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## Technological change and modernization of marine fisheries: A case of Kerala

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**Abstract:** The fisheries resource in Kerala is on the threshold and stagnation and a collapse of fisheries will affect the livelihood of fishermen and other stake holders who largely depend on fisheries. In India we can't have moratorium on catching as the population who depend on fisheries resources is high. Focusing the issues technological change, modernization, sustainability of ecosystem and livelihood aspects the researchers found the need of a collaborative work linking technology, conservation and livelihood. Motorized sector technological up- fisheries for income generation have led to the adoption of destructive fishing. All these have ultimately worsened the situation of fishermen. This study focuses the technological changes and modernization in marine fishing and threats of fisher folk with special reference to Kerala.

**Keywords:** Marine fisheries, Inland Fisheries, Marine ecosystem, modernization, Sustainability

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### INTRODUCTION

The fishing industry is one of the economic corner stone of a country. This industry includes any industry or activity concerned with taking, culturing, processing, storing, transporting, marketing or selling fish or fish products. Millions of people all over the world have been profitably engaged in fishing and fish trading over the years .Fishing has been one of the oldest activity of human race .In India 'fisheries' is considered to be a sub sector of agricultural sector. The increasing trend in fish production places an important role in earning foreign exchange. Fisheries have been recognized as a powerful income and employment generator owing to the continuous growth of fish production.

Marine ecosystem is one of the most complex systems in the world enriched with a wide variety of resources. A typical marine ecosystem comprises two major subsystems, the tropical and the temperate ecosystems each characterized by a unique resource base. Marine ecosystems are very important for the overall health of both marine and terrestrial environments. According to the World Resource Center, coastal habitats alone account for approximately one third of all marine biological

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productivity and estuarine ecosystems (I.e., salt marshes, sea grasses and mangrove forests) are among the most productive regions on the planets. In addition, other marine ecosystems such as coral reefs provide food and shelter to the highest levels of marine diversity in the world.

Fishing is the most important driver in many marine ecosystems. Marine fisheries and fishery related activities make an important contribution to the nutrition, food security, sustainable livelihood and poverty alleviation of many countries especially in developing countries. Capture fisheries and aquaculture supplied the world with about 142 million tons of fish in 2008, the latest report that is available in this regard Global capture fisheries production in 2008 was about 90 million tons, comprising of 80 million tons from marine water and 10 million tons from inland waters.

Fishery sector occupies an important place in the socio-economic development of the country. The continued changes and up graduation of existing fishing technologies and modernization helped to increase the efficiency of craft and gears. At the same time it has also marginalized the fisher folk who are not able to cope up with the changes, in recent years there has been a considerable increase in the activity in the motorized sectors, especially the ring seine and mini trawl fishery, causing concern for certain exploited species. There have also been dimensional changes in the gear and the time spent for fishing in the mechanized sector by undertaking voyage fishing and use of sophisticated electronic devices for fish finding has resulted in increased fishing pressure and fishing efficiency. This raises an important issue, called sustainability.

### **Statement of problem**

The fisheries resource in Kerala is on the threshold and stagnation and a collapse of fisheries will affect the livelihood of fishers and other stake holders who largely depend on fisheries. In India we can't have moratorium on catching as the population who depend on fisheries. Focusing the issues technological change, sustainability of ecosystem and livelihood aspects the researcher gradation in the form of size of the net and boat has increased over the years. Declining fish availability, coupled over capacity and the dependence of the small scale sector on coastal The fisheries resources in Kerala are on the threshold of stagnation and a collapse of fisheries will affects the livelihood of fishers and the stakeholders who largely depend on fisheries. In India find the need of a collaborative work linking technology, conservation and livelihood. And the issue of overcapacity in fishing fleets and their reduction to the levels that should be in balance with long term sustainable exploitation of resources has received global attention during the past two decades. Many countries have adopted policies for limiting the growth of national fishing capacity in order to protect the aquatic resources and to make fishing economically viable for the harvesting enterprises. In South East Asia, overcapacity is seen as the largest fisheries management problem threatening sustainability. Similarly in motorized sector technological up- fisheries for income generation has led to the adoption of destructive fishing. All these have ultimately worsened the situation of fishermen.



### Research questions

1. What are the important technological changes that have occurred in the fisheries sector?
2. Do the technological changes constitute a threat to the marine ecosystem and whether there is over fishing?
3. What are the problems associated with modernization.

### Methodology

The study is based secondary data The secondary data has been collected from government documents like Census of Kozhikode (2011), economic review, directorate of fisheries, and also from other published articles, journals, published thesis, and internet sources. The data were analyzed by using statistical tools such as percentage, pie diagram,

### FISHING; NATIONAL AND STATE SCENARIO

#### NATIONAL SCENARIO

Indian fisheries are important components of the global fisheries and the sector have been recognized as a powerful income and employment generator. The contribution of this sector to foreign exchange earnings is substantial and forms 1.1 percent of GDP. More than 6 million fishermen in the country depend on fisheries for their livelihood. The country with a long coastal line of 8129 kms has an Exclusive Economic Zone (EEZ) extending to 2.02 million sq.kms, and is a major marine fish producer ranking seventh in the world. However, inland fishery resources are equally rich and varied comprising rivers and canals (17,3287kms) food plain lakes (20,2213 hectares), estuaries (28,5000 hectares) mangrove (33,6500 hectares), estuarine impoundments (12,35000 hectares), lagoons (19,050 hectares), upland lakes (72,000 hectares), reservoirs (3153366 hectares) and ponds (22,54000 hectares)

In India, the inland fishery is classified in to fresh water aquaculture and capture fisheries, in rivers, estuaries, lakes, reservoirs etc. the Ganga river system and its tributaries have a combined length of 12,500kms and Brahmaputra is 4,023 km long. The Peninsular river, Mahanadi, Godavari, Krishna and Cauvery cover 6,437 kms while the west flowing Narmada and Tapi of Western Ghats have a combined length of 3,380 kms. The catch rivers does not contribute significantly to the total inland fish production in terms of volume, although a large number of traditional, artisanal fishers make a living on it. A substantial part of Ganga and its tributaries flowing through Indo Gang etc plains provide the source of fresh water capture fisheries in India. Commercial fisheries in the upland water of the Ganga system are virtually non-existent because of exploitation problems, low quantity of sized commercial species, in accessible terrain, and poor communication links.



India is the second largest fish producing nation in the world, with a share of 5.4 per cent of global fish production. India is also major producer of fish through aquaculture and rank second in the world after China. Total fish production in India has increased since 1991. From 3.84 Million Tons (MT) in 1991 it increased to 10.06 MT in 2014-2015(provisional figures), of which 6.57 MT was from inland sectors and 3.49 MT was from marine sectors .fisheries sector contribute significantly to the national economy while providing livelihood to approximately 8.74 lakh fishermen families in the country. Contribution to fisheries sector to GDP of India is around 1 per cent. Share of fisheries in the GDP from agriculture, Forestry and fishing is 5.5 per cent. The sector has been recognized as a powerful income and employment generator as it stimulates growth of a number of subsidiary industries. It is also a source of cheap and nutritious food besides being a source of foreign exchange. During 2015-16, export of marine products from India was 9, 45,892tones valued at 30,420.82 cores. Compared to the previous fiscal, a decline has been recorded in the quantity and value of exports. Fishery is recognized as a promising sub sector of agriculture and allied activities in India. Details of fish production in last 5 years are given below the table.

**Table 1**

**Fish production in Kerala & India during the last five years**

Fish production in Kerala & India during the last five years						
(lakh tones)						
Year	Kerala			All India		
	marine	Inland	Total	Marine	Inland	Total
2011-12	5.53	1.4	6.93	33.72	52.94	86.66
2012-13	5.31	1.49	6.8	33.21	57.19	90.40
2013-14	5.22	1.86	7.08	34.43	61.36	95.79
2014-15	5.24	2.02	7.26	34.91	65.77	100.69
2015-16	5.17	2.10	7.27	Not available		

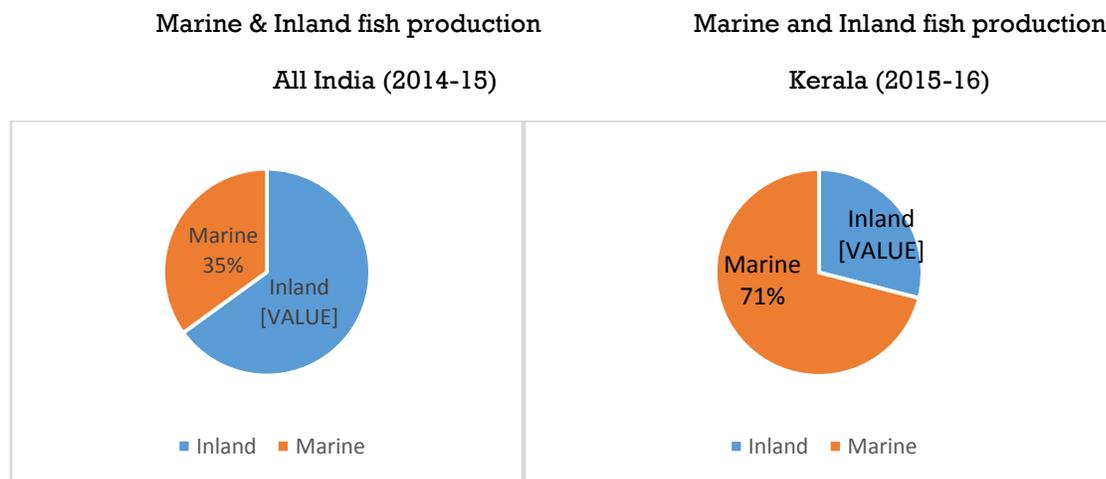
Source: Fisheries Department, GoK; department of Animal Husbandry, Dairying & Fisheries,



Marine fish production of India during the year 2014-15 has provisionally been estimated as 3.49 million tones with an increase of about 0.05 million tons compared to the estimate for the last year. As per estimate of 2013-14, among the states, Gujarat was the highest contributor of marine fish production followed by Kerala. Total fish production in 2014-15, Andhra Pradesh was the highest contributor and Kerala stands 5<sup>th</sup> position. Indian marine fisheries is also passing through a crisis due to over capacity and open access nature. During 2014-15, India's total fish production is provisionally estimated to be 10.06 million tone of which 3.49 million tones was from marine sector and 6.58 million tones was from inland sector

**Figure 1**

**Marine and Inland Fish Production- All India and Kerala**



Source: Department of Fisheries

In the 11<sup>th</sup> five year plan, marine fisheries sector achieved growth especially in the area of infrastructure development. The 12<sup>th</sup> plan strategy was to ensure sustainable growth of fish and fisheries for nutrition, food security and economic growth by ensuring proper utilization of infrastructure created in the plan. Special emphasis is being given to conservation and management of inshore fishery resources, enhancement of offshore marine fish production, maximum utilization of harvested fish and value addition.



## **DEVELOPMENT OF MARINE & INLAND FISHERIES IN INDIA**

Despite of vast fishery resources, the production of fish in India is far from adequate. India produces only 9% of total supply of fish in Asia, where Japan contributed to the extent of 43% and China coming next, to about 18%. The Indian Ocean Expenditure has estimated that only 1 to 8 per cent of the fish available along the Eastern and Western coasts is being caught at present. If better methods of catching fish is employed, it is possible to increase the fish catch by 10 times. This indeed would make a tremendous impact on nutritional standards of the people and on raising the standard of living of fishermen as also on India's foreign exchange earnings.

The government of India has set up the National Fisheries Development Board (NFDB) to reduce the untapped potential of fishery sector with the application of modern tools of research and development including biotechnology. Even though the subject of fisheries in the state list in the Indian Constitution Government of India has launched a comprehensive marine policy in November 2004, with the objective of boosting fish production so as;

- a) To increase exports of fish and increase per capita consumption of fish within the country
- b) To promote economic security of coastal fishermen

While there has been remarkable improvement in inland fisheries there are some disturbing trends as well. In the first place, there is a danger to river line fisheries because of growing river population. Discharge of untreated effluents from the industrial units located near the rivers and of urban sillage destroys fish in thousands and million. Secondly, the construction of dams, weirs and barrage prevents the migration of fish to their usual breeding and feeding grounds and thus adversely affects the stock of fish in rivers.

### **Major developmental programmes**

The plan schemes of the Government under fisheries sector can broadly be classified into the following categories they are

1. Marine fisheries development
2. Inland fisheries development
3. Extension, trading & service delivery
4. Modernization of markets and value addition
5. Social security to fishermen
6. Development of fishing harbors and management
7. Scheme for the fisheries university
8. Coastal Area Development



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India has a vast and diverse potential of fishing resources comprising two million square kilometers of exclusive Economic Zone for deep sea fishing. The government of India launched National Fisheries Development Board in 2006. Located in Hyderabad its activity focus areas are.

- Intensive Aquaculture in Ponds and Tanks
- Fisheries Development in Reservoirs
- Coastal Aquaculture
- Marine culture
- Seaweed Cultivation
- Domestic Marketing
- Technology Up gradation

#### **FISHERMEN COMMUNITY**

Fishermen community is a distinctive group of people geographically located in coastal areas and have their own way of life and distinctive culture, and to understand the special relationship, they share with the sea and the environment. The life of fishermen community is centered on the fishing seasons. They are the victims of middlemen and money lenders

Fishing communities in India, are not homogenous, as they belong to different castes. These communities have their own distinct social, cultural governance structures and traditional practices, depending on the coast, where they inhabit. At least 2-3 castes are exclusively involved in marine fishing in each maritime state, and are not related to the mainstream agrarian system.

The community institutions, (such as the caste panchayats, peddalu, padu system etc.), mostly organized along caste, kinship or religious lines, play an important role in resolving conflicts, besides regulating and allocating resource use, ensuring equitable access to resources and providing some form of social insurance. Most communities have evolved their management systems over time to regulate human interaction with the resources especially when large number of people bank on a limited resources to avoid conflicts.

Besides the traditional caste based organization of fishing communities., they are also organized into various sectors such as the mechanized sector- boat owner associations, trade unions, co-operatives (both state- run and private ), associations based on gear type, self-help groups, federations etc.,

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## **STATE SCENARIO**

Kerala, rich in a variety of tropical marine fauna, is intensively exploited. Kerala is also a leading supplier of prawn and other demersal species. The fishery sector is very vital for Kerala since it contribute much to employment, income, foreign exchange earnings and protein intake of the people. Both mechanized and traditional fishing is prevalent in Kerala. But both are concentrated near the coast where the sea is up to 50 meters deep. The off- shore fishery is not yet developed in the region. Kerala coast is the first in Indian where mechanization was introduced on a large scale in the 1950s with the launching of the Indo-Norwegian Project. And Kerala is one of the leading producer of fish in India with 590 kilometer of coastal belt, 4,00,000 Hectares of inland water resources and about 2,20,000 active fishermen and around 1.1 million people earn their livelihood from fishing and allied activities. The rain fall and a large number of rivers makes the Kerala coast especially fertile for fish. Fish is a source of livelihood and of rich protein for the fishermen as well as people of Kerala. The state working population of about 10 lakhs.

The Government of Kerala has so far completed construction work of 14 fishing harbors and the works of 10 fishing harbors are processing. The Puthiyappa fishing harbor is the second highest revenue earner in 2015- 2016. Together, Neendakara and puthiyappa contributed about 65 per cent of the total revenue collection from fishing harbors and fish landing centres in Kerala. Kerala State Co-operative Federation for Fisheries Department Ltd (Matsyafed) Agency for the Development of Aquaculture in Kerala (ADAK), Kerala Fishermen Welfare Fund Board (FIRMA), Kerala State Fisheries Resource Management Society (FIRMA), Marine Enforcement & Vigilance and National Institute Fisheries Administration (NIFAM) are the various arms of the department of fisheries in Kerala.

Fisher folk form an important segment of population of the state. Kerala has eighth position, with regard to the population of fisher folk among the fourteen coastal states. The total population of fisher folk residing in the state of Kerala is estimated to be 11.114 lakh, which include 8.55 lakh in the marine sector and 2.255 lakh in the inland sector. Out of this the number of active fishermen is 2.28 lakh. Nearly 12% of the fisher folk depend on allied activities like marketing, repairing nets, fish vending, and processing and other fishery related activities

Kerala is situated on the south west coast of the Indian sub- continent with an area of about 38863 square kilometers, which makes about 1.27 per cent of the India territory. Kerala is separated from the rest of sea. The main coastal village of Kerala from the three zones. That are North Zone, South Zone, and Central Zone. District representing three zones with Thiruvananthapuram, and Kollam represented by South Zone. Ernakulum India by the Western Ghats in the east and the Arabia Sea in the west. The territory of Kerala can be divided into three regions, the high lands, mid lands, and the

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low lands. The low land lies close to the sea and Alappuzha representing Central Zone and Malappuram and Kozhikode representing North Zone.

The fishermen population of the state for 2015- 16 is estimated at 1024 lakh based on the projected population of Kerala as on 1<sup>st</sup>October, 2015. The population of the state as per census 2011 is 33.4 million. Hence the fishermen population is around 3.1 per cent of the state population. They reside in 222 marine fishing village and 113 inland fishing village of the state. Out of this, 7.88 lakh fishermen belong to inland sector. Alappuzha (1.90 lakh) is the largest fishermen population, followed by Thiruvananthapuram (1.70 lakh) and Ernakulum (1.36 lakh).

**Table.2**

**District wise distribution of fishermen population in Kerala 2015-16**

<b>District wise distribution of fishermen population in Kerala 2015-16 (estimated)</b>										
Sl. No	District	Marine				inland				Marine & inland (total)
		Male	female	Childr en	Total	Male	Female	Childr en	Total	
1	2	3	4	5	6	7	8	9	10	11
1	Thiruvananthapuram	63248	55837	49616	168701	447	520	446	1413	170114
2	Kollam	39859	33262	19901	93022	13513	12723	8144	34379	127401
3	pathanamthitta					932	810	377	2119	2119
4	Alappuzha	52139	47620	28738	128497	25014	23954	12962	61929	190426
5	kottayam					9837	9327	5773	24937	24937
6	Idukki					268	268	170	706	706
7	Ernakulum	28706	26885	16935	72526	23721	23218	16874	63813	136339
8	Trissur	20976	21434	13561	55971	7927	7925	4594	19780	75751



9	Palakkad					863	854	873	2590	2590
10	malappuram	35574	28491	25803	89869	1809	1577	852	4238	94107
11	Kozhikode	38937	33790	25813	98540	4178	4396	3412	11986	110526
12	wayanad					76	82	77	235	235
13	Kannur	17808	10771	9261	37840	2424	2563	1371	6358	44198
14	Kasaragod	17440	16162	9756	43358	412	392	185	989	44347
State		314687	274253	199384	788324	91421	87943	56110	235472	1023796

Source: Department of Fisheries

This table shows the district wise fish production in Kerala. In this table Kollam is the leading producer of marine fish followed by Kozhikode and Ernakulum. These 3 district together contribute more than 50 per cent of the total marine fish production in the state. Alappuzha, Trissur and Palakkad are the leading district in case of inland fish production occupying the first, second, and third position respectively.

Fisheries and aquaculture contribute around 8.9 percentage of the Gross Value Added (GSVA) from the primary sector which is of significance to the state economy. The Gross State Value Added of the state has been increasing over years, but the share of primary sector and that of fisheries sector has been declining. The share of fisheries sector in the state value added has declined from 1.12 percent in 2011-12 to 1.04 percent in 2015-16. The share of primary sector in GSVA has declined from 15.20 per cent in 2011-12 to 11.58 percent in 2015-16. The contribution of fisheries sector in GSVA is given below the table. (3.4)



**Table 3**

<b>Contribution of fisheries sector to gross state value added(base year 2011-12)(in core) Constant price</b>				
Category	2011-12	2012-13	2014-15 (provisional)	2015-16 (quick)
Gross State Value Added (at basic price)	336293.11	356354.73	371651.47	424791.11
fishing and aquaculture	3773.63	3764.19	3978.45	4402.14
share of fisheries sector in GSVA	1.12	1.06	1.07	1.04
Primary sector	51100.77	51357.60	49409.05	49206.30
Share of primary sector in GSVA(%)	15.20	14.41	13.29	11.58

Source: Directorate of economics & statistics

### **Contribution of fisheries sector to gross state value added**

As the state moves into its 13<sup>th</sup> five year plan, fisheries sector is looked upon with interest due to its immense potential to contribute positively towards development. The sector need to take upon itself objectives like

- a) Nutritional security through enhancing fish production
- b) Poverty reducing among the fisher folk by ensuring distribution of production benefits to the community on a sustainable and equitable basis.



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The resource base of the state offers ample scope for growth of aquaculture especially in the inland waters. However, resource conservation and elimination of harmful fishing practices need greater emphasis in the future endeavors. Inland fish production is an area which holds promise for future in Kerala. Insufficient availability of good quality fish seed was identified as a major problem. To increase the production of fish seeds and to ensure quality, it is required to strengthen the existing hatcheries, nurseries, fish farms and construct new units to existing infrastructure. During 2016-17, an amount of rupees 15.99 core was allocated for the scheme, additionally, an amount of rupees 5.5 core was also provided for setting up demonstration units for innovative aquaculture practices.

In order to address the relative backwardness of the fisher folk population and the fishing community, the state of Kerala had initiated a new scheme 'basic infrastructural facilities and human development of fisher folk' in 2015-16 with an outlay of rupees 181.97 core. The following are the new initiatives and priorities envisaged by the state government.

- Prime importance to protecting the traditional rights of the fishermen over fishery resources and coastal areas.
- Fishermen vulnerable to sea erosion will be rehabilitated to safe locations on priority basis
- Thrust will be given for ensuring basic amenities such as pure drinking water, sanitary toilets and waste management systems in all fishing village.
- Concentrated efforts will be made for empowering traditional fishermen for deep sea fishing
- Matsyabhavans will be made more functional by providing the basic infrastructural facilities and manpower.

The Kerala Marine Fisheries Regulation Act 1980 (KMFR Act, 1980) will be amended for addressing the present challenges in maritime fisheries resource conservation.

## **TECHNOLOGICAL CHANGE AND MODERNIZATION IN THE FISHING SECTOR**

Modern age has witnessed far reaching development in fisheries as in so many other fields. This includes a great acceleration in the use of fisheries resources, along with basic changes in the use of fisheries resources, along with basic changes in the technology of catching and big development in marketing and commercial organization. Since the Second World War, there was an overall development of an extensive and sophisticated range of equipments and improved method of vessel propulsion and gear hauling and included much advanced means of navigation and fish location. One of the most significant early developments was the expansion of trawling in the Eastern channel and the Southern North Sea from the late eighteenth century (Hardy, 1959). Over time, a great variety of

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fishing methods and techniques developed whereby gear made of locally available materials evolved to exploit a diversity of ecological situations and riches, and the rise and fall of the tide, annual river rises, spawning and feeding migrations, and many other features of the natural environment were in some degree harnessed.

In addition to the employment of particular gears could be the building of obstructions, including weirs in streams and barriers in coastal shallows and estuaries which helped direct, swimming fish into traps and nets. Traps are of materials like basketry or osier set in streams, are well the first methods for catching fish in quantity. The great variety methods which have developed also range from the widespread practice of poisoning to stun fish (Gunda, 1984) to the use of trained birds such as cormorants to catch fish (kani, 1984). As time passed gear and methods were developed in the direction of attaining greater efficiency. In line fishing the advent of barbed hook from the late Bronze Age (Clark, 1952) represented a very improvement as it was difficult for the fish to escape once hooked. The earliest nets have been made materials as nettle fiber and tree baste Clark, (1952) the latter, spinning of stronger fiber like linen and hemp after the advent of farming has provided stronger and more efficient lines and nets.

#### **4.1 Development of commercial fisheries in the past**

The development of commercial fisheries is by and large linked to the development of methods which can be employed on a bigger scale in the open sea. For bottom living fish and especially for those species with limited shoaling behavior, the use of the long line involving the use and frequently the baiting of hundreds or even thousands of hook was an important advance which was used by the Dutch from the seventeenth century on the open sea.

To catch fish en masse the best method used has been the use of nets a variety of types of nets has been developed. The earliest nets were simply placed in the water of location, fish were known to frequent. There are indications that from the Mesolithic period in Europe they were equipped with head floats and with sinkers along their bottom edge. To use nets on a bigger scale in the open sea, the Dutch development of drift netting played an important role. It was operated from big decked boats and involved setting net trains of as much as a kilometer or more in length, and this was one of the important methods in the days of sailing ship. The draft net still in use, especially in the tuna fisheries of the tropical oceans. Another advance made was the use of trawl bag nets in the open sea from the early nineteenth century. Even though this method was used on a limited scale in coastal waters around the Southern North Sea it is more productive in demersal fisheries than long lining.

Another modern method the purse seine employs the encircling principle for catching mainly pelagic species. This is more energy efficient and is suited specially for catching densely shoaling species. Even though encircling principle is age old in fisheries, the invention of power block for hauling along with making of bigger nets from strong synthetic fibers has opened up its use in the



open sea and turned out to be the main method of pelagic fisheries. Since the Second World War efficiency of all type of gears has been enhanced by using and refining echo sounding methods of fish location modern methods of navigation and position finding at sea has also improved the catching power of modern fleets.

### **Fishing Technology in Kerala over the years**

The total complex of fishing units, comprising a variety of composite systems of two factors- crafts and gear constitutes the means of production. There existed a variety of craft and gear. The craft is an important instrument as it is used to take the fishermen to the fishing ground, gear is used to catch fish

Analyzing the past production techniques helps in understanding the transition which has occurred in this sector, capital requirement needed, and the extent of modernization and mechanization in the fishing sector. In fish harvesting the major means of production involved are (1) crafts, (2) gear and its accessories, (3) methods of fishing

The place to place changes in the type of equipments and their operations depend upon factors such as nature of coastal region, climatic conditions, species of fish available capital at the command of fisher folk and local conditions ( Kurien, 1978). Any change in technology necessarily implies a change in the craft and gear combination for any substantial increase in out put. The development of the fishing industry on scientific grounds and thereby increasing the catch necessarily and gear combination. Mechanization of fishing craft, introduction of mechanized boats of new designs, use of improved gear materials and gear design, adoption of modern techniques are all contributing to the development of fishing industry on scientific lines and thereby bring about increased catch(Rajasenan, 1987)

On the basis of distance of operation, craft were divided into three categories: crafts for small distance or coastal fisheries, crafts for middle distance or offshore fisheries and craft for distant fisheries or high sea fisheries. The crafts used for small distance are of 12 metres length, can be mechanized or non-mechanized depending on the type of operation and generally they take daily trips whereby the crafts for middle distance vary between 12 metres to 30 metres in length they usually have to operate for more than a week and hence preservation facilities are provided by the board. Depending an surf conditions, nature and availability of fish stock and the relative economic condition of fishermen the use of the instruments of production vary in coastal region .crafts are usually classified as indigenous and mechanized crafts on the basis of operation the non mechanized crafts are divided into three categories they are

1. Catamarans
2. Dugout Canoes
3. Plank-Built Canoes.



### **Catamarans**

Catamarans are mainly used by fishermen residing south of Kollam stretching up to coastal areas of Kanyakumari District in Tamilnadu. Dugout and plank built canoes are used by fishermen all over the coastal Kerala. It is a keel less craft formed by lashing together many logs, carved and shaped like a canoe. Two wooden supporters called kadamarams are used for lashing them together. It is of Egyptian Origin. The word catamaran is derived from the Tamil word "cattumaram" which means tree or wood together. This traditional craft is used commonly by the fishermen of Thiruvananthapuram and Kollam District of Kerala.

The length of catamaran ranges from 7 to 8.5 metres and width from 1.5 to 1.1 metres. The big catamaran can carry more than two persons usually paddled by two men whereas in a log craft, only a single person goes fishing. For fishing in catamaran, gill nets and hook and the line fishing are two important gears used. In addition to this, they also use the drift net. Fishermen use catamaran only once a day, they go for fishing in the evening and return in the early morning. But sometimes they go more than once due to availability of a particular species of fish.

### **Dugouts canoe**

The dugout canoe is most prominent traditional craft, of indigenous origin. This is used all over Kerala to catch the different species of fish both near and shore as well as deep waters. It is made by scooping out the wood from a large single log of mango or jungle jack making the keel portion thicker than the sides. In Kerala the size of the dugout canoes varies between 8 to 13 metres and is called "Odam or vanchi" the middle size of 9 to 10 metres, called 'Thonies' and the smallest is 8 to 9 metres called 'Beputhonie'.

The dugout canoes are generally used for fishing during October to May when the weather is clean. They are used for propulsion as well as for control. "Beputhoni" is mostly used for hook and line fishing they are used for gill netting. A smaller dug out canoe with a capacity to carry only five people, is used for operation of "ayilavala" which is 220 metres long and 8 metres wide. The method and design used for operating the chalavala and ayilavala are one and the same but the mesh size of the ayilavala is larger than the chalavala.

### **Plank built canoe**

The dugout canoes are enlarged by placing wooden planks with or without ribs inside. Plank built canoes are constructed by seaming together planks of wood using coir ropes and copper nails. Black pitch coating is used to make them water tight. Depending on the size and methods of planks used plank built canoes are grouped under two classes. Both are called "kettuvalam". The first type is 7 to



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12 metres length and the other is 7 to 16 metres in length. The large ones are operated by 12- 15 fishermen while the small ones carry a crew of 4-6 persons. The cost of the canoe ranges between Rs5,000 to Rs. 2,000/ and has a life span of about 5 to 7 years. The larger ones are usually used from July to October and the smaller ones are used from September to March/ April

### **Gears**

In the traditional fishing sector a wide variety of fishing gears are used by fishermen. The gears have evolved from the knowledge and skill they gained through the long experience of shooting and feeding habits of each variety of fish. The principal fishing gears employed with traditional sectors of the fishing industry in Kerala are gillnet, boat seines, and hook and lines. Besides several other minor gears, such as cast nets, stake nets and Chinese nets are used locally. These gears are used in combination with the crafts depending upon the seasons for the availability of fish as well as the biological characteristic of species.

### **Gillnets**

The Gillnets are single walled nets which can be set either above and seabed when fishing for demersal species or anywhere from mid water to the surface when pelagic are being sought. Gillnets are of set, floating or drifting types depending upon the way they are used. This drifting type of gillnets are attached to the side of catamaran or canoe and the craft and the net is allowed to draft along with current.

### **Boat seines**

The boat seines are a kind of encircling nets which are either conical bell shaped or bag shaped with or without wings made from cotton or nylon filaments. The open end of the boat seines has larger mesh size which decrease towards the closed end. The most striking feature of boat seines in Kerala is that they are equipped with a strong central bag preventing the fish from escaping and two long wings attached either side. They are operated with the help of two canoes or catamarans, which pull at either end of the wings and keep the mouth of the net open and allow the fish to swim towards the narrower end. Scaring device of wood or coconut leaves are used to beat the water or side of boats, to drive the fish into nets. Boat seines are used in Kerala to fish for pelagic and mid water shoaling species.



### **Shore seines**

The shore seines are bad shaped nets operated from the shores with two coir wings of over 1500 m in length. The shore seines, popularly known as 'karamadis' or 'kambavalas' in Kerala are operated with the help of boats or canoe. Traditionally the shore seines had a very important position especially in southern Kerala. But during the last two decades, they have steadily lost their importance and have decreased in number. The working of the shore seine is that one wing of the net remains in the beach and the other wing is taken out in the canoe drawing it in a semicircular manner and finally brings the other end to the shore.

### **Hook and lines**

The hook and lines, which is the most traditional methods of fishing in Kerala has been used since ages for catching a large variety of fishes like sharks, seer, skates and rayes, eelfish, cat fish etc. A long length of line is set out to which, short lengths of line is set out to which, short lengths of line carry baited hooks are attached to every two or six feet. The fishes are attracted by the bait hooked and held by the mouth, until they are brought aboard the operating vessel which periodically hauls the gear. This type caught depends upon the depth to which the line is set as well as the size of the hook. Kerala is typical of using three different types of fishing lines they are

- Hand lines (Kaichunda)
- Long line (Beppu or AyiramChunda)
- Chain chunda( ChangalaChunda)

The hand line is the simplest fishing line and is generally cast from anchored canoes in shallow as well as deep water of the sea the long line consist of a master line with equidistant thinner branch lines to which the fishing hook are attached. The number of hook attached depends upon the length of the line. The chain lines are used for catching shark and they use especially strong hook and line. Hook and lines are used for fishing in deeper water or in uneven grounds. Where other fishing methods are not easily possible in kerala this method is carried out only by very few fishermen, because to catch larger quantity fishes fishermen will have to go to greater depths



### **Development of fishing crafts and technology**

In Kerala fisheries, the modernization programme started in 1953 and modernization in capture fisheries was confined basically at three levels.

1. Crafts movement (method of propulsion)
2. Development of gears
3. Tacking techniques

These changes have considerably helped in improving the productive capacity of the fishing sector. The new techniques have raised the productive capacity by four ways.

1. Use of machine power enables the fishermen to reach the fishing ground early thereby raising the fishing time.
2. The new technology enables the fishermen to increase the distance range of fishing operations.
3. Fishermen could succeed in capturing the bottom dwelling or crustacean species like prawns, crabs, lobsters, etc. since the new technology has raised the depth range of operations.
4. The fishermen become less fatigued which thereby increase the productivity.

The development efforts for the evolution of suitable crafts gears and techniques are divided into three distinct periods.

- a) 1953 to 1963
- b) 1963 to 1979
- c) 1979 onwards

From 1953 to 1963 a major part of research and development during this period was undertaken by the Indo- Norwegian project which started functioning from the Neendakara-SakthiKulangara region near Kollam in 1953. The work was primarily the mechanization of fishing crafts. The possibility of utilizing existing crafts by fitting suitable engines. But to this the fishermen showed no interest and they preferred the specially built motor boats to become available. Many experiments were carried out but the experiments did not reap success, and finally, the idea of mechanizing existing local crafts were abandoned with little success in mechanization of existing crafts, project started to concentrate on the development of suitable new designs. Imports of bascule 22 ft boats with 4 H.P semi diesel engines from Norway was made in 1954. Simultaneously construction of similar boats was undertaken at the boat building yard in Neendakara. In March 1955 the first four mechanized boats were issued to four fishermen and in August 1957, 63 such boats were issued to the local fishermen. but after 1957,



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project stopped the construction of this type of boat due to poor response from Araya fishermen of Neendakara region.

Later by the end of 1957 project began constructing 25 ft boat with 8-10 H.P full diesel engine. By the end of 1958, 19 such vessels were introduced in 1961 23 ½ ft with 8-10 H.P was introduced. By 1962 the project introduced a 25 ft. boat fitted with 16 H.P. diesel engine capable of using a small shrimp trawl. With the introduction of this crafts and trawl nets there was some appreciation of mechanized fishing over non mechanized fishing and there was a complete shift in favour of mechanization and trawl fishing. The project had to design very small trawl nets to meeting the new demand from fishermen.

The discovery of shrimp grounds and their exports potential led the project to design more types of mechanized vessels exclusively for shrimp trawling. The nets and fishing gear which was initially imported from Norway was started to be made through co-operatives. In November 1961 the government of India & Norway signed a third supplementary agreement. Where in the projects activities were shifted to Cochin. The administrative of the project came under the direct control of Government of India. Since, 1963, the project activities were more exploratory and experimental fishing than the evolution of any further craft types. This work was undertaken by the Central Institution of Fishing Technology (CIFT).

#### **DEVELOPMENT UNDER THE FAO/ EPTA PROGRAMME**

On the basis of an agreement between the Government of India and the Food and Agricultural Organization of United Nation in 1953, FAO appointed Mr. Paul B Ziener, a naval architect, to advise and assist the government on problems of boat design. Later FAO sent a second naval architect in 1955, Mr. K. Rasmussen. They concluded that it was practically impossible to mechanize catamarans and canoes the FAO experts reached the conclusion that the only possibility of carrying out mechanized fishing from long surf- beaten coasts seem to be the development of a surf-boat.

Between 1954 and 1958, the FAO experts in India tried to develop three Proto types of mechanized surf boats for India. But each one of these had some technical snags and operations from these proto types proved financially unsound. The FAO besides attempting to develop the mechanized surf boats had also tried to develop a number of new designs of mechanized boats from 1953 to 1963. In 1962 a finalized design of the crafts was developed. It had a 40 H.P. diesel engine, a crew requirement of five persons, and could fish at a depth of 20 fathoms(20 ft) and could stay in the sea for about 65 hours at full power. Among the various craft designs standardized, the four most important designs that become very popular in the state are the 25 ft. gill-netter, the 32 ft trawler the 32 ft gill netter and the 36 ft trawler.



From 1963 to 1979 the technical changes which took place during this period was indigenous in nature. The technical changes were in response to the changes in the economic sphere of the marine fishery sector. This period marked the development of medium and large fishing vessels, indigenous engines for fishing vessels, research on alternative material for boat building, new and efficient designs of fishing gears and new methods of fishing. This was in response of fishing. This was in response to the development of export market, especially for shrimps which resulted in large volumes of capital flowing into capture fisheries which necessitated the increased need for fishing vessels. The local capitalist developed indigenous engines for mechanized boats. The legacy of research and development (R & D) carried out by foreign institutions and experts were continued by National Institutions within the "Technological Standards" determined by them. After 1979 most of the research was carried out under the auspices of the CIFT Cochin. The CIFT carried out most of the research and development activities according to the recommendation made by FAO experts. The activities during this period focused mainly on

- New design of mechanized crafts
- Indigenous engines
- Alternative materials for boat building
- New materials and design of net
- New method of fishing

### **Transition in fishing methods**

Changes in the method of fishing became the direct outcomes of mechanization of craft. Certain of the fishing methods developed along with improvements in craft were

1. Gill netting
2. Boat seining
3. Bottom trawling
4. Pelagic trawling or purse seining
5. Long lining
6. Lift netting
7. Pumps fishing

The only substantial difference observed in the process of fishing with gill net and boat seine in mechanized boats from that of traditional fishing was that in mechanized boats, the size of the net will be bigger.

A very active fishing techniques for harvesting prawn is bottom trawling if a trawl net is pulled along behind a boat in the sea bed it is trawling (FAO, 1980). A trawl net is a large one having a bag at



the end of the net. It is wider at the open part and tapering through the body of the net to the closed end. The fishes are trapped at the closed end. The mouth of the net, look like a oval opening, when viewed from the front, and the two wings of the net stretch out in front on either side to widen the area swept. The float are fixed around the upper edge of the mouth along the headline. Around the bottom of the mouth is the ground rope, which is weighted to remain at the bottom. Horizontal spread of the mouth of net is attained by the “otter boards” or doors towed ahead of the net and set at an angle of attack to the towing direction thereby providing the outward force necessary to spread the wings to which they are fastened. Bottom trawling is categorized into stern trawling, otter trawling, out rigger trawling and pair or bull trawling. In stern trawling crafts is maintained on a straight course while hauling and setting and the pull is along the direction of the motion of craft. This method is advantageous. Since some of the voyage time can used for fishing thereby lessening fuel costs. In otter trawling, a large trawl net whose sides are held open by otter boards, capable of fishing more because of its flexibility to sideways. Otter trawling requires huge engine power and hence it is not popular in the coast of Kerala. In out rigger trawling the outrigger booms are tied to the main mast of the vessel with trawl net on both sides. These nets are towed from the end of the outrigger booms on each side of the craft.

This type of trawling, by using the power required for a single trawl net, two trawl nets can be used. In pair or bull trawling, two boats, pull the trawl. The mouth of the net is kept open by the outward pull provided by the correct lateral spacing of the vessels. This method, use a large net and also can catch more fish, because a single boat towing in front and at the center of a trawl net will frighten some of the fishes away with noise of its engine. While two boats towing in the front at the sides of the net will make noise, which will scare the fish towards the center and straight into the net

#### **Research and development efforts in fisheries sector**

The process of technological change in the industry consisted predominantly the activities of research and development for fisheries resources, fishing crafts, fishing gears, fishing techniques etc. The research and development efforts for fishery resources were mostly carried out by the CMFRI, pelagic fisheries project and the Indo- Norwegian project. The surveys which these institutions have carried out establish the vast potential for exploiting prawns and other pelagic/demersal resources in the state. The INP after initial experimentation introduced a number of new designs of small and medium mechanized boats for trawling for shrimp/prawn in the inshore waters. Moreover the use of new materials in the making of gears enhanced the durability and gave flexibility in the mesh size of nets. Thus “technological package” which was ‘nouveau’ regarding crafts, gear and new method of fishing was gifted to the society.

The efficiency of trawling was increased enormously through mechanization and manifold technical improvements. The organizational structure by which fish reach the market and consumer involves landing and first sales often processing also. With the growth of technology changes have



crept in to the various methods by which the harvested catch can be preserved. Landing involves manual unloading from pulled up on the beach or floating near the shore. In the third world it often involves individuals wading into the sea. Unloading from larger boats is generally done with mechanical aids, as well as vessels own derricks, land based powered cranes and winches may be employed. In many traditional situations a significant part of the production does not enter into commerce, but goes to feed the families, relatives and business contacts of fishermen. As much as twenty percent of production in India has been reported as going directly to domestic consumption.

### **Constraints in fisheries development**

Some of the weakness and threats that effect the growth of the fisheries sector are

- Decline in fish catch
- Depletion of natural resources
- Over exploitation of coastal fisheries
- Weak marketing and extension network.
- Work multi- disciplinary approach in aquaculture
- Unscientific management of fisheries and aquaculture activities
- Lack of reliable data base relating to aquatic and fisheries resources.
- Non availability of suitable fish yield models for multi- species fisheries.
- Inadequate attention to the environmental, economical, social and gender issues in fisheries and aquaculture.

### **Conclusion**

Marine fish stocks are under severe threat from over fishing and environmental degradation. Over exploitation of resources using new technologies destroy the resources base and the social foundation of society. Pressures from capitalist who invest in fisheries enhance the problem of overfishing. Also pollution, discards, use of destructive overfishing technique posed sustainability issues in fisheries which pose a threat on the livelihood of the fishers. High population density in coastal areas, limited alternative opportunities for other job, increasing or common use of destructive gears, use of high speed engine, stagnating/ declining overall catches income per fishermen, entry of new fishers with fishing tradition, and increased competition in the fisheries sector pose threat and in this context the Kerala fisheries is going through the stage of overfishing.

Due to institutional and human conditions like open access, greed and competition fisheries face greater in security. Due to the new technological development lead to damages in the ecosystem. Globalization brought about new changes causing structural shift, creating new development and income generating opportunities. Fishing became a commercialized venture with



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advent of globalization. Before commercialization almost all activities relating to fisheries had been carried out by the community themselves and had acquainted with versatile skills and knowledge viz, craft engineering, navigational skill, oceanography, astronomy, transportation.

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