fishing gears like gillnets and hook lines for tuna and seer. The tuna gillnetting is the dominant fishing practice targeting high value table fish in this zone. Quite often the fuel cost of OBM that run on kerosene is severely affecting the net income of this fisher groups.

Usage of insulated ice boxes onboard of the gillnet boat is a noticeable change to maintain the freshness of catch. Combination fishing with gillnets and hooks & line and seer hunting at northern Kerala by southern fishermen is also on a decline mainly due to the poor catch and increased efficiency of ring seine in that area targeted the same high value fishes. It is also a fact that the fishing throughout Kerala is tilting towards bottom of the pyramid of the food chain due to the overfishing of predators.

4. Boat seine once dormant due to the failure of ribbonfish fishery became revived due to the lucrative squid fishing using light. The gear operated earlier on catamaran became now operating exclusively on plywood boats. The lucrative earning by squid fishing in 2012 in this zone has attracted many fishers to acquire boat-seine. Consequently the number of boat-seine shoot-up in most of the fishing villages in Trivandrum. The new comers enlarged the size of bag more than double than that of the old and now it reached to the larger bag size of a beach seine. It necessitated more carrying capacity of the craft and therefore number of boats per unit increased 2 to 3 and more crew for the shooting and hauling of the heavy net. Unfortunately all the investments and preparations become led to a crisis because of the failure of squid fishery in the

next consecutive years to till now. However, the fishers managed such investment by occasional redeployment of the craft and OBMs to other fishing methods such as gillnetting and lining. The occasional boat seining able to land ribbon fish, scads, rainbow sardine and anchovies in which the ribbonfish become an export item fetching higher price.

5. Long stay fishing (*Thangal* fishing)

Long stay fishing for one week at distant waters is one of the important and major developments in the last 10 to 15 years in this zone particularly in the southern villages of Trivandrum with the influence of Kanaykumari fishermen. By gaining inspiration of Thoothoor deep-sea fishing the fishermen of the neighboring villages such as Paruthiyoor, Pozhiyoor, and South Kollemkode started deep sea fishing for a period of one week locally known as *thangal* (= stay fishing). These fishermen have an earlier tradition of migration with their catamarans to northern Kerala, either by road by transporting it on lorry or through sea using sail and later by plywood boats, fished with gillnet and line or combination of both at different seasons. But this was confined in the coastal waters of one day fishing with the ordinary 28 footer plywood boats. This was initiated earlier by the southern fishers to manage the livelihood during the lean fishing seasons and also to reduce the fishing pressure locally because of the dense population of fishers in the southern villages of Trivandrum coast.

The *thangal* fishing starts just after the monsoon and these long stay fishers used to migrate from one port to another such as Kollam, Alappuzha, Kochi, Trichur and finally settled any of the villages at Northern districts of Kerala and sometimes it may extend up to Malpe of Karnataka. This intermediary crafts do not migrate to that extend of Thoothoor IBM boats (i.e. up to Gujarat) and will not stay that longer (> one month) as that of the Thoothoor boats because of the very minimum facilities in these 30-35 footer FRP boats. The normal duration fishing of FRP boats is either one week or till the catch is enough upto the storage capacity of the boat, whichever is earlier.

DISCUSSION

Mechanized, motorized and non-motorized are the subsectors in the current production system of fisheries of Kerala since 1980. Mechanized sector always privileged among them due to the application of comparatively better entrepreneurial ingredients of the external role players such as capital, coupled with R&D benefit of the Central institutions and Government incentives. R&D institutions are always biased in setting their agenda and priorities favorable to mechanized sector and quite often this has been wiped out the subsistence poor from the production system. The setting up of R&D agenda is always for the capacity development and diversification of mechanized sector targeting 'dollars', which in a way aggravating the problem. On the other hand the dollars not diverted for solving the livelihood issues of the deprived.

To compete and survive in the dollar driven production system the traditional fishers switched on from their earlier non-motorization to an intermediary option of motorization during 80's. Further, to increase the fish catching efficiency they have also adopted mechanization in their ring-seine fishing without considering their earlier customary conservatory mode of gear design, and fishing practices the since the last 15 years (See D'Cruz T. 1999 for details). The deviation from customary resource conservation practices is the provocation from foreign deep sea fishing and local trawling that involved large scale dumping of by-catch on the open sea after segregation of high value fish. This has been demoralized the traditional fishers and they also arming to grab maximum from the already over exploiting fish resources Thus ring-seine gradually becomes synonyms to traditional fishing of Kerala in terms quantity of fish produced

by the traditional sector since late 80's. Till the end of 90's the traditional fishers retained ring-seine as an intermediary motorized unit with the support of OBM, for two purposes: to reach the fishing ground chase the shoal and.

Since 2000 the ring seiners started using mechanical energy for the operation of gear also by installing winches that necessitated the requirement of higher hp IBM. The advantages of IBM are many such as less consumption of fuel, easy accessibility of fuel, higher carrying capacity, less maintenance, longer life and avoidance of separate machine for the operation of winch. Replicating the fishing method of purse-seine, mechanical energy has been used for reaching the fishing ground chasing the fish shoal and operation of fishing gear which created a situation that the leading and competitive fractions of traditional fishers "elevated" to the mechanized category and harbor dependent fishers that led to state wide demand for harbors from the traditional fishing villages of Kerala.

The average fish production in Kerala was stagnated around an average of 3 lakhs tones during period 1969 to 1988. It almost doubled as 5.61 lakhs tones during the period 1989 - 2010. Widening of fishing at farther deep with aid of OBM, introduction of ring seine since mid 80's are the prime factors for the hike in fish production, particularly of pelagic catch by the later. Though the fishing potential was estimated as *7.95 lakhs tones up to 200 meter depth zone in 2010* [1] a record production of *8.39 lakhs tones has registered in 2012* [2]. The official explanation for higher production over the potential limit is that *State is fully exploiting its resources within 200 meter depth zone and the remaining production is being harvested from depths beyond 200 meters* [3]. The trend indicates that the current production is at or beyond the MSY level; the hunting competition registered new heights and vigor irrespective of the earlier conflicting groups such as traditional or mechanized. Over fishing and disposal of bulk landing at harbors on a throw away price is giving advantages to the intermediaries (great margins), disadvantageous to the producers (poor returns) and consumers (poor quality fish). The wide spread distribution of poor quality fish also reduced the selling price of the local, non-harbor dependent small scale fish workers.

The trawlers are famous in destructive fishing methods such as juvenile fishing; over fishing, by-catch fishing and the cumulative impact is the habitat damage and depletion of the resources. This has been increased proportionally on a higher scale due to the increase in size of the mechanized craft from 32-45 footer to 60-90 categories and extended period of fishing from single day to weekly trip. The extended mechanized fishing even at night lead to a large scale violation of KMFR Act such as night trawling, trawling very close to shore for juvenile fishing and squid fishing, pair trawling that involved large scale juvenile fishing and by-catch for fish meal — all are created serious threat to the coastal fishery. Unfortunately the traditional fishermen are also adopted destructive fishing in certain pockets with the mini trawling, mini pair trawling locally known as *vali-vala* and the large scale over fishing by IBM ring seining created a situation that customary control practiced by traditional communities against such kind of illegal fishing has been eroding. Their sensitization and response against IUU fishing is diminishing all over the coastal districts of Kerala.

REFERENCES

1. CIFT 2015 Advances in Fishing Technology in India – Contribution of CIFT V.R. Madhu and Leela Edwin, *Central Institute of Fisheries Technology, Matsyapuri, Willingdon Island, Cochin – 682 029*
2. CMFRI 2005 Marine Fisheries Census 2005 Part III (6) Kerala
3. CMFRI 2010 Marine Fisheries Census 2010 Kerala
4. CMFRI. 2011. Annual report 2012-2013. Kochi. CMFRI.
5. FAO. 2008. FAO Fisheries Department, Fishery Information, Data and Statistics Unit.

6. Government of India. 2009. Annual report of the Department of Animal Husbandry, Dairying, and Fisheries. New Delhi. Download
7. Government of India. 2011. Report of the Working Group for Revalidating the Potential of Fishery Resources in the Indian Exclusive Economic Zone. New Delhi. DAHDF.2010 by an Expert Committee.
8. Meena Kumari 2014 Report of the Expert Committee Constituted for Comprehensive Review of the Deep Sea Fishing Policy and Guidelines
9. SIFFS 1991 A Census of the Artisanal Marine Fishing Fleet of Kerala, South Indian Federation of Fishermen Societies, Trivandrum
10. SIFFS 1998 A Census of the Artisanal Marine Fishing Fleet of Kerala, South Indian Federation of Fishermen Societies, Trivandrum
11. D'Cruz.T.1998 THE RING SEINE –Evolution And Design Specification. South Indian Federation of Fishermen Societies, Karamana, Thiruvanathapuram.
12. D'Cruz.T.1999 ARTISANAL FISHING GEARS OF KERALA –Design Specification. South Indian Federation of Fishermen Societies, Karamana, Thiruvanathapuram.

Websites

1. Government of Kerala. 2009. Kerala Marine Fisheries Statistics. Download
2. Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India
3. National fisheries development board, Government of India
4. Central Marine Fisheries Research Institute
5. Fisheries- India portal

Price list

1. Price list of Ashok Leyland Marine Diesel Engines, as on 2009
2. Price list of Matsayfed Vyasa store on OBM, various nets and accessories