ALTERNATIVE LIVELIHOOD STRATEGIES AND FISHERIES MANAGEMENT PRACTICES OF THE SMALL-SCALE FISHERMEN OF KERALA

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DECLARATION

I, **Fr. Celestine P. F.** hereby declare that the thesis entitled **"ALTERNATIVE LIVELIHOOD STRATEGIES AND FISHERIES MANAGEMENT PRACTICES OF THE SMALL-SCALE FISHERMEN OF KERALA"** Submitted by me for the award of the Degree of Doctor of Philosophy in Economics to University of Calicut is the original work done by me under the guidance and the supervision of **Dr. Sinitha Xavier**, Research Supervisor and Assistant Professor, Research and Post Graduate Department of Economics, P. M. Govt. College, Chalakudy. I also declare that this thesis has not been submitted to any other University for the award of any other degree, diploma, associate-ship, fellowship or title or recognition and no plagiarism is made in the thesis.

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ABBREVIATIONS

ADAK	Agency for Development of Aquaculture Kerala
ANOVA	Analysis of Variance
ARIMA	Auto Regressive Integrated Moving Average
CBFM	Community Based Fishery Management
CCRF	Code of Conduct for Responsible Fisheries
CIFT	Central Institute of Fisheries Technology
CMFRI	Central Marine Fisheries Research Institute
CPUE	Catch Per Unit Effort
CRZ	Coastal Regulation Zone
DFID	Department for International Development
EBFM	Ecosystem based Approach to Fisheries Management
EEZ	Exclusive Economic Zone
EU	European Union
FAO	Food and Agricultural Organization
FFDA	Fish Farmers Development Agency
FIRMA	Fisheries Resource Management Society
GOI	Government of India
GOK	Government of Kerala
HE	Harbour Engineering Department
KFWFB	Kerala Fishermen’ s Welfare Fund Board
Hp	Horse Power
IAD	Institutional Analysis Development
IFQ	Individual Fishing Quotas
KMFRA	Kerala Marine Fisheries Regulation Act
KSFE	Kerala State Financial Enterprises
MANOVA	Multivariate Analysis of Variance
MATSYAFED	Kerala State Co-operative Federation for Fisheries Development Ltd
ME	Marine Enforcement
MPA	Marine Protected Area
MSY	Maximum Sustainable Yield
NIFAM	National Institute of Fisheries Administration and Management
OBM	Out Board Motor
SIFFS	South Indian Federation of Fishermen Society
SLA	Sustainable Livelihood Approach
SESF	Socio-Ecological Systems Framework
SEM	Structural Equation Model
TAC	Total Allowable Catch
TURFs	Traditional Use Rights in Fisheries System
UNCLOS	United Nations Convention on Laws of the Sea

ABSTRACT

The present research work deals with the alternative livelihood strategies and fishery management practices of the small-scale fishermen of Kerala. The study examines the various livelihood challenges faced by the small-scale fishermen who are marginalized in Kerala. The small-scale fishermen face serious crisis in their livelihood due to low income, illiteracy, resource degradation, proliferation of trawlers, illegal fishing, and immobility in occupation and the absence of alternative livelihood opportunities. The principal challenge faced by the small-scale fishermen today is the reduction in the earnings from fishing. The widespread depletion of marine resources along the coast of Kerala in the last five decades have ruined the livelihood of the small-scale fishermen by and large. The Fishery Management Practices such as Trawl ban or closure of seasons, regulations in mesh size, specifications in gear, specifications in engine, Marine Protected Areas (MPAs), Coastal Regulation Zones (CRZ) were implemented in Kerala in order to check the rampant depletion of fish species. The ineffective execution of the Fishery Management Practices led to destruction of the pelagic species like Sardine, Oil Sardine, catfish and ribbon fish which were once the major source of income to the small-scale fishermen. The demersal species like elasmobranchs and Penaeid Prawns also face depletion. The low level of literacy and immobility impede the possibilities of alternative employment opportunities for the small-scale fishermen.

The first objective of the study identified the trend and structure of the fishery management practices in Kerala. The Compound Annual Growth Rate (CAGR), ARIMA model and Chow Break model were the statistical tools employed to examine the trend and structure of fishery management practices in Kerala. The Compound Annual Growth Rate of Fish landings of Kerala showed fluctuations and variability during the period from the year 1981 to 2010. The CAGR was two per cent during the period 1981-1991 and it increased to 3.5 per cent during the decade 1991-2000 due to the introduction of fishery management practices in 1988. The CAGR came down to two per cent in the subsequent decade (2000-2010) and showed a slight increase of 2.1 during the period 2010 -2018. The influence of the fishery management practices upon the fish landings was further analyzed with the aid of ARIMA model and Chow Break model. The Compound Annual Growth Rate and the Annual Average Growth Rate of three periods namely, 1981-1987, 1988 -1995 and 1996 to 2020 were compared and quantified. The period 1988-1995 was the

period during which Trawl Ban and other Fishery Management Practices were introduced in Kerala. The analysis found out that the effect of the fishery management practices could not be found in Period I (1981 to 1987) and Period III (1996 to 2020). The influence of fishery management practices in maintaining the sustainability of fishery resources was assessed by identifying the extend of depletion in selected species. The assessment reiterated that heavy depletion has occurred in oil sardine, Sardine, Ribbon fish, Elasmobranches, Catfish and Penaeid Prawns.

The second objective was to estimate the Sustainable Livelihood of the small-scale fishermen in order to analyze the challenges of the small-scale fishermen of Kerala. The statistical tools such as One sample 't' test, independent sample 't' test, One Way ANOVA, Descriptive Statistics Means and Percentages were used for the analysis. The Sustainable Livelihood Approach was used as an organizing framework for the study. The analysis was designed in such a way that the accessibility of the small-scale fishermen to natural, physical, social and financial assets were assessed. The small-scale fishermen of Kerala have less access to these assets which make them marginalized and the most disadvantageous sections of the society. They are being deprived of the basic necessities of livelihood opportunities. The fishery resources are the natural resources upon which the small- scale fishermen depend upon. Due to uncontrolled and illegal fishing there is depletion of fishes in the sea. 73 per cent of the small-scale fishermen are unaware of the fishery management practices existing in the State. Moreover, 50 per cent of them do not follow the norms of the fishery management practices. The annual income of the fishermen is so low that they can hardly meet the household expenses. The literacy rate among the small - scale fishermen is lower than the state average. 52.6 per cent of the heads of the family is illiterate. The educational opportunities of the children of the fishermen are also not so high. 73 per cent of the children belonging to the fishermen families could afford only up to higher secondary education. The social security schemes and incentives for the small-scale fishermen did not help the small-scale fishermen to overcome the livelihood vulnerabilities. 50 per cent of the social security schemes are not properly implemented for fishermen communities. Due to irregular income and uncertainty associated with the fishing, fishermen seek alternative employment. Every year, the number of fishing days decreases. This could be due to unpredictably bad weather or a steady stream of no-catch days. During times of low revenue, fishermen are obliged to seek alternative employment opportunities to earn a living.

The third objective found out the factors in fisheries management practices that influence the livelihood of the small-scale fishermen. The influence of the fishery management practices upon the livelihood of the small-scale fishermen was assessed using Factor Analysis, Structural Equation Modelling, Correlation Coefficient and Regression Analysis. An exploratory factor analysis was done in order to ensure dimension reduction and to study the inter relationships among the variables in an effort to find new set of factors. Accordingly, six common factors were extracted to facilitate the study of the relationship of original variables. The factors so extracted were named Level of Awareness on Fisheries Management Practices (LAOFM), Awareness on Welfare Schemes for Fishermen (AWOS), Level of Satisfaction from Fisheries Trade (LSFT), Flaws in the Current Fisheries Management Practices (FCFM), Unscientific Fisheries Management Practices (USFM) and Proactive Measures for Improving Fisheries Management Practices (PAMIFM). In the Structural Equation Model, Level of Satisfaction from Fish Trade was taken as the variable representing the livelihood of the small -scale fishermen. Lack of awareness about the fishery management practices, lack of awareness of subsidies and incentives, flaws in the current fishery management practices were found to be leading to unscientific fishery management practices. As the pro-active measures for improving the fishery management practices were enhanced the level of satisfaction in fish trade tend to improve. Five SEM models were individually constructed to identify the interaction of the six variables. In all such models the livelihood of the small-scale fishermen tended to be affected due to the presence of unscientific fishery management practices.

The fourth objective was to analyze alternative livelihood strategy and suggest appropriate measures for sustainable fishery management of small-scale fishermen of Kerala. The study found out that the opportunities for alternative employment were less among the small-scale fishermen. The low level of literacy among the small-scale fishermen makes them vulnerable to switch over to employment which guarantee higher income. The study found out that 74.4 per cent of the households in the areas of study did not have even a single member who joined fishing. This stressed the fact that the younger generation did not pursue this profession. Unfortunately, the younger generation who got employed with higher income occupation are just two per cent. Therefore it is concluded that the alternative employment opportunities for the small-scale fishermen are comparatively low in the present scenario.

The study found out that the creation of alternative employment opportunities is the solution to build up the livelihood of the small-scale fishermen. This was also found to be the pro-active fishery management practice to avoid crowding in the fishery sector. The Government of Kerala should provide additional funds for the small-scale fishermen to take up new employment opportunities. Awareness about the social and welfare schemes was a significant variable in determining the livelihood of the small- scale fishermen. Livelihood of the small-scale fishermen was enhanced through social security schemes such as grant-in aid, grant for education, insurance schemes and aid for alternative employment opportunities. Government can take initiatives for implementing the social schemes so that the small-scale fishermen may get additional financial and social aid for building up their livelihood.

CHAPTER -1

INTRODUCTION

1.1 Introduction

Kerala, situated on the southernmost tip of India is known for its abundant fishery resources. The 590 km long coastline of the State which spreads over nine coastal districts is the abode of major pelagic and demersal fishes. The State occupies predominant position in India with regard to marine fish resources. The traditional fishing of Kerala underwent tremendous changes owing to the mechanization process which commenced from 1970 onwards. The Indo-Norwegian Project (INP) was instrumental in bringing about dramatic changes in the marine fishery resources of Kerala. Mechanization resulted in excessive number of trawlers and big canoes which took over the fishing industry. Simultaneously, traditional fishing effort increased, and the rate of catch dwindled considerably. The excessive fishing along the coastal waters of Kerala, compelled the government of Kerala to enforce fishery management practices in order to conserve the fishery resources. “The Kerala Marine fishing regulation Act (KMFRA) of 1981”as well as subsequent measures such as regulation of mesh size, specifications in gear, regulation of engine power, and demarcation of Marine Protected Areas (MPAs) were enacted to preserve the fishery resources. The depletion of fish stock, reduction in catch, declining profit and the antagonism from mechanized trawlers, affected the livelihood of the small-scale fishermen.

The livelihood of the small-scale fishermen of Kerala is affected by social and economic constraints. The income from the daily fish catch is the mainstay for making their both ends meet. In the scenario of their occupation not supporting their survival, the fisher folk were compelled to think about an alternative for their means of livelihood. Alternative Livelihood Strategy within the small-scale fishery is unlikely to cause fishers to leave fishery, instead strengthen the livelihood portfolio as a supplementary activity. Various studies have substantiated that fishing is not a sufficient activity for livelihood, for the small-scale fishermen, who do not own fishing equipment such as outboard engine boats, nets and other equipment. The same is undertaken enthusiastically by the owners of fishing gadgets as well as wealthy boat owners who have capital to invest. However, fishing as the sole income and configures a greater share of revenue, employment and livelihood of the dependent communities of the Kerala region. Very often these communities are encountering financial hardship on account of the decline in their income owing to the depletion of the fishes in the sea, and the consequent dip in their daily fish catch. Due to this, a substantial number of small-scale fishermen lack the wherewithal for meeting the expenses regarding education of their children, health care expenses of their families and other essential requirements. Consequently, the younger generation of the small-scale fishermen are least interested in engaging in fishing as a means of livelihood. Therefore, they are bound to seek alternative means of employment. The hardship in realizing the same is attributed to the fact that, in spite of their aspiration, they are not sufficiently equipped with educational quality. The small-scale fishermen face innumerable adversities while trying to attain their livelihood by way of fishing.

1.2 Background of the Study

The sustainability of both capture and culture fisheries faces serious challenges globally. (Mathew, 2008). Two key issues of the fishery sector of Kerala are “open access” and “over fishing”. Internationally, “United Nations Convention on Laws of the sea (UNCLOS),” “United Nations Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks,” “FAO Compliance Agreement, Code of Conduct for Responsible Fisheries (CCRF) 1995” have been introduced for better fishery management. All these agreements and principles were aimed at the conservation of bio diversity in fisheries sector and also called for the upliftment of the fishery dependent communities. (CCRF, 1995). In India too there are many fishery management measures initiated by the government. The Central Government included fisheries management in the Five-Year Plan of the Eighth term (1992-1997)” and initiated measures to carry forward the plan outlay in the subsequent Five-Year Plans too (Mathew, 2008).

Ever since 1970, legislative Acts have been enacted which were aimed at improving fisheries management. Notable among them are the Exclusive Economic Zone (EEZ) Act of 1976, the Indian Maritime Zones “(Regulation of Fishing by Foreign Vessels) Act of 1981,” and “Coastal Aquaculture Act of 2005.” (Mathew, 2008).

In Kerala, fishery management principles were introduced from 1970 onwards. In Western Malabar, *Kadakkodi* (which literally means sea- Court') (Paul, Antonyto, 2005) existed. It functioned as a legislative, executive and judicial body that enacted regulations for fishing operations; enforced the regulations and resources conflicts. "Kerala Marine Fisheries Regulation Act", 1980 and "the rules and orders promulgated there under" by the Government of Kerala formed the most important formal institution in the fishery Sector of Kerala (Gok 1981). The Act aimed at prohibition of dynamite fishing, regulation in the collection of chants, clams and oysters, provision of licensing of fishing operations and for fishery closures in certain seasons. Despite of all these measures globally, nationally and regionally, the marine fishery sector experiences depletion and over exploitation. Moreover, the fishery dependent communities are marginalized.

1.3 Significance of the Study

The competition posed by mechanized boats, indiscriminate harvesting technologies, and ecological changes have led to severe depletion of resources. The excessive fishing effort coupled with illicit means of fishing reiterated the need for efficient management of fishery resources. It is quite unfortunate that despite of various legislations, management practices and policies, the small-scale fishermen are still living under poverty. The mechanization of the fisheries sector resulted in the overcrowding of the sea and decrease in the catch. The study aims at analyzing the management scenario of marine sector at the backdrop of degradation of resources and the deterioration in the livelihood of the small-scale fishermen. The depletion of fishery resources forces the fishermen to increase the fishing effort which affect the measures of conservation of resources. The exploitation of the deep -sea resources by the mechanized fleets disrupt the habitat of the demersal fish resources. Therefore, this study explores the ways of building up the livelihood of the small-scale fishermen of Kerala by revamping the existing fishery management practices in the State.

1.4 Research Gap

The studies which were reviewed on fisheries management and livelihood conditions of the small-scale fishermen of Kerala were either limited to the socio-economic conditions of the small-scale fishermen or the various welfare measures implemented to improve their livelihood conditions. The studies which specifically enquired about the functional relationship between the “livelihood of the small- scale fishermen” and the “fisheries management” practices are conspicuously few. The gap found in the findings of the reviewed studies brought out the fact that the area of alternative livelihood strategy and fishery management practices were left out. The present study fills this gap. It focuses on two key issues: the “livelihood of the small-scale fishermen” as well as the drawbacks prevalent in the present “fisheries management” approaches in Kerala.

1.5 Statement of the Problem

In ancient Kerala, there were locally administered informal fishery management institutions such as ‘kadakkody’ (court of sea) which regulated and managed fishery sector. The government of Kerala introduced formal fishery management institutions such as Kerala Marine Fisheries Regulation Rules during the year 1980 and various institutions thereafter. Thus, the management of fishery sector became a dynamic process in which fishing communities and society at large take careful decisions to regulate the use of resources for the sustainability of the ecology and viability of the fisheries sector. The role of the management regimes was to sustain fish stock and protect the livelihood of the dependent communities. The modernization of the fisheries sector took place as early as the inception of the well-known project called the Indo-Norwegian Project (INP) in the beginning of 1950s. The mechanization of the marine fishery brought in new fishery management practices such as trawl ban, regulation of the size of the mesh, specifications of the gear, Coastal Regulation Zone (CRZ) and Marine Protected Areas. However, the ineffective management practices paved the way for overfishing and indiscriminate fishing along the coastal belt of Kerala. The incessant decline in the fish stock due to overfishing and climate change adversely affected the livelihood of the small-scale fishermen of Kerala. The depleted fish stock resulted in the reduction of the rate of the catch landed by the small-scale fishermen. The income of the small-scale fishermen declined and their misery increased. This led to a reduction in the income of the small-scale fishermen and to an increase in their misery. This phenomenon raises certain research questions

1. Why the fishery management practices in Kerala is found to be ineffective despite of all the policy measures?
2. What are the various livelihood challenges of the small-scale fishermen of Kerala in the post-mechanization era?
3. Why is it that the small-scale fishermen of Kerala are marginalized in spite of the existence of various fishery management practices in Kerala?
4. What are the alternative livelihood opportunities available for the small-scale fishermen of Kerala?

The first research question enquires into the present fishery management practices of Kerala fishery. “Kerala Marine Fisheries Regulation act (KMFRA 1980)” conceived marine resources as a state regulated property with formal fishery management rules. Both the Central and State Governments set specific rules and regulations which governed the marine fishing. The performance and the present status of the management practices should be scrutinized to assess their effectiveness.

The second research question analyses the factors which affect the livelihood challenges of the small-scale fishermen even in the presence of the various fishery management practices. The national and regional frame work of fishery management tools are not implemented successfully. For instance, in the “Report of the Committee to Evaluate Fish Wealth / Impact of Trawl along Kerala coast,” it is clearly given that in value terms the benefit of the trawl ban was present only up to the year 2000.

The third question is a pertinent one in the present study. The benefits of fishery management have not reached the fishermen. The economic gains from fishing have been on the decline due to overcrowding and overfishing (Krishna Kumar, 1999). The current situation of their livelihood has to be reviewed and alternative livelihood approaches have to be proposed.

The fourth research question enquires into the possibilities of diversification of the livelihood opportunities among the small-scale fishermen of Kerala. This research question has dominant importance in the study as the livelihood of the small-scale fishermen can be enhanced only by diversifications in the occupation.

These are the main concerns of fishery management practices in Kerala along with the livelihood challenges of the small-scale fishermen. In the light of the research questions stated, the **objectives** pursued in the study are the following:

1.6 Objectives of the Study

1. To identify the trend and structure of the fishery management practices in Kerala.
2. To estimate the Sustainable Livelihood and to analyse the challenges of the small -scale fishermen of Kerala.
3. To find out the factors of fisheries management that influence the livelihood of small-scale fishermen of Kerala.
4. To analyze alternative livelihood strategy and suggest appropriate measures for the sustainable fishery management of the small-scale fishermen of Kerala.

1.7 Hypotheses

1.7.1 Hypothesis 1

The small-scale fishermen have access to natural, physical, financial and social capital for building up their livelihood. [1]

1.7.2 Hypothesis 2

There are significant factors in the "fisheries management practices" which influence the livelihood of the small -scale fishermen of Kerala.[2]

1.7.3 Hypothesis 3

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[1] (The livelihood challenges of the small- scale fishermen were assessed using the variables of "Sustainable Livelihood Approach." "Sustainable Livelihood Approach" presupposes that the resilience of any community rest upon its ability to access the natural, physical, social, and financial assets. The socio-economic parameters of the small-scale fishermen are analysed using the statistical tools of One Way Anova, Mean Score Analysis, Descriptive Statistics, Multiple Response Analysis)

The result of the testing of the hypothesis is given in pages 158-161

[2] The result of the testing of the hypothesis is given on page 213

There are alternative livelihood opportunities for the small-scale fishermen of Kerala for enhancing their livelihood. [3]

1.8 Conceptual Clarity

The two key concepts of the study are fishery management and small-scale fishermen. Fishery management is a broad concept which includes the rules and regulations, policy measures, sustainable indices and bio-physical conditions of the fish. The development of the concept of fishery management provides the variables such as tools of fishery management practices, fishing methods of coastal regions policy measures for the sustainability of marine resources and the bio-physical conditions of the small-scale fishermen. This assessment is done from the perspective of fishery management practices which is prevalent in Kerala since the inception of KMFRA. Small-scale fishermen and small-scale fisheries are the other concepts in the study. The Sustainable Livelihood Approach is used as guiding tool to identify the variables such as accessibility to natural, physical, financial and social assets, level of awareness about fishery management practices, level of awareness on the fish depletion and level of awareness on welfare schemes.

1.9 Operational Definitions

1.9.1 Fishery Management

In the present study, the term, 'fisheries management' refers to the governmental system of appropriate management rules based on defined objectives so as to sustainably protect the marine fishery resources. The technical definition for fisheries management is "the integrated process of information gathering, analysis, planning, consultation, decision making, allocation of resources, and formulation and implementation, with enforcement as necessary of regulations or rules which govern fisheries activities in order to ensure the continued productivity of the resources and the accomplishment of other fisheries objectives (FAO, 1995)."

[3]The result of the testing of the hypothesis is given on page 155

From the definition, the complex nature of fisheries management is evident. From the various definitions and nuances, it can be narrowed down that fishery management is a system in which there are analysis and planning which will ensure fishery resource diversity and the optimum use of fishery resources. Fishery management practices are better understood and implemented when the ecological, social, economic and human concerns are taken into account. The reason is that in the fisheries sector we see a constant interplay of nature and humans. (Kurien, 1988).

1.9.2 Small Scale Fishermen

The term 'small-scale fishermen" in the present study is used to denote those fishermen who depend on conventional means of fishing such as kattamaram, mini trawlers and plywood decked boats which are either owned by them or others. They also pursue fishing by seeking employment in trawlers and big canoes.

1.9.3 Small Scale Fisheries

There is no formal definition of small-scale fisheries in the literature on fisheries. Many different phrases are employed, such as traditional, artisanal, and subsistence, which, while not technically equivalent, are frequently used synonymously to emphasise the scale of operations in comparison to those of major industrial fishing ventures. Nevertheless, they all share a few traits in common. They are constrained to a small area of land and water around their village, operate close to their home base, are largely dependent on natural resources, and have a limited range of options due to their limited fishing range and associated socio-economic characteristics. The word "small-scale" is employed in the present study to refer to both small and traditional in the sense of using traditional equipment, including improved versions. The term "small-scale fishery" includes fishermen who use vessels with outboard motors, according to this definition.

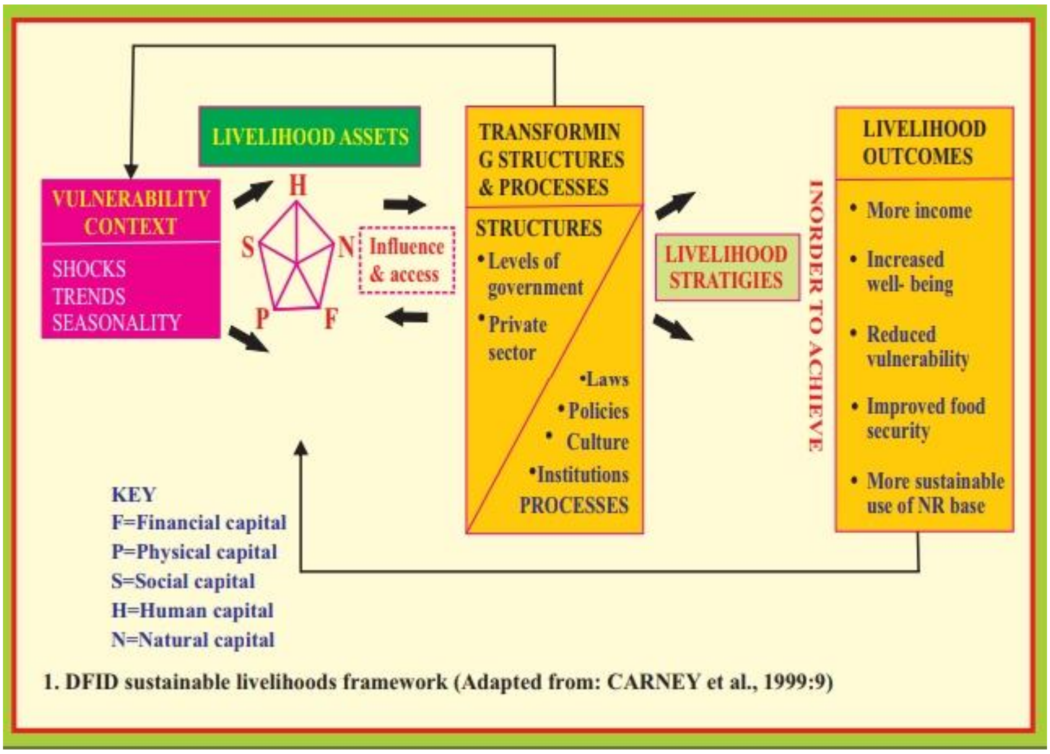
1.9.4 Maximum Sustainable Yield

The Maximum Sustainable Yield (hereafter MSY) of a particular group of fish refers to the highest continuous catch that can be sustained over time by maintaining the stock at the level yielding the most growth. The MSY designates a theoretical situation in which fisheries activity and habitat exploitation are at an equilibrium.

1.9.5 Sustainable Livelihood Approach

The Sustainable Livelihoods Approach (hereafter SLA) is a technique for examining and improving the quality of life of those who are disadvantaged and live in poverty. It is a participative strategy built on the understanding that everyone has skills and resources that may be designed to aid them better their lives. The sustainable livelihood framework aims to conceive livelihoods comprehensively, taking into account their many intricacies as well as the opportunities and restrictions they are faced with. These limitations and possibilities are influenced by a wide range of variables, including more local norms and institutions, assets that the household or individual has direct access to, and trends and structures at the global or national level over which individuals have no control and may not even be aware of.

Figure 1.1
Framework of Sustainable Livelihood Approach



1. DFID sustainable livelihoods framework (Adapted from: CARNEY et al., 1999:9)

1.9.6 Trawl Ban

Trawl ban or closure of seasons is the fishery management practice in which fishing activity by mechanized vessels is banned for a specified period of time. In India, Trawl Ban came into being with the introduction of Marine Fishing Regulation Acts in the year 1981.

1.9.7 Mesh Size Regulations

Regulations in mesh size is implemented to reduce juvenile fishing and to do away with fish discards. The prescribed size for trawlers in Kerala is 35 mm as against the earlier size of 28 mm. The rules and regulations regarding the meshes also contain green protocol. The fishermen are given the mandate not to use plastic meshes for fishing.

1.9.8 Marine Protected Areas

Marine Protected Areas are those areas which are set apart for conservation and protection. Marine protected Areas are instituted for wild life resources which are ecologically sensitive, marine resources which are experiencing depletion and for all other natural resources which are open access in nature. These area are protected by way of zoning system and by delimitation.

1.9.9 Seine Fishing

Seine fishing is a method of fishing which involves a circled net containing weights in the bottom edge. There are floats in the upper edge for facilitating easy fishing. Seine fishing is done from the shore as well as from a vessel. Seine fishing which is done from the shore is called beach seine.

1.9.10 Ring Seines

Ring seines, are also called mini purse seines which has circled nets. The ring seines were initially used in the traditional motorized crafts. Later on these nets were used by big vessels with additional length and size. The nets are cast into the sea after the detection of fish school. the nets has weights and sinkers to the bottom. The surrounding shape of the net falls on the fish school and the purse line attached to the bottom of the net prevents the fish from escaping through the net.

1.10 Theoretical Models Used in the Study

The present study made use of three models to explain the livelihood challenges and the flaws in the fishery management practices. ARIMA model was used to analyze the trends in fishery management practices. The purpose of applying the models was to assess whether fishery management practices helped to attain sustainable growth in fisheries thereby enhancing the livelihood of the small-scale fishermen.

The Institutional and Development Framework (IAD) and Socio-Ecological and Systems Framework (SEFS) were used to identify the influence of the fishery management practices upon the livelihood opportunities of the small-scale fishermen of Kerala.

1.10.1 ARIMA Model

In time series analysis, an Auto Regressive Integrated Moving Average (ARIMA) model is a generalized version of the Auto Regressive Moving Average (ARMA) model. These models are fitted to the time series data for examining the trends and for forecasting. The forecasting is done after checking the non-stationarity of the time series data. The initial differencing can be avoided by way of differencing. If the non-stationarity persists, second differencing can be done. The model is generally referred to as "ARIMA p, d, q model. P, d and q are non-negative integers in the model.

The Auto-Regressive model is quantified through the intervention analysis. "By Y(t) itis represented the Integrated Moving Average landings in time period t (year or quarter) then the functional form of an ARIMA (p,d,q) model (with p autoregressive terms, q moving average terms and regular differencing d) is" :

A(B) (1-B)d Y(t) = b(B) e(t)

where, $a(B) = 1 - a_1 B - a_2 B^2 - \dots - a_p B^p$

$b(B) = 1 - b_1 B - b_2 B^2 - \dots - b_p B^q$

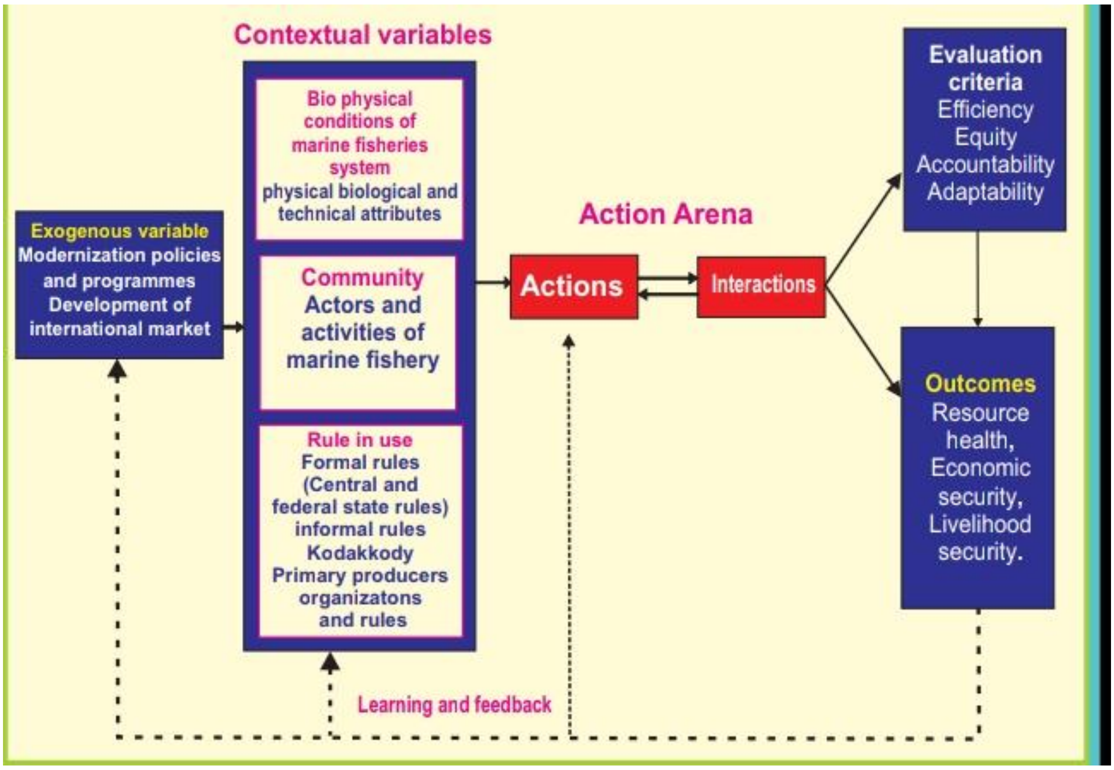
Bk Y(t) = Y(t-k)

1.10.2 Institutional Analysis and Development (IAD) Framework

The IAD framework is built on the concept of policy processes as dynamic systems. Individual choices are influenced by social, organizational, and ecological variables (either individually or group -wise). Individual choices are brought together to form forms of behaviour, which, associating with external variables, result in observable results. Depending on the degree of aggregation used, systems typically seem significantly different, and this fact particularly applies to action circumstances. "IAD" paradigm defines "three levels of analysis" where different sorts of decision-making processes occur: operational, collective, and constitutional. The users who are involved in the decision making make a choice which is very practical at the operational level. Both collective-level and individual-level decisions dictate whether techniques, conventions, and regulations are, should be, or are not available to actors fulfilling specific roles. The IAD framework was developed for use in any policy situation where individuals and groups build new policies as partial solutions to changing policy concerns. When applied to resource management concerns, the IAD framework's natural propensity is to approach resource system dynamics as primarily exogenous forces, that is, as a driver of changing conditions rather than something directly within the control of the individual's making policy in those settings (Ostrom, 2015).

Figure 1.2

Diagram of IAD Frame Work



Source: Ostrom *et al*., 1996

1.10.3 Socio-Ecological Systems Framework (SESF)

This framework is provided by Professor Ostrom in her work "A general paradigm for studying the sustainability of socio-ecological systems" — that is, ecological systems that take the aid of human intervention – in an important integrative article published in “Science” in 2009 (Vol. 325, 24 July). She sought to identify ten subsystem characteristics that affect the likelihood of effective self-organization of efforts to attain sustainable socio-ecological systems by the communities involved, based on her own study. The Socio-Ecological Systems Framework (hereafter, SESF) was created with the intention of being used in a narrowly restricted “domain of common-pool resource management” scenarios in which the players in the scene use resources from a common pool. The beneficiaries also ensure that the resource base is maintained in accordance with the norms and regulations established by an all-encompassing governance system, as well as in the context of linked natural systems and broader social, political, and economic settings (Ostrom, 2015)..

In the study, the framework is used to identify the nature and use of fisheries management practices while maintaining the livelihood of the dependent communities.

1.11 Research Methodology

The present study used both descriptive and exploratory methodology. Secondary source of data collection included previous research works, journals on fisheries management publications and articles books, published reports of central and state governments on fisheries and fisheries management and websites related to the topic. The secondary data was collected from the data base of the fishery institutes such as the Central Marine Fishery Research Institute (CMFRI), Central Institute of Fisheries Technology (CIFT), Fishery Survey of India and Department of Fishery and *Matsyafed*. Secondary Data form departments like Directorate of Fisheries and State Planning Board and Non-Governmental Organizations (NGOs) like South Indian Federation of Fishermen Society (SIFFS) and Programme for Community Organization also were made use of for the secondary data.

Primary data was collected from the fishermen households of the sample districts by making use of structured questionnaire, schedule method and participant observation. Those households whose heads of the families were pursuing fishing as the main occupation was selected as samples. The sample survey was done in three districts (Thiruvananthapuram, Ernakulam and Kozhikode) in Kerala and in selected three fishing villages from each district.

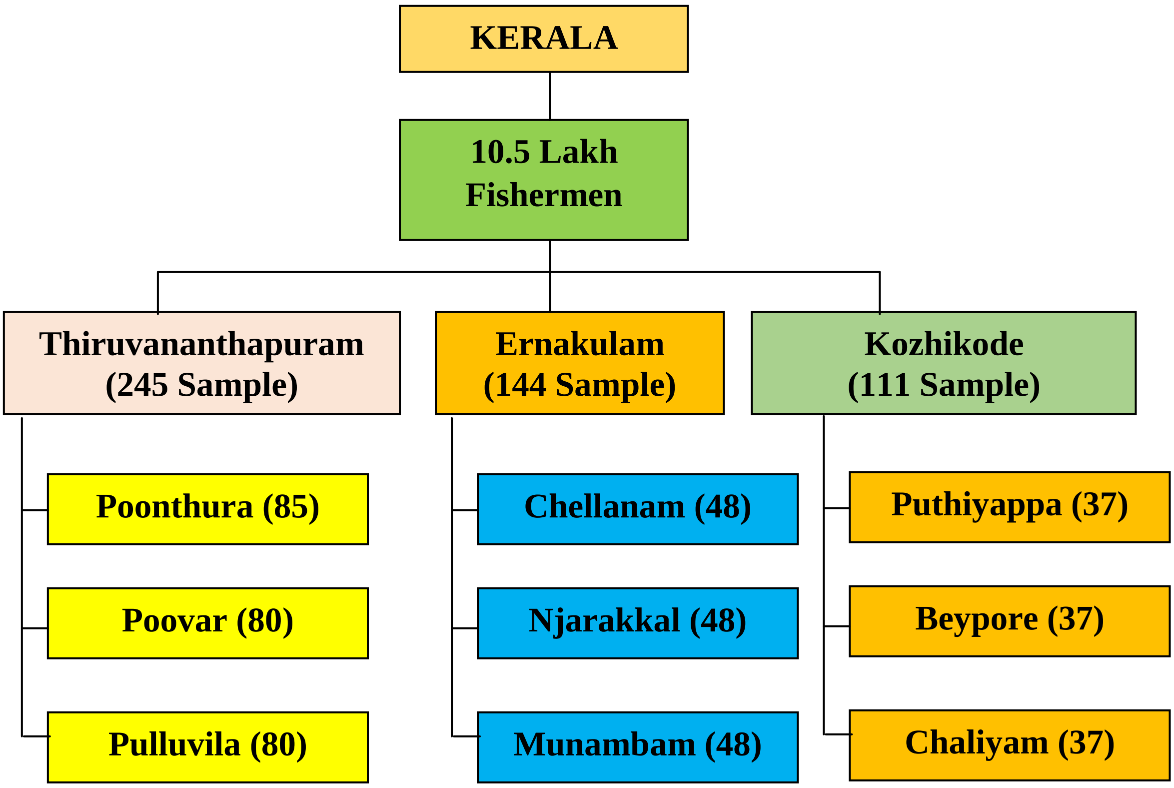
1.11.1 Area of the Study

The present study used multi-stage random sampling method. In the first stage, the population of the study was identified which is the small-scale fishermen of Kerala. in the second stage three districts were selected based on purposive random sampling. The three districts selected for the study constitute the districts of Thiruvananthapuram, Ernakulam and Kozhikode. The three districts selected for the study were Thiruvananthapuram, Ernakulam and Kozhikode. The district of Thiruvananthapuram was selected because it has the highest number of fishermen population in the State and it geographically falls in the southernmost part of Kerala. Ernakulam falls in the central fishing zone and the district possesses different communities working in the fisheries sector. Kozhikode belongs to the northern fishing belt of the State.

1.11.2 Sample Design

In the third stage, sample area, sample area of the study was selected through simple random method. Figure 1.3 depicts the sample design. Thiruvananthapuram, Kozhikode and Ernakulam were the districts chosen for the survey. Poonthura, Poovar and Pulluvila were the districts chosen from the district of Thiruvananthapuram. Chellanam, Munambam and Njarakkal were the villages chosen from the district of Ernakulam. From the fishing district of Kozhikode, Puthiyappa, Chaliyam and Beypore were selected for the sample survey.

Figure 1.3
Sample Design



1.11.3 Estimation of the Sample Size

For systematically determining the sample size, Proportion Test was used. As the population is finite the formula was used to determine the sample was,

$$n = \frac{Z^2 \text{ x PxQxN}}{e^2 (N-1) + Z^2 \text{xPxQ}}$$

Where,

Z=standardized value corresponding to a confidence level

N = size of the population

P = proportion of success

Q = (1-p) e = allowable error

1.11.4 Sample Frame

The fishermen in the selected nine districts of the study area constituted the sample frame.

Table 1.1
Sample Frame

District	Population	Percent of Population*	Sample*
Thiruvananthapuram	193493	49.0	245
Ernakulam	87664	22.2	111
Kozhikode	113726	28.8	144
Total	**394883**	**100.0**	**500**
Margin of Error#: 4.38%, Population Proportion: 50 %, Confidence Level: 95 %			

1.11.5 Interview Schedule for the Study

A structured interview schedule was carefully designed for the collection of responses from the small-scale fishermen.

1.11.6. Pilot Survey

The interview schedules were standardised after the pilot survey to ensure the accuracy and clarity and made necessary corrections to ensure smooth collection of the primary data. The pilot study also helped to identify the small-scale fishermen in the study area.

1.12 Methods of Data Collection, Management and Analysis

The primary data was collected from the fishermen households of the three coastal districts of Kerala viz., Thiruvananthapuram, Ernakulam and Kozhikode. Descriptive, parametric and non-parametric statistical tools such as means, percentages Standard Deviations and cross tabulations were used for the analysis of data. The parametric statistical tools such as mean value analysis, one sample t-test, one way ANOVA, two-way ANOVA, MANOVA, Discriminant analysis, Karl Pearson Correlation, Analysis of Co-variance, Regression analysis, Factor analysis and Structural Equation Modelling were also employed for the analysis.

1.12.1 Statistical Tools Applied for the Objectives

1.12.1.1 To identify the trend and structure of the fishery management practices in Kerala.

Compound Annual Growth Rates, ARIMA model and Descriptive Statistics were employed to analyze the secondary data from 1988 to 2018.

1.12.1.2 To estimate the Sustainable Livelihood and to analyse the challenges of the small -scale fishermen of Kerala.

Means, Percentages, Standard Deviations, one sample T test and Cross Tabulation were used for the first objective.

1.12.1.3 To find out the factors of fisheries management that influence the livelihood of small-scale fishermen of Kerala.

An exploratory factor analysis was done in order to ensure dimension reduction and to study the inter relationships among the variables in an effort to find new set of factors. Accordingly, six common factors were extracted to facilitate the study of the relationship of original variables. The factors so extracted were named:

1) Level of Awareness on Fisheries Management Practices (LAOFM)
2) Awareness on Welfare Schemes for Fishermen (AWOS)
3) Level of Satisfaction from Fisheries Trade (LSFT)
4) Flaws in the Current Fisheries Management Practices (FCFM)
5) Unscientific Fisheries Management Practices (USFM)
6) Proactive Measures for Improving Fisheries Management Practices (PAMIFM)

A confirmatory Structural Equation Model was constructed using the same variables to ascertain the factors which are responsible for the faulty fisheries management.

1.12.1.4 To analyze alternative livelihood strategy and suggest appropriate measures for sustainable fisheries management for small-scale fishermen of Kerala.

1.13 Limitations of the Study

The present study is an attempt to view the livelihood challenges of the small-scale fishermen owing to the deficient fisheries management systems prevailing in Kerala. The study is location-specific and any generalization from of the findings of the study should be made within the framework of the study. The primary survey of the study was done during the trying times of the peak spread of the pandemic Covid -19, in the state of Kerala. This posed serious threat and the process of the survey was time consuming and tedious as there were restrictions on travelling and had to keep social distancing. The primary survey was completed after the incessant effort and hard work.

1.14 Chapter Scheme

The study is organized in such a way that the entire study consists of seven chapters.

The first chapter deals with introduction, background of the study, significance of the study, research gap, statement of the problem, objectives, hypothesis, methodology, limitations and chapter scheme.

The second chapter makes an elaborate review of major theories and postures of various natural and social scientists on fisheries management at the global and regional level with a special focus to derive strategies for managing marine fisheries in Kerala, India

The third chapter explains the historical outline of the fisheries sector and the fisheries management.

The fourth chapter provides the trend and structure of the current fisheries management practices.

The fifth chapter deals with the socio -economic conditions of the small -scale fishermen.

The sixth chapter gives the factors which are responsible for the negative growth in the livelihood conditions of the small -scale fishermen.

The seventh chapter contains the summary and findings.

Figure 1.4
Chapter Scheme of the Study

- Chapter 1 — **INTRODUCTION**
- Chapter 2 — **THEORETICAL AND ANALYTICAL REVIEW OF LITERATURE**
- Chapter 3 — **HISTORICAL OVERVIEW OF FISHERIES SECTOR**
- Chapter 4 — **THE FISHERY ECONOMY OF KERALA AND THE TREND OF FISHERY MANGEMENT PRACTICES**
- Chapter 5 — **THE SOCIO ECONOMIC AND LIVELIHOOD CONDITIONS OF THE SMALL-SCALE FISHERMEN AND THEIR LIVELIHOOD PROBLEMS**
- Chapter 6 — **THE LIVELIHOOD CHALLENGES OF THE TRADITIONAL FISHERMEN OWING TO THE FAULTY FISHERIES MANAGEMENT IN KERALA**
- Chapter 7 — **SUMMARY, FINDINGS AND RECOMMENDATIONS**

CHAPTER -2

THEORETICAL AND ANALYTICAL REVIEW OF LITERATURE

2.1 Introduction

The sustainability of marine resources and the need for proper fisheries management practices have been discussed in detail in the academic and scientific circles since 1800s. These reviews led to the formulation of theories which sustainably maintained the natural resources. These theories in turn have been used by the beneficiaries of these resources in order to protect their stock. The chapter aims to review the theoretical background as well as the opinion of the scientific community about the conservation of fishery resources. In compliance with the objectives set up of the study, the review of literature has been done based on the three pertinent issues. In the first issue, a detailed review was undertaken on the depletion and sustainability of fishery resources. The second issue of the review deals with the practices of marine fisheries management in the world, in India and Kerala. The third issue on the review in the present chapter consists of the major theoretical approaches used in the study such as the "Institutional Analysis and Development Framework (IAD)" and the conservation of fishery resources

2.2 Natural Resources and Their Conservation: An Integral Approach

Natural resources are important for the economic well-being as well as social upliftment concerning any nation. Their sustainable use is being discussed across the globe. Natural resources are exhaustible (Rasmus, 2010). There are theorists who argue that the economic advancements achieved by the mankind over the years have been detrimental to the depletion of natural resources worldwide. Initially, several natural resources seemed to be inexhaustible to mankind (Jodha, 1985). There was low population pressure, industrialization was still in its initial stage and only one-third of the resources was fully discovered ("ETHIOPIA: World Bank Report", 2016). The sustainable development goals of this century regarding natural resources are multi-dimensional, with larger objectives. Compartmentalizing the sustainability on the lines of environment alone will not work. The social and economic impact of maintaining and conserving natural resources will play a major role in enhancing larger developmental goals of the world nations (Panayotou, 1994). An integral or comprehensive approach considering all the dimensions of society is essential to natural resources. An "integrated" policy requires comprehensiveness, aggregation and consistent criteria being met. Comprehensiveness relates to issues, actors and space and aggregation relates to an overall perspective of the evaluation policy (i.e., environment, economy and society) while consistency shows that the different components of an integrated policy are in accordance with each other (Barthelmes, 1983)). The livelihood of the poor is often dependent upon the natural resources of various kinds. They are often engaged in various activities to derive income from these natural resources. These natural resources provide basic amenities for them. The poor acquire income for their household from these resources.

2.3 Natural Resources and Economic Growth

Natural resources fall under three classes (Chipman, 2006): Sunlight and wind are continuous resources. Their use does not lead to a reduction in their size. Wood and crops are renewable resources. These can be harvested at a lower rate as compared to replenishment. Non-renewable resources, the third reserve, are created by a very slow process. Scientists and economists have deeply studied the relationship between economic growth and natural resources. In the discussion on non-renewable natural resources that began in the 1970s, the main point was whether sustained economic growth is possible with limited natural resources. Solow (1974) and Stiglitz (1974), using an exogenous-growth model, found out that a balanced growth was possible if the physical capital could be converted into resources which were inexhaustible. Environmental degradation was later found to increase along with economic advancement. The restrictive scope of economic environment and models had to be expanded to include the environmental quality aspects. Economists thus began to analyze the inter-connectedness between the economic growth and the pollution which was generated along with the economic growth. There were attempts worldwide to estimate the social cost imposed by economic advancement upon the environment. In 1996, Canadian ecologist William Rees along with Mathis Wackernagel introduced the concept “ecological footprint” comparing the use of exhaustible resources and the aptitude of the mankind to regenerate them laying focus on environmental sustainability (Hoekstra, 2009). The concept stressed on the fact that the natural resources which were currently available had already reached the saturation level. Estimations showed an increase in the ecological foot print year after year (Rees, 2006). This shed light on “hidden” prerequisite for sustainable environment, and emphasized the need for resources in the sea as well as the inland resources to lie inside an ecological system. This explained that the actions of the people though it appeared to be separated from environment, was unproductive without a reassuring ecosystem. “Ecosystems” that form the precondition for marine production and consumption had a secretive function which was not understood by many, even though it was a reality. The abatement cost, widely used in environmental accounting, should be included in the cost analysis of economic assessment. The discipline of environmental economics often stressed the need for such costs in the form of pollution tax, quota maintenance, and spill over tax, green tax and green protocol which at least reduced the societal burden that had a lasting consequence. The inclusion of environmental costs results in a hike in the price of resources which would lower the demand of that particular resource. Ultimately such a process had allowed the resource to last longer.

2.4 Fishery Resources, Their Depletion and Sustainability: A Historical Review

Fishery resources are natural resources. The valuable fish stocks were exploited either fully or beyond limits (FAO, 2008). Eighty-five per cent of the marine fishery resources were estimated to be fished to their biological limits or beyond (FAO, 2020). A wide range disruption of the marine ecosystem happened due to the destruction of major kinds. There are huge number of people, who depend upon the fishery resources in variety of ways, on the marine environment for their livelihood and daily food. Tonnes of fishes need to be caught to meet the global demand. Our oceans face the threat of depleting supply of edible sea creatures. Earlier, fishing was more sustainable around the globe mainly because the technology to go deeper into the ocean was inadequate. In pre-historic times, fishing was minimal as the primary need was to get food for subsistence (Pitcher and Lam, 2010). As fishing technology became more sophisticated and human population dispersed and expanded, fishing transformed from a hunter-gatherer subsistence to a bartering system and new trading system where millions of rupees were transacted. The subsistence sector can be compared to the Robinson Crusoe economy where the production was limited to needs and the mode of fishing was raw and crude. Scientific evidence showed that earlier fishing techniques were rather natural. The earlier ancestors, *Homo erectus* and *Homo Sapiens* had used these for their daily consumption. Evidences from the mid Stone Age showed a cleverer use of natural fishing devices (Stringer, 2002). Later during the Neanderthal era, earthen fish nets (Radcliffe, 1921), tied fish nets (Adovasio et al., 2010) and fish hooks made of bones and horn ((Sahrhage et al., 1992)) were invented. Archaeological evidences proved that around 42000 years ago there were devices for tuna fishing (O'Connor et al.., 2011). This was purely subsistence fishing. Fish stocks never saw a decline during this period. In the early Middle Ages, mercantilism arose in the entire Europe during the later phases of the Roman Empire (Braund, 2004). Throughout the Middle Ages, marked by the decline of the Roman Empire and the rise of Constantinople, there was commoditization of fish and fish trade flourished across the globe. Trade was on the rise, but there was no historical evidence towards serious marine resource depletion barring some local depletion (Hoffman *et al*., 2015). The modern era of fisheries which had its beginning in the industrialized Europe and Britain drove major commercial expansion. There was a revolution in rapid fish marketing and cold storages. Ice became popular as a major preservative along with drying and salting. Sail-powered trawlers led to steam-powered trawlers, increasing the catch ten times (FAO, 2011). Steam trawlers made massive catches and a significant expansion of herring, flatfish and cod possible (Wimpenny, 1947). The period between 1700 and 1800 was remarkable as it marked the beginning of expansion from natural methods to machine-based fishing. From 1800 onwards there was a shift from the indigenous management techniques to more mechanized and profit-based fishing techniques. The new trade pattern with the aid of capitalism could supply excessive volume which was actually a paradigm shift during the period (Pitcher, 2014). By then fish had become a commercial commodity. A close analysis of the marine history during the period between 1900 and 1950 showed that the habitat of the fish species was extensively affected as a result of rapid mechanization. From the mid- 1930s, diesel-engine crafts came in instead of steam engine crafts. During the 1940s and 1950s, key technological improvements such as frame stern trawlers, motorized net drums, freezer trawlers, sonar, heavily mechanized purse seiners, Global Positioning System (GPS) were applied making it easier to locate fish species and catch them instantly (Burd, 1991). Improved fishing technology and increased demand for fish led to excessive fishing and illegal occupation of the seas by the trawlers (Lam and Pitcher, 2014). Several slow-growing and non-traditional fish species were largely caught and brought to the culinary tables. Some of the wild fishes became victims of large trawlers. Increased hunting of slow-growing but long-lived fish species reached the threshold of extinction and affected the marine habitat as a whole. A historical review of fisheries gave a picture of the evolution of the fisheries sector from the pre human period up to now and how abundant fish stocks became a thing of the past. Commoditization was followed by mercantilism, commercialization, technological improvement in crafts alongside and preference for fish species resulted in widespread destruction of fish species by way of overfishing.

2.5 Overfishing and Depletion of Fishery Resources

Till the early eighteenth century, fish resources were considered inexhaustible and a common property available to all. By the late eighteenth century, however, it became clear that exploiting fish had put the survival of fish species in danger (Rothschild et al., 1994). According to FAO, 50 per cent of the global fisheries resources were fully fished, 25 per cent are overfished ("New FAO Fisheries Reports," 2013). Overfishing was considered to be the principal reason for destruction of marine resources. Scientists have dealt with this subject for a hundred years or more. Schaefer's stock production model (Schaefer, 1957), Thompson and Bell model which came to light in 1930s and "yield per recruit and dynamic pool model" developed by Beverton and Holt in 1950s detailed and quantified the concept of overfishing during the 19th century. Overfishing is the depletion of fish stock (a body of water) by excessive fishing (Banerji, 1969). Overfishing occurred when fish stocks were reduced below an acceptable level. The biological and bio-economic overfishing outlined tolerable fishing capacity of the oceans. When the death rate of fish species reached a level where their total stock signifies a negative growth marginally, biological overfishing happened. (Ssentongo 1989). It referred to the slow replenishment rate in the fish stock, characterised by a decline in fish population. Bio-economic overfishing was considered in terms of the reward obtained from the exploitation of natural resource and fish resource. The economic reward displayed a negative trend as the exploitation increased. The non-availability of the resource dissipated the economic rent completely. One can conclude from this discussion that overfishing obstructed the marginal profit and marginal growth that could have been derived from the normal catch. Further the concept demanded sustainable limits of fishing globally - without depleting the resource base and impacting the environment. A key tool used by the economists and the scientists around the globe was "Maximum Sustainable Yield (MSY)" which is the highest volume of "catch" which was obtained from a particular species' stock over a period when the environmental conditions were favourable. For a viable and thriving fishing sector, production of fish stocks must cross the MSY over an indefinite time frame (World Ocean Review, 2012). Overfishing had both environmental and socio-economic dimensions posing crisis for fish, their ecosystems, and communities that depended on them. It was proven that as the intensity of fishing activity escalates, the fish biomass and catch per unit effort decrease (Lae, 1997). Despite of various management measures, the plight of the small-scale fishermen continued to worsen due to excessive fishing. It was estimated that illegal and unregulated fishing escalated drastically between 1980 and 2016. The depletion of major species posed a great threat to marine bio-diversity. The United Nations "Sustainable Development Goals" contained goals for ceasing the illegal fishing, processing and uncontrolled trawling and thereby normalizing the Maximum Sustainable Yield to sustainable levels. Nevertheless, rebuilding the depleted stock of 35 per cent fish species was not possible in the near future considering the life span of different species (FAO, 2018). The fish production across the globe had increased to around 80 million tonnes. (FAO, 2012a). Every year, the number of fish stocks which were not utilized to maximum level went on decreasing. This increased the possibility of an upsurge in category of the over exploited fish species. (FAO, 2011c). FAO, in 2009 reported that 57.4 per cent of the fishery resources which were scrutinized by them were fully exploited. Another 29.1 per cent found to be over exploited and yet another 12.7 of the fish stocks happened to be below the danger levels. Tuna, blue marlins and swordfish – three very common fish species were facing the danger of extinction. This was based on the report from five major ocean bases across the globe. (Myers and Worm, 2003; Worm et al., 2006). The Excessive fishing, uncontrolled trawlers, ineffectiveness of fishery management practices were the three major reasons which were responsible for the destruction of the habitat of fish species. This had been observed in all the coastal belts of almost all countries. (FAO, 1995; Boehlert, 1996; Jackson et al., 2001; Worm, 2013; *FAO rights-based Fisheries Management Perspective* 2000). These disturbances affect the marine diversity to large extent which prevents the inherent capacity of the oceans to regenerate itself for marine bio-diversity.

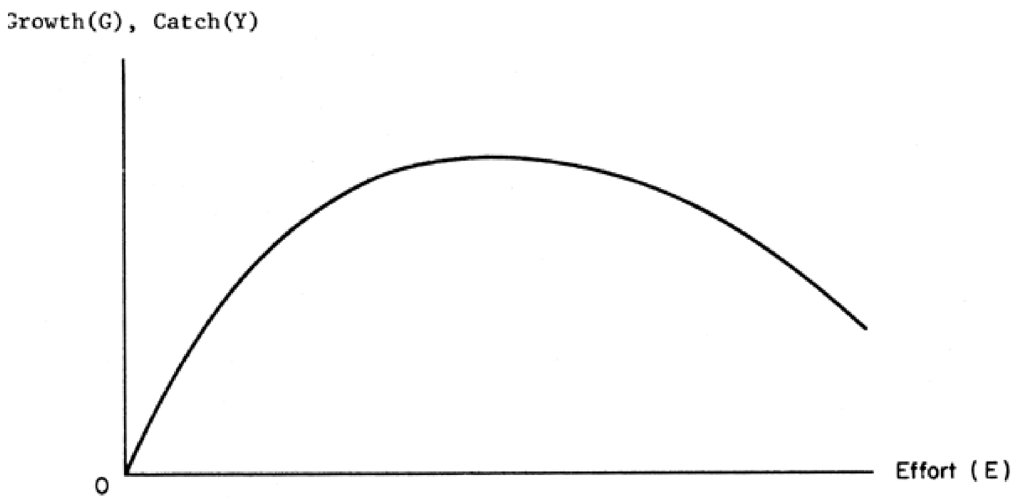
Sustainability in fishery resources is the key concern here. By strengthening the fishery management practices, implementing measures to stop the illegal and uncontrolled trawlers and demarcating the marine protected areas can be a starting point for greater sustainable goals. (Worm et al., 2006, 2009; UNEP, 2011). Another major problem which affects the habitat of the marine bio-diversity is proliferation of fishing fleet across the marine sector. The present data regarding the fishing fleet shows that occupancy of fishing fleet is 2.5 times more than the optimum. (Porter, 2008).

2.6 Depletion of Fishery Resources: A Theoretical Approach

As per the industrial classification system, fisheries come under the agricultural sector. Though there are no well-built theories on fishing by “Adam Smith, Alfred Marshall, Thomas Malthus”, Irving fisher, “A.C. Pigou, Karl Marx, Jacob Viner”, J. M. Keynes or others, some of their observations are worth noting. Alfred Marshall believed fishing to bring prosperity to those who are engaged in it (Marshall, A., 1974). “Fisheries require both a fixed and a circulating capital to cultivate them; and their produce replaces with a profit, not only those capitals, but all others in the society” (Smith, A., 1937). Furthermore, sea resources compared to agricultural resources are renewable and replenishable year after year. Even if a certain quantity of the total fish stock in seas is exploited, it is still self-renewing - which means the same amount of fish can be harvested every year without depleting the stock. Fishing industry is a prominent employment generator for the society. It was the chief source of food for subsistence as Thomas Malthus explains in his work “An Essay on Principle of Population” (Pullen, 2010). Fish production does bring benefits, but it is solely a matter of nature (Fisher, I., 1930). As Smith mentions, “the success of a particular day’s fishing may be a very uncertain matter, yet the local situation of the country being supposed, the general efficacy of industry in bringing a certain quantity of fish to market taking the course of a year or of several years together; it may perhaps be thought, is certain enough; and it, no doubt is so. As it depends more, however, upon the local situation of the country, than upon the state of its wealth and industry; as upon this account it may in different countries be the same in different periods of improvement, and very different in the same period; its connection with the state of improvement is uncertain” (Smith &Cannan, 1994)). Karl Marx also mentioned that, “the continuity of reproduction may be more or less interrupted in those branches of production which are dependent on the season, either on account of natural causes, such as agriculture, fishing, etc., on account of conventional circumstance such as the so-called season -work" (Marx, K. 1906)

A scientific enquiry into the depletion of natural resources explicates that their open access makes them more vulnerable to destruction. This is applicable to fishery resources too. The situation can be better explained with the help of simple biological and economic models. Schaefer (1954) developed such a biological growth model to explain the relative depletion in fish species. The model of Schaefer postulates that "the growth of fish stock depends on the existing fish stock size". "At a small size, the rate of growth is directly proportional, until a point is reached beyond which growth becomes inversely proportional to stock". One can graphically explain this model by taking growth and fishing effort as variables.

Figure: 2.1:
Biological Growth Model



The inverted U shape of the curve shows the intensity of the depletion as the effort increases. In the beginning phase of fishery management, the increased fishing practices resulted in approximately same level of fish catch. This is due to the abundance of fish stock. As more and more efforts are put in, after a particular point catch declines. This point is called ‘Maximum Sustainable Yield’, a century-old term. MSY is the highest volume of fish production on an average which could be fished from the pool of fish stock for a continuous period. The fish species may either be an exploited one or otherwise (Maunder, 2008). It was Beverton and Holt who developed more complex models in this regard in 1957 and Ricker added to the model the variable called “age structure” and “the pattern of recruitment” which specified a complete picture of MSY (Cortés et al., 2019). Gordon (1954) developed a bio-economic model in which the resource rent was involved. It was modelled with simple economic terms like “Total Revenue”, “Total cost”, “Marginal Revenue” and “Marginal cost”. By summing up the “revenue and cost”, Gordon’s bio economic model was purely economic as he stated that the economic yield or Maximum Economic Yield can be computed by finding subtracting total revenue from total cost. Catch Per Unit Effort which is computed from open access fishery is often higher than the profitable level as at the end the resource rent totally disappears. Fish populations are considered as common-pool resources (Ostrom, 1977). Common pool resources have two characteristics: excludability and subtractability. It is very difficult to avoid the possible users as it involves expensive exchanges. Laws and customs pertaining to public or communal rights can also make it difficult. The subtractability or rivalry in consumption arises when the resource is finite and the extraction by one user diminishes the amount available to other potential users. These two characteristics make fisheries vulnerable to exhaustion and depletion. The biological and economic models have clearly revealed that the depletion in fisheries was a mixture of several ecological and social factors (Liu et al., 2017).

2.7 Fish Depletion and Fishery Dependent Communities

The extent of fish depletion can have serious consequences on the society and the economy. Ecological concerns have also been raised by environmentalists and the biologists. Fishing communities around the globe are seriously affected due to fish depletion. The relationship may not be direct and vivid. The fishery resources are exploited in different ways and using different methods across the globe. It involves large fishing vessels as well as small trawlers. The purpose of fishing also ranges from food for subsistence to profit (Lam and Pitcher 2012). With the advent of technology, the fishery resources could be easily commoditized. Economic well- being is the rationale behind every commercial exchange. So is the case with fishery too. (Larson & Bromley, 1990). In course of time crafts grew bigger in size, the number of fishermen who pursue fishing became less, and the volume of fish became meagre. The growing demand for fish had attracted many big players into fishing industry. As the investments grew, the traditional fishermen were wiped out from the scene. Offshore fishing is affordable for a fisherman, but not profitable. Mechanization made large-scale fishing possible. The big trawlers were able to explore deeper waters within a short time span to meet the increasing demand. Traditional fishermen residing on the fringes of the shore belonged to particular castes in most of the developing countries (Allison et al., 2011). The technology was labour intensive to a greater extent. The space limitations in the craft prevented any sort of overfishing or destruction of juveniles. The widespread destruction of fish species destroys the livelihood opportunities of traditional fishermen.

2.8 Fishery Management- Different Approaches

Fish and fisheries constitute an important sector in the world economy. They provide economic security and nutritious diet to the world population (Bianchi, 2008). In recent years global production from capture fisheries varied between 85 to 90 million tonnes approximately. Even though this sector holds importance in terms of value, the fish resources of the world suffered from overfishing and environmental degradation. The "Food and Agricultural Organization" (FAO) evaluations showed that in 2018, 48 per cent of fish species were found to be nearing extinction,18 per cent of common fish species were excessively fished, 9 per cent of the fish species showed signs of depletion and just 1 per cent showed recovery (FAO, 2000). Fisheries sectors around the world contributed to economic security by ensuring well-being for humans by being a productive sector of food, nutrition and occupation. Without proper enforcement of fishery management tools, the diminishing benefits will damaged the ecosystem. The ecosystem that we live in is interconnected in many ways. The other sectors and the integral growth of the ecosystem will be affected in many ways (Pitcher & Pauly, 1998).

John Cleghorn, a British fisherman first employed the term 'fishery management' in 1850s, when there was a crisis in the habitat of particular fish species in the UK (Cleghorn,1855). In UK and Norway there were attempts to bring in fishery management strategies to discipline the fishing business. The idea of conservation was not in the scene at that time. The authors like Huxley, Heinke, Johan Hjort, Baranov, Edward Russel and Ottestad wrote extensively about the stock fluctuations and the consequences which arise there after (Beverton, 1990).“Fisheries that are unlimited become unprofitable” wrote British Fisheries scientist Michael Graham and he invited a global action against the depletion of fish stocks and advocated conservation of fishery resources (Finley, 2011). The overall objective of any resource management involves attaining an “optimum exploitation rate”. A specific feature of marine resource is that it has a biological dimension as well. Fishery resources are reproductive and renewable. This characteristic affects its equilibrium. An economic theory of fishery thus includes both technical and biological equilibrium. Nammalwar and Prakasham (1979) enquired the livelihood and the problems of small-scale fishermen. According to them, overfishing was a menace which affected marine resources and was capable of reducing the number of units. To avoid group clashes, it was advisable to protect exhaustible marine resources and stop the economic crises. Advances in fishing technology have not reached the poor fishermen. Several factors namely, existence in lower strata in society, low income, low educational profile, exploitation by brokers, unscientific fishing methods impede the growth of the fishery dependent communities.

Every country having marine capture of fisheries had its own statistics. The major reason behind this unacceptable affair was the failure of proper fisheries governance. The very purpose of fishery management tools was to ascertain the policies to stop excessive fishing and the illegal means of fishing methods (Higgins, 1942). Due to the existence of such practices in our coasts, the marine diversity and the habitat of the fish species were affected drastically. Basically, the coasts remain same despite of the technological improvements in the craft and gear. The implementing authority had been responsible for this state of affairs. The Food and Agricultural Association defined the term “Fisheries Management” “as the integrated process of information gathering, analysis, planning, consultation, decision-making, allocation of resources and formulation and implementation, with enforcement as necessary, of regulations or rules which govern fisheries activities in order to ensure the continued productivity of the resources and the accomplishment of other fisheries objectives" (FAO, 2013).

The principles of resource management comprise tasks and measures aimed at sustainable benefits from the resources. The human consumption demand for fish species was high, which negatively affect the depleted stock of fishes. Current technology has equipped the fisheries to extract the maximum out of the total stock available and fisheries management is gaining ground (Thompson, 1974). The major goal is the sustainable use of fishery resources. A general trend in any management regime is the reactive approach. Fisheries management is addressing a crisis (Young, 2008). There are possibilities for enforcement or applying rules that may succeed in maintaining order or reaping benefits temporarily. The modern-day management demands a broader perspective which would consider conflicting ideologies in order to get the best results. Generally, "fishery management goals can be divided into four, viz., biological, ecological, economic and social." The sustainability of the fish species is the biological goal entails. The stock and the recruitment are studied as a measure. This goal is in direct relation with the sustainability goal of fishery management (MDG, 2009). Fisheries management is purely ecological and this objective entails minimizing the effect of marine environment on other ecological systems and other species. Fisheries management has an economic objective – safe guarding the economic opportunities with regard to the small-scale fishermen (Hortoto, 1999). The fourth and final objective is to ensure the occupational security of the fishing community. The biological considerations or goals of the fishery management are related with annual growth and reproduction of a fish species on an average. As a living organism, each species is naturally capable of renewal and growth. For a fish "population at equilibrium, the additive processes of growth and reproduction on average equals the loss process of total mortality" (Lam and Pitcher, 2010). The mortality rate varies between the fished and unfished population. The task of the fishery manager is to scientifically study each species, and to assess the stock preferences, genetic specifications, distributional and behavioural patterns of each species. Another major task is to study the sustainability of fish species. Ecological considerations consider fish population as an important component of a large, dynamic ecosystem. Any change in the habitat by way of human intervention, pollution, natural weather changes and other climatic factors can affect the population and its growth. The social objective of the fisheries management is very difficult to achieve as humans are involved. The fishing communities live in tandem with nature – especially the seashore. They may not be willing to seek alternative employment in case of job loss. The problem is worse when no such livelihood opportunities are available. The social goal of fisheries management is indebted with the task of handling the fishery-dependent communities. In many developing countries, the problem of open access still persists. Under such circumstances, attaining the Maximum Sustainable Yield becomes impossible for any fisheries management technique (Basson and Beddington, 1991). The "fisheries management" has an economic aim - sustainably maintaining marine species as well as supporting the economic well–being of the fish dependent communities. The United Nations put forth three main "fisheries management" approaches – Ecosystem approach, Integrated Management Approach, and Livelihood Approach (Anderson et. al., 2018). An Ecosystem Approach tries to balance the societal objectives of the ecosystem management with the various biological and non-biological specifications which affect the other ecological concerns (FAO, 2003). The definition addresses human as well as ecological well-being combining both conservation of human bio-diversity and sustenance of human livelihood (Hoggarth et al., 2006). "Integrated Coastal Management Approach (ICM)" is the collective conglomeration of "eco-system approach" and "people-oriented approach". ICM is an integrated framework which takes into account both the stakeholders and the environment. ICM faces several institutional and scientific hurdles. The most important problem in the integrated approach is that its implementation mainly deals with governance (Liu et al., 2018). It is very important to combine natural and social science while managing the marine environments. The third objective has greater relevance in the context of the fishers of the developing nations especially India, viz., the "Livelihood Approach to Fisheries management". The over dependence which the fishermen upon fishery resources results in poverty and marginalization. The Livelihood Approach recognizes the complexity involves in this strategy. The purpose of the Livelihood Approach is to devise a development policy and practice which helps in removing the factors which impede them from accessing the various capitals necessary for their growth (Allison and Ellis, 2001). "A livelihood involves the assets which a family group or individual need to possess in order to cope with the vulnerabilities of the life. The possession of these assets is a prerequisite for overcoming shocks (Allison, 2001).

2.9 Sustainable Fishery Management and Livelihood Challenges of Traditional Fishermen

Fisheries management purposively brings out that the sustainability of fishery-dependent communities is predominantly important in the present scenario. Artisanal fisheries have continuously expanded in spite of the undue importance given to industrialization of marine fisheries sector and the neglect the small-scale fishermen have faced over the years. The escalation of technological fishing in all the regions and the expansion of small trawlers among the small-scale fishermen have brought fears in to the minds of many. The resource depletion in the marine sector has been alarming since 1900s (Allison, 2005). “Small-scale fisheries” can be denoted “the occupation of last resort” and the fishermen as “the poorest of the poor” (Allison and Eliis, 2005). The solutions focus on making the financial conditions of the poor small-scale fishermen better without compromising the ecological concerns of the marine fishery sector as a whole. The broader picture of the situation is that there should be incentives for the fishermen to leave the industry to find better jobs (Pauly et al., 2000). These policies do not address the fisheries sector in the wider spectrum of things. They are trying to connect with the concept of “equilibrium” alone. The focus is on the productivity aspect where the resources are assessed in terms of maximum productivity. The Maximum Sustainable Yield or Maximum productivity of each species is analyzed here. The livelihood challenges of the traditional fisherfolk of Kerala are embedded in the proper governance of the ocean resources. They have been deprived of their normal catches and landings in the sector due to improper governance. The history of marine fishery of Kerala reveals technological advancement brought huge changes to the marine fishery sector. The fisheries sector in Kerala possessed an open access nature along with improper fishery management techniques and illegal fishing which resulted in the depletion of fishery resources (Kurien, 1991). Devaraj and Vivekanandan (1999) divide the marine fishery growth of Kerala into three phases viz., predevelopment era (1947-1962), transition era (1963-1988) and expansion era (1989-1997). Fishery Management phases were reflected in the division. The “open access” existing in the marine fishery paved the way for unregulated expansion of fishing effort and depletion of resources. Increased fishing efforts from 1976 reduced the per capita availability of fishing area for small-scale fishermen and the decreased CPUE (Bhoopendranath, 2006). The older, less efficient capital-intensive fishing units are now dysfunctional or less economical due to technological advancements. This has resulted in underemployment. (Sathiadas et al., 1999). A closer look reveals a growth in the fish landings and production. The state could not reap the fruits of this growth in a sustainable manner. The mechanization that was brought forth after the Indo-Norwegian Project (INP) gave great impetus to the fisher folk of Kerala.

2.10 Sustainable Livelihood and Sustainable Fisheries Management in India

The Indian marine fisheries sector is experiencing heavy degradation. The livelihood challenges of the fishermen and the other allied workers also keep increasing. This section reviewed the concerns about the Marine fishery economy. In India, from 1890 onwards there were many attempts to introduce fishery management tools to curb overfishing. The Indian Fisheries Act of 1897 delegated the “responsibility of development and conservation of fisheries in the inland and territorial waters of the respective states to the erstwhile Provinces” (Silas, 2000). The set of fisheries legislations that followed later became a strong foundation for the fisheries management. (Sathiadas, 2003). “The Maritime Zones Act” of 1976 stressed the need for exercising supreme power in protecting the living organisms especially the marine resources in the EEZ. The “Marine Fishing Regulation Acts” of different States were designed to manage the marine resources within the limits of 12 nautical miles. Subsequently, the Acts were enacted after 1980 to conserve the fishes and to regulate unreported and unregulated fishing along their coasts. “The Coastal Regulation Zone Protection Act (1986)” regulated development in a defined coastal strip by means of a zoning scheme (Hanumatha, 2004). The principal objective of all the Acts pertaining to Maritime activities in all the States of India was sustain the economic and opportunities concerning the “small-scale fishers” ensuring the sustainability of fish resources (James, 1992) Several bio-economic models became the bases for different management techniques in India. In order to analyze the status of depletion, it was necessary to know the biological aspects of the species in detail and also to study the economic aspects of the depletion and the livelihood diversification that followed. The “Food and Agricultural Organization” (FAO), after enforcing “the Code of Conduct of

Responsible Fisheries" had put forward several bio-economic models for the maritime states. These models were targeted actions for single species, multi species and at times for the whole ecosystem. Vijayakumaran (1993) says that these models helped Indian scientists start their research towards understanding the biological conditions of specific fish populations which are native to the waters of India – a tropical country.

One of the major concerns that the fisheries managers of India faced was the selection of the tools for managing Indian Coast. The common methods which were suggested were demarcation of marine protected areas, closed seasonal ban of fishing on selective period, mesh size regulations, pollution control, controlling the proliferation of trawlers and so on. Devaraj and Vivekanandan (1999) observed that non-implementation of effective management of fisheries in India is due to socio-economic and political factors. The enforcement and regulations have been very difficult in India as the open access nature of fishery like in any other developing country is paving the way for unregulated and uninterrupted fishing along the Indian coast. The basic management strategies used in India are specifications for meshes, fixing quota or licensing the vessel, closure or ban of fishing activity, variation of crafts and habitat arrangements, gear rules and Protected Area Specification (Pillai and Ganga, 2004). Mesh size plays an important role in sustainability. The measures to control mesh can contain juvenile fishing to a great extent. The science behind limiting the size was to protect immature and spawning fishes too. Mesh size delimiting will ensure protection and it is cost effective. (Dill and Pillay,1968). Even though the mesh size regulation was considered to be an effective tool in determining sustainability, the measure seems ineffective in multi-species fishery. Here the target species may vary and it became difficult for the managers to specify it correctly. Sometimes the measures were contradictory to each other. The large mesh size which is wide enough to allow the small fishes to grow and ensure sustainability may also allow yet another category to escape always. A mesh size which is smaller is found to be more harmful in all the regions (Anderson, 1977). The decision has to be very critical whether to protect some fishes or not to contaminate many. This being the case, a common mesh size for all the regions was impossible. Many ocean reservoirs were multi-species and the protection of which resulted in the destruction of many. In some regions seasonal restrictions were imposed and found to be impressive.

The ban on fishing ground and “closure of seasons” is another fisheries management method which increased the productivity and regenerating capacity of the various species during their spawning periods. During this ban period all the activities of fishing were prohibited in both spawning land and feeding land in order to protect the valuable fishes and younger ones. The ban in these areas allowed the fishes to grow to their maximum stature within the period of spawning (Nikolskii, 1969). Here too the exact decision about the timing of the ban period was very important. In a multi-species ocean, the feeding ground and the spawning ground varied for each species. In a large water body, the ban period was between two to three months. The lucrative trade enjoyed by the trawlers attracted excessive trawlers and it led to depletion of fish and resource degradation in Indian waters (Salim, 2007). Several studies conducted in the marine villages of Indian maritime states had clearly pointed out that trawl ban period in India was not reaping the expected results. Sonak et al., (2006) in a detailed study provided insights into the conflicts arising in the Indian maritime states during the trawl ban period. The interplay between the different institutional arrangements, conflicts arising between the traditional fisherfolk and the industrial fishermen, poverty and inequality were the major consequences of the trawl ban period. Limitation of entry, another method used along the Indian coast, included limiting the number of fishermen, crafts, time period, area of operation, implementing Identity card system and so on. This allowed for proper allocation of resources and ensured sustainability (Adasiak, 1979). These measures directly reduced the rate of effort of fish catch in a particular area. Each craft allotted a fixed quota which prevented over fishing for a longer period. The main benefit of the measure was that it stopped overfishing and rejuvenated the fish species. Different types of taxes could also be used under this tool as it limited overfishing. Fixation of entry was not so common in India as there were many practical difficulties. These measures could be enforced only in a large reservoir where intense fishing was very common and there were multi-species fishery resources with depleted nature are present. Although there were restrictions regarding gear types, licensing and quota system were yet to evolve as a system of management in the marine waters of India. In India local gear regulations in particular communities prevailed in order to curb juvenile fishing. In Tamil Nadu, the fishing communities had banned fishing gears that caught juvenile fries (Bavinck, 1996). In Tamil Nadu, some communities had banned innovations in gear types (Bavinck, 2006). Sathiadas (2009) in his study observed that in spite of attaining impressive growth in fish production and fish trade, the fishery management tools seemed to be overlooked. Improper investment in the industrialized sector of the fishery methods, less investment in the non-motorized sector, receding average production capacity of the non-motorized sector and declining trend in the investment and ownership of craft and gear by the traditional fishermen comprise major problems of the fisheries sector of Kerala.

2.11 The Fisheries Sector of Kerala

The fisheries sector of Kerala is strong and vibrant. Kerala contributes about 20 per cent to national fish production annually. Kerala has a fishing population of 10 lakhs who are spread in 223 fishing villages and around 9 lakh fishermen involved in fishing and the active fishermen numbering around 1.85 lakhs. Kerala is known for pelagic fishery and fifty per cent of the resources are within 50 meters range. Major marine resources of Kerala comprise “pelagic fishes”, “demersal fishes” and “crustacean”. Oil sardines, anchovilla, ribbon fish, carangids, mackerel, sear fish and tuna are the major pelagic fish varieties of Kerala. Almost 60 per cent of the annual yield is derived from the pelagic fishes. The major “demersal fishes” are “elasmobranches, catfish, perches, cuttlefishes, squids” which constitute 32 per cent. The crustacean family consists of mainly prawns of different variety covering another 10 per cent. As an analysis of the fish landings of the state over the last six decades was considered, a steady growth could be found. The production of fish increased from 2.5 lakh tonnes to 7 lakh tonnes in 2018 (Handbook of Fisheries Statistics, 2018). There were ups and downs and also periods of recovery during these six decades. Among the central and state government interventions in the marine fishery sector of Kerala, a remarkable one was the introduction of Indo-Norwegian Project in 1975. The intention was to modernize the fisheries sector by introducing new designs and technology in the country crafts. Although the attempts were not successful as it was expected, there was an impetus to use technology in the crafts for better catches. This was also the period when fishing of prawns was becoming lucrative. The period between 1970 and 1980 saw technological advancements and high investments in the marine fishery sector. Later it was supplemented by the motorization of country crafts with modern technology. The end result was around 30000 country crafts and big trawlers operating at the coast of

Kerala. As Rajasenan (2000) stated, uncontrolled mechanization led to over capitalization of resources, resulting in conflicts between traditional fishermen and the mechanized boat owners. With the advancements in technology, the traditional fishermen lost their normal catches. The presence of trawlers and big boats in a limited fishing ground like Kerala made it economically unsustainable. Kalawar committee report stated “the trend curve for marine fish production by the artisanal fishermen of Kerala indicated steady increase from 1950 to 1968 at the annual rate of 5.5 per cent which was higher than the fishermen growth of 4.37 per cent. The period 1968 – 80 showed a decline in the production curve at an annual rate of 3.34 per cent resulting in very poor household incomes which began to manifest in the form of general social unrest” (Kalawar, 1985). The third session of the Balakrishnan Nair committee observed the depleted and overfished state of Kerala Fisheries after the introduction of Indo-Norwegian Project. The committee also added that the trawl ban introduced in the year 1981 was crucial in controlling the unregulated fishing in the state (Nair, 1999). The political policies of the various ruling governments were in support of the mechanized sectors of the time. This was more during the period between 1970 and 1980 after the introduction of the INP and before trawl ban (Kurien, 2005). The sector was officially encouraged and financial supported by way of incentives and export promotion facilities. A mechanized trawler needed 10 times more investment than an ordinary artisanal craft which was just 22 yard long. The government officials thought that the artisanal sector would switch over to the motorized engines or would vanish (Kurien, 1999). Even though there were attempts from the part of the small-scale fishermen to motorize their indigenous crafts, a complete switch over was not done. Even now the situation is still the same. The inter-sectoral disparity increased with the advancements in the mechanization. In the mechanized sector, the average catch potential far exceeds that of the motorized segments and is even higher in the non-motorized segment (Panayotou, 1996). The livelihood challenges were escalating day by day for the traditional fishermen. The traditional management measures had disappeared and the formal management measures were not in good shape. The State government appointed different committees to study the management regimes that can take shape in Kerala (compilation of different committee reports, from 1970-1980) Babu Paul Committee studied the conflicting interests of the various people involved in the fisheries sector. The committee presented the ideas of different groups and also took the opinion of scientific community regarding the protection of marine resources. They had divided opinion on the effects of trawl ban on the marine resources. Kalawar Committee (1985) reported that Trawl ban could not bring the conservation the State envisaged. The committee stressed the need for exclusion of mechanized trawling and advocated for limiting trawlers to 1145. Balakrishnan Nair Committee (1989) enquired about the conflicts that happened in the Kerala coast between the traditional and the mechanized fishermen. The committee recommended a trawl ban in Kerala in the spawning and breeding period between June and August. The second Balakrishnan Nair Committee (1991) reviewed the progress of the Trawl ban introduced in 1988. The committee found the period too early to make a detailed assessment of the conservation of fishery resources after the trawl ban. Another committee headed by Silas in 1992 recommended "a Restricted Fishing Zone" in the "months of June, July and August" and suggested closure of sea during those months. This committee incorporated the suggestions of the earlier committees with regard to mesh size regulations. The Committee stipulated that mini-trawlers should be banned totally in the "Exclusive Artificial Fishing Zone (EAFZ)" and banned all the activities in the area with specific gear size. The specifications such as 300 m long and 35m depth for gear with an engine size not more than 15hp were permitted. As per the Central Government direction, Kerala introduced the "Kerala Marine Fishing Regulation Act (1980)." "A total ban of purse-seines, ring seines, pelagic trawl, mid water trawl and bottom trawl within the regional waters of Kerala coast" came into being (Govt. of Kerala, 1988). Ever since 1988, the state has initiated several measures to curb the marine activities which happens in demersal waters too. The automated fishing crafts which had been operating in the demersal waters were also banned during those months. This was popularly called 'Trawl Ban' (Govt. Of Kerala, 1988). These measures which were administered at the state level did not fetch results and the comprehensive management measure brought forth by the state did not produce the expected results (Kurien, 1999). Sinitha (2014) in a work on economic sustainability of the trawl fishery of Kerala, found out that trawlers operating in the fishing zone of Kerala coastal waters was two times more than the vessels needed to catch Maximum Sustainable Yield (MEY). The study estimated that one thousand nine hundred and fifty vessels were enough to catch the

MEY. In spite of this fact licences to new trawlers are issued every year. The study also found out that “Kerala Marine Fisheries Regulation Act 1980 (KMFRA, 1980)” is violated in spite of the emphasis on policy circles.

The management regimes that had come up after the post modernization period was considered to be inadequate as it lacks viable opportunities for the traditional fishermen to attain sustainable livelihood. In the fisheries literature, ‘co-management’ is a new term used extensively in the recent past (Hartoto, 2009).an effective management can be initiated by the government only by taking to confidence the stakeholders involved in the marine fisheries management system. These stake holders include the small-scale fishermen, trawlers, middlemen, scientists and marine fish workers who are involved in fishing and allied activities.

Terminologies such as, ‘collaborative’ and ‘collective’ are utilized as equivalent words for “co-administration”. This is defined as the collective activity which should be done in collaboration with the public administration and the marine fishery network of Kerala (Pomeroy and Berkes, 1997). Borrini-Feyerband (2001) defined it as a situation in which two entities in the society interact with each other for sharing and collaboration. This collaboration meant sharing the responsibilities of a particular problem. These interactions helped both the parties to tackle the particular problem or situation. As the participation of the stake holders increased, efficiency and equity also increased. It was a harmonized interaction among the different players who engage in fishing. In a broader sense, in fisheries this particular arrangement or technique sets a platform in which the higher officials and other stakeholders share their responsibility for efficient use of resources to achieve these goals: sustainability, social and economic equity (Sen and Nielsen, 1996). Pinkerto in his study found out that various ideologies could be efficiently addressed by implementing ideologies such as collection of information regarding harvesting, allocation decisions, ecological damages, enforcement and rules, betterment of the length of craft and other issues (Pinkerto, 1989). The term ‘co’ in “co-administration (co-management)” accentuated shouldering the objectives and responsibilities between stake holders and the administration (Hartoto et al., 2009). The government had a major role in building up the co-management strategy. In most of the local fishing communities the institutional arrangements for participatory work were not there (Pomeroy et al., 2005). The fundamental concerns to be included were regarding the ownership of the resource, the rights over the resource and the legal framework under which the co-management principles had to work (Macfadyen, 2005)

2.12 "Sustainable Livelihood Approach"

"Sustainable Livelihoods Approach (SLA)" plays a key role in helping the vulnerable communities to build up the livelihood amenities in a better way. The purpose and aim are to reduce their livelihood vulnerabilities (Nieland, 2004). Definition of sustainable livelihoods depends on the management programmes it is located in. In the context of fisheries, livelihood attains much importance as poverty and vulnerability played a crucial role. The concept of 'a livelihood' takes into consideration the negatives and positives which affect the basic amenities of a household. The term "livelihood" denotes the capabilities and possibilities of a family or individual in coping with the unexpected vulnerabilities that come up on their way. The accessibilities to the assets serve as the only way out to deal with the vulnerabilities (Ellis, 2001). The dynamics of "livelihood analysis" of fisher folk needs to be done with regard to their non-accessibility to natural resources and physical capital assets (FAO, 2006). "The United Nations Conference on Environment and Development (UNCED)" took the initiative in coining this concept of SLA. UNCED wanted to help the member nations especially the developing nations to design policies and strategies to cope with the vulnerable social and economic conditions. The normal tendency was to relate the livelihood to poverty. The term now includes other aspects with poverty as a major component. The beginning of the concept was during the natural calamities in some Asian countries. There were attempts to assess the ability of the people to overcome the dangers of the calamities (Chambers & Conway, 1992). There were attempts to study the ecological concerns and environmental concerns too. The two key terms that came up during the discussion was "flexibility" and "affectability". The "flexibility" of a region to adapt to any disaster is a key element in overcoming such calamities. "Affectability" constitutes the size of the reaction or volume of reaction. A livelihood framework which shows high flexibility and low affectability is strong in coping with the natural disasters and on the other hand, a livelihood framework which shows low flexibility and high affectability is weak. In

The SLA framework the accessibility to different assets have assessed to check the fishing industry in a particular region is aiding the fishery dependent communities as a whole. The aim is to reduce the shocks and stresses created by weak livelihood patterns in the coastal areas and to build a strong network to support them (Bebbington, 1999; Allison, 2004). The SLA in the opinion of social scientists is a method to deal with the vulnerable livelihood system of the affected people. The theory and practice in the affected areas will give a true picture of strength and weaknesses. The scientists and the managers who are involved in the framework make rules and arrangements to deal with the livelihood problems. Townsley in his work found out that the fishery networks in all the regions, especially the networks of the Asian regions as vulnerable. They were characterized by low income, very poor political administration, low enforcement of fishery management measures, low standard of living, poor medical facilities and less ownership of land and other assets. All these factors made them vulnerable. The vulnerability resulted in their inability to cope with a disastrous situation (FAO, 2000). The approach to livelihood and the rules of the approach analyzed different interactions. The fundamental socio-economic unit, household, was "considered as the gathering of people who lived in a similar spot, shares similar dinners and settled on joint or facilitated choices over asset allotment and pay pooling" (Allison and Horemans 2005). How particular regions fared in a disastrous situation – whether they succeeded or failed in an emergency was the starting point in designing policies and interventions.

Major policy measures would include giving assistance to training and setting up of medical care centres, strengthening legal facilities to ensure the ownership of land and giving assistance to start fishery related businesses, permits to start fish outlets for daily living, financial aid for alternative employment opportunities and settlements. Hardly do these measures get incorporated into policy measures (Allison and Horemans, 2005). The SLA stressed on result-based actions. "Livelihood" could be treated economically when a household was able to live without work healthily and with prosperity. In such an atmosphere the livelihood objectives would be to overcome the challenges that come their way. The other opportunities that made up the living and aided the household to meet their livelihood demands. The approaches towards livelihood advancements especially in the fishery sector were applied in various Asian economies so as to find out the various nuances it created in marine, inland and other allied fishery activities. In all the cases the studies had been ended up with similar results of ineffective fisheries management. The effectiveness of fisheries management lies in empowering the dependent communities to overcome fishery related shocks. The SLA principles can be used in fisheries management to analyze the availability of assets to the poor fisher folk, their livelihood challenges while pursuing the depleted fishery ground. In fact, poverty and marginalization prevent communities from acquiring natural resources and other capitals. Social scientists refer to 'social deprivation' which marginal communities face at the face of poverty and inequality. As the non-accessibility to social and physical assets increased, the livelihood challenges also escalated. The major problem in fishery is that the traditional fishermen are resource dependent to a large extent. The only skill and profession which is at their disposal is fishing. Being dependent on a single resource that is fish, accessibility becomes very important. The depleted stock of fish population says all about the vulnerable conditions of the traditional fisher folk (Bailey and Pomeroy, 1996). Livelihood approach is an attempt to analyze the various shocks and trends the traditional and artisanal fisher folk undergo. After analyzing the shocks, the approach assessed the outcomes that could be drawn from the strategies designed for them. SLA frame work took into consideration the vulnerability aspect of the fisher folk in detail. Vulnerability of any occupation is decided by hazards it got entangled with or exposure faced by people, the volume of the disaster they were engaged in and their ability to come out of that danger with all the assets they were having access to (FAO, 2004). In fishery related occupations, the dependent communities will be exposed to huge dangers (e.g., cyclones, accidents in the sea), ecological dangers (rise in sea surface temperature, reduction in oxygen level), health-related dangers trade related dangers and safety-related dangers (burglary) and similar other. The adaptability to the dangers related to fishery sector may show their dependency on the fishery sector and the adaptability to other dangers requires various social factors which the public authority should provide. In both the case the affectability of the communities is defined by the accessibility to assets. The analysis on vulnerabilities may well identified with the characteristics of need. The households who are living in isolation without any external help for medical care will be prone to diseases than a household which is habituated in an atmosphere with medical facilities. More over the situation demands cash which is not affordable to a household in destitution. A rich household may afford to pay for good medical care. Macfadayen and Corcoran, 2002 in their work analyzed the isolated households as those with no accessibility to social and financial assets. The inability to be accessible left those households with lesser option to live on. They remain vulnerable to all the external shocks and calamities. The core principles of SLA could be summarized as follows - Accessibility to all the assets are very much crucial for the livelihood Approach. The principal occupation remains at the centre as the primary cause of isolation from different assets. In Fishery related activities, the improper fishery management practices and the depletion of fish resources contribute much to the sorry state of affairs. The Asian economies and the African economies are living examples of destitution and isolation. The ability of the communities to adapt to the disastrous situation is central to SLA principles. Sometimes a good employment may not provide opportunities for the household to adapt to situation. There are different assets which play a vital role in creating an atmosphere allowing the different sectors to cope up with the situations. The major factors which are aligned to the approach - economic, organized policies, communal or societal factors and sustainability of environment (Charles, 2001) are exceptionally vital on the whole for effective enforcement. A "vocation approach" is a balanced approach which allows for compromises and trade-offs. This is a system which not only recognizes the capital arrangement for livelihood but takes into consideration the overall wellbeing (Allison and Horemans, 2005). These capital entitlements were affected by the public and private investment in the area. In every economy the public authorities will invest for public health and well-being. In this approach along with various system specific arrangements, the public amenities were also strengthened (FAO, 2001). There are also processes which include rules and regulations which govern the policies. The policies whether private or public should be aided by proper rules and measures which will help the authorities to enforce them. In the fishery sector fishery management tools are used as policy measures which govern management regimes. Even though there are several factors involved in it, the ultimate aim of the tools is to ensure sustainability and enhance the livelihood viability. In the vocations approach the key element was capital and the public authority was in charge. Even though there were rules, unless the public authority took a poor-friendly approach the accessibility to assets would remain to the minimum (Quandt, 2018).

2.13. Management of Fisheries and Institutional Dynamics

2.13.1 Management Institutions for Fisheries and Aquaculture

"Institutional Framework" means the institutions meant for imparting training and education to the budding and seasoned professionals as well as institutional bodies that developed implementable models and took major decisions on behalf of the Governments in specified disciplines. It could be any field of biological or physical sciences, social sciences, social organizations, or legal bodies (Symes, 2007).

In the broader perspective, the institutions took definitive responsibilities in integration of developmental policies and took account of performances of state to state, state to union, and government to agencies (FAO, 1997).

Fisheries governance has social, legal, political, and economic arrangements which were used for managing marine resources. This had both regional and trans-national nuances. This is composed of legal formalities including international treaties or national legislation and it is dependent on social arrangements along with specific trans-national framework. Fisheries management after 1950 has benefitted a lot from the institutions which managed fisheries and the organizations and processes that implement and develop these rules. The policymakers and stakeholder, especially, the fishing communities have made a strong urge to develop sustainable resource management in the global marine ecosystem. Thankfully, this appears to be an international consensus that supports conservation of fisheries resources (Vivekanandan, 2011).

At the global level, these set of rules are treaties- bilateral as well as multilateral- which contributed effectively for sustaining the resources. "The FAO World Conference" – an important initiative in this regard emphasized the requirement for better effective implementation of fishery management tools for sustaining the fishery wealth. It highlighted "that rational management is the necessary basis for the sustainable and sound development of fisheries" (Frank, 2006).

2.13.2 Directions in Fisheries Resource Management

The effective management of various species of fish within a sustainable eco-system and using the same for providing the livelihood to people are the objectives of marine resource management. The absence of statutory laws in asserting the owner of the natural resources allows the opportunity of forming laws clearly stating the rights and accountability for the use of the resources. The effective distribution of rights and accountability is necessary. The rights reserved for the Indian fishery should limit to the following terms:

a. IFRs (Individual Fishing Rights), also known as tradable fishing rights that can rightfully offer a certain percentage of share of MSY as the real quantity of fish fluctuates from year to year,
b. CFRs (Community Fishery Rights) enables communities in sharing the rights in terms of TAC, based on the number of members registered while providing allocation for the same.

Adopting an ecosystem-based method to fisheries management might offer the chance to create closer links between local ecological knowledge and fisheries science based on the practical knowledge of fishers (Symes, 2007). The ecosystem approach will help management of fisheries by protecting fish habitats and conserving fisheries resources. This method can offer a better knowledge of trypho-dynamics in the ecosystem and can affect fishing gear selectivity on marine resources. (Mathew, 2001)

2.13.2.1 Identity-based Fisheries Management

The immediate cause for the initiation of Community Based Resource Management was the unsuccessful traditional centralized management, market failure and exclusion for being public property. The basic idea of community- based fisheries management is that resource-based communities and resource users become primarily responsible in managing the resources. There are little involvement of communities and resource-dependent people in other management approaches. The basic idea is that users must be given the main responsibility to manage a resource base. In the process, mismanagement by the users shall affect the livelihood adversely. Moreover, they can manage the resources in a better way as they are aware of the resources better. They understand the need for conservation, systems productivity, adaptability to stress and shocks and the limit of resilience. Therefore Community-based fisheries management not just target to harvest the benefit but try to achieve the health of the ecosystem and promote sustainable use and conservation of resources (Economic Review, 2013).

A Community-based management system has the possibility to solve the common dilemmas by incorporating the high transaction and information costs. A community has an in-built incentive of social capital, which can be used for overcoming the problems caused due to reduced opportunity costs and asymmetrical information compared to the state machinery. A community has the necessary social corrective mechanisms for forcing compliance with an expected harvest (Grima and Berkes, 1989). The Community Based Fisheries Management is invested with the capacity-building aspect and empowerment aspect. In the first case, it helps the users in developing specific skills and brings new innovation to manage fishery resources. In the latter case, it authorizes the resource users and coastal communities to gain higher social, economic, and political power (Berkes et al., 2001)

2.13.2.2 **Basic Principles of Community Based Fisheries Management**

'Writing the rules', a grassroots project in 1998 stressed that the shareholders should have the authority in Management and management decisions must be made at the local level. Two more additional principles were added at the Stonington Fisheries Alliance in Stonington. These are a) authority should come with participation and b) there should be rules to protect the community as well as resources. The basic principles of Community based Fisheries Management taken from IIRR in 1998 include Ecosystem-Based Management, Empowerment, and Respect for community Knowledge. These principles were expected to minimize poverty and ensure sustainable use of resources (FAO, 1997).

2.14 Fisheries Management and Livelihood – A Theoretical Review

A theoretical model for managing common pool resources in communitarian context was given by Elinor Ostrom in her work titled, "A general paradigm for studying the sustainability of socio-ecological systems". Ostrom narrated the ecological arrangements that take the aid of human intervention with pragmatic examples from resource-dependent communities. She tried to analyze “ten subsystem characteristics” that may influence the effective “self-organization efforts” for attaining “sustainable socio-ecological systems by the communities involved”, based on her own study. Later several theorists went on to elaborate the claim with sufficient empirical models of common-pool resource management. The model came to be known as Socio-Ecological systems Framework (SESF). Marine resources, regional waters, and resources from forests face serious threat and have incurred substantial mutilation, harm, and huge reductions biological stock. The “resources” which are given to the population belong to “complex social-ecological systems (SESs)”. In various realms, “SESs” constitute multiple minor circles as well as interior “variables” inside the minor circles, just like the body of any organism which consists of organs, cells, tissues and bones. The minor circles like natural resource stock (marine fishing unit) and sub circles make up a complex SES, with the presence of beneficiaries (fishermen) and management units (fishery management institutions). These units form largely distinct units, nevertheless they correlate in bringing out SES results which then influence the minor circles as well as the factors of these circles, irrespective of the size of the “SES”. Methodical information has to be collected for improving “SESs”. Moreover, researchers had a tendency to use basic “theoretical models” to generalize specific problems in a universal manner. Theoretical forecasts of natural resource destruction because of the dearth of rights-based possession of properties for example, resulted in similar proposals for executing certain strategy retort, which typically be a flop. When there are dissimilarities and diversities among the users of the resources, there are problems in interaction. This results in denying the implementation of rules and regulations for the resources management. In the absence of proper rules and regulations, the users of the resources will find it difficult to devise ways to stop excessive use of resources thereby initiating unsustainable fishing practices.

The SES framework was created with the intention of being used in a narrowly restricted area of “common-pool resource management” scenarios where the beneficiaries of the resources harvest their units from a common resource pool. The beneficiaries of the resource ensure that common stock is maintained in accordance with the norms and regulations which come under an all-encompassing executive body which is linked to socio-economic and political systems.

Ostrom constructed an array of pragmatic models in her work, “Governing the Commons: The Evolution of Institutions for Collective Action” in order to present a "broader theory of institutional arrangements connected to the successful governance and management of common-pool resources".

She put forward “three models” which later became a theoretical base for many countries in initiating market remedies. She goes on to provide "theoretical and empirical alternatives to these models in order to begin to highlight the multiplicity of answers that go beyond states and markets".

These models are not incorrect, rather, they became "specific models that use extreme assumptions rather than universal ideas." These models can accurately forecast tactics and results in fixed settings that are close to the models' initial conditions, nevertheless the models could not anticipate events which were part of the outside realms".

“Tragedy of the Commons”, “The prisoners' dilemma model” as well as Olson's “Logic of Collective Action” became the three pillars of this approach. “Tragedy of the Commons” was utilised like a metaphor in order to explain broader issue i.e., overpopulation. The concept “carrying capacity," is the key term which is used in this context along with over population. “Much of the globe is dependent on resources that may be prone to a tragedy of the commons,” as Ostrom points out.

The sub systems explained by the SEFS model are the following:

The ten variables were summarised as follows:

The overall productivity of the Resource System – The regional or locally administered management measures are ineffective as the resource base is excessively used.

The magnitude of the resource base – The size of the base needs to be smaller for effective implementation of rules

The ability of forecasting – The management becomes difficult when the system faces technical issues of forecasting

"Mobility" of the resource stock– Management of the resource base becomes difficult with regard to mobile resource stock.

The size of the population of the users– The maintenance costs are higher for large number of users. The size of the population determines the mobility of the factors too.

Guidance – The management system requires skilled personnel to implement rules and procedures

"Norms and social capital" – This defines shared morals and ethical behaviour within the system

"Knowledge of the socio-ecological system" –

The significance of the resource base – The communities which regard resources as a vital part of their livelihood become part of the management system effectively

Co-management – The participatory approaches can lower down the cost

"Hardin's concept has often been formulated as a prisoner's dilemma game," writes Ostrom. Ostrom later creates extra models to stimulate debate about institutional solutions to commons challenges. This entails adding more systems for the users of the resources to form a legally enforceable agreement for devising a "co-operative strategy". Olson's The Logic of Collective Action is the third paradigm that Ostrom investigates (1965). She later dubbed it as "theory of collective inaction" with a sneer. Philanthropical clusters are deliberately excluded in Olson's theory, yet it is these groups that have grown in numbers and membership since 1965. Working from a broadly institutionalist approach, Ostrom explored the prisoners' dilemma and also used game theoretic reasoning in a novel method to discover answers to the "Tragedy of the Commons." She aimed to offer alternatives to commonly used and tightly designed rational decision models. She emphasised the importance of incorporating actors' self-perceptions of their roles as well as their ideas about what constitutes right or acceptable behaviour in specific situations.

Hardin in his notable works had previously described about individuals who were stuck in excessive use of resources. “The SES framework” was compelled to organize its framework to complete the issue of over use. According to numerous empirical examinations by specialists from several disciplines, majority of the resource users try to build management systems which are expensive and try to maximise the sustainability. The SESF is widely referenced and linked to other concepts, notions, as well as theoretical models. The popular links include ecological sustainability (Partelow and Winkler 2016), flexibility (Berkes and Folke 1998), as well as different management system for ecological protection (Berkes et al, 2001) such as “multilevel governance”, “polycentric governance”, along with co-management.

A significant proportion review of literature devoted to traditional Common-pool systems, which are found in fisheries sector. Several others continue to study about the commons by focusing on forests and irrigation systems (Meinzen-Dick et al. 2002) Majority of the researches are qualitative and significant other articles emphasise ongoing expansion of the framework, either theoretically, pedagogically, or for the formulation of theory. The vast majority of SESF research, on the other hand focuses on both secondary and primary data.

Fishermen and others who use the resource system, especially landowners, local inhabitants, and dependent communities become significant "actors" of the management system who contribute to fishing activity. “Actors”, influence the resource system collectively even though specific individuals act as agents on their behalf. The stakeholders who are significant, characteristics of economic and social conditions, previous history of fishing significantly influence the placement of fish production and general perceptions of fishing occupations. Conflicts can be affected by the characteristics of actors with regard to the resource. Local leadership can help encourage development and the establishment of new businesses, such as aquaculture. Norms including social power, such as trust and reciprocity, are essential factors that affect a fishing unit's sustainability. Sustainable fishing requires an understanding of the SES, including the environmental factors that influence the target species' growth and health.

The governance system in the SES consists of both legal and tacit institutions that influence behaviour of the stakeholders. The policy domain, which is equivalent to the resource sector variable, consists of organizational routines designed for a specific field of knowledge, location, or time. Operational rules, collective choice rules, and constitutional rules are some of the overt and covert norms that guide human conduct and social interactions. Property rights establish certain relationships between people and things. Fishermen have more influence which they have to use to create a futuristic view while establishing rights of property in fishing activity.

The external, socially relevant elements which may influence the SEFS framework are represented by the social, political, and economic variables. The SEFS is shaped by dynamic features from socio-political environment, which influence a decision-making and conduct of the actors. Through case studies or data analysis a few researchers have clearly inculcated the socio-political and economic situations. Instead, these considerations are briefly addressed in the beginning and later in the analysis by researchers. Regional, national, and worldwide economic dynamics, such as decline in wild catch fisheries, often drive the development of fish production.

Basurto et al. (2012) quantified the characteristics of the SES system in an article titled "The social–ecological system framework as a knowledge classificatory system for benthic small-scale fishing." Two small-scale benthic fishery locations “in Mexico and Chile” were chosen. The study in Mexico looked at three separate “fisheries in the Gulf of California” (Puerto Penasco, Kino, and Seri). In research which was pursued in the similar conditions in Chile was examined using the time series data of 3 periods continuously. In both the cases, important characteristics which are linked to self-organization capacity of the fishermen were assessed for stabilizing the accessibility to fishermen of other categories. It was found that the fishermen devised additional reinforcement to switch from “open access” to a shared “property-rights” framework. The fishermen belonging to these two groups discovered that pursuing novel procedures and norms would limit entry. Moreover, they realised that effective use of their sea bed would provide them with more benefits than the current “open access” situation. They also made sure to overcome the perceived costs of revising their regulations in order to successfully undertake institutional change.

2.14.1 Institutional Analysis and Development Framework

The model is built on the concept of policy processes as dynamic systems. Individual choices are influenced by social, organizational, and ecological variables. Personal choices were brought together for building models for collaboration. These choices are put together with extraneous variables and result in apparent results. The actors' (or other observers') evaluations of the outcomes are assessed using the previous components in a continuous process. Depending on the degree of aggregation used, systems typically seem significantly different, and this fact particularly imposed upon the action arena. “The IAD paradigm” defines 3 phases of scrutiny - operational, collective, and constitutional -where decision making processes are done. The users of the resources conduct pragmatic decisions out of their existing choices among their available options at the operational level. Both collective-level and individual-level decisions dictate whether techniques, conventions, and regulations enable the actors to attain the particular roles they are assigned with. The IAD framework was developed for use in any policy situation where individuals and groups build fresh strategies for transient outcomes and concerns. The natural propensity of IAD framework is to approach resource system dynamics as primarily exogenous forces, which are not within the purview of individuals.

The problem of dealing “with complex” SEFSs, in which numerous players intermingle with diverse ways and rely on and effect “multiple resource units within a resource system,” can be brought to the fore by our application of the SESF to the maritime fishery. The choice of the resource unit, is thus very critical. The dealings of the different units control the necessary borders concerning the management system as the option depends whether it is dependent on appropriation or provisioning.

2.14.2 Details of the Institutional Analysis and Development Framework

"Common Pool Resources (CPR)" are an exciting but difficult form of asset which can be sustainably managed (Ostrom et al. 1994). CPR is often subjected to human exploitative pressures and “complex multi-user conflicts of interest” since it is difficult to exclude beneficiaries “and has a high degree of subtractability” (Steins and

Edwards 1999). Garett Hardin (1968) warned against the elimination of “CPR” systems due to the existence of excessive number of users pooling few “resources”. The decision to use or over use is purely the decision of the resource user. in his landmark essay, "The Tragedy of the Commons". As a result, policymakers have come to believe that resource users cannot be relied adequately to regulate “CPRs”, prompting many to go “for centralised” “or private governance” arrangements (Janssen 2015; Ostrom 2015). The capacity of societies to build norms and procedures to govern the stock of resource, as well as the results of these management, has been usefully investigated using the “Institutional Analysis and Development (IAD) framework”. This helps the investigators and the students to evaluate the rules and norms at the backdrop of the sustainability of resources (Janssen 2015; Ostrom 2015). Biophysical conditions of “the CPR”, “community” traits, “and institutions”, according to the IAD paradigm, influence actors' activities toward the resource management. (Hardy and Koontz 2009)

Elinor Ostrom developed “the IAD framework” for investigating commons pool resources and community governance without the involvement of the state. Over the last three decades, Ostrom and other scholars have been refining the framework. Ostrom's work defied popular knowledge regarding regulation of governments to achieve sustainability and capacity building. The IAD paradigm has been used in a number of studies so as to enquire how individuals collaborate and organise across organisational and regional borders for managing “common resources” like wild life resources and marine resources.
This framework is particularly suited for fisheries management and livelihood systems

The framework was formed with the intent of understanding the evolution and formation of institutions. This is critical since open platforms and broad procedures had been constructing community collaboration, which was challenging present structures and practices while establishing fresh and different commons pools of resources that are often "informal" before becoming "institutionalised" or codified. The transition of activities from informal places to formal institutional frameworks could be a key subject of research. This relates to the incentive, acknowledgement, and reward management issues. The IAD, according to Hess (2005), is well adapted to comparative examination of the following question: "How can flawed humans get along, form communities and organisations, and establish decisions and rules in order to sustain a resource or achieve a desired outcome?" When one of the network's main study themes is the establishment of a community of open scientific practitioners in many situations, the statistical methods supplied by IAD could be very useful. The IAD framework gives high priority to actors in their institutional environments, which is critical. This is critical since some of the existing definitions of open research, as well as some of the concepts and theories offered for accessibility and growth, ignore the role of actors and their ability in achieving various results (Schlager & Cox, 2018). The underlying processes are frequently viewed as autonomous entities functioning according to their own set of laws. The IAD framework outlines how to comprehend the formal and informal rules and norms that members of a community follow, oppose, or amend. This feature of the paradigm will be especially useful for examining the motivations for engagement or non-engagement in open ventures, as well as open discussions.

“The IAD” contains an overview regarding different factors (stakeholders, values, contextual factors, methodological approaches, market incentives, strategies, and so on) that researchers should analyze in their process of research, as well as model which integrates specific features to a data set. The step would help with testing the case studies and related analysis for further research. The framework allows for regular evaluation process easier by permitting an integration of the lessons arrived from these case studies with trans-national themes. Even though the wide picture of “IAD” framework seems to be simple, the scenario gets complicated as the system is applied to specific management problems. The process of addressing the complex systems is rather viewed as a strength of the framework. While “the IAD framework's” general schema appears simplistic at first glance, it can become quite sophisticated as several of the features (for example, community characteristics and action scenario) is revealed in further detail. Another benefit of the framework is that it is incredibly resilient and allows for the gradual unveiling of complexity.

“The European Commission’s Seventh Programme for Research and Development work titled COMET-LA (Community-based Management of Environmental challenges in Latin America)” tried to extend the IAD frame work in to the fishery model of the “Bahía Blanca Estuary and the Monte Hermoso – Pehuén Co coastal area”, Argentina.

The “COMET-LA” introduced “sustainable community-based governance models” to control the sustainable issues in natural resources in the context of climate change and over population. "COMET-LA" called for a “sustainable society -based governance models” for managing the natural resources which were to be deployed for a variety of social and economic models at the backdrop of the current climatic fluctuations as well as increased conflict for resources. “Bottom trawl boats” found to be fishing in the deep waters for maximising the fish landings due to regulations. Limited availability of financial resources at the disposal of government entities, volume of available resources, muddled national and regional distinctions, vague national and human limits, various modes of exposure regarding the eco-system and very high elasticity of the stock of natural and other resources make the management activities tough as well as expensive. Inherent mechanism seems to be missing (Ostrom 2009). The small-scale fishermen are the people who disclose the existence of unauthorised vessels in the demarcated region or excessive catches to the authorities. However, they obviously lack the policy competence to ensure that procedures are applied and violators are punished. Local fishermen, on the other hand, are typically the ones that defy norm by venturing out to locations off the coast where there are more resources. Regardless of what the official institutional structure says, users have devised a set of technical and operational norms. Collective action and mutual interaction are the key factors which help the fishermen in overcoming the vulnerabilities. The artisanal fisheries have to compete against the big fish vessels which have the ability to harvest fish at a big scale with illegal and harmful techniques. The study found out that working with other colleagues and collective defence is an effective skill in managing the risk of deep-water operations. Traditional small-scale fisheries directly compete with big trawlers, which use carbon intensive tactics to earn profits on a larger scale. The allocation of slots on the basis of fleet reveals a markedly unbalanced "carrying capacity" benefitting big boats. The rate of regeneration is directly affected by the excessive consumption of resources. Trawling is solely accountable for overfishing and the consequent reduction in fisheries. In addition, the appropriation and production costs of large-scale fisheries are cheaper. The technical assumptions of the IAD frame work can be empirically proved in this case study (London, 2014).

The IAD framework has been used by Li et al. (2016) to examine rules that manage marine resources and coastal eco-system. “The old command and control system”, must give way to “regulatory assistance” for managing the natural resources and for sustainability. These components contribute to TCCF, which can be seen as a contending “ecosystem service with the provision of other ecosystem services”. TCCF, according to Li et al. (2016), necessitates cooperation between players at various levels, which might become a government duty. The IAD paradigm was used by Imperial and Yandle (2005) to highlight the difficulties of organizational quality and performance in capture fishery management. They discovered that the approach was incredibly useful for studying the environmental circumstances and contextual factors unique to each environment, minimizing gross generalizations about each regime. Moreover, according to Ostrom (2015), the dearth of “an institutional structure” for developing regional regulations as well as conflict resolution model resulted in the collapse of self-managed fishery sector in Turkey's “Izmir and Bodrum Bays”. A system with high transaction costs was discovered as a result of a lack of operational regulations, insufficient law enforcement, diversity of members' interests, as well as the drive towards speedy economic gains. As a result, the IAD framework can be utilized to figure out why institutions aren't present.

2.15 Summary of the Chapter

The review of literature explained in detail the various nuances of resource crisis which has implications for fisheries management and the livelihood of the small-scale fishermen. The exhaustible nature of the natural resources makes it vulnerable to exploitation and destruction. The fishery resources being a natural resource has been subject to severe depletion for the last two centuries. The destruction of the fishery resources detrimentally affects the life of the dependent communities. The in depth analysis of the literature explicated the causal relation which exists between the livelihood challenges and degradation of natural resources. It is at this backdrop the scientists and the biologists stressed the need for an effective marine fisheries management which could be useful in conserving the natural resources and the livelihood of the small-scale fishermen. The present system of the management has left the marine resource scenario in serious crisis by being ineffective in maintaining the sustainability of the resources. Sustainable Livelihood Approach has to be empirically applied in the fisheries communities to ensure sustainability of the resources as well as the well-being of the dependent communities. The theoretical models explicated by Ostrom et al, clearly stated that natural resources with open access nature had to maintain by way of informal and formal rules. Social action with the aid of proper management systems is the significant factor in maintaining sustainability of natural resources.

CHAPTER -3

HISTORICAL OVERVIEW OF FISHERIES SECTOR

3.1 Introduction

The theoretical and analytical literature explained in detail the extent of depletion in natural resources, its impact on the dependent communities and the various nuances of fisheries management practices. The purpose of this chapter is to give a historical overview of the fisheries sector which had always been subject to uncontrollable exploitation. The oceans of the world have been considered to be the abode of rich fishery resources which are constantly exposed to exploitation. Fishermen have escalated their contentions regarding open access and selective rights over a period of time. Significant fish species have declined in large numbers, reaching at critical limits. Presently we realize that the current oceanic resources, are not endless, and need great administration for maintaining reasonable yields. Today, with exhaustion of numerous fish species, there is greater understanding among the different stake holders around the world to protect the oceanic resources. “The United Nations Law of the Sea Convention (UNCLOS) of 1982”, confirmed in 1984, gave Coastal States the rights to build their fisheries with an all-inclusive jurisdiction over their Exclusive Economic Zone (EEZ) of 200 nautical miles from the coast. Beyond the conventional 12 nautical miles of regional waters along the coast by Bay Islands, India has a 2.02 x 10' sq. km ocean zone, with 0.86 x 10' sq. km on the west coast (counting the Lakshadweep Sea), 0.56 x 10' sq. km on the east coast and 0.60 x. 10' sq. km surrounding the Andaman and Nicobar islands.

3.2 History of Fisheries in India

Fisheries, a well - established occupation of humankind is as old as human history. As a hunter and a gatherer, the early human being designed numerous instruments for his benefit and improved way of life. The invention of fire, the innovation of stone apparatuses set man on the course of development. All civic establishments were on the banks of rivers. The waterway valleys have been the support of human advancements, because of rich soil, availability of water and furthermore the accessibility of fish as a wellspring of nourishment from the waters. The action of fishing can be found in the Sumerian civilization which goes back to 2300 B.C. The Chinese are viewed as the pioneers of lake fish culture.

In India, the references for fishing goes back to Mesolithic time. The archaeological evidences of the Mesolithic sites confirm the activities of hunting and fishing. Fish and tortoise were abundantly present in the lakes and waterways and became part of their diet. The Mesolithic sites contain tortoise shells and fish bones (Sahu, 1988). From the Mesolithic art works one can imagine the hunting– fishing– gathering economy of the individuals of the period. The cave paintings of Bhimbetka which is found in Madhya Pradesh is an example of hunting culture (Singh & Agarwal, 2014). The ability with which the individuals practiced hunting, transforming it into workmanship, portraying it into arts show its importance during those times. Fishing as an occupation assumed great significance as archaeological evidences suggest (Thapar et al., 1984). During the time of the Indus Valley Civilization, of the Harappan and Mohenjo-Daro destinations give testimony of the presence of fishing activity. There are evidences of the turtle and fish on the earthenware fossils which uncover the significance of oceanic domesticated animals of the individuals. Fish additionally formed part of the diet of the Harappan individuals. These evidences unmistakably reveal that fishing is an activity which was predominant in ancient India. The Indians at that point knew the importance of fishing and had built up the skill of fishing. The early remains of nets and instruments which were unearthed from these sites bear witness to the relationship of Indian civilization to the occupation of fishing (Thapar et al., 1984).

The period of Aryans marked the authentic time of the historical backdrop of India in fishing. The Aryans started the human settlement over the *sapta-sindhu* - the place that is known for the seven rivers. It was a period of transformation from nomadic state to settled life. Development of human civilization occurred on the banks of the Ganges. The development of *Janapadas* and *Mahajanapadas* brought a new life into the history of Indian Civilization. Huge and little urban communities prospered. The tribal settlements also developed. Among all the occupations that attained significance, fishing was a major one. The Rigveda, one of the earliest texts of Aryans, uses the word *'Matsya'* which means fish. It discusses the technique for finding fish using nets. During the age of the Rigveda, there was no compartmentalization of the classes. Be that as it may, this doesn't relate to the later Rigvedic age. The *Shatpatha Brahmana* talks about “King *Matsya – Sammada*” whose kith and kin were water dwellers. *Sayana's* editorial gives a point-by-point portrayal about the fisherfolk who were dependent on fishing activity. There are a lot of characters appearing in this literary text who are engaged in fishing. *Dharvara* is the person who fishes in a tank. *Dasa* and *Sauskala* fish by using fish snares. *Baind, Kaivarta*and *Mainala* used nets to get fish. *Margara* fishes in the water utilizing hands. Anda utilizes pegs and *Parnaka* places a harmed leaf in the water to get fishes. In all these old narrations one can find the growth of fishing as an occupation. In *Arthasastra*, the political treatise of *Kautilya*, there are laws governing fishing. There are references on aqua culture which was practiced in reservoirs. There were specific laws concerning taxes to be levied on fishermen and the use of fish as manure. *Kautilya* states that "the King shall exercise his right of ownership on fishing, ferrying and trading of vegetables in reservoirs and lakes" (*Kautilya* et al., 1967). It is noteworthy that *Kautilya* brought fishing under the ownership of the King. Perhaps, *Kautilya* had understood the importance of fishing and the rich revenue which could be earned from this occupation. Fish was a common produce from the sea as well as the rivers. A country like India, which has a lengthy coastline and numerous rivers flowing across it, would definitely be a prime producer of fish and thereby required a proper management, just as agriculture. True statesmen understood this aspect and brought fisheries under their purview. The imperial Mauryan rulers had brought fishing under legislative administration and taxes were levied. The *Asokan* edicts are another important source of information fish history of India. They speak about fish and other animals which needed protection and care and King Asoka imposed restriction on the limit of fishing (Hora, 1950). After having converted to Buddhism, Asoka was a great missionary of non- violence which was also reflected in his later laws and promulgations. The Edict V specifically banned killing of animals for rituals. There was a law which prevented the people from catching or selling of fish on fifty-six specified days (Smith, 1901). "On the last two days of the first fortnight and the initial days of the second fortnight as well as on the fasting days throughout the year, fish shall neither be caught nor sold". The Edict V also proved fish as an important diet of the people of those times. Asoka completely banned unregulated fishing since it was as an important diet of the people then. The ban on killing of other animals was also prevalent and the same restriction could not be applied to fish. The edicts do not ban fishing, but only placed limit on fishing (Thapar, 1961). Hence the time of Asoka bore witness to a period where fishing was common.

The non- violent attitude of the King later provided protection for fish species and the other animals. The *Jataka* tales of the ancient India have evidences of fishing as many stories are based on it. There are also references to many culinary practices. Taxes were also imposed on fishing. One – sixth of their haul was to be paid as fishing license. References are also in plenty that speak about the instances where dried fish was taken as tax (Kautilya *et al*., 1967). Drying was the method of preserving fish for future use in Ancient India. The historical evidence proved that the value of dry fish was equal to that of fresh fish since it was used to pay taxes. The knowledge possessed by the Indians is unparalleled when compared to their contemporary civilizations. *Manusmriti* (2nd to 3rd cen. C.E.), another important piece of literature which speaks of the social life of the people of ancient India instructs the people about the first offering of fish to God before they consume fish items. Here we witness fish becoming a part of the rituals. During the rule of the *Kushanas* fish was more widely prevalent. *Varahamihira,* uses various terms with regard to fish such as – *Matsya, Jhasa, Ming, Prithuloma.*

The review of these early texts reveals that fishing was a very important activity. Fish formed an essential part of the diet of the people in the ancient period. There are also references regarding fisheries management – laws prohibiting fishing activity. Taxes were being levied on the fishing. Licenses were being issued to catch fish. The fisheries came under the preview of the royal court. Legislations were passed with regard to fishing. Ban on fishing during the breeding period has been an age - old practice to allow fishes from becoming extinct. Knowledge of fishing using various tools, preserving of the catch, drying the fish, extracting fish oil and the medicinal uses of fish have formed a major portion of scientific advancement of the knowledge of fisheries since ancient times. Such type of knowledge could definitely have been commercialized. This did not happen in the past. Fish was considered a natural resource and used for local consumption. Its commercial importance was not totally exploited. The nutritional value of fish was realized since there are evidences which state that the priestly class also consumed fish. The Brahmans of Bengal also took fish as an important part of their diet (Hora, 1950). It is a known fact that Indians have excelled in all forms of sciences in the past. The glorious past had transcended all civilizations in science, technology and engineering. In the same manner, fishing was also one branch of science and technology which witnessed immense growth and development. Not only, because it was the need of the people but also because it came under efficient management and administration of the ancient Indian rulers. A study of the Bharuch sculptures leads us to infer that "*Catla* and Rohita were popular Indian freshwater fish".

Manasollasa, the work by King *Somesvara*, the son and successor of King *Vikramaditya* VI, the ruler of the Chalukyas is the first written work which classified the fresh water fishes and the marine fishes. King *Somesvara* also elaborated about gaming fishes. He was a person who wanted fishing as an activity of recreation for the rulers. This book describes in detail about the various methods of fishing (Someśvara and Shrigondekar, 1939). The royal patronage given to fishing during the earlier times was seen as an encouraging sign but in no way reduced the sufferings of the fishermen. King Somesvara was more concerned about gaming fishes as he was very much interested about it. It was a rare exception since hunting of wild animals was considered as a mark of valour and bravery and so practiced by rulers (Subramanian, 2016)

In Medieval India too, there was once increasing significance for fish associated activities. The *Mansabdars* had been honoured with "insignia of the Mahi (fish)". "Alivardi Khan" used to be honoured with such insignia (Edwards & Steins, 1999). Abul Fazal in his *Ain – i – Akbari* mentions about rice along with fishes the preferred food of the people of Bengal. He talks about the taxes levied on catching fish. He also speaks about the fishes of river Sind. He mentions about spears as an instrument used to fish. Jahangir, in his auto biography made references of the fish wealth of Kashmir and Gujarat. Jahangir who was once fond of fishing and took terrific activity in it made measures to guard the fish species by levying taxes (Beveridge, 1914). "Ghazi ud din Haidar, the Nawab of Avadh, used fish as a symbol of fortune". He issued coins with the fish symbol. Fish used to be a fundamental factor of Indo – Arab exchange between the 15th and the18th centuries. We have to take into account the reality that fish used to be greater famous in the coastal areas and the locations (Barendse, 2000) adjoining the water bodies. People residing inland did no longer have get entry to fish or very not often had fish (Raychaudhuri et al., 1982)

The production of fish was commercially done in Bengal alone (Ray, 2019). As fish caught was sufficient for the needs of the individuals, much intrigue was not created in fishery research and development (Schmiedchen, 1994). Great possibilities for fish trade had consistently existed, with fish being the principal diet of majority of inhabitants during those times (Francis, 1874). Many historical records are available, authored by eminent personalities of the time which speak about the various species present in Indian waters. It was the specific explanation of these men, which incited the British organization to comprehend the incredible possibilities of the Indian marine resources and tap its potential. They additionally described the healthy benefit of these species and the dietary varieties these species could deliver. The commercialization of the fisheries compelled the administrators to invest resources into this field. Auslandiche Fische by Bloch was the primary literary work about Indian fishes which was brough to light in 1785. He likewise authored another book on Ichthyology alongside Schneider in 1801. This work contains names of numerous Indian marine structures. Lacepede's Historie des Poissons came was out in 1803. Around the same time Russell, drew out his work portraying 200 species in Vishakhapatnam. Also, Hamilton's book Fishes of the Ganges, portrays 269 types of fishes of river Ganga. Memorable Naturelle des Poissons by Cuvier and Valencienne enquired about the need to consider the fishes of India (Agarwal, 1967). Dr. Francis Day CIE, a military specialist and a naturalist in the Madras Presidency of the East India Company administration distributed two volumes on fish in *The Fauna of British India*. It portrayed 1400 types of fishes. He likewise composed the Fishes of Malabar (1865) (Michael and Beolense, 2015).

3.3 Development of Fisheries in India

"The H.M.S. Challenger Expedition", which occurred in the Indian Ocean in the last part of the 1960s and mid-1970s, started interest in marine asset overviews. "In the Bay of Bengal and the Andaman Sea", the R.I.M.S S Investigator directed waterfront and profound water studies. New and strange fauna were found by means of these asset evaluations (Panikkar, 1998). The Andaman Sea zeroed in on a progression of articles composed by James Wood-Mason on crustaceans seen there. Also, there were analysts who were Navy surgeon naturalists, and among them are Alfred Alcock's work, Lloyd's work, and Lieutenant-Colonel Robert B. Seymour Sewell's work.

Naturalist in the Indian Seas, Alcock's book published in 1902, recounts the account of his various discoveries while on his endeavours. Sewell was a main marine Copepodologist. On a later date in 1908, Sewell joined the Zoological Survey of India (ZSI), where he chipped away at the hydrology and microscopic fish of *Rhamba* Bay and distributed his discoveries in “The Memoirs of the Indian Museum during the Chilka lake Survey”.

“The Department of Animal Husbandry, Dairying and Fisheries (DAHD&F)” is one among the three-constituent branches in the “Ministry of Agriculture”, the other two being the “Department of Agriculture and Cooperation (DAC) and the Department of Agriculture Research and Education (DARE)”. The division of fishery is managed by “the Ministry of Agriculture” as well as by the Ministry of State. “The Department of AHD&F” was established on 10th February, 1991 by the merger of two divisions of the “Department of Agriculture and Cooperation” viz. “Creature Husbandry and Dairy Development” into a different division.

3.3.1 Resources of Fisheries in India

Marine Fishing is very much crucial in coastal states due to economic, geographic, traditional, and cultural factors. “The Arabian Sea and the Bay of Bengal form the fishable areas of our country” (Sathiadas, 2004). “India’s long coastline of 8,118 km with an Exclusive Economic Zone (EEZ) of 2.5 million sq. km and 0.5 million sq. km of continental shelf is important for both exploration and exploitation of natural resources” (Economic Survey, 2019). It was the establishment of “Central Marine Fisheries Research Institute (CMFRI)” that paved the way for long term research in India. An analysis of the fish landings of six decades reveal the fact that there was phenomenal growth in fisheries sector. The marine fishery resource potential comprises the total area of fishing activity, total stretch of coastline, availability of amenities for fish landings, total number of fishermen population, investment in fishing technology and prospective growth of marine fishery resources.

The marine fishery resources of the marine States of India are given in table 3.1

Table 3.1

State – wise Marine Fisheries Resources in India

States	Continental Shelf ('000 Sq. kms)	Fishing villages	Length of coastline	Fishermen families	Fishermen population	Landing centres
Gujarat	184	263	1600	59889	323215	123
TamilNadu	41	581	1076	192152	790408	352
AndhraPradesh	33	498	974	129246	509991	271
Maharashtra	112	406	720	65313	319397	152
Kerala	40	222	590	120486	602234	178
Orissa	26	641	480	86352	450391	57
Karnataka	27	156	300	30176	170914	88
West Bengal	17	346	158	53816	269565	44
Goa	10	39	104	1963	10668	34
A&N islands	35	100	1912	3275	15266	25
Lakshadweep	4	20	132	5381	40322	19
Pondicherry	1	28	45	11541	43028	26
Daman & Diu	--	22	27	5278	29305	7
Total	530	3322	8118	764868	3574704	1376

Source: Report of the Department of Fisheries, GOI, 2018

Inland fisheries can be divided into "capture and culture fisheries". "Capture fisheries" is the principal supply for inland fishing. India is a leading country in inland fishery production, only second to China. The value of the inland fishery for sustenance as well as income has been greater than the GDP of other sectors. A major chunk of the fish production has been generated by the small-scale fishery units. The presence of large trawlers and big canoes with sophisticated technology have been instrumental in increasing the fish production (Handbook of Fisheries Statistics, 2018)

3.4 History of Fisheries Management in India

3.4.1 Indian Fisheries Act – 1897

Dr. Francis day was appointed by the Government of India to study the marine resources of entire India and Burma. The special focus was on fresh water resources. Dr, Day presented two reports in 1878 which paved the way for India Fisheries Act in 1897. In his analysis Dr. Day had found out the depleted nature of marine resources as well the illegal fishing practices in India. The Act passed legislations to decimate the properties of illegal fishing and destructive fishing. Dynamite fishing and slaughtering of fishes were prohibited in India and Burma. This was equally applicable to inland water bodies. The Act issued guidelines to improve the life of the marine resources. The conservation of fish and fishery resources became a State-wide subject.

3.4.2 The Wild Life Act, 1972

The purpose of "The Wildlife Protection Act, 1972**"** was enacted for the sustenance of the animal and plant species in the country. There were "six schedules" in this Act which empowered the authorities to sustainably shelter plant and animal species. The animal and plant species which were listed in the six schedules cannot be hunted or harvested. The law was applicable to the whole of India. There were provisions to give absolute protection to the species which fall under "Schedule and part II of Schedule II".

3.4.3 Maritime Zones Act, 1976

The "Third United Nations Convention on the Law of the Sea (UNCLOS)" was instrumental in bringing about the Maritime Zones Act in 1976. The United Nations had unanimously accepted the offer of the member countries to specifically set boundaries of jurisdiction in conserving and exploiting the marine resources which fall under their jurisdiction. By initiating the legal framework through the Maritime Zones Act, the Government of India framed laws concerning the Maritime travel, use of resources, relation with other maritime nations and fisheries management tools. The Act was completely in compliance with the international Maritime Laws which had already been published by the United Nations.

3.4.4 The Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act (MZI Act) 1981

"The Maritime Zones of India Act was purposively framed to curb the illegal activities which were occurring in the Indian seas due to the intrusion of the foreign vessels. Even though there were international legislations to curb illegal activities in a native land, they were not widely accepted by all the member countries. In the International Court of Law the law of the native land had predominant importance in settling the affairs.

3.4.5 Marine Fishing Regulation Act, 1978

"Marine Fishing Regulation Act" is a charter which helps the coastal States to initiate legislations to manage fishery resources and regulate excessive and illegal fishing in the demersal as well as pelagic waters. Major proposals of the Act are: "regulation of mesh size and gear, zone reservation for various fishing sectors and also declaration of closed seasons". Norms were to be outlined and modified occasionally as per the discretion of the coastal states with regard to the geographical specifications (Handbook on Fisheries Statistics, Government of India, 2014). "Fisheries within the 12- mile territorial limits are managed under the Marine Fishing Regulation Acts (MFRA) of the Indian maritime states" (Government of Kerala, 1978). Kerala was the first State in India to adopt the regulations under Kerala Fishing Regulation Act (KMFRA) in 1980. The other maritime states also adopted the Central Government direction and adopted the regulations. The following table gives the details.

Table 3.2
Maritime regulations

States/ Union Territories	Year Adopted	Area reserved for traditional craft	Area reserved for mechanized craft
Gujarat	2003	5 nautical miles	Beyond 5 NM
Maharashtra	1981	5 fathoms (Mumbai, Raigad, Thane) 10fathoms (Ratnagiri, Sindhudurg)	
Goa, Daman Diu	1980	2.6 NM (5 km)	Beyond 2.6 NM (5km)
Karnataka	1986	3.23 NM (6km)	Beyond 2.6 NM
Kerala Southern sector (1) Kollengode to Paravoor Pozhikara Southern Sector (2): Pozhikkara to kovilthottam Northern Sector: Kovilthottam to Majeshwaram	1980	Sector 1(1): up to 25 fathoms Sector (2): Up to 18 fathoms Sector 3: Up to 12 fathoms	Beyond 20 fathoms
Tamil Nadu	1983	3 Nautical miles	Beyond 3 nautical miles
Andhra Pradesh	1994	Up to 8 km	Mechanized boats – beyond 8 km 20m
Orissa	1982	2.6 nm (5km)	Up to 15mts – beyond 2.6 nm (5km) Above 15mts – beyond 5.39 nm (10km)
West Bengal	1993	Up to 9 mts – till 4.3 nm (km)	Mechanized up to 15m – up to 50kms but not 10.7 nm (20kms) Mechanized above 15m – beyond 26.99 (50kms)

Source: Department of Fisheries, Government of India

3.4.6 Comprehensive Marine Fishing Policy 2004

"Comprehensive Marine Fishing Policy 2004 has been launched in November 2004". The goal of the policy was to expand fish landings of the country not undermining the sustainable level and in a responsible manner, to increase the export of the marine products and increasing the protein intake of the people; to guarantee a decent livelihood for the dependent communities; and "to ensure sustainable development of marine fisheries while conserving ecological integrity and bio-diversity" (Report of the Department of Fisheries, 2014).

3.4.7 The Environment (Protection) Act, 1986

The Environmental Protection Act is entitled to protect the environment from pollution arising out of industrial structures, emission of excessive carbons and illegal pollutants. The Act made it mandatory to get an Environmental Impact Assessment (EIA) clearance for the industrial settlements which are set up in vulnerable areas. The Ministry of Environment authorizes its sub-divisional zones in the State to conduct public hearings for all disputes related to environmental issues. "The Coastal Regulation Zone (CRZ) 1991" was the byproduct of this Act. The Act introduced a zoning scheme specifically set apart rules for settlements near the sensitive areas. "It declared the coastal stretch influenced by tidal action in the landward side up to 500 m from the high tide line (HTL) and the land between the low-tide line (LTL) and the HTL as the CRZ" (Department of Fisheries, Government of India, 2014) . "It enforced rules regarding settlements, advancements of factories, operations or processes etc., in the CRZ. The Act further brought forward rules and regulations under four categories:

"CRZ I" denoted environmentally sensitive areas such as "national ponds. Marine parks, wildlife resources which are reserved, wildlife habitats which are endangered, areas which are proximate to spawning and breeding grounds, genetically diverse areas". These areas are specifically lying between "the Low Tide and High Tide Line"

"The CRZ-II" is composed of the already built -up settlements close to coastal areas.

The III Zone of CRZ are the areas which are not included in the I and II zone. These areas are usually “undisturbed”. The coastal areas in the rural areas, the municipal settlements close to the shore are included in the III zone

The CRZ-IV “includes coastal stretches in the Andaman and Nicobar, Lakshadweep and small islands except those designated as CRZ-I, CRZ-II or CRZ-III.”(Department of Fisheries, Government of India, 2014)

3.4.8 National Fisheries Policy, 2020

From the immaculate Himalayan oceans to the huge Indian Ocean, the Indian fisheries industry has a huge and differed assortment of assets. As far as fisheries biodiversity, it covers an expansive reach from a physical and organic perspective, which is fundamental since it helps a large number of individuals support their job. Different territories have various kinds of fisheries assets. In recent times, aquatic assets are in more interest than any other because of the rising populace and worldwide interest for fish protein. A sound National Fish stock Policy (NFP) system dependent on value and correspondence and embracing a group driven and participatory methodology is expected to fulfil the squeezing needs and guarantee a development direction that meets the present prerequisites while additionally leaving a superior fishery for the future. Gender orientation mainstreaming and keeping up with intergenerational value are likewise fundamental parts of the NFP (Gandhi, 1998).

To develop, bridle, oversee, and control catch or culture fisheries capably and economically, the National Fisheries Policy 2020 proposes a coordinated methodology. The Policy will ensure that other monetary areas, including agribusiness, waterfront region advancement, and eco-travel industry, is beneficially incorporated to accomplish the 'Blue Economy' goals (Kalawar, 2000; Kurien, 1981). Notwithstanding inter-state and state participation, the Policy stresses the financial prosperity of fishers and fish ranchers, especially in customary and limited scope fisheries. The Policy mirrors the nation's desires and advancement destinations.

3.5 The Fishery Economy of Kerala

Kerala is one of the largest and most significant maritime states, ranking fifth in terms of coastline length. Kerala owns 7.35 per cent of the total marine resource area of the country (Marine fisheries. This stretches along the Arabian Sea is considered to be among the most fertile. The Exclusive Economic Zone (EEZ) of Kerala accounts for 1.78 per cent (0.36 lakh sq km) of India's total demarcated regions (Govt. of Kerala, 2014). The centres of fish landings in Kerala account for 13.38 per cent of total fish production centres of India (Department of Fisheries, Govt. of India, 2010). Kerala also has a larger proportion of traditional fishermen (98 %) which is larger than any other State in Kerala (Govt. of India, 2010). It is a proof that just a small proportion of fishermen have shifted to the fishing industry which transformed itself into a mechanized sector. Kerala's fisheries sector emerged itself into a dualistic structure, with both a dominant small- scale sector on the one hand and a highly advanced modernized sector on the other. While the modernized sector has evolved into a significant economic activity, the traditional sector has remained a mere subsistence source of employment (Kurien, 1978). Nevertheless, the state government's efforts in the modernization of the fisheries sector, particularly after 1991, have resulted in considerable advancements in fishing technology in Kerala. However, for a better balance and maximization of socio-economic benefit of the dependent communities, sustainability of the resources with equitable wealth distribution is required. Although technical advancements have increased the production of fish resources, governments- both national and state - have pursued progressive policies that have culminated in overfishing (Kurien, 1985). This has also resulted in fierce competition between domestic and international fishing fleets, as well as depletion of resources in the fishing industry. As a result, the industry witnessed disguised unemployment, a reduction in per capita output, sub sectoral imbalance, and a disruption in the pleasant political and social environment of the coastal villages.

The fishing industry plays a significant role in the progress of India, particularly in Kerala. The fisheries sector employs 2.98 per cent of Kerala's total population, comprising 77 per cent working in the marine sector and 23 per cent in inland fishing (Govt. of Kerala, 2017). During 2016-17, there were 2, 36,300 active fishermen, with 78.83 per cent working in the maritime sector and the rest working in aqua culture (ibid). During the year 2016-17, the inland and marine industries produced 4.88 lakh tones and 1.88 lakh tones, respectively. Kerala contributes 12.97 per cent (178646 metric tons) of India's total marine exports, generating 13.12 per cent of the country's revenue during the year 2017-18 (Handbook on Fisheries Statistics, 2018). Fisheries is one of India's most potential sectors, alongside agriculture and related activities. The thrust of fisheries development has switched progressively in the line of development paradigm since the inception of economic planning. The widespread adoption of the growth-oriented technology-driven model known as the "Indo-Norwegian Project" created the platform for innovations and advancements in fishing technology in the country which was dominated by primary sector. Ever since, major public and private efforts have been directed at developing the fishery sector as one of the economy's primary sectors, allowing it to play a large role in trade pattern, commerce and the advancement of occupation and livelihood of fishing communities.

Table 3.3
Fishery Resources of Kerala and India

Marine	**Kerala**	**India**	**Kerala's Percentage (percent) Share**
Length of Coast Line (Km)	590	8118	7.27
Continental Shelf('000 sq km)	40	530	7.54
Number of Fish Landing Centre's	187	1537	12.16
No of Fishing Villages	222	3432	6.47
No of Fishermen Families	118937	874749	13.59
Fisher-Folk Population	610165	4056213	15.04
Inland			
Total Inland water bodies(Lakh Ha)	5.43	73.59	7.38
River & Canals(Km)	3092	195210	1.58
Reservoirs(Lakh Ha)	0.3	29.07	1.03
Tanks & Ponds(Lakh Ha)	0.3	24.14	1.24
Flood Plain lakes/Derelict waters(Lakh Ha)	2.43	7.98	30.45
Brackish Water(Lakh Ha)	2.4	12.4	19.35

Source: Department of Animal Husbandry Dairying and Fisheries Handbook on Fisheries Statistics, Government of India 2014

Kerala's shoreline represents around a modest amount of India's aggregate. EEZ loosens up to 200 nautical miles past the mainland rack, covering 218536 sq. km., and offers opportunities for conventional inshore looking for a long time along this shore of 590 km. 39 139 km make up the continental shelf. The district somewhere in the range of 18 and 73 meters is around 25000 square kilometers, while the leftover region is 73 and 182 meters. “Thiruvananthapuram, Kollam, Alappuzha, Ernakulam, Thrissur, Malappuram, Kozhikode, Kannur, and Kasaragod” are waterfront regions of Kerala. Census information from 2010 shows that Kerala is home to 1, 18,937 anglers living in 222 shoreline fishing networks and 187 fish landing offices (Economic Review 2018).

3.6 Major Phases of Fisheries Development in Kerala

In Kerala too, the repercussions of changes in fishery were felt extensively. The phases of change in Kerala fishery sector can be divided into five stages. The first phase which started off in 1950’s (1950-1970) marked the beginning of “Indo-Norwegian Project” that kicked off the initial stage of mechanization in India. The country crafts were mechanized and small motorized boats were introduced into the Kerala shore. This period also saw incredible demand for shrimp and the export of the same started to show an increasing trend. An improvement of the existing mechanization can be seen in the second phase (1970-1980) and there were moves to bring in specialized big crafts which was a bit more sophisticated. In 1980s there was rapid motorization and the period also saw recurrent collision between artisanal fishermen as well as the mechanized counterparts. Kerala became the first State in India to introduce the “Kerala Marine Fishing Regulation Act (KMFRA)” as per the recommendations of the Central Government. The trawling operations were banned in monsoon months in 1980s in order to curb juvenile fishing and the growing fish depletion in Kerala coast. There was further expansion of fishing fleet in the fourth phase (1999-2000) and the fishing industry experienced the effects of globalization in Kerala. The exports of marine products further increased during this period. The fifth and the last phase (2000 – 2010) showed reflections of global emergency about fishery resource depletion which had its impact in India. We see a lot of government interventions in this period along the lines of fisheries management and the welfare of the fishermen.

3.6.1 First Phase (1950-1970)

The first twenty years after the independence was really tough period for the state. The state had not taken the full shape along the linguistic lines. The TCM programme, FAO Technical Assistance and Indo- Norwegian Project (INP) helped the state to begin a mechanized era of its own. The TCM programme gave a new impetus to the state as it was instrumental in modernizing the Kerala fishery by way of different types of modern crafts and gear along with new transportation facilities. FAO technical guidance was mainly in the field of guidance and training to the fishermen.

3.6.2 Indo – Norwegian Project (INP)

"The Indo-Norwegian project" marked the beginning of mechanization in the Kerala fishery sector. Indo – Norwegian Project was the result of "a joint agreement between the United Nations, the Government of Norway and the Government of India in 1953" (Kurien, 1985). The agreement was signed in 1952. The main objective of the INP was to develop the then fishery sector and enhance the livelihood opportunities of the fishermen groups in three villages in Quilon district. The first method was to motorize the indigenous crafts which was found to be unsuccessful. Later, new designs for boats were introduced into the Kerala shores. There were indigenous boats with 22 ft and 25 ft length with semi diesel engines. Apart from that 30ft long fishing vessel from Norway was brought to Kerala. 1958 a 33 ft. decked boat equipped with 36 HP Diesel engine, echo sounder and radio telephone, especially suited for operation from Ashtamudi Lake, were imported from Norway. The nets and other fishing gears also was not indigenous. In order to cater to the growing demands of the fishermen, boat yards were built in the district of Quilon (Korakandy, 1998). The INP at Quilon was really an experiment and it paved the way for new methods in preservation of fishes, development of ports, ice-making and all the more for multi-day fishing. The project was extended to Cochin in 1961 and went on to become the headquarters of the project later. In Ernakulam, the project concentrated its emphasis on deep sea fishing with large trawlers. The INP at Kannur was commenced in 1962. The principal objectives of the project were to set up a fishing harbour, a boat yard and to expose the fishermen of the area to training.

Table 3.4
Details of Boat standardized in 1963

Size of the boat	Type of boat	Type of fishing	Life span(years)	Displacement (tonnes)	Engine (hp)	Crew	Cost
24 ft.	Surf boat	Gillnetting	15	1.30	10-12	3-4	10000
25 ft.	Fishing boat	Gillnetting and shrimp trawling	15	2.30	10-15	4	85000
32 ft.	Trawler	Shrimp Trawling	15	7.28	40	5	32000
32 ft.	Fishing boat	Drift Netting	15	7.50	30	5-6	30000
36 ft.	Trawler	Shrimp trawling	15	12.20	60-60	5-6	45000
38 ft.	General	All types	15	14.40	50-60	6-8	50000
42 ft.	Fishing Boat	Drift netting	15	22.30	80-90	6	65000
49 ft.	Trawler	Drift Netting	15	30.00	80-100	6	90000

Source: FAO, Third Report to the Government of India on Fishing Boats Based on "the Work of Peter Grutner", Paper "No. 1535" (FAO, 1963), Pp 14, 60-90

The INP was a remarkable step in the history of Kerala Fishery. The mechanization process which INP initiated was instrumental in creating a new work culture among the Kerala fishermen. The large potential of Kerala fishery sector was revealed because of this project. The experiments INP made were not limited to mechanization alone. The training of the youth, introduction of post-harvest methods, the entry of new craft and gear combination and above all the enhancement of the livelihood standards of the fisher folk were also attained in a limited way. The small-scale fishermen benefitted much from this project as they began to use the Nylon nets instead of the cotton nets. The mechanized crafts were very small and the highest per centage of landings were still contributed by the small- scale fishermen. The first phase also showed an increasing demand for prawns in the worldwide market. The inshore fishing for prawns in 0-50m depth was very profitable for the trawlers and the small-scale fishermen.

3.6.3 Second Phase (1970-1980)

The second phase was a transitional period for Kerala fishery sector as new trawlers arrived for the prawn resources of Kerala coast. In the inshore area of 0-50m depth lied large resources of prawns which had global demand. The profitable shrimp catch escalated the profitability of trawlers in the inshore areas. The number of trawlers operating along the Kerala coast increased. The steady increase in the number of trawlers affected negatively the artisan fishermen.

Table 3.5
Marine Landings of Kerala (Quantity in Tonnes)

Year	Total Landings	Mechanized Sector	% Share	Artisanal Sector	% Share
1969	2,94,787	28,177	9.6	2,66,610	90.4
1970	3,92,880	52,571	13.4	3,40,309	86.6
1971	4,45,347	47,291	10.6	3,98,056	89.4
1972	2,95,618	38,648	13.1	2,56,970	86.9
1973	4,48,269	93,659	20.9	3,54,610	79.1
1974	4,20,257	1,01,412	24.1	3,18,845	75.9
1975	4,20,836	1,80,111	42.8	2,40,725	57.2
1976	3,31,047	58,717	17.7	2,72,330	82.3
1977	3,45,037	1,07,424	31.1	2,37,613	68.9
1978	3,73,339	1,17,571	31.5	2,55,768	68.5
1979	3,30,509	94,779	28.7	2,35,730	71.3
1980	2,79,543	1,34,783	48.2	1,44,760	51.8

Source: SIFFS, 1981

The marine resource landings from 1969 to 1980 show that in the early years of 1970‘s a considerable increase in catch happened due to the presence of trawlers, but in the later part of that decade a descent in the total production can be seen. The share of artisanal sector in 1971 was 89 per cent, but it came down to 51 per cent in 1980. The mechanized sector on the other hand recorded a steady progress throughout the period.

Table 3.6

Total Landings – Mechanized and Artisanal

Year	**Total Landings**	**Mechanized Sector**		**Artisanal**				**Total**	
				Motorized		**Non-Motorized**			
		(Qty)	Share (%)	(Qty)	Share (%)	(Qty)	Share (%)	Qty	Share (%)
1981	273978	73056	26.7	22848	8.3	178074	65.0	200922	73.3
1982	325367	85190	26.2	63050	19.4	177127	54.4	240177	73.8
1983	385282	98070	25.5	99082	25.7	188130	48.8	287212	74.6
1984	392895	129641	33.0	133313	33.9	129941	33.1	263254	67.0
1985	325729	127835	39.3	120767	37.1	77127	23.7	197894	60.8
1986	382788	129526	53.8	186540	48.7	66722	17.4	253262	66.2
1987	303286	151178	49.9	112208	37.0	39900	13.2	152108	50.2
1988	468808	196780	42.0	238808	50.9	33220	7.1	272028	58.0
1989	647526	208013	32.1	406652	62.8	32861	5.1	439513	67.9

Source: SIFFS

3.6.4 Third Phase 1980 - 1990

There was tremendous growth in the mechanized period during the third phase. There were attempts for motorization extensively through motorization of indigenous crafts and by way of new motorized crafts. The share of the mechanized sector in 1980 was just 8.3 per cent and it rose to 62.8 per cent by the end of 1989. The share of the non-motorized sector showed a decline of 65 per cent in 1981 to 5.1 per cent in 1989.

The period between 1980 and 1990 also saw an increase in the use of ring seines replacing the use of boat seines. This helped the fishermen to exploit the pelagic fish resources to the maximum. The innovative gear introduced in the new craft was 450 to 1000 m long which required 40 crew members to operate. The large indigenous crafts enabled with 3 engines with horse power 40 were very common during this period. The newly introduced craft and gear contribution doubled the fish production of the state. The unprecedented growth in trawlers, mini-trawlers, purse seiners led to over exploitation and over capitalization in fishing industry. The inshore area where shrimp and other small pelagic were in plenty was heavily exploited. It was during this period that the juvenile catch of the fish species became rampant. The entry of the fishing vessels from other states without any regulation also caused over exploitation of the fish species.

Under the Centrally Sponsored Scheme of Central Government, in the Seventh Plan period, a motorization programme for the indigenous crafts was introduced. The objective of the scheme was to upgrade the indigenous crafts technologically and also to train the fishermen to operate the new crafts enabled with technology. It is estimated that more than 50000 crafts in India came under the programme. The technological advancement in the craft and gear along with the training for fishermen helped the industry to grow rapidly both in volume and value. The increased engine power, new methods for fish preservation, increased size of the boat, introduction of multi-day fishing were the major achievements of this period. The growth of the industry gave way to growth in the exports too.

Table 3.7
Trend in Exports of Marine Products (1981-82 to 1990-91)

Year	Quantity (Tonnes)	Value (Crores)	Annual Growth Rate (Qty)	Value
1981-82	70,105	286.01	-7.2	21.8
1982-83	78,175	361.36	11.5	26.3
1983-84	92,691	373.02	18.6	3.2
1984-85	86,187	384.29	-7.0	3.0
1985-86	83,651	398.00	-2.9	3.6
1986-87	85,843	460.67	2.6	15.7
1987-88	97,179	531.20	13.2	15.3
1988-89	99,777	597.85	2.7	12.5
1989-90	110,243	634.99	10.5	6.2
1990-91	139,419	893.37	26.5	40.7

Source: G.O.I, Report of Fisheries for the Tenth Five Year Plan (Compiled)

3.6.5 Fisheries Regulation Acts

After the introduction of purse seining in 1970s, the pelagic fishes like sardine and mackerels were caught on a large scale by the trawlers and big fishing vessels. The profitability of the small- scale fishermen was at stake due to the large exploitation of these species along the in-shore areas of the coastal lines of the maritime states. The main thrust of the 10th Meeting of the Central Board of Fisheries, held on 23rd March 1976 was to discuss the problems faced by the small- scale fishermen due to mechanization. The Meeting constituted a committee to study the various provisions for delimiting the areas for fishing for different types of boats. The committee submitted its report in 1978 in the form of Marine Fisheries Bill. This bill was later circulated among the states and the Union Territories. Kerala and Goa were the first two states in India to enact the Marine "Fisheries Act in 1980". "The Kerala Marine Fisheries Regulation Act of 1980" was mainly enacted to prohibit the use of dynamite in fishing, to regulate the collection of Chunks, Clams and Oysters and to introduce licensing of fishing operations (GoK, 1980). This act was supplemented with several government orders which gave clear direction for the regulation of marine fishing (Antonyto, 2002). The KMFRA was the first attempt by a State in India to amend the unhealthy fishing practices in the sea. The unfortunate thing was that the provisions enshrined in the act were not fully implemented. The seasonal trawl ban which was a major provision in the Act was taken up by the government to be implemented. The mechanization of the crafts which was once seen as a catalyst for increase in fish production was proved to be unsustainable in the long run. The use of purse seine, ring seine, pelagic trawl and mid water trawl were proposed to be regulated in the KMFRA.

3.6.6 Trawl Ban

Trawl ban was a resource management measure adopted by the government of Kerala at the wake of the fishing regulation Act. (Salim, 2007). There was a demand from different corners of the fisheries communities for a directive from the part of the government to protect fish resource. The Government of Kerala, declared a ban on mechanized fishing in Kerala during the months of June, July and August during the year 1981. But this step was questioned in the High Court of Kerala by the trawlers and those having large fishing vessels. This forced the government to appoint a committee under D. Babu Paul, to assess the problems connected with the conservation of Marine Fishery Resources during the monsoon period (Gok, 1981). But this committee could not reach a unanimous decision on the matter and thus a new committee was appointed in the year 1984 headed by Dr. A.G. Kalawar. As per the recommendations of the Kalawar committee (GoK, 1984) a partial ban on trawling (except *Neendakara* in Kollam district) was implemented by the Government of Kerala in the year 1988 (Balakrishnan, 1988).

The trawling which was introduced in 1988 was partial since it did not include the whole coastal area. The move of the government could not bring the expected results and large concentration of the trawlers on the Neendakara coast of Kollam (where trawl ban was not imposed) during that monsoon created a high pressure on the fishing ground of that coast. This led to the appointment of a new committee under the chairmanship of N. Balakrishnan Nair who proposed a total ban on trawling in any form throughout Kerala in the territorial waters during the monsoon (GoK, 1988). From the year 1989 onwards, a complete trawl ban which was spread over three months in monsoon became a widely accepted management measure in Kerala. In fact trawl ban is the only management measure which had some impact on the depletion of fishes.

Table 3.8
Year-wise Details of the Trawl Ban (1988-2013)

Year	Ban on Trawling from	To	Number of Days	Jurisdiction of Ban
1988	2/7/1988	31/08/88	61	Except Neendakara
1989	2/7/1989	31/08/89	60	Complete
1990	28/06/90	21/07/90	24	Complete
1991	15/07/91	13/08/91	30	Complete
1992	21/06/92	3/8/92	44	Complete
1993	15/06/93	29/07/93	45	Complete
1994	15/06/94	29/06/94	45	Complete
1995	15/06/95	29/07/95	45	Complete
1996	15/06/96	29/07/96	45	Complete
1997	15/06/97	29/07/97	45	Complete
1998	15/06/98	29/07/98	45	Complete
1999	15/06/99	29/07/99	45	Complete
2000	15/06/00	29/07/00	45	Complete
2001	15/06/01	29/07/01	45	Complete
2002	15/06/02	29/07/02	45	Complete
2003	15/06/03	29/07/03	45	Complete
2004	15/06/04	29/07/04	45	Complete
2005	15/06/05	29/07/05	45	Complete
2006	15/06/06	29/07/06	45	Complete
2007	15/06/07	29/07/07	45	Complete
2008	15/06/08	29/07/08	45	Complete
2009	15/06/09	29/07/09	45	Complete
2010	15/06/10	29/07/10	45	Complete
2011	15/06/11	29/07/11	45	Complete
2012	15/06/12	29/07/12	45	Complete
2013	15/06/13	29/07/13	45	Complete

Source: Department of Fisheries, Government of India, 2014

During the trawl ban period "the use of purse seine, ring seine, pelagic trawl and mid-water trawl gear for fishing in the territorial waters of Kerala are prohibited by the Government" (Department of Fisheries, Government of India, 2014). From 1993 onwards the trawl ban period is fixed for 45 days from 15th June to 29th August.

3.6.7 Fourth Phase (1990-2000)

The period of globalization had its effect on the fisheries as well. With regard to the then worldwide situation the fisherfolk were getting exposed to the market powers. In fish production and exports a more extensive scope was opened during this period. Contrasted with the previous decade, mechanization increased rapidly. The number of total crafts operating in Kerala during 1988-89 was 34007 and it has expanded to in 2001-2002 (Balakrishnan, 2000). This sort of increment shows more prominent weight on the angling ground. As a matter of fact, it was absolutely against the Kalawar committee proposal (1985) to decrease the number of crafts on the Kerala coast. The committee set the limit for 24105 crafts of which 20,000 non-mechanized, 2960 mechanized and 1145 motorized crafts.

The 1990's saw new approaches with respect to fisheries. The Government of India declared its “Deep Sea Fishing Policy (DSFP)”in the year 1991 focusing on the misuse in demersal fishery assets by way of innovative techniques and collective endeavours of canoes form abroad. Consequently, permits were issued to “129 foreign deep-sea vessels” to exploit deep sea ocean fishery resources. The aftereffects of this strategy uncovered the reality that exploitation and stagnation took place in marine fishery sector of Indian coast.

3.6.8 Fifth Phase (2000 – 2010)

The opening of the new century offered extraordinary expectations in the field of fisheries. Kerala being one of major maritime states in India with immense potential in marine fish production compared to other coastal states, the expectation was still higher. Tsunami that struck Kerala coast on 26th December 2004 was an extra ordinary occasion which affected the marine life of the State.

The technological advancement that happened in the craft and gear combination along with the infra structural developments in the fisheries sector worked as a catalyst during this period. This decade also recorded significant rise in the volume of fishing vessels in Kerala. According to Marine Fisheries Census 2005, the total number of crafts in operationwas29177 of which 5504 crafts are mechanized and 14151 motorized and the rest non-motorized. Out of the 5504 mechanized crafts 3982 were Trawlers and 428are Gillnetters (Economic Review, 2007).

Various new facilities and advanced technology in fishing and safety at sea was the main feature of this period. State Government provided wireless facility with an intention to improve the efficiency of rescue missions and to increase the profitability of the fisher folk. This technique helped the fishermen to receive predictions on weather from Meteorological Department while fishing at sea. This project connects all the coastal areas from Ernakulam to Kasaragod under one network (GoK, 2002). This is true that the last decade witnessed with the introduction of new innovation such as “GPS and echo sounder” on a larger measure throughout Kerala. The use of mobile phones and modern devices help them to reduce the risk at sea.

During the fifth phase there is a huge leap in the fish landings on an average. Although there are fluctuations and negative growth rate in some years, the production has grown from 651 million tons in 2000 to 698 in 2010. It is noteworthy here that the inland fish landings showed a tremendous growth during this period from 85.23 million in 2000 to 128 million tons in 2010 (Economic review, 2010).

Table 3.9
Total Fish Production in Kerala from 2000-2001 to 2009-2010

Year	Marine	Inland	Total	% change
2000-2001	566.57	85.23	651.81	0
2001-2002	593.78	78.04	671.82	2.98
2002-2003	603.29	75.04	678.32	0.96
2003-2004	608.52	76.18	684.7	0.93
2004-2005	601.86	76.45	678.31	-0.94
2005-2006	558.91	77.98	636.89	-6.5
2006-2007	598.06	79.57	677.63	6.01
2007-2008	586.29	81.04	667.33	-1.54
2008-2009	583.15	102.84	685.99	2.72
2009-2010	570.01	128.84	698.86	1.84

Source: Handbook of Fisheries Statistics, 2010

3.7 Organizations and Agencies in the Fisheries Sector of Kerala

The marine fisheries sector has an important part in the economic sphere of Kerala by inducing revenue as well as livelihood for the people. However, the social, economic and livelihood conditions of the fishing communities in Kerala are deplorable when correlated to the general section of the population of the same state. For the development and welfare of the fishermen, the following agencies were initiated (Kurien, 1984):-

3.7.1 Kerala Fishermen’s Welfare Fund Board (KFWFB)

KFWFB or Kerala's Fishermen Welfare Fund Board is a mandatory body which was instituted by the Government of Kerala in 1958. The board was constituted to look after the welfare of the Fishermen who are deprived of the livelihood opportunities by way of normal means of living. The Board was entitled to give financial help to the fishermen during trawl ban days.

3.7.2 Kerala State Cooperative Federation for Fisheries Development Limited (Matsyafed)

Kerala State Cooperative Federation for Fisheries Development Limited (Matsyafed) federation of cooperatives comprising 654 cooperatives which were deemed to be primary cooperatives. “Out of these 654 cooperatives, 340 cooperatives are in the marine sector, 184 in the inland sector and 131 women's cooperatives” (Marine Fisheries Statistics, Government of Kerala, 2014).

3.7.3 Schemes of Matsyafed:-

- Beach level auctions
- Service and supplies
- Central sponsored and plan schemes
- Employment generation activities
- Welfare activities
- Integrated Fisheries Development Projects (IFDP)

3.7.4 Agency for Development of Aquaculture, Kerala (ADAK)

The Agency for Development of Aquaculture, Kerala (ADAK) initiated to develop aquaculture in the State in the context of depletion in the marine sector. ADAK is an independent body which oversees the development of aquaculture in the various parts of Kerala by way of subsidies and technical help. The body has been instrumental in developing the integrated aquaculture in the State. (Marcus and Michael, 1986).

3.7.5 Implemented Schemes of ADAK

- P.C.R lab
- Mussel culture
- Sustainable development of shrimp farming

- Combined development of aquaculture in Kuttanad
- Hatchery at Odayam (recommended to build a hatchery with a production capacity of 15 lakhs P.L)

3.7.6 Fisheries Resource Management Society (FIRMA)

"The Fisheries Resource Management Society (FIRMA) was established by the government of Kerala in 1997under the Literacy, Scientific and Charitable Societies Act, 1955" (Marine Fisheries Census, 2005". FIRMA is an independent body for the enhancement of the fisheries sector in Kerala. It reviews and evaluates all the fisheries "development, management and conservation programs". It also builds appropriate contracts with research and development agencies of the nation (Marine Fisheries Census, 2005).

3.7.7 Programs of FIRMA

- Silvo fisheries
- Aquashow
- Development of technoparks for production of ornamental fishes
- Preparation of bibliography for enlisting the endangered species of Kerala
- Preservation project for cold fishes
- Mangroves Project

3.7.8 National Institute of Fisheries Administration and Management (NIFAM)

The National Institute of Fisheries Administration and Management (NIFAM) aims to organize "short term training programs for fisheries officers, fishermen, fish farmers, social workers and even common people" (Das et al, 2005a).

3.7.9 Fish Farmers Development Agency (FFDA)

Fish Farmers Development Agency (FFDA) is a central government scheme which was organized for the development of fisheries sector by way of training and skill development. The agency is also entrusted with the task of developing aquaculture as an alternative employment for fishermen.

3.7.10 Brackish Water Fish Farmers Development Agency (BFFDA)

Brackish Water Fish Farmers Development Agency (BFFDA)are a district-level organization with 50 per cent assistance from the Government of India. BFFDA is registered under the Charitable Societies Act. BFFDA has been set up in Kerala at Kollam, Ernakulam, Alappuzha, Thrissur, Kozhikode and Kannur (Das et al, 2005b).

3.7.11 Harbour Engineering Department (HED)

The Harbour Engineering Department (HED) is a department of services under the Department of Fisheries. It mainly focused on the execution and construction activities for the department construction of fishing harbours, fish landing centres, buildings, ponds and so on.

3.7.12 Marine Enforcement (ME)

Marine Enforcement (ME) is under the direct control of the Superintendent of Police (SP). It is responsible for the implementation of the Marine Fish Regulation Act through five fisheries stations at Kannur, Beypore, Vypin, Neendakara and Vizhinjam.

3.8 Summary of the Chapter

The historical outline of the fisheries sector revealed how fishing evolved from a mere recreational sport to a vibrant economy. The historical evidences portrayed the management regimes which were prevalent in the world and India. The fishery resources being the natural resources had been subjected to over use and depletion since time immemorial. As indications suggested, the inherent mechanisms across the globe played a crucial role in sustaining the fishery resources. The evolutionary growth in fishery witnessed widespread depletion of the major species world-wide. The history of fishing in Kerala is also the history of destruction of fishery resources too. The state witnessed the wave of mechanization sweeping over the coastal districts, resulting in the growth of fish landings. In the process of increasing the profits, Kerala could not sustainably conserve the rich bio-diversity for which the State is known for. The small-scale fishermen who had always been at the receiving end could not with stand the competition from the mechanized counterparts. The historical analysis of the fisheries sector calls for making sustainability the priority of fishery management.

CHAPTER -4

THE FISHERY ECONOMY OF KERALA AND THE TREND OF FISHERY MANAGEMENT PRACTICES

4.1 Introduction

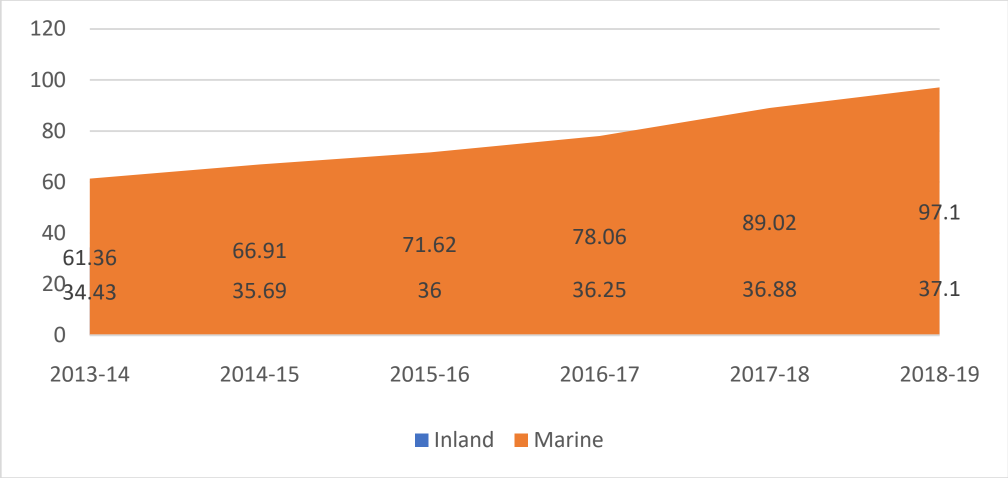
The historical overview of the third chapter explicated the various phases through which the development of fisheries sector happened over the years. This chapter specifically focuses on the trend and growth of fishery management practices which had serious implications regarding the livelihood of the fishermen who are socially and economically backward and also on the sustainable growth of fisheries sector. The Indian subcontinent is known for its rich marine resources. The total fish production in the country for the last six decades (1950 to 2010) showed an average compound growth rate that varied between 4.45 and 5.21 (Handbook on Fisheries Statistics, 2020). The allied activities of the sector contribute livelihood opportunities to another 15-lakh people.

The fishing pressure in Indian seas is on the rise and as a result out of the 47 commercially important fish species have reached critical limits and 55 per cent of them are partially facing depletion. The situation is further worsened by the catching of juveniles and increasing volume of discards due to the presence of heavy trawlers. The catch rates have declined with the number of fishing fleets increasing day by day. The demand for fish products from India has also risen over the years. All these factors have given rise to undue pressure to the sea bed leading to depletion of fishery resources. The livelihood conditions of the traditional fishermen are becoming worse. By traditional fishermen here we mean those fishermen who do not own any fishing vessel and who are heavily dependent for their employment. The fishing fleet and other equipment require huge capital investment. 45 per cent of the active fishermen in India are living below poverty line. The ownership of means of production by the fisher folk declined from 14 per cent in 2014 to 12 per cent in 2016. Another unfortunate fact is that 70 per cent of the earnings from the fishery sector are enjoyed by one third of the fishery population. The tradition and small-scale sector have access only to seven per cent of the common property resources from the sea. (Handbook on Fisheries Statistics, 2020). The allied activities of the sector contribute livelihood opportunities to another 15-lakh people.

4.2 Structure and Trends in Fish Production in India

During the last six years from 2013-2019, both the inland and marine fishery sectors of India have witnessed an upsurge in fish production. The marine fish production in India rose to 7.75 per cent in the span of six years and the inland sector increased by 58.2 per cent. The overall fish production increased by 38.5 per cent in these six years.

Figure 4.1
Inland and Marine Fish Production in India



Source: Handbook on Fisheries Statistics, 2018, Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries, Krishi Bhavan, Government of India.

A thorough study of marine fish production would enable us to ascertain certain facts in fish production from the Indian perspective. A steady increase could be seen in India's share to world fish production. A comparison of fisheries contribution shows the growth in terms of percentage. The contribution of India to world fisheries was 3.83 per cent in 1950 which when compared to 2010 had risen to 5.73 per cent (Handbook on Fisheries Statistics, 2020). This is a healthy indicator as far as the growth in the fisheries sector is concerned. The fisheries growth has been significant when taken as a whole.

Table 4.
Contribution of India to World Fish Production

Year	Inland (%)	Marine (%)	India's share (%)
1950	9.40	3.10	3.83
1960	6.96	2.79	3.27
1970	11.09	1.83	2.69
1980	11.54	2.42	3.40
1990	10.61	2.65	3.89
2000	9.80	2.85	4.45
2010	9.96	3.42	5.73
2020	**10.34**	**4.43**	5.83

Source: Handbook on Fisheries Statistics, 2014, Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries, Krishi Bhavan, Government of India.

The contribution of India to the world fisheries has been remarkable since 1950. In certain periods there are some fluctuations. The percentage of contribution of the marine fisheries shows a decrease till the 1970’s, thereafter a marginal increase can be seen since the 1980’s and in 2010 it got increased to 3.42 per cent. The increase in the fishing effort has contributed significantly to the increase in the fish production. The mechanization of the Indian marine fisheries sector which started off in 1970 was instrumental in the tremendous increase in fish production.

4.3 Trends in Marine Exports

The export revenue from marine resources accounts for eight per cent of the total fish landings of India, making it a significant source of foreign currency revenue. It accounts for about 16 per cent of all agricultural exports. Marine goods, including fish, shellfish, and other marine species, are shipped worldwide. In 2019-20, the export value of goods amounted to ₹46,662.85 crore which is only one per cent of India's total exports (Handbook of Fisheries Statistics, 2020). India exported 12,89,650.90 tonnes of marine products in 2019-20 (Hand Book of Fisheries Statistics, 2020). There was a rise of 60.23 per cent in rupee terms, 5.98 per cent in volume, and a gain of 42.60 per cent in US$ compared to the previous year. The export profits surpassed $5 billion in 2018-19, the most recent year for which data was available. Frozen shrimp which has been the most valuable export of India accounted for 64.1 per cent of export revenue in dollar terms. The sharp rise in the output of shrimp, rise in the productivity of “Black tiger shrimp”, and rise in the price of products such as Cuttlefish, Prawn, and Calamaries have contributed to a substantial export turnover. Frozen finfish, frozen cuttlefish, and other seafood products also brought in foreign exchange to India.

The United States of America was the biggest export market of India in 2019-20 with a total share of 38.37 per cent. China (20.61%) and European Union (13.15%) were the other two countries which contributed to the foreign exchange revenue of India in 2019-20 (Hand Book of Fisheries Statistics, 2020). Exports of shrimp to the U.S. market have increased by 59.63 per cent both in terms of volume and value (US$) during the period 2015 -16 to 2019-20 (Handbook of Fisheries Statistics, 2018).

Table: 4.2
Compound Annual Growth Rate of Exports from 2010-11 to 2019-20

Year	Volume (in Tonnes)	Growth Rate	Value (₹. Crore)	Growth Rate
2010-11	813091		12901.47	
2011-12	862021	6.018	16597.23	28.646
2012-13	928215	7.679	18856.26	13.611
2013-14	983756	5.984	30213.26	60.229
2014-15	1051243	6.860	33441.61	10.685
2015-16	945892	-10.022	30420.83	-9.033
2016-17	1134948	19.987	37870.9	24.490
2017-18	1377244	21.349	45106.89	19.107
2018-19	13,92,558.89	1.112	46,589.37	3.287
2019-20	12,89,650.90	-7.390	46,662.85	0.158
AAGR		5.73		16.80
CAGR		4.72		13.72

Source: Handbook on Fisheries Statistics, 2020 CMFRI

The Compound Annual Growth Rate (CAGR) of the exports of the marine products was examined to analyse the export potential of the marine sector. The table 4.2 provides the volume, value and growth rate of the exports from India from 2010-11 to 2019-20. The growth rate was 6.018 per cent in 2011-12 and it increased to 7.679 in 2011-12. The momentum of the growth could not be maintained in the subsequent year as the growth rate fell from 7.679 to 5.984 in 2013-14. The growth in the exports touched a negative figure in 2015-16 due to global recession and grew up to 19. 987 per cent in the next year. The growth rate further increased to 21. 349 per cent in 2017-18. After the recessionary tendencies the marine exports of India could achieve considerable growth due to favourable trade deals and due to increase in the fish landings. After a booming growth, the exports have again come down to a negative figure i 20l1-20. The recent global crisis of COVID 19 and recessionary tendencies followed thereafter have contributed a lot to this negative growth rate. The Compound Annual Growth Rate of the volume of exports is 4.72 during the period between 210-11 and 2019-20. This growth rate is minimum compared to the growth rate achieved in the previous decades. The value of the exports increased from ₹12901.47 in 2010 11 to ₹46, 662.85 in 2019-20. The Average Annual Growth Rate is 16.80 and the CAGR is 13.72 per cent. The Annual Average Growth Rate and the Compound Annual Growth

Rate showed that the volume of exports and the value of exports have been steady since 2010-11.

Table 4.3

The Volume of Exports and Value of Marine Products from India from 2010- 11 to 2019-20

Year	**Volume (in Tonne**	**Value (Rs. Crore)**
2010-11	813091	12901.47
2011-12	862021	16597.23
2012-13	928215	18856.26
2013-14	983756	30213.26
2014-15	1051243	33441.61
2015-16	945892	30420.83
2016-17	1134948	37870.9
2017-18	1377244	45106.89
2018-19	13,92,558.89	46,589.37
2019-20	12,89,650.90	46,662.85

Source: Handbook of Fisheries Statistics, 2020, CMFRI

4.4 The Growth of Fisheries in Kerala

The State of Kerala is a major maritime State in India which has a coastline stretching 590 kilometres (Economic Review, 2019) Kerala has rich marine resource potential in its 590 km long coastline and it adds significantly to the fish landings and the exports. The continental shelf into which Kerala falls is rich in marine resources. The State has 223 fishing villages and 10.5 lakh people rely upon the marine assets for their livelihood (Economic Review 2019). The unique position enjoyed by Kerala in marine fishery production and other miscellaneous activities reflect the skill and rich resource potential of the state.

4.4.1 Resource Potential

The fishery resources of the marine sector of Kerala fall under three categories, namely, pelagic fishes, demersal fishes and crustacea. Kerala coast is rich in Sardines, oil sardines and mackerels. The ratio of pelagic and demersal fish resources in Kerala is 6: 3. Prawn and squids are the major crustacean species which constitute the remaining 10 per cent (Hand Book of Fisheries Statistics, 2020). The oil sardines are mainly found in the South – West Coast and the region accounts 86 per cent of the resource potential. “White baits and Mackerel” are also found in the region and their share is about 75 per cent. The south-west coast is the abode of 50 per cent of the perches and prawns.

Table 4.4
Quantity and percentage distribution of pelagic and demersal group of fish landings in Kerala

Year	Landings			Percentage		
	Pelagic	Demersal	Total	Pelagic	Demersal	Total
1960-1970	233.75	67.65	301.40	77.55	22.45	100
1970-1980	249.91	130.41	380.31	65.71	34.29	100
1980-1990	238.70	140.00	378.70	63.03	36.97	100
1990-2000	341.82	231.43	573.25	59.63	40.37	100
2000-2010	388.32	260.34	648.66	57.43	42.57	100
2010-2018	403.45	280.67	684.12	55.25	44.75	100

Source: Handbook on Fisheries Statistics 1960-2018, CMFRI

The fish landings of Kerala underwent drastic change ever since the introduction of mechanization. The contribution of pelagic group of fishes came down from 77.55 per cent in 1960-70 to 44.75 per cent in 2010-2018. The reduction in the contribution of pelagic group could be seen in each decade. The contribution was 65.71 per cent in 1970-80 and it further reduced to 63.03 per cent in 1980-90. The demersal group of fishes was 22.45 per cent in 1960-70 and it increased to 34.29 per cent in 1970-80. The last three decades (1990-2000, 2000-2010 and 2010-2018) also witnessed considerable reduction in the growth rate. The growth rate fell from 59.63 per cent in 1990-2000 to 55.25 per cent in 2010-2018. The demersal group of fishes on the other hand recorded substantial increase of 36.97 per cent in 1980-90 to 44. 75 per cent in 2010-2018.

The decline in the contribution of pelagic group of fishes confirmed that there is depletion in the pelagic sector of Kerala. The small-scale fishermen predominantly concentrate in the pelagic waters for their subsistence. The increase in the fishing effort caused serious damage to the pelagic species that the landings from the pelagic waters drastically reduced. The small-scale fishermen cannot explore the demersal waters with the limited technology available to them. As the production from the pelagic waters reduce, the livelihood of the small-scale fishermen gets affected.

4.4.2 Marine Fish Landings

Kerala witnessed an upsurge in fish production in the last four decades. The growth of fish landings of Kerala from mere two lakh tonnes in the early fifties to six lakh tonnes in 2018 is remarkable. The growth had not been steady. There had been times when the State touched a low growth rate. The ups and downs in the growth rate of fish landings reflected the stagnancy in the fish production of Kerala. the period between 1980 and 1990 is a period of recovery due to the implementation of Trawl Ban. Even then, a steady growth rate in fish landings could not be achieved. The analysis of the catch data of Kerala revealed the fact that the growth in the fish production has been steady showing signs of stagnancy. The stagnancy that can be seen in the production can be attributed to over fishing and the increase in the fish effort due to mechanization. Excessive fishing which is the by-product of mechanization has caused heavy depletion in the Kerala marine sector. The resource degradation has affected the livelihood of the small-scale fishermen.

Table 4.5
Marine Fish production of Kerala (1980 – 2018)

Year	Quantity	Year	Quantity	Year	Quantity
1981	274.396	1995	531.646	2009	517.720
1982	325.367	1996	572.005	2010	560.398
1983	385.817	1997	574.774	2011	553.177
1984	394.372	1998	542.696	2012	530.638
1985	325.536	1999	507.287	2013	522.00
1986	382.791	2000	604.113	2014	524.00
1987	303.286	2001	593.783	2015	517.21
1988	468.808	2002	603.286	2016	523.45
1989	647.526	2003	608.525	2017	585.64
1990	662.890	2004	601.863	2018	643.33
1991	564.161	2005	536.215		
1992	560.742	2006	591.902		
1993	574.739	2007	619.255		
1994	540.813	2008	670.095		

Source: Handbook on Fisheries Statistics 1981-2020, CMFRI

4.4.3 Compound Annual Growth Rate of Fish Landings in Kerala

The Compound Annual Growth Rate (CAGR) of fish production of Kerala was estimated to find out the trend in the annual catch during specific decades. The data on fish landings were divided into four periods for the purpose of comparison in each decade.

Table 4.6
Compound Annual Growth Rate of Landings from 1981 to 2018

Decade 1			Decade 3		
Year	Quantity	Growth Rate	Year	Quantity	Growth Rate
1981	274.396	-	2001	593.783	-1.71
1982	325.367	18.58	2002	603.286	1.60
1983	385.817	18.58	2003	608.525	0.87
1984	394.372	2.22	2004	601.863	-1.09
1985	325.536	-17.45	2005	536.215	-10.91
1986	382.791	17.59	2006	591.902	10.39
1987	303.286	-20.77	2007	619.255	4.62
1988	468.808	54.58	2008	670.095	8.21
1989	647.526	38.12	2009	517.72	-22.74
1990	662.89	2.37	2010	560.398	8.24
AAGR		12.65	AAGR		-0.252
CAGR		9.22	CAGR		-0.58
Decade 2			**Decade 4**		
1991	564.161	-14.89	2011	553.177	-1.29
1992	560.742	-0.61	2012	530.638	-4.07
1993	574.739	2.50	2013	522	-1.63
1994	540.813	-5.90	2014	524	0.38
1995	531.646	-1.70	2015	517.21	-1.30
1996	572.005	7.59	2016	523.45	1.21
1997	574.774	0.48	2017	585.64	11.88
1998	542.696	-5.58	2018	643.33	9.85
1999	507.287	-6.52			
2000	604.113	19.09			
AAGR		-0.554	AAGR		1.88
CAGR		0.69	CAGR		1.91
AAGR (37 Years)					**3.26**
CAGR (38 Years)					**2.27**

Source: Computed from the data of CMFRI Handbook 1981-2018, CMFRI

The CAGR of the fish landings was 9.22 per cent in the first decade i.e., 1981-1990. The period is characterised by proliferation of trawlers and the introduction of trawl ban in the State. The Average Annual Growth Rate (AAGR) was 12.65 per cent during the decade from 1981-1990. The CAGR of fish landings declined to 0.69 in the subsequent decade and the AAGR touching -0.554 per cent. The CAGR further declined to -0.58 during the period 2001-2010. The AAGR also declined to -0.252. A revival can be seen in the last decade in the total fish landings. During the period 2010 to 2018 the CAGR is 1.91 and the AAGR is 1.88. The analysis of the data revealed that the growth of fish landings of Kerala had not been steady. Another major observation is that the fishery management practices had not been effective in bringing about sustainability in fishery resources. The fish landings of Kerala achieved a negative growth in the decade after the introduction of trawl ban in the State.

Table 4.7
ANOVA of CAGR and AAGR

	Decade	N	Mean	Std. Deviation	Std. Error	ANOVA*
Production	1.00	9	432.9326	135.25503	45.08501	F (3,33) =7.853 P=0.000
	2.00	10	557.2976	27.32642	8.64137	
	3.00	10	590.3042	43.38714	13.72022	
	4.00	8	549.9306	44.08713	15.58716	
	Total	37	534.3745	93.49775	15.37094	
Growth Rate	1.00	9	12.6467	24.33862	8.11287	F (3,33) =1.784 P=0.169
	2.00	10	-.5540	9.18258	2.90379	
	3.00	10	-.2520	10.04173	3.17548	
	4.00	8	1.8788	5.78303	2.04461	
	Total	37	3.2646	14.64062	2.40690	

Source: Computed from the data of CMFRI Handbook 1981-2018, CMFRI

A real growth can be seen only in the first decade. There were also huge investments in craft and gear combination. The advancement in the fishing gear and engine which resulted in widespread mechanization led to higher yields from the sea. The compound annual growth rate declined in the consecutive decades drastically owing to overfishing, juvenile fishing and due to climatic factors. Along with trawl ban the other fishery management techniques such as mesh size regulation, earmarking of Marine Protected Areas (MPAs), regulation of engine power, nautical mile regulation for specific craft and gear combination were not met. The ultimate impact of the faulty fishery management system was fishery resource degradation.

4.4.4 Fishery Management Practices and the Growth in Fish Production

There fish production in the State increased drastically due to the mechanization. The immediate outcome of the mechanization was over fishing leading to depletion of fishery resources. The proliferation of the mechanized trawlers affected the catches of the small- scale fishermen and their income. The small-scale fishermen responded to the mechanization by motorizing the indigenous boats and canoes. The motorization of indigenous crafts increased their catches but not as big as their mechanized counterparts. The collective mechanization in the small-scale as well as the mechanized sector caused excessive fishing and illegal fishing. It was at this juncture that the Government of India initiated fishery management practices to control the excessive fishing in the coastal sector. The Marine Fishing Regulation Acts of 1981 was the first attempt in this regard followed by mesh size regulations, Marine Protected Areas (MPAs), gear specifications and engine power regulations.

4.4.5 ARIMA Model

An “Autoregressive Integrated Moving Average (ARIMA) model” is tool used to analyse the trend in a time series data and also to forecast the future trends. This is done by generalizing “an autoregressive moving average (ARMA) model”. The trends in the data are computed to assess the growth pattern as well potential growth pattern. ARIMA model is used when the data shows “non-stationarity”. If the data has non-stationary, the results cannot be significant. The non-stationarity can be removed by the method of differencing.

Table: 4.8

Model Description

			Model Type
Model ID	Quantity (lakh tonnes)	Model_1	ARIMA(0,1,1)

Model Fit

Fit Statistic	Mean	SE	Minimum	Maximum	Percentile						
					5	10	25	50	75	90	95
Stationary R-squared	.000	.	.000	.000	.000	.000	.000	.000	.000	.000	.000
R-squared	.490	.	.490	.490	.490	.490	.490	.490	.490	.490	.490
RMSE	66.208	.	66.208	66.208	66.208	66.208	66.208	66.208	66.208	66.208	66.208
MAPE	9.350	.	9.350	9.350	9.350	9.350	9.350	9.350	9.350	9.350	9.350
MaxAPE	33.776	.	33.776	33.776	33.776	33.776	33.776	33.776	33.776	33.776	33.776
MAE	46.614	.	46.614	46.614	46.614	46.614	46.614	46.614	46.614	46.614	46.614
MaxAE	177.331	.	177.331	177.331	177.331	177.331	177.331	177.331	177.331	177.331	177.331
Normalized BIC	8.573	.	8.573	8.573	8.573	8.573	8.573	8.573	8.573	8.573	8.573

Model Statistics

Model	Number of Predictors	Model Fit statistics			Ljung-Box Q(18)			Number of Outliers
		Stationary R-squared	R-squared	RMSE	Statistics	DF	Sig.	
Quantity (lakh tonnes)-Model_1	0	.000	.490	66.208	24.071	17	.118	0

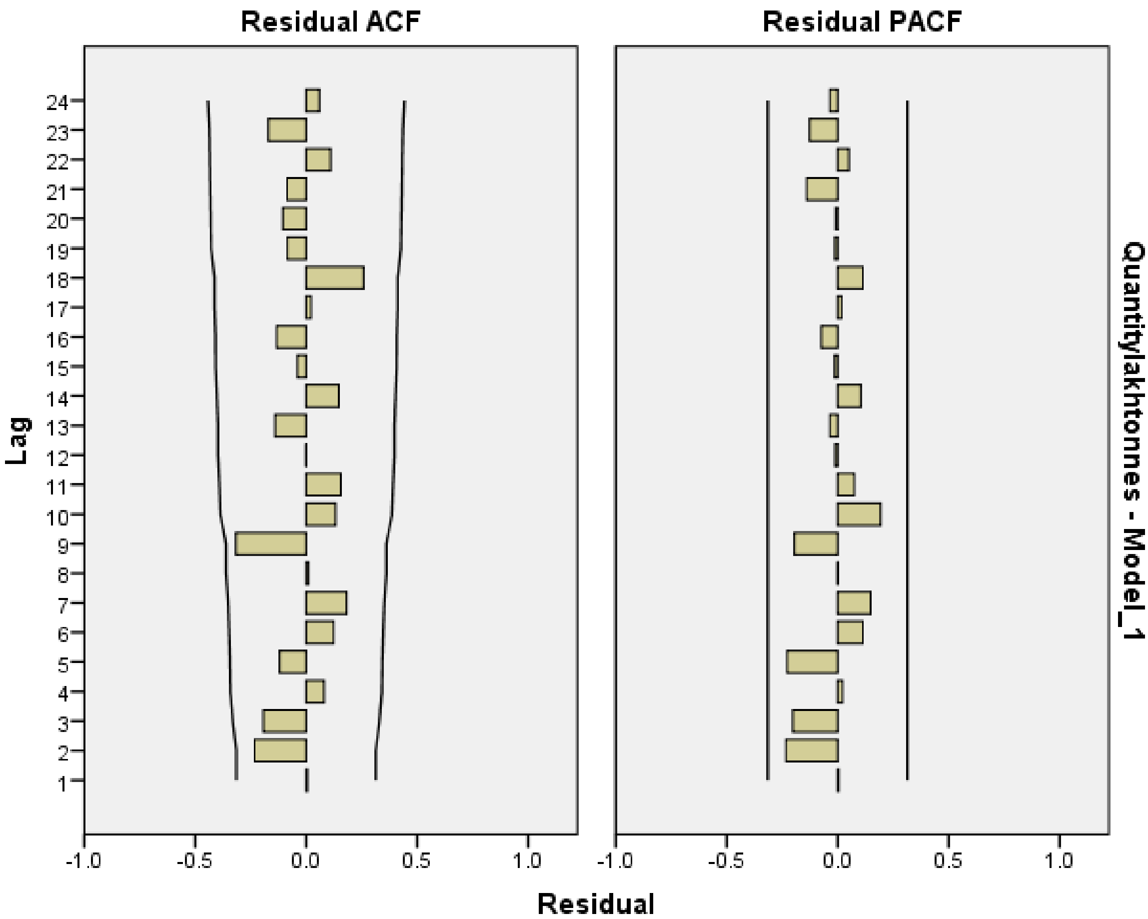
ARIMA Model Parameters

					Estimate	SE	T	Sig.
Quantity (lakh tonnes)-Model_1	Quantity (lakh tonnes)	No Transformation	Constant		5.178	10.360	.500	.620
			Difference		1			
			MA	Lag 1	.024	.168	.143	.887

Source: Computed from the data of CMFRI Handbook 1981-2018, CMFRI

Figure 4.2

Autocorrelation



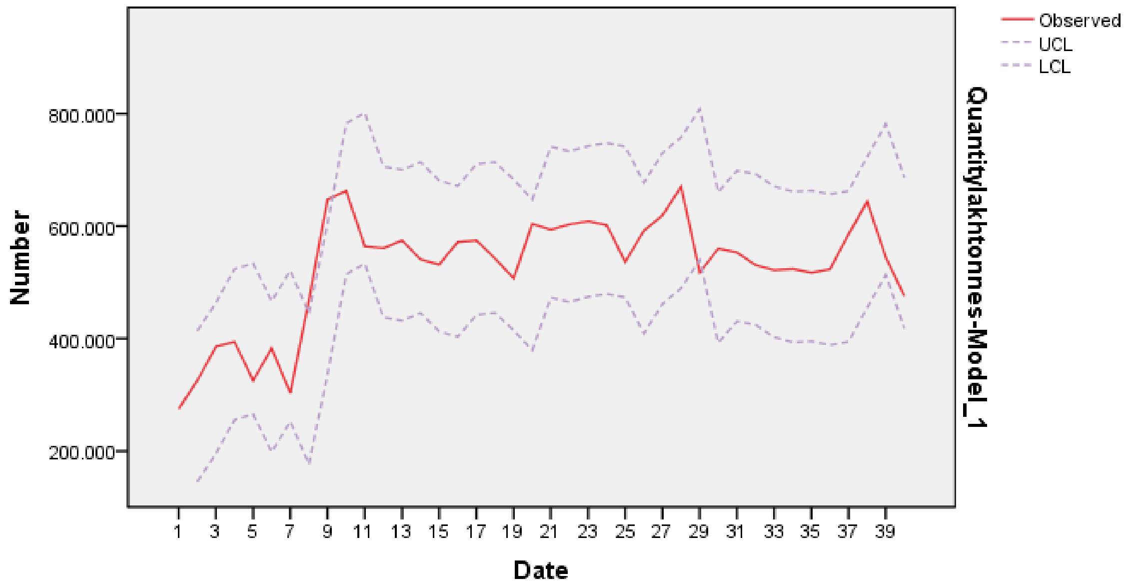
Source: Computed from the Data of CMFRI

The analysis of the data in ARIMA model has to be done with Auto Correlation. In Auto Correlation, the lagged values are taken into consideration in order to find out the growth` pattern in a time series data. The presence of trend in the data can be proved by the presence of larger and positive lags. The Auto-Correlation of the data which has a trend will be positive and the lags tend to be smaller compared to the data which is not trended. In seasonal analysis the Auto correlation will be larger.

The logic behind the analysis is to find out the growth rate in seasonal data which may not have a continuous growth as in other data. The presence of lags can be easily found out using the ACF.

Figure 4.3

ARIMA model



Source: Computer from the Data of CMFRI

The ARIMA model is a forecasting tool which analyses the potential growth in “time series data”. The difficulty with “the time series data” of the natural resources is that recurrent growth during the time cannot be guaranteed. The data which is analyzed for the model is from 1981 to 2018. The analysis of the data using the ARIMA model alone cannot bring results as there is stationarity in the model. The P value is greater than 0.05 and the model is not significant. Hence, ARIMA model is used along with the Chow-break test statistic.

Table 4.9

Chow Break Model

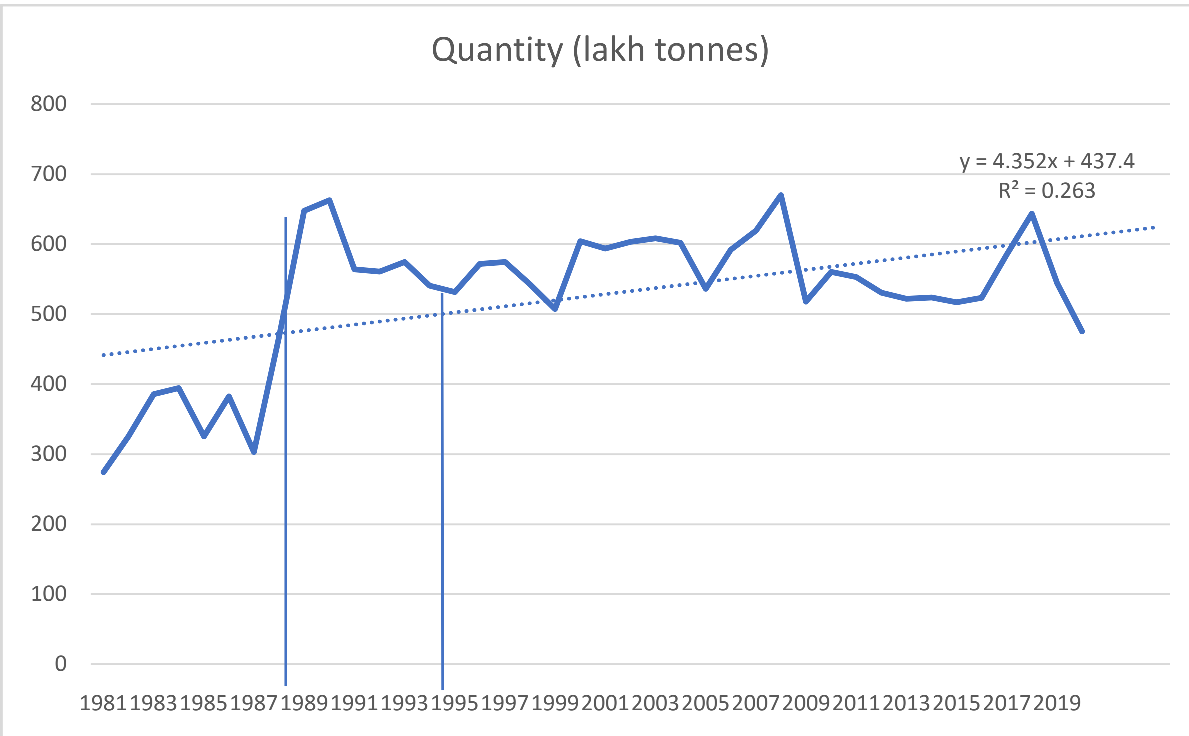
Period 1			**Period 2**			**Period 3**					
Year	Quantity (lakh tonnes)	Growth rate	Year	Quantity (lakh tonnes)	Growth rate	Year	Quantity (lakh tonnes)	Growth rate	Year	Quantity (lakh tonnes)	Growth rate
1981	274.396		1988	468.808	54.57621	1996	572.005	7.59133	2009	517.72	-22.7393
1982	325.367	18.57571	1989	647.526	38.12179	1997	574.774	0.484087	2010	560.398	8.243452
1983	385.817	18.57902	1990	662.89	2.372723	1998	542.696	-5.58098	2011	553.177	-1.28855
1984	394.372	2.217372	1991	564.161	-14.8937	1999	507.287	-6.52465	2012	530.638	-4.07446
1985	325.536	-17.4546	1992	560.742	-0.60603	2000	604.113	19.08703	2013	522	-1.62785
1986	382.791	17.58792	1993	574.739	2.496157	2001	593.783	-1.70994	2014	524	0.383142
1987	303.286	-20.7698	1994	540.813	-5.90285	2002	603.286	1.600416	2015	517.21	-1.2958
			1995	531.646	-1.69504	2003	608.525	0.868411	2016	523.45	1.206473
						2004	601.863	-1.09478	2017	585.64	11.88079
						2005	536.215	-10.9075	2018	643.54	9.88662
						2006	591.902	10.3852	2019	544.45	-15.3976
						2007	619.255	4.621204	2020	475.56	-12.6531
						2008	670.095	8.209865			
AAGR		**3.12**	**AAGR**		**9.31**	**AAGR**					**-0.0179**
CAGR		**1.44**	**CAGR**		**1.58**	**CAGR**					**-0.74**

Source: Handbook on Fisheries Statistics 1981-2018 (compiled)

A Chow test is a tool which is used to analyse the coefficients of the two regression models with different data pattern are equal. The Chow break analysis is done to check whether there is any structural break in the data due to significant interventions. The data set in the present analysis is decadal growth of the fish landings. The decades are compared to find out whether there is any comparative break in any specific period. The regression lines in each decade is computed separately and compared with subsequent decade. The method is helpful in finding out the specific growth patterns in separate data sets.

Figure 4.4

Chow break model of fish landings from 1981 to 2020



Source: Handbook of fishery statistics, 2018-2020

The analysis of the data on fish landings from 1981 to 2020 is done to check whether there is any structural break in the time series data. Trawl ban was officially introduced in Kerala in the year 1988. Trawl ban is taken as representative fishery management practice to check the efficiency of fishery management practices. The Chow Break statistics analysed whether there was any “structural break in the time series data of fish landings” in the context of trawl ban. For the purpose of analysis the data was divided into three periods. Period 1 is the pre- trawl ban period from 1981 to 1987. Period 2 is the trawl ban period from 1988 to 1995. The rest of the data is taken as a whole for comparison. The analysis showed that the structural break happened only during the second period, that is, the ban period. In both the pre-trawl ban period and the post- trawl ban period the fish landings showed stagnancy.

Table 4.9

Chow Break Model

Period	N	Average Production	Std. Deviation	Std. Error
Period 1	7	341.65214	46.444607	17.554411
Period 2	8	568.91563	62.489336	22.093317
Period3	25	564.94328	46.870744	9.374149
Total	40	526.66180	99.165973	15.679517
ANOVA		F (2,37) = 57.790, p= 0.000***		

Source: Computed from the data from Handbook on Fisheries Statistics 1980-2020

The analysis of the fish landings in the three periods was done focusing on the period which followed after the implementation of the trawl ban in Kerala in 1988. Period I is the pre-ban period which was characterized by the implementation of the Kerala Marine Fishing Regulation Act (KMFRA) in 1981. Even though the main objective of the KMFRA was to implement effective curbs in sustaining the resources, there were no effective measures in the initial years of pre-ban period. The ban period, which is Period II in this analysis is the period between the years 1988-1995 (8 years). The Chow Break Model found out a break in the year 1995 after which the fish landings did not show any steady increase. The third period i.e., Period III is taken collectively as post-ban period.

Table 4.10
Chow Break Point Test: Structural Beak in Production (1995)

Chow Breakpoint Test: 1995				
Null Hypothesis: No breaks at specified breakpoints				
Varying regressors: All equation variables				
Equation Sample: 1981 2020				
F-statistic	13.71322		Prob. F(1,38)	0.0007
Log likelihood ratio	12.32509		Prob. Chi-Square(1)	0.0004
Wald Statistic	13.71322		Prob. Chi-Square(1)	0.0002

Source: Computed from the data from Handbook on Fisheries Statistics 1980-2020

The model portrayed that 1995 was a Chow Break Point after which the fish production of Kerala was going down. The trend line which was generated along with the model explained that in “period I and period II”, the rate of growth is unstable. A steady growth was seen in the model during period II.

Table 4.11
Chow Break Point Test: Structural Beak in Production (1988)

Chow Breakpoint Test: 1988				
Null Hypothesis: No breaks at specified breakpoints				
Varying regressors: All equation variables				
Equation Sample: 1981 2020				
F-statistic	118.5437		Prob. F(1,38)	0.0000
Log likelihood ratio	56.62997		Prob. Chi-Square(1)	0.0000
Wald Statistic	118.5437		Prob. Chi-Square(1)	0.0000

Source: Computed from the data from Handbook on Fisheries Statistics 1980-2020

The ANOVA table of 1995 and 1988 was significant as they were less than 0.05. From this analysis it can be concluded that during the representative fishery management practice, trawl ban was effective only till 1995. The fish landings after the ban period showed zig-zag lines for the last 25 years. The effectiveness of trawl ban has to be scientifically studied at this juncture. The present time period for trawl ban is from June to August which was biologically deemed to be the spawning period of fishes. The biological aspects of the spawning period of the major pelagic and demersal need to be scrutinized.

Given the changes in the climate, the disposition of the fish species should also be studied in detail.

4.5 Fishery Management Practices and Resource Degradation

The ineffectiveness of the fishery management practices has to be seen at the backdrop of resource degradation. As the trawlers increased and the population engaging in fishing rose high and the fishery resources started depleting.

The fish production of Kerala had been showing signs of fluctuations since 1981. The introduction of mechanization resulted in an increased rate of growth in fish landings. The fishing industry of Kerala was very soon became export oriented. The fishing effort was increased by the mechanized fishing sector undermining the artisanal counterparts. Kalawar Committee had already raised concerns over the impact of mechanization on the small-scale fishermen. The Report of the Committee stated

"The trend curve for marine fish production by the artisanal fishermen of Kerala indicated steady increase from 1950 to 1968 at the annual rate of 5.5 per cent which was higher than the fishermen growth of 4.73 per cent. For the 1968 – 80 period, however, the production curve has shown a declining trend at an annual rate of 3.34 per cent resulting in very poor household incomes which began to manifest in the form of general social unrest". (Kalawar et al, 1985)

This report has been instrumental in bringing about changes in the fishery management practices in order to sustain the fishery resources. The worsened situation of the resources in the State was explained by the third Balakrishnan Nair Committee Report. The committee unanimously stood for fishery management practices at the wake of illegal ad excessive fishing (Nair 1999).

The resource degradation in Kerala is analyzed by examining the data on the catch of 6 species from both the pelagic and demersal fish species. Oil sardine, other sardine and ribbon fish were selected from the pelagic group and elasmobranches, penaeid prawn and cat fish were chosen from the demersal group.

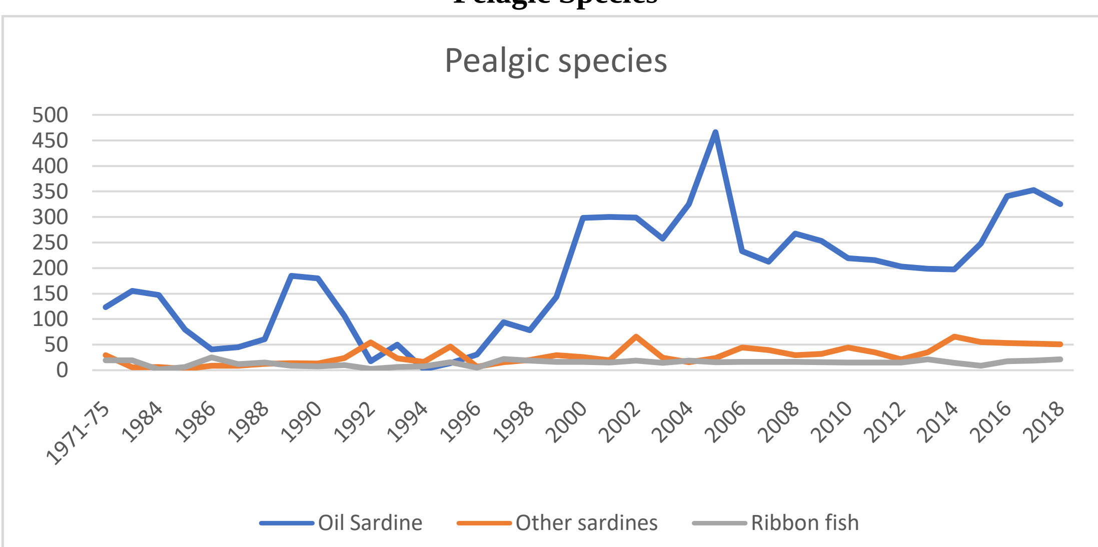
Table 4.12
Year Wise Landings, MSY and Peak Period Landings of Depleting Species (quantity in million tonnes)

Pelagic				Demersal		
	Oil Sardine	Other sardines	Ribbon fish	Elasmobranchs	Catfish	Penaeid Prawn
MSY	111.274	12.637	18.58	7.579	8.817	64.482
1971-75	123.3	29.1	19.2	8.3	22.3	58.8
1983	154.879	5.315	19.4	8.3	15.332	29.754
1984	147.139	6.022	1.112	8.537	11.582	35.529
1985	79.225	2.473	6.464	7.636	5.17	26.684
1986	40.613	8.934	25.142	5.972	8.594	37.188
1987	44.717	8.697	11.88	6.034	4.66	52.866
1988	60.508	12.701	15.295	4.473	9.96	67.494
1989	184.879	13.752	8.952	6.761	4.097	53.317
1990	179.276	12.9	7.179	4.68	2.739	45.483
1991	106.263	23.73	9.751	6.968	1.744	60.318
1992	16.967	54.118	2.167	3.441	1.029	51.067
1993	49.675	22.819	6.162	3.323	0.597	47.988
1994	1.554	16.482	7.29	4.432	0.499	71.871
1995	13.328	46.131	15.435	5.887	0.308	43.224
1996	30.607	6.737	4.641	4.109	0.39	46.143
1997	93.636	15.573	21.884	4.422	0.192	56.131
1998	77.795	19.889	18.976	3.915	0.213	58.523
1999	143.152	29.09	16.579	4.11	0.248	54.876
2000	298.12	25.432	16.54	3.21	0.346	56.548
2001	300.15	19.223	15.234	4.555	1.89	65.412
2002	298.678	65.431	18.768	3.221	0.65	56.890
2003	257.18	23.987	14.235	5.998	0.76	54.321
2004	325	15.778	18.90	4.431	0.75	57.098
2005	466	23.875	15.679	3.160	1.67	49.743
2006	233	44.123	16.329	3.252	1.76	52.008
2007	212	38.961	16.156	3.225	1.72	51.405
2008	267	29.076	16.118	3.208	1.71	51.082
2009	253	31.654	15.487	3.066	1.69	50.105
2010	218.848	44.543	15.196	3.001	1.67	49.348
2011	215.433	34.876	15.175	2.906	1.81	48.623
2012	202.815	21.367	14.776	2.884	1.79	46.256
2013	198.364	34.890	21.443	2.873	1.68	43.642
2014	196.944	65.32	14.585	4.888	1.472	57.390
2015	248	54.678	8.465	4.235	1.34	45.679
2016	340.73	52.987	17.564	3.456	1.23	54.321
2017	352.83	51.987	18.654	4.421	1.98	52.398
2018	325	50.654	21.342	3.160	1.87	57.431

Source: Handbook on Fisheries Statistics, CMFRI, 1951-2020

The total fish landings of Kerala have grown considerably since 1975 after the mechanization was ushered in by the Indo-Norwegian Project. The growth of the individual species had to be analyzed in order to examine the resource degradation in Kerala. the Maximum Sustainable Yield (MSY) of the 6 fish species was collected from the secondary sources of Central Marine Fisheries Institute, Kochi. The data pertaining to the initial mechanization period, namely, the period between 1971 and 1975 was obtained for comparing the individual growth rate in selected species. The secondary data from 1983 to 2018 was collected and analyzed for examining the growth rate in resources. Oil sardines, other sardines and Ribbon fish were the species selected from the pelagic group of fishes. Elasmobranches, catfish and penaeid prawns were selected from the demersal group. The primary observation which could be drawn from the table is that the six species could not restore the initial mechanization level , ie, 1971-75 level. Moreover, except oil Sardine, the other five species could not maintain their Maximum Sustainable Level after 1975. The period between 1983 and 1997 are crucial in this analysis as fishery management practices such as Trawl Ba, Mesh size Regulations, and CRZ I was initiated in this decade. The effect of implementation could not be seen in the resource growth. After 2010, all six species have shown tendencies of depletion. The extend of depletion was less in the case of Oil Sardines as well as Penaeid Prawns.

Figure 4.5
Pelagic Species



Source: Handbook of fishery Statistics, 2018 and 2020

The MSY level of each species is helpful in analyzing the extend of depletion. The period 1971-75 is the period of the introduction of mechanization in Kerala. A comparison of the data of 1971-75 with other years can explain the extend of depletion as a result of the increase in the catch per unit effort.

4.6 Extent of Depletion of Important Species

In this section, the degradation in the resource was examined by comparing two time periods with the initial mechanization period. The initial mechanization period was 1971-1975. This is the period in which the mechanization was introduced in Kerala. 1976 to 1987 was selected as the Period I and 1988 to 1999 was selected as the period II. The period I was the period after the mechanization was introduced in Kerala. Period II was the period of Trawl Ban or fishery management period. Both these periods were compared with the initial mechanization period of 1971-75. The mean, the upper and lower bound of confidence intervals of depletion ratio was compared and computed. The fish species which obtained a negative value in the lower bound and positive value in other coefficients were considered to be species with moderate depletion. The species with all positive values were considered to be the species with heavy depletion. Oil Sardine in the first period and Penaeid Prawn in the second interval showed moderate depletion. All the species in all other periods are showing the status of heavy depletion in these decades.

Table 4.13
Depletion Status of Important Species on the Basis of the Initial Peak Period (1970-75) Landings

Fish	Period	Mean and C. Interval	Remark
Oil Sardine	1976 — 1987	0.1254 (-.0807 0.3316)	Moderate Depletion
	1988-1999	.3331 (0.0224 0.6437)	Heavy Depletion
Other Sardine	1976 — 1987	0.5989 (.4104 .7874)	Heavy depletion
	1988-1999	.3224 (.097 .5452)	Heavy depletion
Ribbon Fish	1976 — 1987	.3307 (.0653 .596)	Heavy depletion
	1988-1999	.4183 (.2118 .6249)	Heavy depletion
Elasmobranches	1976 — 1987	.1937 (.0859 .3015)	Heavy Depletion
	1988-1999	.4386 (.3438 .5334)	Heavy Depletion
Catfish	1976 — 1987	.553 (.4608 .6451)	Heavy Depletion
	1988-1999	.9716 (.8369 .9984)	Heavy Depletion
Penaeid prawn	1976 — 1987	.3759 (.2656 .4862)	Heavy depletion
	1988-1999	.0718 (-.0318 .1767)	Moderate depletion

Source: Computed from the data from Handbook on Fisheries Statistics 1980-2020

The enormous depletion in the marine resources can be attributed to the increase in the fishing effort coupled with illegal fishing. After 1975, Kerala witnessed tremendous increase in the number of fishing vessels. The fishing pressure on the marine habitat has caused much damage to the fish stock. Out of the six species that were analyzed oil sardine is the only species which could withstand the increased fishing effort. These species are the representatives of the fish stock which are heavily depleted in the last three decades

4.7 Summary of the Chapter

This section analyzed the trends in the fishery management practices and the growth in the fishery resources of Kerala. An overview of the trends in marine exports gave a detailed picture of the growth of marine fishing industry in India which has a robust future. The analysis showed that the CAGR of exports for the marine products stands at 11 per cent which brought out the sign of a positive growth. This growth in the exports sector could not be seen in the marine fish landings. There were fluctuations and variability in the CAGR of marine fish landings from 1981 to 2010. The CAGR registered in the 1981 -90 was 2 per cent which showed a slight increase of 3.5 per cent during the subsequent decade 1991-2000. This growth can be attributed to the introduction of fishery management practices especially, trawl ban. The CAGR of the last decade is again 2 per cent which reflected stagnancy in growth. The formal fishery management practices are the tools employed to ensure sustainability in fishery resources. The influence of fishery management practices in maintaining the sustainability of fishery resources was assessed by identifying the extend of depletion in selected species in both pelagic and demersal groups. The assessment reiterated that heavy depletion has occurred in the major species from 1990 onwards. The ARIMA model was employed to check the effect of fishery management practices on the fish landings. The model statistics revealed that the trawl ban did not bring desired results after the year 1995. Thus, the chapter shed light on serious degradation of resources of the marine sector which affected the livelihood of the dependent communities as well as the sustainability.

CHAPTER – 5

THE SOCIO ECONOMIC AND LIVELIHOOD CONDITIONS OF THE SMALL-SCALE FISHERMEN AND THEIR LIVELIHOOD PROBLEMS

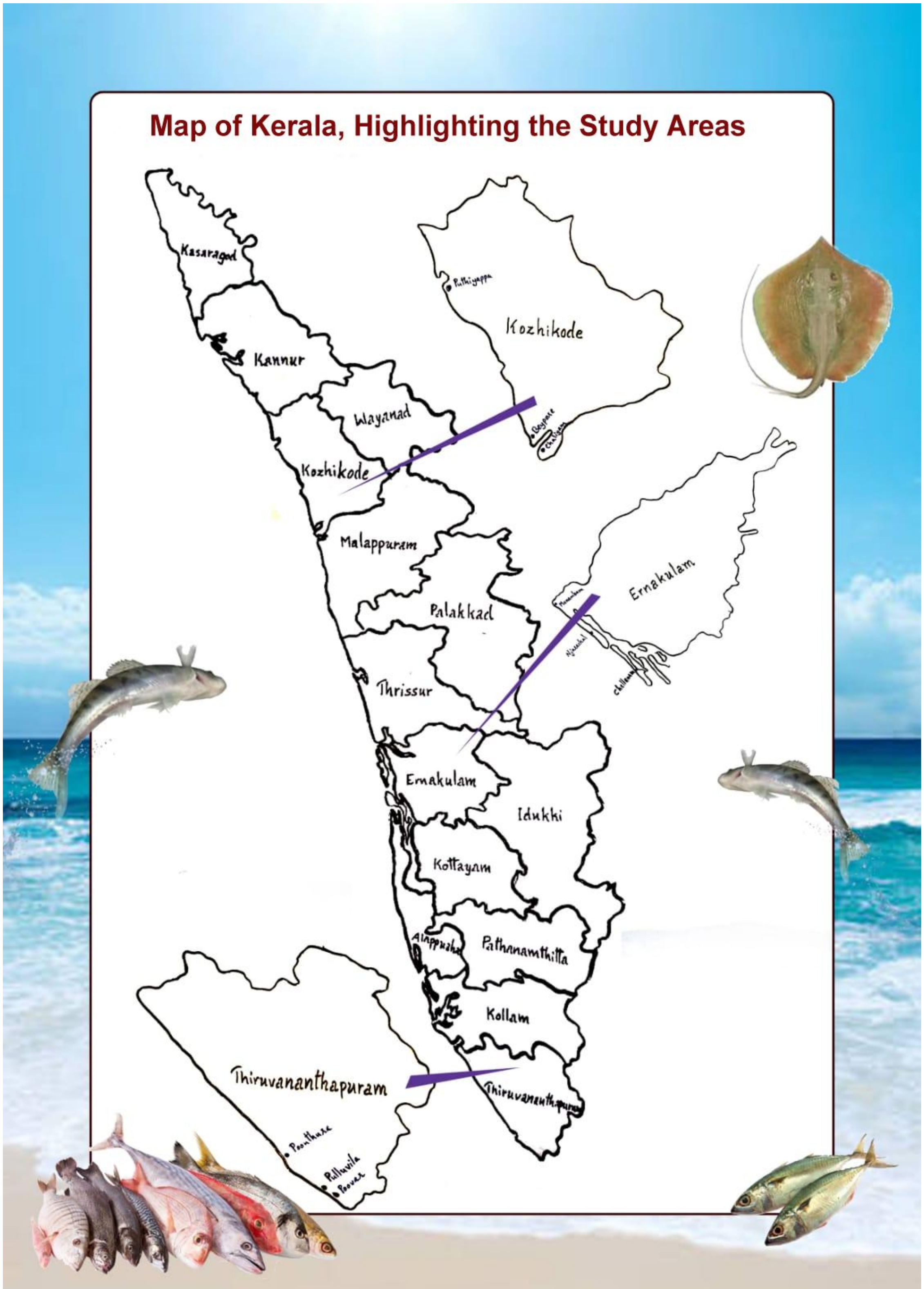
5.1 Introduction

The earlier section explored the trends in the present fishery management practices which detrimentally affected the resource potential and sustainability of the fishery resources in Kerala. This chapter elaborates on the socio- economic conditions and livelihood issues of the small-scale fishermen. As explained in section 1.11 of the research methodology of the study, the analysis is based on primary data collected from three major fishing regions, viz., Thiruvananthapuram, Ernakulam and Kozhikode. From each of these, three fishing villages were selected the primary data were collected from 500 fishermen. The purpose of the survey was to assess the livelihood challenges of the small-scale fishermen of the area of the study. The 'Sustainable Livelihood Approach' (SLA), which is a globally accepted model for livelihood analysis is taken for the elaboration of the results of the survey. The SLA model presupposes the ability of the poor people to access the assets. The non-accessibility to the assets makes the poor vulnerable to overcome the challenges of livelihood. Thus, the assets owned and operated by the households are considered for the analysis.

The State of Kerala is a significant maritime state in India with rich resource potential for marine resources. The State possesses a coastline of 590 kilometres which spreads around nine coastal districts. The frontiers naturally created by Western Ghats and Arabian Sea serves as a protective boundary for the State. The presence of streams, ponds, estuaries and rivers make Kerala fertile and green even in the scorching heat of summer (Economic Review, 2019). The State is known for its rich marine resources- both pelagic and demersal. There are 10.5 lakh active fishermen in the State who are engaged in fishing and allied activities. The coastal region of the state is spread around the nine marine districts namely, Thiruvananthapuram, Kollam, Alappuzha, Ernakulam, Thrissur, Malappuram, Kozhikode, Kannur and Kasargode. The fishery industry of Kerala contributed $1.5 billion to the national exchequer in the fiscal year 2019-20 (Handbook of Fisheries Statistics, 2020).

Figure 5.1

Map of Kerala, Highlighting the Study Areas



5.2. The Profile of the Study Area

The coastal belt of Kerala is spread around the nine coastal districts. The districts of Thiruvananthapuram, Ernakulam and Kozhikode are chosen for the primary data survey. The district of Thiruvananthapuram lies at the southernmost end of the State and Kozhikode is the prominent coastal district of Northern part of Kerala. Ernakulam falls in the central fishing zone of Kerala.

Table 5.1
Fisheries Population of Kerala

District	Population
Thiruvananthapuram	164883
Kollam	123100
Pathanamthitta	2073
Alappuzha	167793
Kottayam	24420
Idukki	691
Ernakulam	133387
Thrissur	90300
Palakkad	2534
Malappuram	82044
Kozhikode	106613
Wayanad	230
Kannur	60208
Kasargod	43342

Source: Economic Survey, 2019

5.2.1 The District of Thiruvananthapuram

Thiruvananthapuram, the capital city of Kerala, has a coastline of 78 kilometres. The district has a population of 1,50,000 fishermen among whom 50 per cent are small-scale fishermen. Poonthura, Poovar and Pulluvila are the major traditional fishing villages chosen for the primary data collection. Poonthura, thickly populated village, lies to the north of the capital city. Its geographical proximity to Thiruvananthapuram makes it easier for the people to switch over to other occupations whenever necessary. Poovar is a fishing village located in the Kerala – Tamil Nadu border. It has two wards predominantly inhabited by the fishermen community. Fisherfolk live in a very narrow strip of land, about one kilo meter along the coastline.

5.2.2 The District of Ernakulam

Ernakulam falls in the middle of the coastal belt of Kerala. The district has 1,12,000 active fishermen (Economic survey, 2018). The region experiences a great divide between the rich and the poor due to rapid industrialization in the urban areas. The 46-kilometer coastline is very rich in both pelagic and demersal fishes. The coastal fishing villages of Chellanam, Munambam and Njarakkal were selected for the primary data collection. Chellanam, towards the western part of the district, has been witnessing heavy sea erosion during the monsoon for a long time. The inhabitants of the village depend primarily on the sea for their livelihood. The mini harbour in the village can cater to around 1000 big canoes at a time. The estuary of Vembanad Lake lies to the east of the village and provides sufficient opportunity to the villagers for fishing during the dry periods at sea. Munambam, a fishing village on the northern side of the Vypin Island, is a landing centre sandwiched between Arabian Sea on the West and river Periyar on the east. It is one of the largest fishing harbours in the district situated 42 kilo meters north of the city of Kochi. Njarakkal, situated 15 kilometers from Kochi, is known for eco-tourism and the inhabitants mainly earn their income by fishing.

5.2.3 The District of Kozhikode

The northern coastal belt of the State is concentrated in Kozhikode. Historically, the port at Kozhikode acted as the gateway to the medieval South Indian coast for the

Arabs, the Portuguese, the Dutch, and finally the British. Beypore, Puthiyappa and Chaliyam were the fishing villages chosen for the primary survey from the district. Beypore, situated 10 kilometers away from Kozhikode city, has one of the biggest fishing harbours in the state. The villagers primarily earn income from fishing. Puthiyappa, situated at the heart of the Kozhikode city, also has a mini harbour which can enable the functioning of 100 – 200 boats at a time. It has easy access to city life. Chaliyam, situated to the west of Beypore, has a large landing centre which can accommodate around 500 boats. The chief occupation of these villages is fishing and allied activities.

Table 5.2
Runs test on the selection of fishermen families

	Number of household earners
Test value	2
Cases <Test value	164
Cases>=test value	336
Total cases	500
Number of runs	234
Z	1.278
P value	0.201

Since the P value is greater than 0.05 the null hypothesis is rejected. Therefore the fishermen in the study area were randomly selected.

Note: ** denotes significant at 1 per cent level

Resource Base and Utilization

The southern part of the coastal area is found to be having a rather rough sea condition. The biodiversity of the sea is also worth mentioning here. The small-scale fishermen are forced to confine themselves to a narrow portion of sea for their fishing which is often lies within the limits of 12 nautical miles. The habitation of the fish species and their movement to the area determine the availability of marine resources. The fishermen in the study area are of the opinion that fishing during monsoon increases the catch rate. The absence of fishing harbours and unfavourable conditions in the sea often prevent them from going for fishing trips during monsoon. The fishermen noted a decline in their yield and earnings in past few years, claiming issues such as an rise in commercial fishing, fishing intrusion, and proliferation of trawlers and so on. The resource potential of the fishermen is not only limited by the availability and productivity but by the competition posed by the mechanized vessels in the chase to exploit more of the limited supply of the marine resources. Profit is the not the only motive behind fishing for the small-scale fishermen. the entire community of the mall-scale fishermen depend on the fishery resources for their sustenance. The small-scale fishermen in the study area share their total earnings

Livelihood Framework for Small-Scale Fishermen

The present section deals with the livelihood challenges of the small-scale fishermen were analysed within an “organizing framework” focusing on socio-demographic issues. In the rural settings of the developing world, the "household" is the biggest component of "production and reproduction", as well as the place where basic choices are taken. Inside the livelihood concept, a "household" has been defined as a space where only a collection of individuals has exceptionally high socio - economic interrelatedness. To be sure, the concept of a "household" as a single entity for making decisions is disputed. Household decision-making, on the other hand, contributes to decisions in investing in the education and healthcare.

In order to survive and prosper, Families adopt a "livelihood plan" that may include a variety of endeavors. Households mobilize their available resources to cope with everyday life. The approach focuses on the capacities of the rural poor. This is because it acknowledges that perhaps the lowest earners have assets in one form or the other.

The analysis of the primary data of the livelihood of the small-scale fishermen disclosed their level of poverty and social marginalization. Access to natural and physical assets, access to education, access to employment opportunities, degree of savings, volume of liabilities, and free movement of labour are all factors that influence opportunities of livelihood. An extensive endeavour is made to analyze these factors in the primary data analysis. Fisheries resources are the natural resources available to the fishermen. There exists the problem of common pool of resources, just as there is with any natural resource. The open access nature of the fishery, make it susceptible to over exploitation. The open access nature of the fisheries permitted an increasing number of people to pursue fishing, resulting in biological exploitation of fish species as well as economic disaster. Management strategies in fisheries have been devised around the world to preserve the long-term viability of fisheries sector. In order to ascertain the degree to which these measures affect the life of the fishermen, the primary survey is used to gauge the level of awareness of various fishery management tactics. Therefore, to acquire a broader view, the challenges that arise as a result of implementing these techniques were also examined. The primary survey, which was done in the three regions of the State, was primarily designed to determine the livelihood challenges of the small-scale fishermen. Five hundred families were interviewed, as it is stated in the methodology. The term 'livelihood' refers to a broader idea that incorporates the overall well-being of an individual both socially and economically. The FAO document of 1974 stated that people who engage in fishery-related activities and their families continue to live on the edge of subsistence and human dignity, with few exceptions (FAO, 1974). In chapter II of the study, section 2.12 of the review of literature has already demonstrated the continuous existence of livelihood issues in the fisheries sector, particularly among small-scale fishermen. Small-scale fishermen in Kerala are among the most vulnerable members of society. The details of the survey are the following

Socio-Economic Conditions of Small-Scale Fishermen

The socio-economic conditions were examined in depth for determining the accessibility of the fishers to natural, physical, social, financial, and physical assets. The socio-economic parameters revealed the potential strengths and disadvantages of the small-scale fishermen. The strategies developed by the household in dealing with the issues of livelihood are of vital importance in the Sustainable Livelihood Approach. Similarly, the primary survey conducted among small-scale fishermen provided us with information about the challenges that the fishermen community, in general, and small-scale fishermen, in particular, face in their daily lives.

5.5.1 Religion and Caste

Kerala is known for its secular identity regardless of the presence of many religions. The social fabric of Kerala is dominated by three major religions: Hinduism, Islam, and Christianity. Kerala is also home to Buddhists, Jains, and Sikhs in addition to the major religions. In spite of their deep sense of ethnicity, the fishermen were dispersed across all regions. Christians make up the majority (47.2%) whereas Hindus and Muslims accounting for the remaining 26.4 per cent respectively. The observation that could be made was that fishing is not exclusive to any particular denomination. Nonetheless, the communities that engage in this occupation are often looked down upon. They are marginalized and have a low profile in mainstream culture. At this juncture it is to be noted that in Kerala, even in this modern era, fishermen and their family are looked down upon by the general society of Kerala. The children of the fishermen in schools and colleges have to experience partiality and teasing from the other communities.

Table 5.3

Religion wise Classification of Fishermen

Religion	Frequency	Percentage
Hindu	132	26.4
Christian	236	47.2
Muslim	132	26.4
Total	500	100.0

Source: Primary data

5.5.2 Age-wise Classification of Fishermen

The active members of the small-scale fishermen belonged to the age group of 50-60 years, which constitute 47.2 per cent. The fishermen who fall under the age group 41-50 years accounted for 34.2 per cent. Only 15.6 per cent of the fishermen were between the age of 30 to 40 years. The age composition of the small-scale fishermen in the study area revealed that the younger generation do not want to pursue the fishing. The small-scale fishermen who were actively involved in fishing belong to the middle age group. The employment opportunities in fishing remained unattractive to the younger generation. Unprecedented irregularities in the fishing industry, as well as a drop in the earnings of the fishermen, have driven the younger generation away from this profession, indicating that job opportunities in the fishing industry are dwindling.

Table 5.4
Age –wise Classification

Age Group	Frequency	Per cent
Up to 40 years	78	15.6
41-50 Years	171	34.2
51-60 years	195	39.0
Above 60 years	56	11.2
Total	500	100.0

Source: Primary data

5.5.3 Size of the Family

The family of the small-scale fishermen were found to be nuclear families. There are five members in 42.4 per cent of the families, four members in 37.4 per cent, and only one member in 2.6 per cent of families. A close relationship between neighbouring families could be observed in three regions. The fishermen families in the study area lived in a cluster adjacent to the sea. The proximity to the sea was beneficial for them to go for fishing. In Thiruvananthapuram and Kozhikode, the clusters of the fishing families form a single group who pursued fishing collectively.

Table 5.5
Size of the family

No. of members	**Frequency**	**Per centage**
1	13	2.6
2	17	3.4
3	71	14.2
4	187	37.4
5	212	42.4
Total	500	100.0

Source: Primary data

5.5.4 Categorization of Fishing Vessels

The main categories of fishing vessels in the study area are traditional crafts, trawlers, and mini trawlers. Traditional crafts, which rely heavily on traditional means of fishing, are gradually shifting to more complex and modern methods of fishing. Traditional fishing methods are those that do not require the use of motorized equipment. Traditional fishing practices are not widely used at present. The non-profitability of conventional techniques is the driving force behind such a change. Mini trawlers were the most profitable and popular fishing category among small-scale fishermen. Mini trawlers were the small fishing boats with a small engine and gear. It had a capacity of accommodating roughly 6 people per trip. The cost of making a mini trawler came up to ₹10 lakhs. The crafts were collectively owned by the small-scale fishermen as they were not able to afford to purchase them single handedly. Trawlers also were preferred by 70 per cent of them in all regions. Trawlers are large boats that are frequently used for midnight fishing. The small-scale fishermen were increasingly benefiting from trawler fishing since it was more profitable. Because of the frequent climate fluctuations, demersal fishing was preferred over pelagic fishing. Since there was no engine attached to conventional fishing methods, they could not enter pelagic waters. Traditional methods were environmental- friendly and long-lasting. Regrettably, the current technology was found to be incapable of supporting conventional procedures. Unsustainable fishing was prevalent because of the presence of trawlers and micro trawlers that clog the oceans. The effective implementation of fishery management practices is the only way to curb the unsustainable practices. The small-scale fishermen abandoned the traditional methods of fishing as they were not income-generating. Moreover, the traditional methods of fishing could not withstand the competition posed by the mechanized trawlers.

Table 5.6
Categorization of Fishing Vessels

Region	Traditional	Trawler	Mini-Trawlers	Total
Kozhikode	11	10	123	144
Ernakulam	52	1	58	111
Trivandrum	36	14	195	245
Total	99	25	376	500

Source: Primary data

5.5.5 Household Earners

The income of the household is essential for overcoming the problems of subsistence. There were two earning members in 44.2 per cent of the households. A single family member made revenue in 32.8 per cent of cases. The families who had five members that work was just 2.6 per cent. This revealed the economic impoverishment that happened among the small-scale fishermen. The number of earning people in a family is an essential aspect in determining the economic possibilities of a household. Around 78 per cent of families in the three regions had only two or three earning members. The wife and children were the primary dependents. The low income of the households affected the educational as well as occupational possibilities of the future generation of the small-scale fishermen. The higher education opportunities require heavy financial investment which the small-scale fishermen cannot afford. As the number of earning members diminishes, so does the quantity of money saved, making it tougher to make both ends meet. The lack of employment diversification in small-scale fishing communities forced the small-scale fishermen to depend solely on fishing.

Table 5.7
Household Earners

No. of household earners	Frequency	Percentage
1	164	32.8
2	221	44.2
3	102	20.4
4	-	-
5	13	2.6
Total	500	100.0

Source: Primary data

5.5.6 Dependents

The primary survey explicated that 59.2 per cent of the families of the small-scale fishermen have two dependents. The families with 3 dependents were 38.8 per cent. There were four dependents in 2 per cent of the families. The wife, children, and parents were the dependents. In 35 per cent of the households, the eldest son was the second-highest earner. Women were not working among the surveyed households except three households. The earning members were under a lot of stress as their day-to-day expenses continued to rise.

Table 5.8
Dependents

No. of dependents	Frequency	Percentage
2	296	59.2
3	194	38.8
4	10	2.0
Total	500	100.0

Source: Primary Data

5.5.7 Ownership of Land

Ownership of land is a significant source of income and provided a sense of security. The small-scale fishermen who owned land was 45.6 per cent. The total land owned by a person is less than 3 cents in all the regions. The fact that 55 per cent of them do not own a piece of land demonstrated that the small-scale fishermen were denied of basic livelihood opportunities. The availability of land for ownership and for other means were limited. Fishermen had access to land that were next to the seaside and, in most cases, they were inherited. These areas were vulnerable to marine erosion and natural disasters. There are landless small- scale fishermen who resided on land that was primarily obtained through illicit means. The livelihood options of the small - scale fishermen were harmed by the scarcity of land available to them.

5.5.8 Mode of Inheritance of Land

In the discussion of natural assets, the manner in which one inherits the land is also important. Inheritance indicates the stability of a household. The inherited land is a strong indication that the forefathers of the small-scale fishermen have set aside something for the next generation. The mode of inheritance was not precisely established in the case of small-scale fishermen. The land, which they possess, was close to the sea which made it more convenient for them to go for fishing. After many decades of battling with successive governments, the government granted inheritance of land to the small-scale fishermen. The land certificates of possession were also not kept in the authorized format. Their extended occupancy of the land was the only legal aid that would assist them in becoming the inheritors of the land. Table 5.9 also clearly demonstrates the purchasing power of the small -scale fishermen. Only 24 of them could afford to buy their own land with their limited resources.

Table 5.9
Mode of Inheritance of Land

	Inherited	Purchased	Granted by Government	Others	Total
Kozhikode	123	6	0	18	144
Ernakulam	67	6	8	25	111
Thiruvananthapuram	194	12	4	37	245
Total	384	24	12	80	500

Source: Primary data

5.5.9 Ownership of House

The importance of housing in society can hardly be overstated. Housing is usually the greatest single item in a home budget, and as a result, it has a significant impact on household spending. However, housing has more than just financial implications. The composition of housing has an impact not just on the lifestyle of the fishermen but also on the overall urban form. As a result, the social organisation of housing, particularly in terms of tenure and dwelling type, can have a substantial impact on society. Housing has significant role in deciding overall quality of life of individuals, and in many southern communities, unequal access to appropriate and affordable housing is a major source of inequality. When evaluating housing inequality, three components of the housing condition can be identified. To begin with, there are issues of housing availability, tenure security, and options of mobility. The physical aspects of housing are another key component of benefit and disadvantage - space, number of rooms, condition of repair, surrounding environment, and so on. Finally, some people could get credit and capital because of their housing condition, while others could not. The land has been inherited by 384 of the 500 households. Their properties are vulnerable to acquisition due to legal issues, future CRZ restrictions, and insufficient documentation. The fact that land value is plummeting along the Kerala coast is making matters worse for them.

The ownership of house was only 50 per cent in districts of Thiruvananthapuram and Kozhikode. In the district of Ernakulum, 40 per cent of the population owned a home. It accounted for 56 per cent of the overall. For three to five years, the small- scale fishermen lived in rented dwellings or *panaya* houses. Even though housing is an essential human requirement, the small-scale fishermen were unable to establish their own houses due to the lower income generated from the occupation of fishing. Rent took up a significant chunk of the meagre income, which is unaffordable due to other necessary expenses. The situation for the third group -those occupying *panaya* house - was substantially worse. A deposit of at least ₹ 1 lakh had to be placed with the house owner which was refundable. Besides this amount, a monthly rent between ₹5000 and ₹10000 had to be paid. The increasing load of expenses which fall upon the fishermen is unimaginable.

Table 5.10
Ownership of House

	Owned	Rented	Others	Total
Kozhikode	54	28	29	111
Ernakulam	72	35	37	144
Thiruvananthapuram	120	60	65	245
Total	246	123	131	500

Source: Primary data

The possession of various assets shows the economic viability of a person in building up a decent livelihood. Compared to other communities, the small-scale fishermen possess fewer assets. In Economics, creation of assets is a kind of saving. It also shows the financial security of a person. Kozhikode region shows a rather high mean score in the possession of assets. Both in Ernakulam and Thiruvananthapuram the asset holding capacity of the fishermen is decreasing day by day.

5.5.10 Ownership of Fishery Assets

Plywood boats, small OBMs and big canoes were the major fishing crafts in the study area. The coastal regions of Thiruvananthapuram were characterized by the presence of *Kattamarams* which is a traditional craft of the small-scale fishermen. They are widely used in the southern part of Kerala. *Kattamarams* are pelagic crafts made out of 4 wooden planks and driven manually by rowing. The mechanization of the fishery sector brought in plywood boats and big canoes which could be propelled by engines. This evolution has left *Kattamarams* out of use in the other two regions except Thiruvananthapuram. *Kattamarams* represented the traditional craft of the small-scale fishery. The fishing crafts were either owned by an individual or a group of individuals depending upon the amount of investment. The more the investment was the more was the possibility of owning the crafts collectively. In the coastal areas of Kozhikode and Ernakulam, the affluent fishermen possessed big canoes or big boats which required an investment of ₹ 70-90 lakhs. A big canoe could accommodate 30-40 people per trip. The plywood boats in the small-scale sector were specifically found in Thiruvananthapuram and Kozhikode. There were attempts among the small-scale fishermen to motorize even the plywood boats. Decked plywood boats and open plywood boats were used in Thiruvananthapuram region. In Ernakulam region, the small-scale fishermen depend on big boats for their occupation. The cost of making these boats comes around ₹ 70-90 lakhs which is unaffordable to the small-scale fishermen. Apart from the big boats, there are small boats which can accommodate around 10 people. The fishermen who use decked plywood boats resort to hook and line where in open plywood boats they use gillnet gears. In Kozhikode too, big canoes and small canoes were present. The fishing methods over the years have not changed significantly in the three regions which were considered in the present study. Nevertheless, innovations in gears and engines could be seen in all the regions.

Fishing vessels, gear, engines, and other equipments are required for fishermen to be productive in their work. A fisherman must invest a minimum of ₹ nine lakhs to own a fishing vessel. Out of 500 fishermen interviewed, 81 have the capacity to possess a craft, 63 have the ability to operate an engine, and 76 have other equipments. Fishermen who do not have these will have to rely on other fishermen who possess this equipment for fishing.

The employment opportunities of the small-scale fishermen get enhanced with the use of craft, engines, and gear. In comparison to Kozhikode and Trivandrum, the Ernakulam region had the least number of craft, gear, and engine. The crafts in Ernakulam are larger in size, necessitating a budget of ₹ 50 lakh. In Kozhikode and Thiruvananthapuram, the crafts are manufactured with less than ₹10 lakh. In spite of the low cost in these regions, the number of people possessing the equipment are few.

Table 5.11
Ownership of Fishing Assets

Fishing Assets	Craft		Engine		Gear		Hook & line		Other equipments		Total
Region	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
Kozhikode	25	122	20	127	24	123	7	140	24	123	144
Ernakulam	18	88	13	93	15	91	8	98	13	93	111
Thiruvanantha puram	38	209	30	217	37	210	10	237	37	210	245
Total	81	419	63	437	76	424	25	475	74	426	500

Source: Primary data

The small-scale fishermen were found to be totally reliant on other fishing crafts for a livelihood. The craft in the Ernakulum region is almost 40 feet long. In the region, a large fishing vessel costs between ₹ 70 and ₹ 80 lakhs. Rather than being owned by a person, such vessels are owned by a group. Joint ownership of big vessels could also be observed in Ernakulum. Except in Beypore harbour, the common fishing vessels in Kozhikode were 22 feet long and cost roughly ₹. 9 lakhs to ₹10 lakhs. The similar situation exists in Thiruvananthapuram. Fishing assets were rarely owned by a single person. For the small-scale fishers, the initial investment appeared to be expensive. Furthermore, the cost of maintenance was also a concern. Ownership of fishing assets is the key factor in overcoming the vulnerabilities of the shortage of the income of the small-scale fishermen.

The reliance of small-scale fishermen on others for employment is one of the key reasons for their low profile and economic well-being.

5.5.11 Ownership of Other Assets

Access to physical or manufactured assets is a critical component of any strategy for increasing livelihood opportunities. The volume of assets and their quality, as previously said, enable small-scale fishermen to overcome the vulnerabilities of livelihood. The listed physical goods represent the basic necessities of the modern period. When all of these amenities are added up, the overall cost will not exceed ₹.5 lakh. The possession of gold, which is not properly disclosed by the members of the household, made significant difference. According to the Sustainable Livelihood Approach, the amount of assets one would have determines one's ability to overcome livelihood vulnerabilities.

Table 5.12
Other Assets

Ownership of assets	Responses	Per cent of cases
	N	
Radio	15	3.0%
TV	485	97%
VCR	9	1.8%
Mixer cum grinder	469	93.8%
Bicycle	68	13.6 %
Motor cycle	332	66.4 %
Car	38	7.6 %
Refrigerator	459	91.8 %
Fan	474	94.8 %
AC	21	4.2 %
Washing Machine	85	17.0 %
Gold	378	75.6 %
Telephone	115	23 %
Mobile Phone	421	84.2 %

Source: Primary data

5.5.12 Size of the House

Every citizen has the right to own a house. The houses of the small-scale fishermen lack basic amenities. On an average, the nuclear family of the present times consists of four members. A decent living requires at least two rooms and a separate kitchen, all of which are unavailable in the houses of the small-scale fishermen. Apart from the kitchen, 50 per cent of the small-scale fishermen in the study region have only one separate room. To put it another way, a typical small-scale fisherman's house has a hall, a kitchen, and a separate room. An important fact which is to be noted here is that the small-scale fishermen live near sea- shore where natural disasters are frequent. The fishermen would have to shift their belongings to the rehabilitation centres during strong monsoons due to high tides and waves. They live in a cramped room with their possessions during the rainy season. Their living conditions are definitely insufficient for a reasonable living, as evidenced by the statistics. The vulnerability of the regions demands adequate housing.

Table 5.13
No. of Separate-rooms (excl. Kitchen)

	No. of Separate-rooms(excl. Kitchen)			Total
	1	2	3	
Kozhikode	49	58	4	111
Ernakulam	61	75	8	144
Thiruvananthapuram	122	118	5	245
Total	232	251	17	500

Source: Primary data

5.5.13 Loans and Borrowings

Financial capital is made up of the available funds and currency equivalents that people employ to realize their livelihood goals. It permits individuals to use a variety of means of subsistence. The two primary areas of financial capital are as follows: a) Stocks that are easily convertible into cash, bank deposits, or cash reserves like jewellery and livestock. These investments have no liabilities and are not reliant on outside parties. b)

Regular cash inflows, such as wages, government transfers, pensions, and remittances that are typically dependent on other people.

The accessibility to financial capital is a prerequisite for secured livelihood for any community. Liability acts contrary to obtaining financial capital and financial assets. The annual income of the small-scale fishermen does not allow them to procure financial assets in great volumes. Liabilities in the form of loans and borrowings prevent them from attaining financial security. Income is the first and foremost determinant in analyzing the financial security of a household. Along with the loans and savings the income of the households is also discussed in this section. The basic macro principle of income-saving relation can be seen among the small-scale fishermen.

The liabilities of the people are reflected in loans and borrowings. In one way or another, small-scale fishermen are susceptible to loans and borrowings. In all three regions, the majority of households have taken out loans ranging from ₹ 80001 to ₹ 1000001 rupees. Fifty per cent of them belonged to this category. ₹ 20000 is the lowest range of liability which could be seen among the small-scale fishermen. The income of the small - scale fishermen are so poor that they have to borrow money to cover his household requirements. The small-scale fishermen encounter problems such as irregular revenue patterns, fewer working days, and an increasing number of "no-catch" days. It's also possible that they have unaccounted smaller loans and borrowings that they were not disclosing. As the pay level of a small- scale fishermen decrease, it's natural for them to resort to loans and borrowings. One of the primary issues with loans and borrowings is that the interest rate swallows up a significant portion of the revenue. Reduced savings will result in a diminishing and uncertain income, as well as debts and liabilities. The small-scale fishermen must minimise debts and borrowings in order to improve their lives and livelihoods.

Table 5.14
Loans and Borrowings

							Total
	Upto20000	20001-40000	40001-60000	60001-80000	80001-100000	Above100000	
Kozhikode	0	14	33	14	73	13	111
Ernakulam	10	21	17	13	40	5	144
Thiruvananthapuram	4	37	51	20	115	20	245
Total	14	72	101	47	228	38	500

Source: Primary data

5.5.14 Source of Credit

The small-scale fishermen depend heavily on money lenders for credit. Local money lenders finance 67.3 per cent of the credit in each of the three regions. One of the most significant disadvantages is that they charge a high rate of interest. The small-scale fishermen find the source appealing because of the easy availability of finance and the lack of documentation. Another significant source of credit is gold loan. Gold loan is attached with high rate of interest. The small-scale fishermen can get financial assistance from government financial firms and banks to buy boats, gear, and engines. However, the number of fishermen who use these services is 17. 4 per cent. The credit facilities of the small- scale fishermen are highly manipulative. They are robbed off their livelihood chances by local credit providers. The refusal of nationalized banks to provide loans is one of the key concerns expressed by the small-scale fishermen. The credit worthiness of the small- scale fishermen is always in jeopardy. The only solution for removing the burden of liabilities is to provide loans for the small-scale fishermen from nationalized banks and government financial institutions at low rate of interest.

Table 5.15
Source of Credit

							Total
	Bank	Govt Financial institutions	Chitties and Kuries	Gold Loan	Money Lenders	Others	
Kozhikode	0	25	0	20	101	1	111
Ernakulam	2	17	6	8	70	3	144
Thiruvananthapuram	0	45	2	32	165	3	245
Total	2	87	8	60	336	7	500

Source: Primary data

5.5.15 Savings

The indebtedness and amount of savings of small-scale fishermen are used to assess their financial security. The entire amount of money saved by small-scale fishermen is less than ₹ one lakh. 450 out of 500 households have less than ₹ 100,000 as savings. The bottom limit is set at ₹. 50,000. This ostensibly refers to the instabilities in their financial structure. The chart shows that the majority of the small -scale fishermen in the study area are likely to have negligible savings, which had a significant impact on their livelihood.

Table 5.16
Savings

			Total
	Up to50000	50001-100000	
Rural	44	127	171
Urban	6	323	329
Total	50	450	500

Source: Primary data

The analysis of the savings in the three regions also portrays a similar picture. Thiruvananthapuram is first on the list, with 228 people saving between ₹ 50,000 to

₹ 100,000, followed by Kozhikode and Ernakulum. The amount of money saved is a key determinant in determining poverty and debt.

5.5.16 Place of Saving

The institution where money is saved has a distinctive character as well. The small-scale fishermen who saved in chits and kuries constitute 46.4 per cent. They create a small savings account (SB A/c) that can be used to save money at any moment. Personal relationships between the operator and the members are also important. KSFE is another source of saving in which 33.6 per cent of the small-scale fishermen save their money. The only thing these two devices have in common is that they both operate for a specific amount of time. Members can borrow money from the chit. The small-scale fishermen prefer short-term savings strategies with little advantages. The money from chits and *kuries* is used for short-term requirements. Banking facility is only used by less than one per cent of the fishermen. A crucial issue is the interest rate. The small-scale fishermen who use the facilities of post office savings are just 10 per cent. The small-scale fishermen were found to be unaware of the advantages of government-owned saving systems. They must be conscientized to seek long term advantages in saving rather than short term advantages in interest rates.

Table 5.17
Place of savings

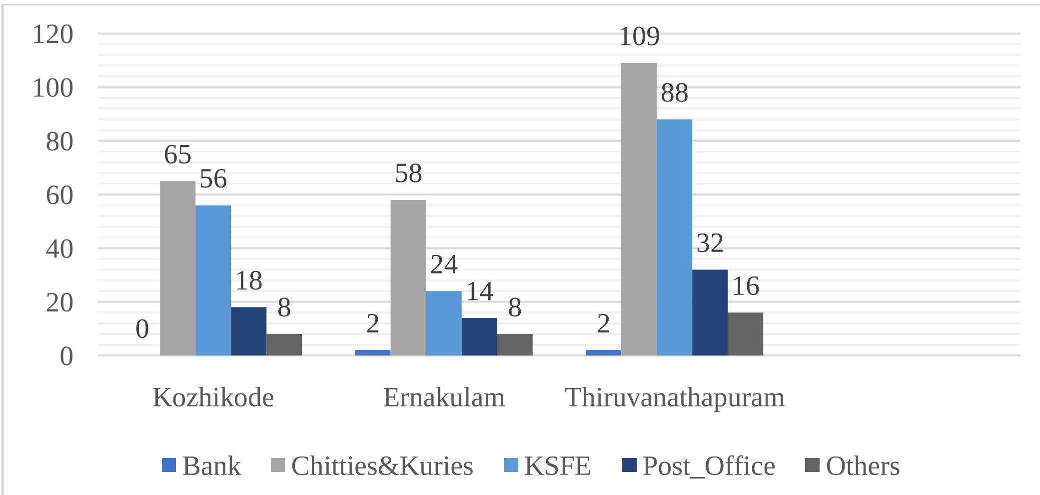
	Bank	Chitties&Kuries	KSFE	Post Office	Others	Total
Rural	4	77	44	40	6	171
Urban	0	155	124	24	26	329
Total	4	232	168	64	32	500

Source: Primary data

5.5.17 Source of Savings

Banks, chits and *kuries*, KSFE and Post Office savings were the main sources of savings. Chits and *kuries* were the most common form of savings in all three regions, followed by KSFE. The fishermen also used the post office and other resources. The nature of savings among small-scale fishermen is clearly reflected by the comparable saving pattern observed in all three areas of study. They are looking for a source of savings that will provide instant rewards rather than long-term returns. Because the amount of savings is limited, small-scale fishermen follow local saving patterns.

Figure 5.2
Source of savings (region-wise)



Source: Primary data

5.5.18 Annual Income of the Household

The small-scale fishermen who earn between ₹. 150,000 to ₹. 200,000 per year are 74.2 per cent. A small-scale fisherman and his family can expect to earn slightly over ₹. 15,000 per month on average. The daily earning is less than 500. Even though there were some inconsistencies and exaggeration, the amount is very small. The small-scale fishermen who earn less than ₹. 100000 is 15.2 per cent. The annual income of the small-scale fishermen reflected the deplorable condition of the community. During the rainy season, fishing days tend to be small. The fact that the small-scale fishermen are unable to go for fishing adds to their anguish. It's also unrealistic to expect a consistent catch every day. Seasonal changes and abnormalities worsened the situation of the small-scale fishermen.

Table 5.18
Annual income

Annual income	Frequency	Percentage
Up to 50000	36	7.2
50000 -100000	17	3.4
100000-150000	76	15.2
150000-200000	371	74.2
Total	500	100.0

Source: Primary data

5.5.19 Investment in Fishing Assets

The investment in fishing equipment by the small-scale fishermen is a significant indication of their growth. The key fishing assets necessary for fishing are the craft, gear, and engine. The larger the craft, the more expensive it is to manufacture. Fishermen in the Ernakulum region typically employ larger boats that need a significant investment. As a result, there are fewer people investing in fishing equipment in Ernakulum. The cost of owning a boat without gear and motor in Thiruvananthapuram and Kozhikode is roughly ₹. 10 lakh. Since a single fisherman cannot afford to pay such a large sum, fishermen combine together to generate funds to invest. As a result, in Thiruvananthapuram and Kozhikode, the number of persons who own craft and gear is larger than that in Ernakulum. The small-scale fishermen who invest in fishing asset is 40 per cent. As a result, when all of the regions are combined, the number of people who own a craft engine and gear is lower. Furthermore, the bulk of those who possess fishing assets have borrowed money to invest the money. As stated in section 5.5.13, the loans and borrowings of the small-scale fishermen are primarily from money lenders that demand a higher rate of interest. For the small-scale fishermen, owning a fishing asset is thus a herculean task. The biggest benefit of owning fishing equipment is that the income increases considerably. The reliance of the small-scale fishermen on the other fishermen comes down as they own fishing equipment. Regardless of the size of the catch, the local custom mandates a bigger share for the asset owner. There are some drawbacks to it as well. Maintenance of the assets is expensive during the off-season. On a non-catch day, the owner is responsible for the costs of maintaining the assets. Those who hold the assets believe that owning them is hazardous and expensive. This, they claim, is the reason why people are hesitant to invest in fishing vessels. The pattern has shifted. Outsiders are now significantly investing in the fishing industry. The small-scale fishers are also affected due to this transition.

Table 5.19
Investment on Fishing Assets

Region	Borrowed	Owned	Total
Kozhikode	40	71	111
Ernakulam	88	56	144
Trivandrum	70	175	245
Total	147	353	500

Source: Primary data

5.5.20 Educational Qualification

Human capital is defined in the Livelihoods Framework as the expertise, abilities, and capabilities that collectively allow individuals to explore various adaptation strategies and attain their living goals. Human capital varies at the community level depending on factors such as the size, skill level, and financial security of the household. If there are any alterations, it is important to consider them alongside the other assets rather than in isolation. The investment in human capital is the basic requirement of development in the communities. The human capital and development are positively correlated. The educational profile, the occupational structure and the mobility of the labour in pursuing other employment opportunities are the key variables that were observed in the study

The majority of the heads of households (52.6%) are illiterate. 41.8 per cent of the members of the household did not even pass matriculation. The heads of the household who are graduate are 0.07 which was negligible. The overall level of illiteracy among the small-scale fishermen is 52.6 per cent which is much lower than the State average. Ernakulam and Kozhikode registered illiteracy of 25 per cent each whereas in

Thiruvananthapuram the rate of illiteracy is 64.5 per cent. The regional differences in educational qualification is the reason for low level of literacy rate among the small-scale fishermen.

Table 5.20
Educational Qualification

Region	Illiterate	Under Matriculate	Graduate	Total
Kozhikode	28	78	5	111
Ernakulam	36	83	25	144
TVM	157	68	20	245
Total	260	209	31	500

Source: Primary data

5.5.21 Educational Profile of the Children

The children of fishermen did not appear to have made advancement in their education. 71. 4 per cent of the children of the small -scale fishermen in three regions, only completed only plus two. The children who completed graduation was 18 per cent and those who completed post -graduation was 11 per cent. The primary survey revealed that the prospects of higher education could not be achieved by many children due to lack of financial aid and proper motivation. The facilities for higher education are few in the coastal areas which affect the career of the children of the small - scale fishermen. Education and health suffer as a result of the loss of livelihood prospects. The cost of schooling having increased in the recent years and the children of the small-scale fishermen who struggle to make ends meet cannot afford to go beyond secondary school. The vicious spiral of poverty and backwardness is perpetuated as a result of the low educational profile of the children. From an analysis of the educational profile of the heads of the household, it is learnt that the majority fall into the category of illiterate. A change can happen only through education - that too, of the younger generation.

Table 5.21
Educational Profile of the Members of the Household

	Upto12th	Graduation	Post-Graduation	Total
Kozhikode	78	20	13	111
Ernakulam	90	34	20	144
Thiruvananthapuram	189	36	20	245
	357	90	53	500

Source: Primary data

From the analysis it is vivid that the educational profile of the fishermen households is low. The children of the small-scale fishermen lagged behind in utilizing the opportunities of education. Children in fishing communities begin assisting their parents at a young age. Naturally, this makes it difficult for them to attend class. Given that these communities have been engaged in this occupation for many generations, there may be some cultural characteristics that allow them to succeed in this profession while also making it more difficult for them to switch to other occupations.

5.5.22 Occupational Structure

The occupational status of the children is cross tabulated based on rural and urban areas. The question as to whether the younger generation likes to pursue fishing as a career was constantly asked in the present study. In table 5.9, 95 of them from all regions have chosen fishing. In comparison to other professions, this is quite low. The educational prospects of the youngsters in the fishing community were limited. This had an impact on their ability to explore better job possibilities. The employment opportunities in the private firms were found to be feasible for the children of the small-scale fishermen. The younger generation who sought job in government circles were limited to 15. The examination of these figures suggested that the predicament of the small - scale fishermen had already been worsened. The development of a community is largely determined by the development of its younger generation. The placement of the members of the fishermen community clearly depicted the community's marginalization in all circles.

A particular stickiness and slow mobility in this career are the combined outcome of low achievement in education and the intricacies of fishery-related abilities.

Table 5.22
Occupational Status of the Members of the Household

	Fishing	Private firm	Govt. Job	Self Employed	Others	Total
Rural	48	80	0	7	36	171
Urban	47	168	15	20	79	329
Total	95	248	15	27	115	500

Source: Primary data

In all three regions, fishing as a profession was not deemed viable. The younger generation believed that the occupation of their forefathers was insufficient to provide enough livelihood opportunities. Since the educational profile of small-scale fishers is so poor, additional career prospects are limited. In Thiruvananthapuram and Kozhikode fishermen attached an ethnic priority to fishing. In the present times, the younger generation seeks diversified work opportunities which are not available to the children of the small-scale fishermen.

5.5.23 Reasons for Joining Fishing

The small-scale fishermen have not depended on fishing as a source of income on a regular basis. Quite so many small-scale fishermen could not be found choosing fishing due to professional interest. From the primary survey it had been found out that fishing is a job accredited to and followed by a specific group. Sixty per cent of the small-scale fishermen cited traditional reasons for opting for fishing. This profession had been followed by their ancestors and they followed in their paths. 35 per cent of them chose this profession due to unemployment. The individuals who belonged to this category had other employment but had to return owing to loss of job, low salary and job mobility. They chose this because they had no other choice as members of this community. The third classification is similar to the second. Because of their poverty, they were unable to find work and were required to participate in fishing. The lack of access to fresh opportunities is a common feature. The small-scale fishermen community is cut off from the rest of the world. As a result, they were less likely to be exposed to other job opportunities. Poverty and unemployment, which were common in their communities, drove people to continue working in their traditional occupation regardless of their preferences. In this community, employment diversification was limited. Following in the footsteps of predecessors is becoming less common.

Table 5.23
Reasons for Joining Fishing

	Reason for Joining Fishing			Total
	Traditional	Unemployment	Poverty	
Kozhikode	93	50	4	111
Ernakulum	62	34	10	144
Thiruvananthapuram	146	91	10	245
Total	301	175	24	500

Source: Primary data

5.5.24 Participation of Family Members in Fishing

Fishing had always been pursued by communities which had strong sense of ethnicity. It is interesting to note that 371 (74%) of the 500 households do not even have a single family member who joined fishing. To put it another way, their children had not adopted fishing as a profession. In 96 households (19%) two members of the family assist the family in fishing. In the third case, just one family member supported the family leader in fishing in 33 families. This is in stark contrast to previous customs. Fishermen's communities all over the world were defined by strong ethnicity and endogeneity, which may even be shown in their marriages. In Kerala, even though there was no such thing as a distinct ethnic or endogenous culture; rather, the fishing as an occupation was primarily done within familial circles. There have been instances in the history of Kerala when the fishermen community rose up to resist the injustices done against them. During those times, the entire family was engaged in fishing. The occupation is currently undergoing a paradigm shift. The fact that fewer members of the family were assisting the head of the family in fishing suggests that they were no longer reliant on this source of income. The occupation has failed to fulfil the financial needs of the fishermen.

Table 5.24
Participation of Family Members in Fishing

	One	Two	Nobody	Total
Kozhikode	7	28	112	147
Ernakulum	8	20	78	106
Thiruvananthapuram	18	48	181	247
Total	33	96	371	500

Source: Primary data

5.6 Accessibility to Natural Capital

Water, terrain, forestry, the quantity of species diversity, quality of air, corrosion control, and pace of change are all included in the broad idea of "natural capital." Natural capital and the vulnerability context have a very strong link when it comes to the issue of livelihood. The natural capital attains importance in the context of poor and vulnerable communities. These communities depend upon the natural capital for their livelihood. The accumulation of natural capital becomes difficult due to internal as well as external factors. Resource degradation also affects the natural capital. In the context of the study among the small-scale fishermen, the degradation that is experienced in the fish stock disrupt the livelihood of the small-scale fishermen. In this section the accessibility to the natural capital is assessed. The resources from the sea are categorically taken as the natural resources in this context. Fishery resources are found to be common pool resources which are accessible to all. The dilemma that is naturally experienced in the common pool resources can affect habitat of the fishery resources at large. The proliferation of the trawlers, the excessive fishing effort and the illegal and unscientific fishing have resulted in unsustainable use of fishery resources. The fishery management practices were introduced in Kerala just as it was introduced globally. The primary objective of the fishery management practices was to sustainably conserve the fishery resources. Along with this, the States were obliged to take care of the dependent communities who were making a living by way of fishing. This fragment of the analysis investigates the effectiveness of fishery management practices upon the livelihood of the small-scale fishermen.

5.6.1 Awareness on the Reasons for the Depletion of Fish

The depletion of the resources of the sea played a decisive role in the livelihood of the small-scale fishermen. Climate change, overfishing, unsustainable fishing, depletion of mangroves, trawling, and drudging, are the main causes of fish depletion. The outcomes were nearly identical across regions and rural-urban areas. This indicated that the causes of fish depletion are universal across all locales. The explanations given by small-scale fishermen were also frequent in international circles, which is a startling truth. All the coastal districts of Kerala are feeling the effects of changed climatic -conditions. The water level has increased significantly as a result of changing climatic circumstances, resulting in massive waves during the rainy season. In Kerala, the number of cyclones had been on the rise. Changes in climatic circumstances have an impact on regional fish habitat in the sea. Some pelagic fishes have relocated their habitat to demersal seas, which is unusual. Overfishing is a well-known fact among fishermen. Kerala's maritime boundaries are clogged with big trawlers plying deep-sea seas. Unsustainable fishing, such as juvenile fishing and fish discards, adds to the overfishing. The degradation of mangroves also harmed the ecosystem's long-term viability. The proportion of fish in the sea was significantly declining due to the presence of trawlers. The small-scale fishermen are the ones that suffer as a result of fish depletion. As the population of fishes declined over time, the volume of fish available for catching decreases dramatically. The small-scale fishermen did not have the same fishing equipment as large trawlers. As a result, the catch of the small-scale fishermen decreased.

"A one sample t – test" was used for testing whether the population mean is equal to a pre- defined value or sample mean or not. In using't' test it was ensured that the distribution of the data is approximately normal. The't' distribution depends on the sample size. Its parameter is called the degrees of freedom (df) which is equal to n-1 where n is the sample size. In one sample't' test,'t' statistics is computed by the following formula

$$t = \frac{\bar{\bar{x}} - \mu}{S/_{\sqrt{n}}}$$

Hence one sample'tʼ test was used in the study for estimating the level of awareness of the small-scale fishermen on the reasons for the fish depletion in the sea.

'tʼ test for specific value (Average =3) on the statements on awareness about the reasons for the depletion.

Table 5.25
Awareness on the Reasons for the Depletion

Reasons for fish depletion (Statements)	Mean	SD	t value	P value
RFFD1	4.93	0.252	171.433	<0.001
RFFD2	4.54	0.499	69.136	<0.001
RFFD3	2.89	1.699	-1.474	0.141
RFFD4	3.33	1.556	4.770	<0.001
RFFD5	2.99	1.650	-.163	<0.001
RFFD6	3.50	1.620	6.875	0.871
RFFD7	3.16	1.651	2.113	<0.001
RFFD8	1.81	1.023	-26.099	<0.05
RFFD9	1.47	1.102	-31.115	<0.001
RFFD10	2.18	0.851	-21.605	<0.001
RFFD11	1.52	0.799	-41.511	<0.001
RFFD12	1.95	0.748	-31.489	<0.001
RFFD13	2.13	1.052	-18.542	<0.001
RFFD14	2.18	1.064	-17.146	<0.001
RFFD15	2.48	1.279	-9.018	<0.001

Source: Primary data

Based on the mean score 8 out of the 15 statements are much below the average level. Hence it can be concluded that the level of awareness of the small-scale fishermen on the reasons for depletion of fish in the sea is much below the average level.

The small-scale fishermen are not responsible for the depletion of the resources of the sea. It is the end result of indiscriminate and illegal fishing practices. All the stake holders related to fishing are in one way or the other responsible for depletion.

Table 5.26
The Reasons for Fish Depletion

	Thiruvananthapuram	Kozhikode	Ernakulam	Total
Climate	4.94	4.95	4.89	4.93
Overfishing	4.57	4.56	4.46	4.54
Unsustainable fishing	4.75	4.74	4.72	4.74
Oil Spillage	3.32	3.19	3.58	3.34
Drudging	3.98	3.89	4.29	4.02
Depletion of Mangroves	4.60	4.61	4.01	4.48
Shrinkage due to Reclamation	4.23	4.20	4.23	4.22
Trawling	4.70	4.67	4.66	4.69
Fertilizers and Pesticides	1.32	1.21	2.15	1.47
Backwater Tourism	2.17	2.19	2.18	2.18
Coconut Husk retting	1.45	1.45	1.75	1.52
Distillery Waste	1.92	1.99	1.94	1.95
Coir Factory	2.14	2.11	2.13	2.13
Excessive weed Growth	2.13	2.12	2.39	2.18
Sand mining from Lakes	2.41	2.46	2.70	2.48

Source: Primary Data

5.6.2 Level of Awareness on Fishery Management Practices

Trawl ban, Marine Protected Areas, Mesh size regulation, Regulation of engines, CRZ are the major fishery management tools applied in Kerala. Trawl ban is the only tool which was familiar to the small-scale fishermen. The reason for its popularity is that there is a fishing ban of 45 days as part of the regulation. The other factors are also important. Unfortunately, the small-scale fishermen were not aware of such measures and do not ensure the implementation of such measures in the governmental level. This leads to the depletion of the fishes. The decreasing level of fish population in the sea ultimately affects the employment scenario of the small-scale fishermen.

Table 5.27

Level of Awareness on Fishery Management Practices

	Trawl ban	Marine Protected Areas	Mesh Size Regulation	HP regulation of engine	CRZ
Mean	5.00	4.65	4.41	4.32	4.28
N	5.00	5.00	5.00	5.00	5.00
Std. Deviation	3.932	0.537	0.571	0.707	0.823

Source: Primary data

Techniques for managing fisheries are designed to ensure their long-term sustainability. Because the long-term sustainability of fish resources is critical for the livelihood safety of the small-scale fishermen, their understanding of the issue is thoroughly examined. Trawl bans, Marine Protected Areas, Mesh size regulation, HP regulation of engines, and CRZ are the most common fisheries management strategies now in use by authorities. Each of these techniques is tailored to safeguard the ocean's ecosystem. The first four measures are directly related to techniques of fishing. Trawl bans are the most popular approach for protecting juvenile fish and promoting the survival of marine species. Marine protected areas are places that have been set aside to allow for the ongoing growth of fish. Mesh size limitations are rules in place to protect the lives of juvenile fish. To prevent fishermen from trespassing into deep sea fishing, the engine power of craft is restricted and monitored. All of these techniques are widely utilised around the world. Trawl bans and marine protected areas are two of the most well-known among them. The trawl ban is implemented irrespective of the circumstances. Even though there is disagreement regarding demarcation, maritime protected areas are well-protected. During the off-season, there had been reports of infiltration. In some areas, mesh size restrictions were not followed. In Kerala, there were no effective measures in place to prevent the indiscriminate use of illicit gear. Due to the unfair usage of gears, juvenile fishing was common along the coast of Kerala. Engine regulation was also not well implemented: effective implementation of these measures can assure long-term fishing sustainability. The CRZ is a set of laws that impact small-scale fishermen's housing. The goal of the measure was to keep the ecosystem in good shape. The vast majority of small-scale fishermen are unaware of this measure.

Table 5.28
Level of Awareness on Fishery Management Practices

Region	Trawl Ban	Protected areas	Mesh size regulation	HP regulation of engine	CRZ
Kozhikode	4.84	2.65	1.39	2.28	1.27
Ernakulam	4.92	1.57	1.41	2.36	1.25
Trivandrum	4.88	1.69	1.42	2.33	1.31
Total	4.88	2.65	1.41	2.72	1.58

Source: Primary data

5.6.3 Level of Satisfaction among Fishermen in Fish Trade

The small-scale fishermen were not involved in the fish trade directly. Once the fish had been delivered to the shore, the entire process was taken over by middlemen and huge merchants. Each region was found to be having excessive number of fishing vessels. On a day when there is a large catch, there will be a surplus of fish and the demand for fish will be low. Fishermen were obliged to sell their catch at low prices due to lack of suitable storage facilities. During periods of low demand, the discount rate set by the middlemen was also very high. Regardless of the catch, the expense of a fishing trip remains the same. In short, the hard work of the small-scale fishermen was for naught due to extraneous influences. Therefore, it was quite understandable that the small-scale fishermen's income remained modest. The presence of these external issues affected the satisfaction of the small-scale fishermen in the fish trade and it remained moderate or low in all three regions.

Table 5.29

Problems faced by the Small-Scale Fishermen in Trade

	Thiruvananthapuram	Kozhikode	Ernakulam	Total
Problem of Cooperatives	4.91	4.97	4.25	4.79
Problems with Local Administration	4.04	4.03	4.01	4.03
Conflict with other Fishers	4.71	4.73	4.33	4.63
Problem with tourists and department	1.49	1.42	2.01	1.58
Transportation no good road	4.21	4.15	4.40	4.23
Inadequate transport	4.73	4.70	4.75	4.72
High Cost of Transport	4.38	4.41	4.41	4.39
Middlemen Exploitation	4.34	4.30	4.33	4.32
Price Fluctuation	4.32	4.31	4.34	4.44
Inadequate Demand	4.42	4.39	4.56	4.29
Low cost offered by Buyer	4.28	4.22	4.40	3.76
Delay in Payment	3.77	3.63	4.33	2.77
Poor Fish Quality	2.79	2.63	2.91	4.57
Inadequate Storage Facility	4.68	4.64	4.23	4.21
Curing facility not available	4.21	4.18	4.25	4.21

Source: Primary Data

5.7 Accessibility to Social Capital

Social capital focuses on the social resources that enable people to pursue their livelihoods, such as collaboration and connectivity that boosts interpersonal trust and cooperation. It also covers any involvement with organized organizations and their established systems of guidelines, standards, and penalties. Here the membership in cooperatives and the awareness of the small-scale fishermen about the governmental schemes are discussed. Social capital is necessary for any community to prosper through connecting through the society. The livelihood challenges can be tackled through group formation and through claiming governmental aids.

5.7.1 Level of Awareness on Social Schemes

The small-scale fishermen are unaware of government programmes that are available to them. The fisherman relief fund is the only government scheme that is more popular among them, according to the indices generated from the opinion of the small-scale fishermen. Among the nine available government schemes, the accidental insurance scheme has the lowest index number. Accidents that occur at work are taken very seriously by all other occupational sectors.

Table 5.30

The Level of Awareness on Government Schemes

	Thiruvananthapuram	Kozhikode	Ernakulam	Total
Awareness about accidental Insurance	1.23	1.22	1.37	1.26
Saving cum relief Scheme	2.23	2.24	2.08	2.20
Fishermen Relief Fund	2.76	2.73	2.67	2.73
Grand in aid for Cart	2.30	2.27	2.43	2.32
GIA for Gill nets Boats Tents	2.35	2.36	2.35	2.35
Construction of Community ponds	2.21	2.21	2.14	2.20
Construction of Fish Pond	2.32	2.31	2.24	2.30
Construction of fish landing sheds	2.32	2.31	2.22	2.29
Training to Fish Farmers	2.36	2.35	2.31	2.34

Source: Primary data

The small-scale fishermen, on the other hand, have reaped lower benefits from the insurance plan. During the survey, some of the fishermen pointed out that the programmes were not being implemented properly. The small-scale fishermen who have registered with a neighbouring *Matsyafed* or equivalent governmental agency are entitled to these benefits in principle. The funding granted for the initiatives are sometimes delayed due to bureaucracy and red tape. A common occurrence is a breakdown of communication between officials and fishers. There were instances when money become lapsed in the rarest of circumstances. The small-scale fishermen are unaware that subsidies exist to assist them in maintaining their livelihood options. The small-scale fishermen believe that more plans are needed to assist them in obtaining fishing equipment. There is currently only one scheme that facilitates fishermen in obtaining nets and, occasionally, crafts. Since the creditworthiness of the small-scaler fishermen is so low, banks that lend money are reluctant to lend money to them. Given the nature of employment, the plans designed to create alternative employment are non-operational. The funds allocated to construct fish ponds and landing sheds have failed to stimulate enthusiasm in creating alternative employment. Furthermore, the training programmes for small-scale fishermen are poorly executed. The original goal of the scheme was to maintain ecological balance by training fishermen how to fish sustainably. In short, the inadequacy of the social schemes coupled with non-awareness add misery to the livelihood of the small-scale fishermen. The money spent for these schemes are often wasted.

5.7.2 Role of Cooperatives

Cooperatives have a specific role to play in the sale and demand of fish across the country. The establishment and implementation of services by local fish cooperatives is quite robust. A cooperative can be defined simply as an organization that protects rights of the fishermen. There are significant disparities between cooperatives and official organizations. Cooperatives are legally recognized organizations that exist to benefit fishermen.

Table 5.31

Role of Cooperatives

Place of Residence	To get Government aid	To get better price	To avoid bureaucratic problems	Compulsory	All the above	Total
Kozhikode	40	53	12	4	1	111
Ernakulam	43	61	15	15	10	144
Trivandrum	79	109	31	20	6	245
Total	162	223	58	39	17	500

Source: Primary data

The responses are obtained from the households in order to enquire into the nature of the aid the cooperatives provide, as the cooperatives deal with the livelihood concerns of small-scale fishermen. In rural areas, 13.4 per cent of the households rely on cooperatives for government assistance, while 60.8 per cent join to secure a better price for their catch. Since the membership in cooperatives is voluntary, 12.5 per cent of the small-scale fishers believe that, in addition to receiving government assistance and obtaining a better price, cooperatives assist them in dealing with bureaucratic issues that arise along the route. The results are slightly different in metropolitan areas. Cooperatives are equally crucial for obtaining government assistance as they are for obtaining better prices. The main reason for the disparity is that cooperatives have less clout in delivering government assistance in rural areas. The responsibility of the cooperatives is limited to bargaining better pricing for fishermen. The ability of the traditional cooperatives to influence the governing circle needs to be bolstered. When the data from the study areas were analysed, the cooperatives' contribution appeared to be essential in obtaining better prices. The small-scale fishermen benefit from the aid of the cooperatives in obtaining government funds. In Kozhikode, Ernakulam, and Trivandrum, the percentages are 32, 33, and 32, respectively. This percentage is slightly lower than the percentage of people that get better deals. The key issues of the small-scale fishermen were not successfully addressed by cooperatives.

5.8. Employment Generation by the Fishery Sector

Small-scale fishermen were unable to find sufficient employment possibilities in the fisheries sector as a whole. The possibilities for other individuals were dwindling as well, but the sector does provide a small number of other occupations. The survey results were used to analyse the employment opportunities generated by the sector. Small-scale fishers believed that the sector is incapable of producing sufficient employment possibilities. The establishment of fish stalls, repair and maintenance of fishing equipment, and transportation of fish and other materials are the principal categories of occupation generated in the sector among the various opportunities available to small-scale fishermen.

Table 5.32
Employment Generation by the Fishery Sector

Region	Help generating employment	Own retail and Fish booth	Own Feed mill unit	Ornamental Fish Production	Integrated Fish Farming	Repair maintenance of Fishing inputs	Transportation of Fish
Kozhikode	2.00	4.60	1.56	2.23	3.76	4.48	4.65
Ernakulam	1.96	4.62	2.08	2.31	3.41	4.49	4.45
Trivandrum	2.02	4.64	1.49	2.22	3.72	4.48	4.67
Total	2.00	4.62	1.64	2.24	3.67	4.48	4.62

Source: Primary Data

The survey results were collated after being transformed into indices. Other than fishing, the fishery sector could only generate three opportunities. The ownership of fish booths for the sale of fish, maintenance of fishing inputs and employment opportunities related to transportation of fish were the major employment opportunities generated by the fishery sector other than fishing. These alternatives are activities which depend upon fish landings. The fishermen who pursue these alternatives could not earn income during non-fishing days.

5.8.1 Alternative Employment of Small-Scale Fishermen

The number of people who pursue fishing as a profession is declining day by day. Fishing is a community-based activity in Kerala. 52 per cent of the households cited irregular income source as the reason for not engaging in fishing. This is nearly identical in all three regions. 33 per cent of the small -scale fishermen opt out of fishing as it is labelled as an occupation with low social status. The rest think fishing as a risky activity. Income irregularity is a serious problem that affected the entire spending pattern of the small -scale fishermen. While savings declined, loans and borrowings rise, putting their income stream in jeopardy. This backwardness has had an influence on them in every aspect. They were misunderstood in numerous social groups, which is one of the reasons why people are hesitant to enter this field. There is also a risk element in fishing. When it comes to professions, the younger generation does not see danger as an adventure. Because their profession is endogenous and ethnic, it must be preserved in order to secure the livelihood opportunities of the dependent communities.

Table 5.33
Alternative Employment of Small-Scale Fishermen

Region	Reasons			Total
	Irregular income source	Poor social status	Risky Factor	
Kozhikode	80	51	16	111
Ernakulam	63	34	9	144
Thiruvananthapuram	138	82	27	245
Total	281	167	52	500

Source: Primary data

Fishing as a profession did not provide enough opportunities for the small-scale fishermen to build up their livelihood. The decreasing level of income forced the small-scale fishermen to go after other alternatives to make a living.

5.8.2 Alternative Employment Opportunities

Fishing as a source of income is insufficient to cover the expenditures of the household. Naturally, the fishermen seek alternative employment. During the survey, some of the prospective skill-based jobs in which small-scale fishermen could find work were examined. Every year, the number of fishing days were found to be decreasing. This could be due to unpredictably bad weather or a steady stream of no-catch days. During times of low revenue, fishermen were obliged to seek alternative sources of money in order to survive.

Table 5.34
Alternative Employment Opportunities

	Alternative Employment					
	Agriculture	Aquaculture	Construction	Dairy	Others	Total
Kozhikode	0	2	63	33	49	147
Ernakulam	6	19	41	13	27	106
Thiruvananthapuram	2	8	104	48	85	247
Total	8	29	208	94	161	500

Source: Primary data

Construction field was the obvious and feasible option for small-scale fishermen. Because opportunities are transient, various categories were given a second chance. Agriculture, dairying, and aquaculture ranked third, fourth, and fifth, respectively. The results clearly demonstrated that the most readily available options were daily wage employment. These were also transitory. The small-scale fishermen were unable to commit to any work for the long term due to the instability in the fishing industry. Alternative occupation provided them with almost no advantage. Their existing educational qualifications and skills prevented them from pursuing other professional opportunities. The poor income was due to the low productivity of alternative employment possibilities. The small-scale fishermen's livelihood chances were insecure in any situation.

5.9 Testing of the Hypothesis

Hypothesis 1

H_0: The small-scale fishermen do not have access to natural, physical, financial and social capital for building up their livelihood. *

H_1: The small-scale fishermen have access to natural, physical, financial and social capital for building up their livelihood. *

In order to test the hypothesis, the accessibility of the small-scale fishermen to land, house, fishing assets, household assets and financial resources were analyzed using chi-square test and ANOVA.

5.9.1 Result of the Hypotheses

5.9.1.1 Ownership of Land

The ownership of land reflected the accessibility of the small-scale fishermen to natural capital. The ownership of land of the small-scale fishermen in three districts were analyzed with the aid of ANOVA and chi-square test. The comparisons of the three regions revealed the level of accessibility of the small-scale fishermen to natural capital.

Table 5.35
Region Wise Land Ownership Status

Region		Land Ownership		Total
		Yes	No	
Kozhikode	N	91	53	144
	%	63.2%	36.8%	100.0%
Ernakulam	N	74	37	111
	%	66.7%	33.3%	100.0%
Thiruvananthapuram	N	154	91	245
	%	62.9%	37.1%	100.0%
Total	N	319	181	500
	%	63.8%	36.2%	100.0%
Chi-Square Result	Value= 0.512, df= 2, p=0.774			

Source: Computed from the primary data

In Kozhikode region, 63.2 per cent of the small-scale fishermen possesses land and 36.8 per cent do not own land. Ernakulam accounts for 66.7 per cent of the small-scale fishermen who own land and 33.3. per cent of the small-scale fishermen who do not own land. Thiruvananthapuram region is slightly lower than the other two regions in the possession of land. 62.9 per cent of the small-scale fishermen in the region own land and 36.2 per cent do not own land. The Chi-square value is 0.512 and the P value is 0.774. Since the P value is greater than 0.05, the null hypothesis is accepted. It can be concluded that the small-scale fishermen in all the three regions do not have access to land. The data revealed that there is no significant difference among the three regions regarding the ownership of land.

5.9.1.2 Ownership of House

The accessibility towards physical capital is a prerequisite for any community to overcome vulnerability as per the Sustainable Livelihood Approach. House is a necessary physical capital to which the small-scale fishermen did not have much access. The regional comparison of the ownership of house among the small-scale fishermen is computed using ANOVA.

Table 5. 36
Region Wise Status of the Ownership of Houses

Region		House Ownership			Total
		Owned	Rented	Others	
Kozhikode	N	103	21	20	144
	%	71.5%	14.6%	13.9%	100.0%
Ernakulam	N	73	23	15	111
	%	65.8%	20.7%	13.5%	100.0%
Thiruvananthapuram	N	171	35	39	245
	%	69.8%	14.3%	15.9%	100.0%
Total	N	347	79	74	500
	%	69.4%	15.8%	14.8%	100.0%
Chi-Square Result	Value= 2.914, df= 4, p=0.572				

Source: Computed from the primary data

The ownership of the house of the small-scale fishermen in the three regions was assessed with the aid of Chi-square test. 71.5 per cent of the small-scale fishermen from Kozhikode region own house. The remaining 28.5 per cent either live in a rented house or in panaya house. Thiruvananthapuram is slightly lower than Kozhikode with 65.8 per cent possessing a house and 34 per cent living in rented and other categories. Ernakulam region has the lowest percentage in ownership of houses. 65.8 per cent of the small-scale fishermen from Ernakulam possesses a house and 35 per cent of them do not own a house. the chi-square value is 2.914 and the P value is 0.572. Since the P value is greater than 0.05, the null hypothesis is accepted. The region -wise analysis of the ownership of house explicated that there is no significant difference in the ownership of house in the three regions. The small-scale fishermen do not have access to a decent house which is a major physical capital.

5.9.1.3.Ownership of Fishing Assets

Fishing assets are physical assets which contribute significantly to the income of the small-scale fishermen. The fishing assets of the fishermen are physical assets which require considerable amount of investment. The accessibility of the small-scale fishermen to fishing assets are analyzed using the statistical tools of ANOVA and Chi-square test.

Table 5.37
Ownership of fishing assets

Fishing Asset			Region			Total	Chi-Square Result
			Kozhikode	Ernakulam	Thiruvananthapuram		
Craft	Yes	N	25	18	38	81	Value= .229 df= 2, p=0.892
		%	17.4%	16.2%	15.5%	16.2%	
	No	N	119	93	207	419	
		%	82.6%	83.8%	84.5%	83.8%	
Engine	Yes	N	20	13	30	63	Value= .325 df= 2, p=0.850
		%	13.9%	11.7%	12.2%	12.6%	
	No	N	124	98	215	437	
		%	86.1%	88.3%	87.8%	87.4%	
Gear	Yes	N	24	15	37	76	Value= 0.487 df= 2, p=0.784
		%	16.7%	13.5%	15.1%	15.2%	
	No	N	120	96	208	424	
		%	83.3%	86.5%	84.9%	84.8%	
Hook and Line	Yes	N	7	8	10	25	Value= 1.579 df= 2, p=0.454
		%	4.9%	7.2%	4.1%	5.0%	
	No	N	137	103	235	475	
		%	95.1%	92.8%	95.9%	95.0%	
Other Equipment	Yes	N	24	13	37	74	Value= 1.255 df= 2, p=0.534
		%	16.7%	11.7%	15.1%	14.8%	
	No	N	120	98	208	426	
		%	83.3%	88.3%	84.9%	85.2%	
Total		**N**	**144**	**111**	**245**	**500**	
		%	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: Computed from the primary data

Craft, gear and engine are the three important equipment necessary for fishing. Fishing equipment fall under the physical capital to which the small-scale fishermen do not have access. The accessibility to the fishing equipment was analyzed using the chi-square test. The combined chi-square value for the three regions for craft is .229 and the P value is 0.850. The chi-square value for engine is .350 and the P value is 0.850. The chi-square value for gear is 0.487 and the P value is 0.784. The chi-square value for hook and line is

1.579 and the P value is 0.454. The Chi-square value for other equipment is 1.255 and the P value is 0.534. In all the three regions, for all the equipment, the P value is greater than 0.05. Therefore, the null hypothesis is accepted. There is no significant difference in the three regions with regard to the ownership of fishing assets. It can be concluded that the small-scale fishermen in the three regions do not have access to the fishing equipment.

5.9.1.4.Household Assets

The accessibility towards household assets determines the ability of the household to build up its livelihood. The common assets possessed by the households were analyzed regionally. The Chi-square test was employed to check the accessibility.

Table 5.38
Region Wise Important Household Asset Status

Household Asset			Region			Total	Chi-Square Result
			Kozhikode	Ernakulam	Thiruvananthapuram		
Motor Cycle	Yes	N	103	63	166	332	Value= 6.525 df= 2, *p=0.038*
		%	71.5%	56.8%	67.8%	66.4%	
	No	N	41	48	79	168	
		%	28.5%	43.2%	32.2%	33.6%	
Car	Yes	N	12	7	19	38	Value= .383 df= 2, p=0.826
		%	8.3%	6.3%	7.8%	7.6%	
	No	N	132	104	226	462	
		%	91.7%	93.7%	92.2%	92.4%	
Refrigerator	Yes	N	131	102	226	459	Value= 0.197 df= 2, p=0.906
		%	91.0%	91.9%	92.2%	91.8%	
	No	N	13	9	19	41	
		%	9.0%	8.1%	7.8%	8.2%	
A/C	Yes	N	3	10	8	21	Value= 8.515 df= 2, *p=0.014*
		%	2.1%	9.0%	3.3%	4.2%	
	No	N	141	101	237	479	
		%	97.9%	91.0%	96.7%	95.8%	
Washing Machine	Yes	N	23	29	33	85	Value= 8.824 df= 2, *p=0.012*
		%	16.0%	26.1%	13.5%	17.0%	
	No	N	121	82	212	415	
		%	84.0%	73.9%	86.5%	83.0%	
Gold	Yes	N	105	90	183	378	Value= 2.479 df= 2, p=0.290
		%	72.9%	81.1%	74.7%	75.6%	
	No	N	39	21	62	122	
		%	27.1%	18.9%	25.3%	24.4%	
Total		N	144	111	245	500	
		%	100.0%	100.0%	100.0%	100.0%	

Source: Computed from the primary data

The accessibility to the household assets was also analyzed with the aid of Chi-square test. The household assets such as motorcycle, car, washing machine, A/c, refrigerator and Gold were selected for assessment. With regard to motorcycle, washing machine and A/C, the P value is less than 0.05 and the household assets such as car, refrigerator and gold the P value is greater than 0.05. It can be concluded that the there are significant differences among the three regions regarding the ownership of household assets like motorcycle, washing machine and A/C. On the contrary with regard to assets such as car, refrigerator and gold, there is no significant difference.

5.9.1.5.Annual Income of the families

The income of the small-scale fishermen constituted accessibility towards financial capital. The income derived from fishing activity by the small-scale fishermen in all the three districts were assessed to find out whether there were significant differences between the regions.

Table: 5.39
Annual Income of Small-Scale Fishermen

Variations	Sum of squares	Df	Mean square	F	Sig
Between Groups	0.014	2	0.007	0.010	0.990
Within groups	370.674	497	0.746		
Total	370.688	499			

Source: Computed from the primary data

The small-scale fishermen do not get regular income due to the fluctuations in the catch. Moreover, the income of the small-scale fishermen did not exceed ₹. 10000 in all the three regions.

Table : 5.40
Annual Income of the Small-Scale Fishermen

Kozhikode	Ernakulam	Thiruvananthapuram
3.57	3.58	3.56

Source: Computed from the primary data

Since the P value is greater than 0.05 the null hypothesis is accepted at 5 per cent level of significance. Therefore, there is no significant difference among the small-scale fishermen hailing from the three regions in their annual income.

5.9.1.6.Loans and Borrowings

Loans and borrowings are liabilities which negatively affect the pattern of saving of the small-scale fishermen. Loans and borrowings on the other hand are necessary for investment too. The small-scale fishermen depend more on the local money lenders for borrowings. The fishermen are forced to remit higher interest rate too. The small-scale fishermen did not depend on banks and other governmental institutions for loan and borrowings. The pattern of loans and borrowings were assessed for the three regions for the present analysis using the Chi-square method.

Table 5.41
Loans and Borrowings

Loans and Borrowings		Region			Total
		Kozhikode	Ernakulam	Thiruvananthapuram	
Upto 50000	N	13	3	20	36
	%	9.0%	2.7%	8.2%	7.2%
50000-100000	N	6	5	5	16
	%	4.2%	4.5%	2.0%	3.2%
100000-150000	N	12	26	38	76
	%	8.3%	23.4%	15.5%	15.2%
Above200000	N	113	77	182	372
	%	78.5%	69.4%	74.3%	74.4%
Total	N	144	111	245	500
	%	100.0%	100.0%	100.0%	100.0%
Chi-Square Result		Value= 16.261, df= 6, $p=0.012$			

Source: Computed from the primary data

The assessment of the loans and borrowings of the three regions showed that there are significant differences in the accessibility to loans and borrowings. The chi-square value of loans and borrowings of the three regions is 16.261. The P value is 0.012 which is less than 0.05. The null hypothesis is rejected. The analysis of the data on loans and borrowings revealed that the small-scale fishermen do have access to loans and borrowings. In fact, the data showed that the small-scale fishermen are in debt trap with 74.4 per cent of them having a loan of ₹ 200000 lakh and above.

Table 5.42

Region Wise Accessibility in Fishing Assets, Physical Assets and Natural Asset

		N	Mean	Std. Deviation
Fishing Asset	Kozhikode	144	*1.1389*	.30955
	Ernakulam	111	*1.1207*	.29453
	Thiruvananthapuram	245	*1.1241*	.29523
	Total	500	*1.1276*	.29876
Household Asset	Kozhikode	144	*1.4792*	.09287
	Ernakulam	111	*1.4968*	.08900
	Thiruvananthapuram	245	*1.4755*	.08739
	Total	500	*1.4813*	.08957
House Ownership	Kozhikode	144	*1.7176*	.48332
	Ernakulam	111	*1.6817*	.48281
	Thiruvananthapuram	245	*1.6925*	.50296
	Total	500	*1.6973*	.49215
Annual Income	Kozhikode	144	*1.7813*	.46829
	Ernakulam	111	*1.7973*	.35277
	Thiruvananthapuram	245	*1.7796*	.44167
	Total	500	*1.7840*	.43095

Source: Computed from the primary data

The regional analysis of the accessibility of small -scale fishermen to natural, physical and financial assets were done with the aid of Chi-square test. The accessibility to natural assets were assessed by examining the accessibility to land. The ownership of land was examined in all the three regions. The household assets, fishing assets and ownership of house were assessed using ANOVA in order to find out the differences in accessibility to physical capital in all the three regions. The annual income and loans and borrowings were examined to assess the accessibility to financial capital. The combined results are assessed in table 5.44.

Table 5.43

ANOVA Result: Region Wise Accessibility in Fishing Assets, Physical Assets and *Natural Asset*

		Sum of Squares	Df	Mean Square	F	Sig.
Fishing Asset	Between Groups	.027	2	.013	.149	.862
	Within Groups	44.512	497	.090		
	Total	44.539	499			
Household Asset	Between Groups	.035	2	.018	2.222	.109
	Within Groups	3.968	497	.008		
	Total	4.003	499			
House Ownership	Between Groups	.092	2	.046	.189	.828
	Within Groups	120.771	497	.243		
	Total	120.863	499			
Annual Income	Between Groups	.025	2	.013	.068	.934
	Within Groups	92.647	497	.186		
	Total	92.672	499			

Source: Computed from the primary data

The accessibility of the small-scale fishermen to fishing assets, household assets, ownership of house and income is analyzed using ANOVA. The F value for fishing asset is .149 and for household asset is 2.222. The F value for ownership of house is .189 and for annual income is .068. The P value of all the assets is greater than .05 which shows that the null hypothesis is accepted. Therefore, we can conclude that the small-scale fishermen do not have access to physical and natural assets.

Table 5.;44
Accessibility Index (Using Equal Weighted Arithmetic Mean)

Region	N	Mean	Std. Deviation	Std. Error	ANOVA
Kozhikode	144	1.5292	.18374	.01531	F (2,497) = 0.177, p= 0.838
Ernakulam	111	1.5241	.18601	.01765	
Thiruvananthapuram	245	1.5179	.18244	.01166	
Total	500	1.5226	.18331	.00820	

5.10 Summary of the Chapter

The chapter explored the demographic and the socio –economic conditions of the small-scale fishermen with special reference to their livelihood conditions. The data was analyzed using the Sustainable Livelihood Approach which focuses on the accessibility of the community to the natural, physical, social, human and financial assets. The more a community is accessible to the assets, better will be the livelihood conditions. The small-scale fishermen of Kerala have less access to these assets which make them marginalized and the most disadvantageous sections of the society. They are being deprived of the basic necessities of livelihood opportunities. The fishery resources are the natural resources upon which the small- scale fishermen depend upon. Due to uncontrolled and illegal fishing there is depletion of fishes in the sea. The depletion of fishes affects the employment opportunities of the small- scale fishermen. The accessibility towards the natural resources is limited for the small-scale fishermen due to lack of awareness about the fishery management practices and due to the faulty fishery management practices. 73 per cent of the small-scale fishermen are unaware of the fishery management practices existing in the State. Moreover, 50 per cent of them do not follow the norms of the fishery management practices. The annual income of the fishermen is so low that they can hardly meet the household expenses. The literacy rate among the small - scale fishermen is lower than the state average. 52.6 per cent of the heads of the family is illiterate. The educational opportunities of the children of the fishermen are also not so high. 73 per cent of the children belonging to the fishermen families could afford only up to higher secondary education. The social security schemes and incentives for the small-scale fishermen did not help the small-scale fishermen to overcome the livelihood vulnerabilities. 50 per cent of the social security schemes are not properly implemented for fishermen communities. Due to irregular income and uncertainty associated with the fishing, fishermen seek alternative employment. Every year, the number of fishing days decreases. This could be due to unpredictably bad weather or a steady stream of no-catch days. During times of low revenue, fishermen are obliged to seek alternative employment opportunities to earn a living.

CHAPTER – 6

THE LIVELIHOOD CHALLENGES OF THE TRADITIONAL FISHERMEN OWING TO THE FAULTY FISHERIES MANAGEMENT IN KERALA

6.1 Introduction

The previous chapter explored the socio-economic conditions of the small-scale fishermen who are deprived of the basic livelihood opportunities. This chapter details about the significant factors in Fishery Management which affect the livelihood of the small-scale fishermen. Fishery resources are vital aspects of all societies, contributing significantly to the "economic and social health and well-being" of people. The fisheries sector of Kerala provides employment to approximately 10 lakh fishermen and other related workers. Despite the immense significance and worth, the fish resources of Kerala face heavy exploitation. There are several explanations for this unacceptably bad situation, but the prominent factors ultimately boil down to a single point of the failure in the state's fisheries management. The blame for dwindling stocks, lower economic returns, and less job prospects in the fishing industry can be rectified by effectively managing the fisheries sector with the aid of proper techniques. The declining stocks in the sea have serious ecological and economic consequences. The fishery dependent communities are the groups who are at the receiving end due to the declining trends in fish stocks. Kerala had been in the forefront in devising fishery management techniques to ensure sustainability in fishery resources by way of implementing Kerala Marine Fishing Regulation Act in 1981. Even after 40 odd years there had been serious ecological challenges in the marine fishery sector leading to depletion of fishes. This has detrimentally affected the livelihood of the fishermen. The chapter analyses the problems in the current fishery management practices which negatively affect the livelihood of the small-scale fishermen.

6.2 Factor Analysis

An exploratory factor analysis was done in order to ensure dimensions of the Fishery Management Practices and to find out the inter relationships among the variables. Accordingly, six common factors were extracted to facilitate the study of the relationship of original variables. The factors so extracted were named as

1. Level of Awareness on Fisheries Management Practices (LAOFM)
2. Awareness on Welfare Schemes for Fishermen (AWOS)
3. Level of Satisfaction from Fisheries Trade (LSFT)
4. Flaws in the Current Fisheries Management Practices (FCFM)
5. Unscientific Fisheries Management Practices (USFM)

6. Proactive Measures for Improving Fisheries Management Practices (PAMIFM)

These factors were responsible for the livelihood challenges of the traditional fishermen of Kerala. The traditional fishermen are dependent upon the fishing practices and the volume of fish landings.

Factor Analysis on Livelihood and Fisheries Management Practices of Small-Scale Fishermen of Kerala.

6.2.1 KMO and Bartlett's Test

Table 6.1
KMO and Bartlett's Test

Kaiser – Meyer - Olkin Measure of Sampling Adequacy		0.521
Bartlett's Test of Sphericity	Chi – Square Value	5118.631
	P Value	< 0.001

Source: Calculated from the Primary Data

KMO is a test used to identify the partial correlation between the variables. KMO values closer to 1.0 are considered ideal while values less than 0.5 are unacceptable. In the present analysis of the study, the factors of the Fisheries Management Practices which affect the livelihood of the small-scale fishermen are identified using KMO test. The Bartlett's test of Sphericity is used to test the null hypothesis that the correlation matrix is an identity matrix. A significant statistical test shows that the correlation matrix is indeed not an identity matrix.

Table 6.2

Factor loadings, Eigen Value and Percentage of Extraction using Principal Component Method based on Livelihood and Fisheries Management Practices of Small-Scale fishermen of Kerala.

Factor	Statements	Factor Loading	Eigen Value	per cent of Variable	Cum. Percentage
I	LAOFM 1	0.828	3.649	17.377	17.377
	LAOFM 2	0.668			
II	AOWS 1	0.859	2.930	9.192	29.569
	AOWS 2	0.778			
	AOWS 3	0.674			
	AOWS 4	0.674			
III	LSFT 1	0.937	2.902	9.016	38.585
	LSFT 2	0.897			
	LSFT 3	0.874			
	LSFT 4	0.842			
IV	FCFM 1	0.854	2.893	8.975	47.56
	FCFM 2	0.762			
	FCFM 3	0.694			
V	USFMP 1	0.912	2.885	8.699	56.259
	USFMP 2	0.756			
VI	PAMIFM 1	0.849	2.753	8.671	64.73
	PAMIFM 2	0.609	1.970	4.513	69.443

Extraction Method: Principal Component Analysis
Source: Calculated from primary survey.

"The Kaiser–Meyer Olkin measure of sampling adequacy is a statistic that indicates the proportion of variance in variables that might be caused by underlying factors. In this research the Kaiser–Meyer–Olkin value of 0.521indicates that factor analysis is useful with our data. Bartlett's test of sphericity which tests the hypothesis that the correlation matrix is an identity matrix which would indicate that variables are unrelated and therefore not suitable for structure detection. Since the 'P' value is less than 0.01, the hypothesis is rejected and indicates that variables are related. Therefore, a factor analysis is possible with our data".

The Factor Analysis employed in the study extracted six factors based on the criterion that only factors with Eigen values of one or more should be extracted. It is also seen from the cumulative percentage of variables, as evident from table 6.3 those six factors extracted together account for 69.443 per cent of the total variables. The original 17 variables are held for extracting the information. This is a really decent outcome given that we were able to minimize the number of variables (from 17 to 6 underlying components), while only losing 30.557 per cent of the total information from the 17 original variables. This serves as an equitable solution for the issue.

Table 6.3

Reliability and Validity Analysis – Construct Reliability, Convergent Validity and Discriminant Validity

Factors	Factor Loadings	Item Reliability	Delta	Average	CR
LSFT 1	0.937	0.878	0.122		
LSFT 2	0.897	0.805	0.195		
LSFT 3	0.874	0.764	0.236		
LSFT 4	0.842	0.709	0.291	0.789	0.937
AOWS 1	0.859	0.738	0.262		
AOWS 2	0.778	0.605	0.395		
AOWS 3	0.674	0.454	0.546		
AOWS 4	0.674	0.454	0.546	0.563	0.836
FCFM 1	0.854	0.729	0.271		
FCFM 2	0.762	0.581	0.419		
FCFM 3	0.694	0.482	0.518	0.597	0.815
LAOFM 1	0.828	0.686	0.314		
LAOFM 2	0.668	0.446	0.554	0.566	0.720
USFMP 1	0.912	0.832	0.168		
USFMP 2	0.756	0.634	0.366	0.733	0.845
PAMIFM 1	0.849	0.721	0.279		
PAMIFM 2	0.609	0.371	0.629	0.546	1

Extraction Method: Principal Component Analysis

Source: Calculated from primary survey.

Construct reliability implies the consistency of all these constructs. For the objective analysis of the research study through exploratory factor analysis we have identified 6 constructs (latent variables). It means wherever similar research study is to be carried out these constructs will assume significance. In this research study the construct reliability is well satisfied. The value of the construct validity should greater than 0.7. Here the present study satisfies the construct validity. It signifies the fact that the indicator variables under each construct is converging to the respective constructs. It is measured by calculating the Average Variance Extracted (AVE). Average Variance Extracted means the average of the item reliability of each construct. The thumb rule is that if the AVE values of a construct is greater than the threshold value of 0.5. in the case of our research study. The AVE values of all the constructs are greater than 0.5. This implies that the convergent validity of the instrument used for gathering data is well satisfied.

Table 6.4
Communalities

	Initial		Extraction
LAOFM1	1.000		.576
LAOFM2	1.000		.734
LSFT1	1.000		.783
LSFT2	1.000		.813
LSFT3	1.000		.886
LSFT4	1.000		.738
FCFM1	1.000		.752
FCFM2	1.000		.825
FCFM3	1.000		.688
USFM1	1.000		.785
USFM2	1.000		.844
PAMFI1	1.000		.796
PAMFI2	1.000		.689
AOWS1	1.000		.771
AOWS2	1.000		.895
AOWS3	1.000		.895
AOWS4	1.000		.702

Source: Computed from the Primary data

Communalities can be defined as the correlation of each variable towards the identified constructs. The minimum communality value of a variable should be greater than 0.5

Table 6.5
Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	per cent of Variance	Cumulative per cent	Total	per cent of Variance	Cumulative per cent	Total	per cent of Variance	Cumulative per cent
1	3.441	20.244	20.244	3.441	20.244	20.244	3.402	20.010	20.010
2	3.377	19.865	40.109	3.377	19.865	40.109	2.563	15.076	35.086
3	2.158	12.695	52.804	2.158	12.695	52.804	2.322	13.661	48.748
4	1.771	10.416	63.219	1.771	10.416	63.219	1.827	10.747	59.495
5	1.415	8.326	71.545	1.415	8.326	71.545	1.619	9.521	69.016
6	1.009	5.937	77.482	1.009	5.937	77.482	1.439	8.466	77.482
7	.742	4.364	81.846						
8	.626	3.684	85.529						
9	.550	3.237	88.766						
10	.439	2.581	91.347						
11	.396	2.329	93.676						
12	.321	1.887	95.564						
13	.290	1.706	97.270						
14	.196	1.152	98.421						
15	.157	.926	99.347						
16	.111	.653	100.000						
17	1.003E-013	1.017E-013	100.000						

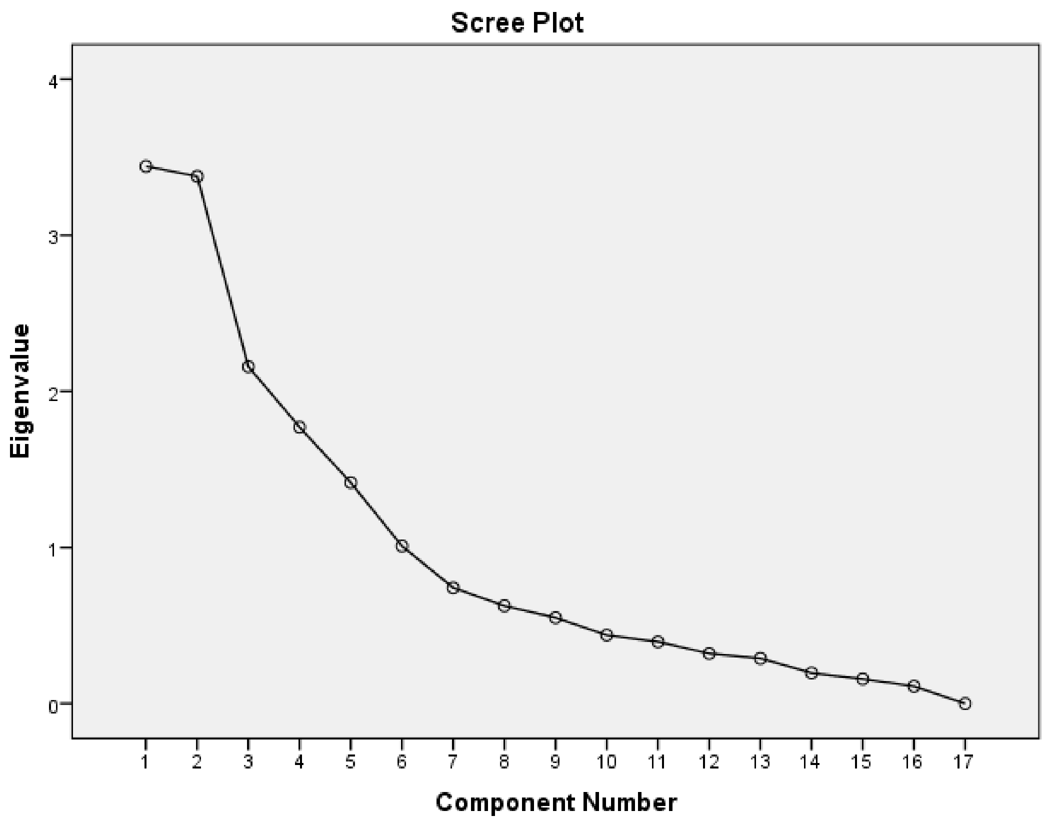
Extraction Method: Principal Component Analysis.
Source: Computed from the Primary data

"The total variance is the sum of variances of all individual principal components. The fraction of variance explained by a principal component is the ratio between the variance of that principal component and the total variance. Principal Component Analysis computes a new set of variables (Principal components) and expresses the data in terms of these new variables. Considered together, the new variables represent the same amount of information as the original variables, in the sense that we can restore the original data set from the transformed one."

"Moreover, the total variance remains the same. However, it is redistributed among the new variables in the most "unequal way". The first variable not only explains the most variance among the new variables but the maximum variance a single variable can possibly explain. "

Figure 6.1

Scree Plot



Source: Computed from the Primary Data

Figure portrays the Scree plot. Scree Plot is a line plot of the Eigen values of principal components in an analysis. The X-axis shows the component numbers and the Y-axis shows the Eigen values. The Scree plot is used to determine the number of factors to retain in an Exploratory Factor Analysis and it always displays the Eigen values in a downward curve, ordering the Eigen values from largest to smallest. The components which fall on the steep slope were extracted because the Eigen values of those components were greater than one. The factors extracted are named

- Imperfect knowledge
- Incentives and subsidies
- Externalities
- Unscientific fishery management practices
- Policy measures
- Trade and marketing

6.2.2 Factor 1 - Imperfect Knowledge

Factor 1 consists of two sub factors: 1) Imperfect information on fishery management practices and 2) Imperfect information on the depletion of fish. Fishery management practices are those tools instituted by the government for the sustainability and growth of fish species in the water bodies. Even though these are implemented by the government by way of rules and regulations, the ultimate takers of the rules are the fishermen. Trawl ban, Marine Protected Areas, Mesh Size Regulations, Coastal Regulation Zones (CRZ) are the major Fishery Management tools which are in use. The small-scale fishermen are not aware of the major tools and practices. The ignorance of the tools makes the situation worse. The inability to implement the tools effectively will reduce the volume of fishes in the sea thereby affecting the employment opportunities of the fishermen that too very specifically the traditional fisherman. Trawl ban and the Marine Protected Areas (MPAs) are the major tools which are familiar to the small-scale fishermen of the study area. Trawl ban is familiar because of its strict implementation in the State. It is the closure of the seasonal fishing in the sea or three months. The purpose of the trawl ban is to allow the major fish species to breed and to prevent the juvenile fishing in the area. Marine Protected Areas are those areas where fishermen are not allowed to go for fishing. Marine Protected Areas are those areas which are very critical to the sustainability of the fishes. The next management practice is the trawl ban. Apart from these two, the other tools of fishery management practices were unknown to the traditional fishermen of the study area.

The lack of awareness of the tools and the rules and regulations ultimately affect the livelihood opportunities of the small-scale fishermen significantly.

The policy formulators are of the opinion that each tool has its own value. The factors which are unfamiliar to the fishermen contribute to the sustainability of the fish species.

Regulations in the mesh size are the most common fishery management practice that prevents the catching of the juvenile fishes. The size of the gear, the measurement of the mesh and their execution are the major factors which contribute to the sustainability of the fishes. The purpose of regulations in the mesh size is to prevent juvenile fishing. The big crafts which go for fishing for multiple days often have gears with multiple mesh sizes which illegally promote catching of the juvenile fishes. The government promulgated a rule which clearly gave guidelines which prevented the crafts with multiple days of fishing to use the gears with mesh with a size of 28 mm which allow the small fishes to escape the fishing gears. This regulation is not complied with.

With the introduction of the engines with higher horse power, the fishermen were able to go for longer nautical miles from the shore. Adding to that the government has clearly given the regulation to use lower horse power engines for the traditional fishermen to go for fishing. After 2004, the catches of pelagic fish in the Kerala coast have shown sharp decline. The small-scale fishermen are forced to go beyond the stipulated nautical miles to get the catch. This has made the demersal waters of Kerala crowded to a great extent.

Coastal Regulation Zone (CRZ) demarcation is another method to sustainably protect the coastal areas. The “CRZ regulations” were devised “to promote sustainable development based on scientific principles taking into account the natural hazards such as increasing sea levels due to global warming”. These regulations were meant “to conserve and protect the environment of coastal stretches and marine areas, and to provide livelihood security to the fisher communities”. The regulations gained more momentum at the wake of the demolition of residences at Maradu, Kochi. After 1991, even after frequent notifications, the government was not able to convey the importance of CRZ regulations to the people concerned. “CRZ-III A: The A category of CRZ-III areas are densely populated rural areas with a population density of 2161 per square kilometre as per 2011 Census.

Such areas have a No Development Zone (NDZ) of 50 meters from the High Tide Line (HTL) as against 200 meters from the High Tide Line stipulated in the CRZ Notification, 2011". The livelihood of the traditional fishermen is at stake if the government goes ahead with the CRZ regulations (Department of fisheries, Government of India).

6.2.3 Factor 2 - Incentives and Subsidies

The factor two is composed of four sub factors, namely, 1) Lack of awareness of welfare schemes 2) Lack of incentives for the protection of resources 3) Lack of specific incentives and welfare measures for alternative employment 4) Lack of proper disbursement of available welfare schemes. The natural resources which are close to livelihood settlements are degraded to a great extent. This is applicable very specifically to the livelihood activities of the resource-dependent communities. The activities of production and consumption by human beings inevitably bring about destruction to eco-system by way of depletion and degradation. Incidentally, excessive or unsustainable use of natural resources can degrade or deplete their stock in the near future. The livelihoods which depend upon the natural resources gets weakened with the degradation of the natural resources. Subsidies and incentives are particular stimuluses' organized to motivate or encourage individuals to behave accordingly. In the context of natural resources, the subsidies and incentives motivate people to abstain from degrading resources. The fishery dependent communities are given incentives and subsidies to sustainably protect the marine environment rather than degrading it. The sustainable protection of the marine fishery resources can extend the employment and financial opportunities for the fishermen. The natural degradation is a by - product of unsustainable resource utilization. An activity is considered unsustainable when the rate of utilization of the natural resource is greater than the rate of regeneration or replacement at a particular point of time. An unsustainable activity can create permanent or temporary destruction to the habitat leading to the destruction of the livelihood. The role of incentives in sustaining the natural resource can be two-fold. The first method is to subsidize activities which prevent degradation of the natural resources. The fishermen for example can be given grant-in-aid to pursue alternative employment activities in other areas other than fishing. The second method is to provide incentives for properly maintaining the eco-system and marine resources. The incentives and subsidies given to the small-scale fishermen are in the form of grant-in-aid for the purchase of the equipment, accidental insurance for the casualties and grants for the education of the children. The structure of the subsidies and incentives in the present system did not specifically help the conservation of the fishery resources directly.

6.2.4 Factor 3 –Externalities

The factor three consists of three sub factors, viz., 1) ineffective implementation of fishery management practices, 2) Improper tools for fishery management practices, and 3) Inefficiency from the part of the government. The success of fishery management practices lies in the effective implementation of the various tools. The Central and the state governments are the custodians of the rules and regulation regarding the fishery management practices. The major fishery management practices which are currently in use are Marine Protected Areas (MPAs), Closed Season, Mesh Size regulations, HP engine regulations and so on. The major fishery management practices are better documented than implemented. Marine Protected Areas for instance are one of the most effective means for protecting marine and coastal bio diversity. “MPAs” are “wild spaces” as they are primarily intended to maintain bio diversity at various scales, although many marine regions are "peopled spaces" in actuality. This has sparked a lot of discussion as to how to manage MPAs most effectively so that they can also contribute to better social outcomes like enhanced food security and reliability and profound cultural ties to natural resources, among other things

Trawl Ban or Closed Season is an effective method which is widely used across the globe. The objective behind trawl ban or closed season is to protect the juvenile fishes. Every fish species has got its own breeding period. By closing the sea and preventing large scale fishing, the fishes will get a chance to breed and multiply. The problem with the closed season is that the breeding period of fishes is subject to change. The period of closure is fixed based on the breeding and spawning period of major demersal and pelagic varieties. Over the period, the breeding period of 90 per cent of the fishes has undergone changes. A suggestion which is made by the scientific community is to spread the period of ban to different small segments in a year. The report of the review committee appointed by the government of Kerala found out that after 2014, the trawl ban was not successful. There must be options for revisiting the present management regimes which control the closed season in our country. A detailed biological survey regarding the fish species is necessary to find out the biomass, mortality rate and stock availability.

The size of the mesh determines the volume of catch of the fish species. The size of the mesh of trawl nets was regulated through "Marine Fishing Regulation Acts (MFRAs) of maritime States in India". Mesh size regulations are necessary for long term sustainability of fishery resources. It is quite unfortunate that the fishermen use small-sized meshes nets to capture even juveniles. Improper use of fishing nets will lead to destruction of large quantities of juveniles, destruction of large number of marine resources as bycatch or discards which are of not much productive use. The quantity of the fish captured depends on the meshes of the nets. It is crucial because tiny mesh washes away little fish from the sea, endangering its survival. The "Marine Fishing Regulation Act" has set a limit on the mesh size for use in trawling gear at 35mm. The meshes used by small-scale fishermen and other fishing vessels, however, are not subject to any regulations. The fishermen who go to see using trawlers feel that the capture of the juvenile of industrially useful species will eventually make these species inaccessible to them as they will relocate beyond the current fishing zones.

6.2.5 Factor 4 - Unscientific Fishery Management Practices

The factor four is composed of two sub factors, namely, 1) illegal fishing and 2) excessive fishing. The unscientific fishery management practices can have negative impacts upon the ecology of the marine sector, the allied services of th7e eco-system and the dependent communities. The instances of illegal fishing and excessive fishing increase the fishing effort on the sea bed which is already under pressure due to legal fishing activities. Excessive and illegal fishing directly affect juvenile species and non-marketable fishes. In addition to all these, these activities create pollution and non-degradable littering. There are social and economic repercussions for illegal and excessive fishing. The additional fishing effort exerted upon the fish stock reduces the fishery resources available to the small-scale fishermen. Excessive and illegal fishing increases the rate of unemployment and reduces the rate of profit.

6.2.6 Factor 5 - Policy Measures

The factor five includes 1) Alternative employment opportunities for the small-scale fishermen and 2) Effective implementation of fishery management practices. The fishery sector of is characterized by increased fishing effort. An increased effort will result in increased pressure on the habitat of fish stock. Any move to increase employment opportunities in the fishery sector will result in excessive fishing. The “Code of Conduct for Responsible Fisheries (CCRF)” advised the regional administration of the water bodies to eliminate excessive pressure on in fisheries sector. The same had been expressed by the FAO action plan which wanted the excessive capacity to be eliminated to conserve the fishery resources. The creation of alternative employment opportunities is the solution for decreasing the pressure on fishing.

The fishery dependent communities will not be willing to seek other employment despite of the diminishing returns from fishery resources. The non-availability of other employment opportunities will make the things worse. The decision to reduce fishing capacity by providing alternative employment opportunities will initiate proactive fishery management practices. However, the long-term “ecological, economic”, as well as societal repercussions are significant. The most important reason which is responsible for overfishing is hesitation of the people to seek alternative employment in their locality.

The significant influence which the excessive fishing inflict upon the ecosystem are important predictors on target species, immediate effects on marine debris, secondary impacts on other creatures transferred through the food webs, and direct influences on the physiological environment. The state and national government must be aware of these possible consequences and take steps to mitigate them. Whether environmental difficulties are caused by individual interaction or are unaffected by it, the capacity to deal with them varies, but biological and non-biological ecosystem components must be handled in both cases. These characteristics define the maximum supply, or carrying capacity, and use of the resources at the most fundamental level in association with the physiology of the organisms. Developments within environment can have an impact on both, and the fisheries manager must address them where they occur. “The Code of Conduct for Responsible

Fisheries" specifies "States should assess the impacts of environmental factors on target stocks and species belonging to the same ecosystem or associated with or dependent upon the target stocks, and assess the relationship among the populations in the ecosystem." It again reiterates,

"States should take appropriate measures to minimize waste, discards, catch by lost or abandoned gear, catch of non-target species, both fish and non-fish species, and negative impacts on associated or dependent species, in particular endangered species".

In order to ensure that socio-cultural concerns are properly addressed, it is essential to involve important participants in fisheries management, to ensure that they may be informed of the fishery management aspects, and to provide them the opportunity to voice their wants and issues. "Open access fisheries", in which anybody can participate in a fishery, seem to be at one extreme, but they are nevertheless very prevalent in fisheries, particularly across many developing nations. The stakeholders will keep coming into fishing industry under these conditions until the benefits of fishing become unattractive to new entrants. The availability of other options will determine how minimal this is, and such alternatives may be extremely few in many countries, particularly poor countries. Even when adequate options are available, open access fisheries inevitably result in revenue absorption, resulting in a loss of economic output.

6.2.7 Factor 6 - Trade and Marketing

The factor six consists of 4 sub factors: 1) price information 2) presence of middle men 3) transportation facilities 4) fluctuations in price.

The prevailing system of demand and supply do not help the small-scale fishermen in getting a fair price. The existence of unequal distribution of market systems, the small-scale fishermen remain price takers in the whole process. In all the three regions, auctioneers take over the market as soon as the crafts reach the shore. The price fluctuates from top to bottom as the number of crafts increases. The crafts which reach last will have to be satisfied with a cheap price for their hard work. The fluctuations in the income prevent the small-scale fishermen from building up their livelihood. The level of satisfaction form fish trade can only be achieved with proper price mechanism.

The present market system in the fishery sector is characterized by the presence of intermediaries who have influence over the price of the fishes. The value chain in the fishery sector is rather complex and lengthy making it disproportional to the small-scale fishermen. The small-scale fishermen do not have any influence over the price. The small-scale fishermen as the primary producers do not sell to the final consumers. The whole process of marketing goes through a complex process of market chain where intermediaries are present. The complexity in the value chain favours the buyers and not the small-scale fishermen. The earnings of the small-scale fishermen from this value chain are marginal compared to the other counterparts.

The small-scale fishermen do not have proper transportation facilities which enable them to sell their products. The small-scale fishermen are left with very few options of selling the fish in other places when they derive a low price in the normal market. The deplorable conditions of the transportation facilities hamper the small-scale fishermen from transporting their products to other places. The small-scale fishermen negotiate individually rather than collectively. The poor organizational capacity of the small-scale fishermen is also reflected here. Lack of access to micro finance, credits and insurance schemes push the small-scale fishermen into debt trap.

The unequal marketing conditions existing in the marine fishery sector make the "socio-economic conditions of the small-scale" fishermen impoverished. The small-scale fishermen abandon their fishing profession due to their fluctuating income and the profession is no longer attractive to the youth. Due to the uncertainty in prices and demand, the small-scale fishermen increase the fishing effort for compensating the declining prices with high volume of catches. This intensifies the burden on the habitat of fish stock.

Table 6.6
Correlation

LSFT Total	Pearson Correlation	.108	1				
	Sig(2-tailed)	.016					
	N	500	500				
AOWS Total tailed)	Pearson Correlation	-.243**	.047	1			
	Sig(2- tailed)	.000	.295				
	N	500	500	500			
FCFM Total	Pearson Correlation	.146**	-.370**	.090*	1		
	Sig(2-tailed)	.001	.000	.044			
	N	500	500	500	500		
USFM Total	Pearson Correlation	-.055	.079	.211**	-.046	1	
	Sig(2-tailed)	.223	.079	.000	.307		
	N	500	500	500	500	500	
PAMFI Total	Pearson Correlation	0.086	-.009	.282**	-.034	.095	1
	Sig(2-tailed)	.054	.054	.000	.451	.033	
	N	500	500	500	500	500	500

Source: Computed from the primary data

- Correlation between Level of awareness on Fisheries management Practices and Level of satisfaction from Fisheries Trade is 0.108 [0.1082 = 0.01167]. So we can conclude that there is 1.167 percentage correlation between Level of awareness on Fisheries management Practices and Level of satisfaction from Fisheries Trade and is significant at 5 per cent level of significance.
- Correlation between Level of awareness on Fisheries Management Practices and Awareness on Welfare Schemes for Small-scale Fishermen by the government is 0.243 [0.243^2= 0.059]. This makes it clear that there is 5.9 per cent correlation between Level of Awareness on Fisheries Management Practices and Awareness on Welfare schemes and is significant at 1 per cent level of significance.
- Correlation between Level of Awareness on Fisheries Management and Flaws in Current Fisheries Management Practices is 0.146 [0.146^2= 0.0213]. There is 2.13 per cent correlation between Level of Awareness on Fisheries Management and

Flaws in Current Fisheries Management Practices and is significant at 1 per cent level of significance.

- Correlation between Level of Awareness on Fisheries management Practices and Unscientific Fisheries Management Practices is 0.055 [$0.055^2 = 0.003$]. This shows that there is 0.3 per cent correlation between Level of Awareness on Fisheries Management Practices and Unscientific Fisheries Management Practices.
- Correlation between Level of Awareness on Fisheries Management Practices and Proactive Measures for Improving Fisheries Management Practices is 0.086 [$0.086^2 = 0.0074$]. So, it is evident that there is 0.7 per cent Correlation between Level of Awareness on Fisheries Management Practices and Proactive Measures for Improving Fisheries Management Practices.
- Correlation between Level of Satisfaction from Fish Trade and Awareness on Welfare Schemes for the Small-Scale Fishermen is 0.047 [$0.047^2 = 0.0022$]. The Correlation between Level of satisfaction from fish trade and awareness on welfare schemes is .22 per cent.

6.3 Structural Equation Model (SEM) on the Livelihood and Fisheries Management Practices of Small-Scale Fishermen of Kerala

Structural equation Modelling is a procedure for estimating a series of dependence relationships among a set of concepts or constructs represented by multiple measured variables and incorporated into an integrated model.

The variables used in the structural equation model are:

6.3.1 Observed Endogenous Variables

1. Unscientific Fisheries Management Practices
2. Proactive Measures for Improving the Existing Fisheries Management Practices
3. Level of Satisfaction of Small-Scale Fishermen

6.3.2 Observed Exogenous variables

1. Level of Awareness on Fisheries Management Practices
2. Awareness on Welfare schemes for the Small-scale Fishermen
3. Flaws in the Current Fisheries Management Practices.

6.3.3 Unobserved, Exogenous variables

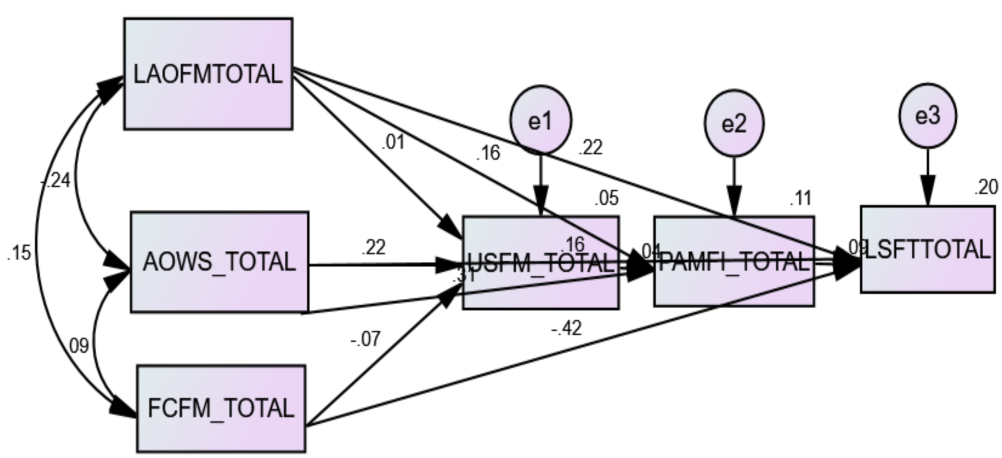
1. $e_{1:}$ Error term for Unscientific Fisheries Management Practices
2. $e_{2:}$ Error term for Proactive Measures for Improving the Existing Fisheries Management Practices
3. $e_{3:}$ Error term for Level of Satisfaction of the Small-Scale Fishermen for Fisheries Management Practices

Hence number of variables in the SEM is:

Number of variables in the model	: 9
Number of observed variables	: 6
Number of unobserved variables	: 3
Number of exogenous variables	: 6

Figure 6.2

Structural Equation Model



Source: Calculated from the Primary Data

6.4 Structural Equation Model Based on Standardized Coefficients on Livelihood and Fisheries Management Practices of Small-Scale Fishermen of Kerala

The unstandardized coefficients are the default values returned by all statistical programmes. In short, they reflect the expected (linear) change in the response with which each unit change in the predictor. For a coefficient value $\beta = 0.5$, for example, a 1 unit change in x is on average, an 0.5 unit change in y.

Table : 6.7
Variables in the Structural Equation Model Analysis

Variables			Unstandardized Coefficient (B)	S.E of B	Standardized Coefficient (Beta)	t. Value	P Value
USFM	⟸	LAOF	-0.240	0.035	0.058	6.846	<0.001**
USFM	⟸	AOWS	-0.260	0.042	0.512	5.692	<0.001**
USFM	⟸	FCFM	0.392	0.051	0.491	7.331	<0.001**
PAFMI	⟸	LAOF	0.381	0.049	0.451	7.561	<0.001**
PAFMI	⟸	AOWS	0.368	0.038	0.489	4.642	<0.001**
PAFMI	⟸	FCFM	0.372	0.084	0.506	4.611	<0.001**
LSFT	⟸	PAFMI	0.218	0.025	0.588	4.288	<0.001**

Source: Calculated from the Primary Data

The unstandardized coefficient of Level of Awareness on Fisheries Management on Unscientific Fisheries Management Practices is -0.240 which represents the partial effect of level of Awareness on Fisheries management on unscientific Fisheries management Practices holding the other path variables as constant. The estimated negative sign implies that such effect is negative and that the unscientific Fisheries Management would decrease by 0.240 units for every unit increase in Level of Awareness on fisheries management practices. This coefficient value is significant at one per cent level of significance.

The unstandardized coefficient of Awareness on Welfare schemes for the small-scale fishermen by the government on Unscientific Fisheries management Practices is -0.260. the value represents the partial effect of Awareness on Welfare Schemes on Unscientific Fisheries Management practices, holding the other path variables as constant. The estimated negative sign implies that such effect is negative and that the unscientific Fisheries Management would decrease by 0.260 units for every unit increase in Level of Awareness on Welfare Schemes. This coefficient value is significant at one per cent level of significance.

The unstandardized coefficient of Flaws in the current fisheries management practices on Unscientific Fisheries management Practices is 0.392 representing the partial effect of Flaws in the current fisheries management practices on Unscientific Fisheries Management practices, holding the other path variables as constant. The estimated positive sign implies that such effect is positive and that the unscientific Fisheries Management increased by 0.392 units for every unit increase in Flaws in the current fisheries management practices. This coefficient value is significant at one per cent level of significance.

The unstandardized coefficient of Level of Awareness on Fisheries Management Practices on Proactive Measures for Improving the Fisheries Management Practices is 0.381 representing the partial effect of level of awareness on Fisheries Management Practices on Proactive Measures for Improving the Fisheries management Practices, holding the other path variables as constant. The estimated positive sign implies that such effect is positive and that the Proactive Measures for Improving the Fisheries Management Practices increased by 0.381 units for every unit increase in the Level of Awareness on Fisheries Management Practices. This coefficient value is significant at one per cent level of significance.

The unstandardized coefficient of Level of Awareness on Welfare Schemes for Small-scale Fishermen on Proactive Measures for Improving the Fisheries Management Practices was 0.368 holding the other path variables as constant. The estimated positive sign implies that such effect is positive and that the Proactive Measures for Improving the

Fisheries Management Practices increased by 0.381 units for every unit increase in Welfare Schemes for Small-scale Fishermen. This coefficient value is significant at one per cent level of significance.

The unstandardized coefficient of awareness on Flaws in the Current Fisheries Management Practices on Proactive Measures for Improving the Fisheries management Practices was -0.372 representing the partial effect of Flaws in the current Fisheries Management Practices on Proactive Measures for Improving the Fisheries Management Practices holding the other path variables as constant. The estimated negative sign implies that such effect is negative and that the Proactive Measures for Improving the Fisheries Management Practices decreased by 0.372 units for every unit increase in Flaws in the current Fisheries Management Practices. This coefficient value is significant at one per cent level of significance.

The unstandardized coefficient of Proactive Measures for Improving the Fisheries management Practices on Level of satisfaction from Fisheries Trade was 0.218 representing the partial effect of Proactive Measures for improving the Fisheries management Practices on Level of satisfaction from Fisheries Trade holding the other path variables as constant. The estimated positive sign implies that such effect is positive and that the level of satisfaction increased by 0.218 units for every unit increase in the Proactive Measures for improving the Fisheries management Practices. This coefficient value is significant at one per cent level of significance.

For the purpose of testing the model fit, null hypothesis and alternative hypothesis are framed.

Null Hypothesis: The hypothesized model has a good fit

Alternate hypothesis: The hypothesized model does not have a good fit.

Table 6.8

Model fit summary of Structural Equation Model

Indices	**Value**	**Suggested Value**
Chi-square value	5.505	-----
DF	2	------
P Value	0.064	>0.05 (Hair e al; 1998)
Chi-square value/DF	2.752	<5.00 (Hair et al; 1998)
GFI	0.996	>0.90 (Hu and Bentler, 1999)
AGFI	0.962	>0.90 (Hair e al; 2006)
NFI	0.977	>0.90(Hu and Bentler, 1999)
CFI	0.985	>0.90 (Daire et al; 2008)
RMR	0.033	<0.08 (Hair e al; 2006)
RMSEA	0.059	<0.08 (Hair e al; 2006)

Source: Computed from the primary data

The calculated P value is 0.064 which is greater than 0.05 which indicates that the model is perfectly fit. Here Goodness of Fit Index (GFI) value (0.996) and adjusted goodness of Fit Index (AGFI) value (0.996) is greater than 0.9 which represents that it is a good Fit.

The Calculate Normed Fit Index (NFI) value (0.977) and comparative Fit Index (CFI) value (0.985) indicates that it is perfectly fit and also it is found that Root Mean Square (RMR) and Root Mean Square Error of Approximation (RMSEA) value are 0.033 and 0.059 respectively which is less than 0.08 which indicates that it is perfectly fit.

The model fit summary of the Structural Equation model is generated on the basis of the values which were taken at the estimation.

Table 6.9
Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	19	5.505	2	.064	2.752
Saturated model	21	.000	0		
Independence model	6	242.938	15	.000	16.196

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.033	.996	.962	.095
Saturated model	.000	1.000		
Independence model	.355	.883	.836	.631

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.977	.830	.985	.885	.985
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.133	.130	.131
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	3.505	.000	14.610
Saturated model	.000	.000	.000
Independence model	227.938	181.126	282.190

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.011	.007	.000	.029
Saturated model	.000	.000	.000	.000
Independence model	.487	.457	.363	.566

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.059	.000	.121	.310
Independence model	.175	.156	.194	.000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	43.505	44.046	123.583	142.583
Saturated model	42.000	42.598	130.507	151.507
Independence model	254.938	255.108	280.225	286.225

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	.087	.080	.109	.088
Saturated model	.084	.084	.084	.085
Independence model	.511	.417	.620	.511

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	544	835
Independence model	52	63

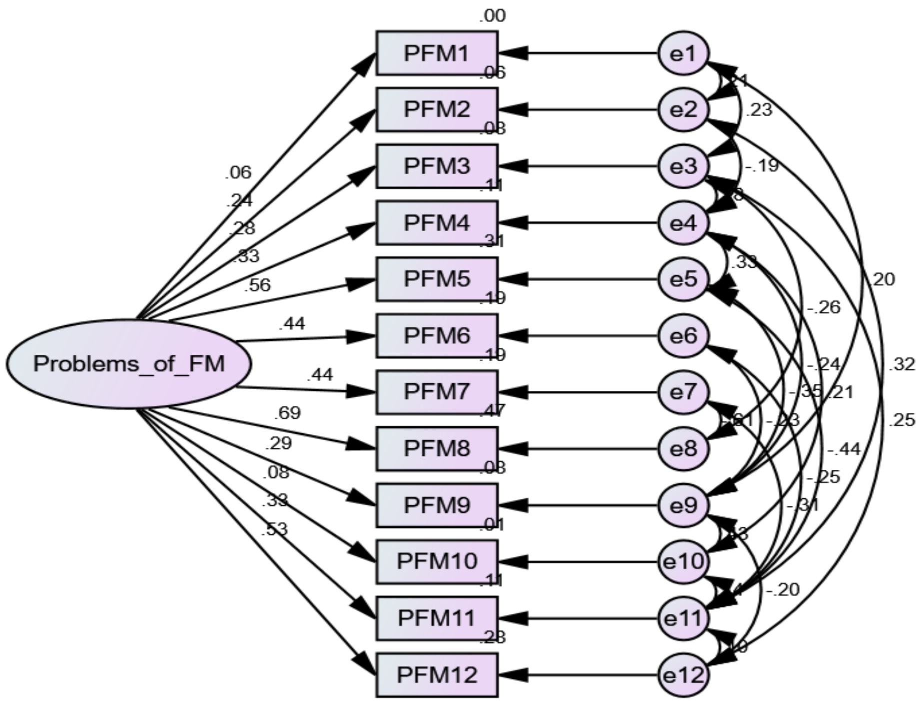
Source: Computed from the primary data

"Maximum Likelihood Estimation" of Structural Equation Model includes minimizing deviations of the expected covariance and means of matrices from the observed data. Here the model fit summary explained the overall fit of the model without any miscalculations. The indices in the model are well below the requirement as indicated in the collective analysis. The Structural Equation Model in the present study is fit for making predictions. Unstandardized coefficients contain information about both the variance and the mean, and therefore are essential for prediction. (Rapport et al, 2019)

6.5 Structural Equation Model on the Important Problems of Current Fisheries Management Practices of Small-Scale Fishermen of Kerala

The Structural Equation Model on the Problems in the present Fisheries Management Practices identified the critical problems underlying the present Fishery Management Practices in Kerala. The problems which were identified were collected from the responses from the primary data. Even though the indices generated from the responses identified eight critical problems with high indices, the Structural Equation Model found out that the other problems with lower indices also influenced the ineffective implementation of the fishery management practices in Kerala.

Figure 6.3:
Structural Equation Model on the critical problems of current Fisheries Management Practices of Small-scale Fishermen of Kerala

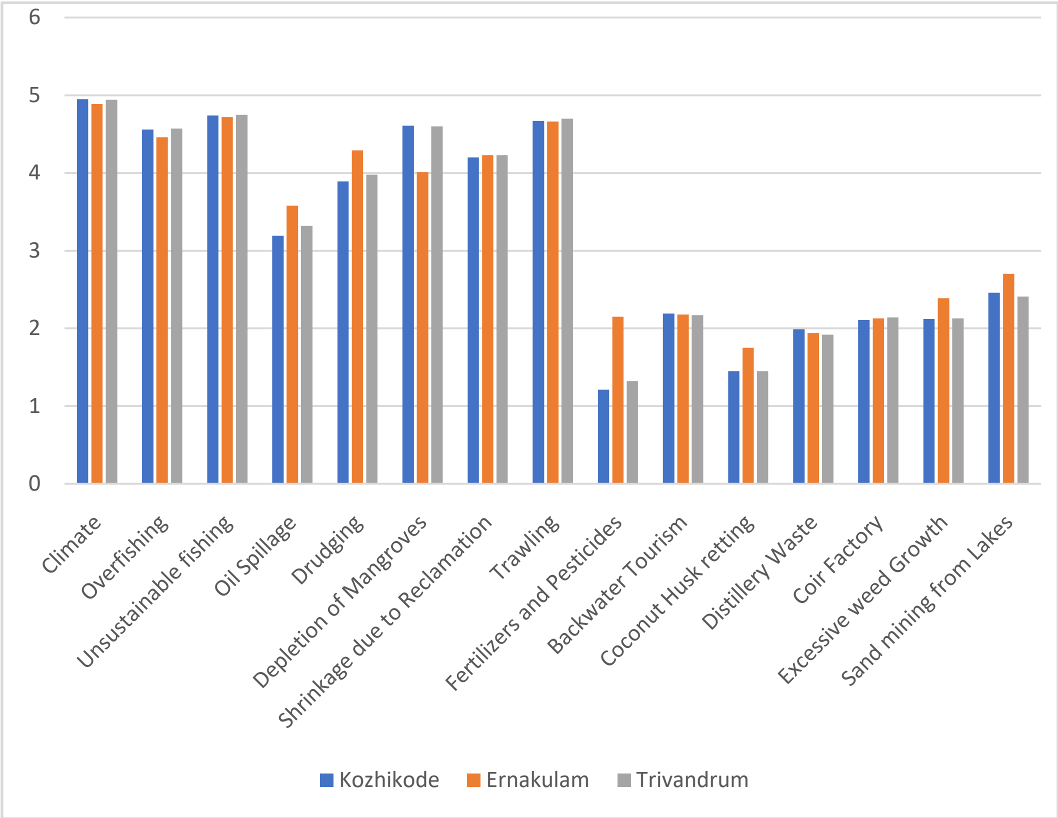


Source: Calculated from the Primary Data

The problems of the current Fisheries Management Practices of the Small-scale Fishermen are:

- Habitat Destruction due to Overfishing
- Juvenile Fishing
- Over Fishing
- Over Pelagic Trawl
- Excessive Mid water Trawl
- Proliferation of Trawlers
- Unsustainable Fishing
- Depletion of mangroves
- Excessive Weed growth
- Coconut husk retting
- Distillery waste
- Wastage from coir factories, fertilizers, chemicals

Figure 6.4
Reasons for Depletion



Source: Calculated from the Primary Data

The responses recorded during the primary survey is also added to the analysis for the purpose of comparison. Climate change, overfishing, unsustainable fishing, oil spillage, drudging, depletion of mangroves, shrinkage due to reclamation and trawling were found to be the critical problems underlying the fishery management practices in Kerala. The prevalence of these problems affect the effective implementation of the fishery management practices.

Table 6.10
Table of Indices of SEM

Indices	Value	Suggested Value
Chi-square value	144.479	-----
DF	33	------
P Value	0.000	>0.05 (Hair e al; 1998)
Chi-square value/DF	4.378	<5.00 (Hair et al; 1998)
GFI	0.959	>0.90 (Hu and Bentler, 1999)
AGFI	0.903	>0.90 (Hair e al; 2006)
CFI	0.918	>0.90 (Daire et al; 2008)
RMR	0.024	<0.08 (Hair e al; 2006)
RMSEA	0.08	<0.08 (Hair e al; 2006)

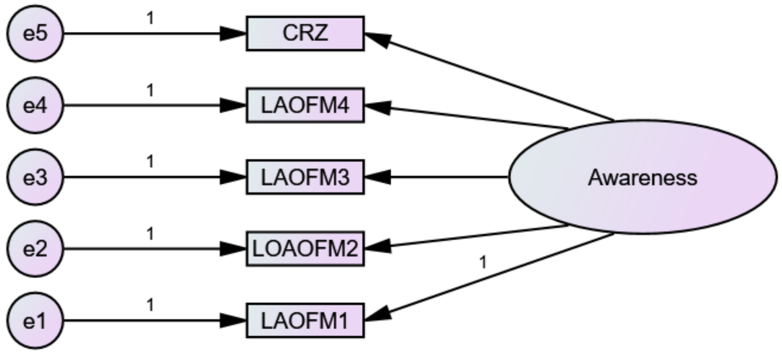
Source: computed from the primary data

The calculated value of Chi- square and Degrees of Freedom was 4.378 which is less than 5.00 which indicates that all the factors identified as problems of Fisheries Management Practices are confirmed and significant as well. The other important indices such as Goodness of Fit Index, Adjusted goodness of Fit, the comparative Fit Index, the Root Mean Square Residuals (RMR) and Root Mean Square error of Approximation are all well within the limits. This indicates that the Factors identified as problems of current Fisheries Management Practices are significant

6.6 Structural Equation Model of the Level of Awareness on Fishery Management Tools

The level of awareness on fishery management tools is a prerequisite for the effective implementation of the fishery management practices. In the primary data collection, it was found out that the mesh size regulations, gear specifications and the Marine Protected Areas are not implemented effectively. Trawl Ban was found to be known among the small-scale fishermen. The Structural Equation Model found out the interaction between the variables in the system.

Figure 6.5
Structural Equation Model of Level of Awareness on Fishery Management Tools



Source: Calculated from the Primary Data

The table of values gives the values which are generated in the Structural Equation Model for prediction. These values are fit for prediction as long as the values are positive. The values that are obtained are positive and they are fit for prediction.

Table 6.11
Table of Values

Iteration		Negative eigenvalue	Condition #	Smallest eigenvalue	Diameter	F	NTries	Ratio
0	e	2		-.216	9999.000	467.778	0	9999.000
1	e	0	93.357		1.045	107.105	20	.709
2	e	0	109.238		.403	31.589	3	.000
3	e	0	23.427		.630	16.234	2	.000
4	e	0	63.457		.230	4.025	1	.909
5	e	0	66.949		.110	3.184	1	.947
6	e	0	63.709		.018	3.156	1	1.030
7	e	0	62.666		.001	3.155	1	1.002
8	e	0	62.662		.000	3.155	1	1.000

Source: Computed from the primary data

The model fit summary gives the efficient fit model which are ready for prediction. The indices which are summarized in the table of values are explained in detail in the model fit summary for detailed prediction.

Table 6.12
Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	9	3.155	1	.076	3.155
Saturated model	10	.000	0		
Independence model	4	427.769	6	.000	71.295

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.006	.997	.969	.100
Saturated model	.000	1.000		
Independence model	.183	.682	.469	.409

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.993	.956	.995	.969	.995
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.167	.165	.166
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	2.155	.000	11.705
Saturated model	.000	.000	.000
Independence model	421.769	357.628	493.317

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.006	.004	.000	.023
Saturated model	.000	.000	.000	.000
Independence model	.857	.845	.717	.989

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.066	.000	.153	.257
Independence model	.375	.346	.406	.000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	21.155	21.338	59.087	68.087
Saturated model	20.000	20.202	62.146	72.146
Independence model	435.769	435.850	452.627	456.627

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	.042	.038	.062	.043
Saturated model	.040	.040	.040	.040
Independence model	.873	.745	1.017	.873

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	608	1050
Independence model	15	20

Execution time summary

Minimization:	.000
Miscellaneous:	.369
Bootstrap:	.000
Total:	.369

Source: Computed from the Primary Data

Maximum Likelihood Estimation of Structural Equation Model includes minimizing deviations of the expected covariance and means matrices from the observed data. Here the model fit summary explained the overall fit of the model without any misspecifications. The indices in the model are well below the requirement as indicated in the collective analysis. The Structural Equation Model in the present study is fit for making predictions. Unstandardized coefficients contain information about both the variance and the mean, and therefore are essential for prediction.

Table 6.13
Table of Indices

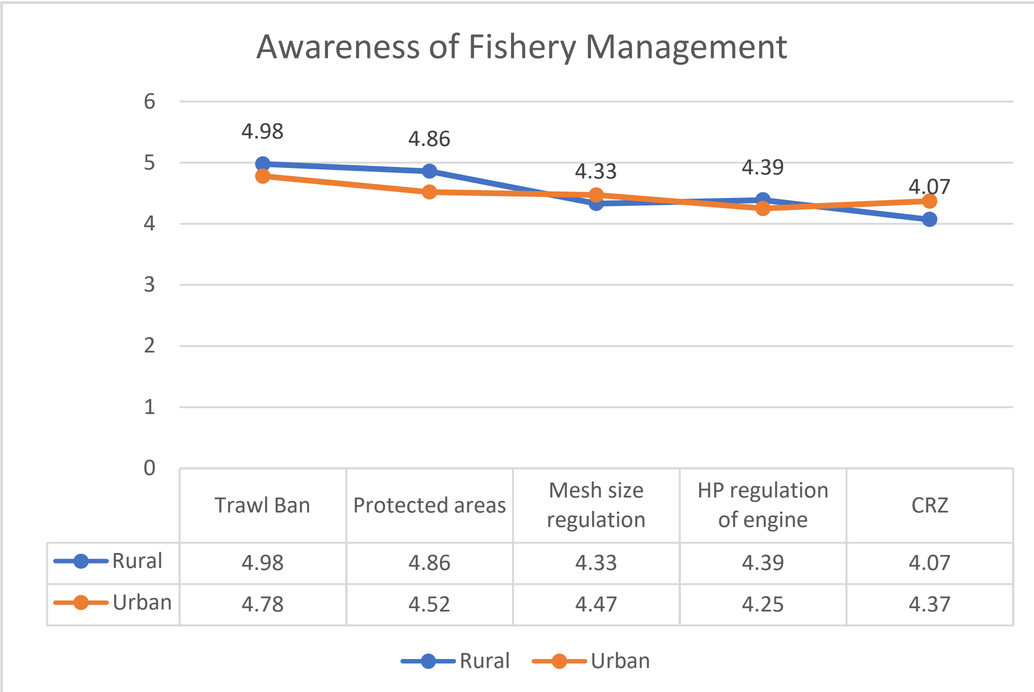
Indices	Value	Suggested Value
Chi-square value	144.479	-----
DF	33	------
P Value	0.000	>0.05 (Hair e al; 1998)
Chi-square value/DF	4.378	<5.00 (Hair et al; 1998)
GFI	0.959	>0.90 (Hu and Bentler, 1999)
AGFI	0.903	>0.90 (Hair e al; 2006)
CFI	0.918	>0.90 (Daire et al; 2008)
RMR	0.024	<0.08 (Hair e al; 2006)
RMSEA	0.08	<0.08 (Hair e al; 2006)

Source: Calculated from the Primary Data

The calculated P value is 0.064 which is greater than 0.05 which indicates that the model is perfectly fit. Here Goodness of Fit Index (GFI) value (0.996) and the Adjusted goodness of Fit Index (AGFI) value (0.996) is greater than 0.9 which represents that it is a good Fit.

The Calculate Normed Fit Index (NFI) value (0.977) and comparative Fit Index (CFI) value (0.985) indicate that it is perfectly fit and also it is found that Root Mean Square (RMR) and Root Mean Square Error of Approximation (RMSEA) value are 0.033 and 0.059) respectively, which is less than 0.08 which indicates that it is perfectly fit.

Figure 6.6
Awareness of fishery management



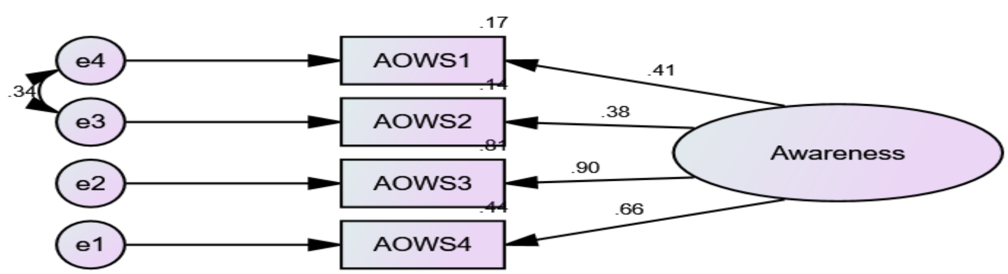
Source: Primary data

Fishery management techniques are the methods made to ensure the long-term viability of fisheries. Because the long-term sustainability of fish resources is critical for the livelihood security of the small-scale fishermen, their understanding of the issue is thoroughly examined. Trawl bans, Marine Protected Areas, Mesh Size Regulation, HP Regulation of Engines, and CRZ are the most common fisheries management strategies now in use by authorities. Each of these techniques is tailored to safeguard the ocean's ecosystem. The first four measures are directly related to fishermen's fishing techniques. Trawl bans are the most popular approach for protecting juvenile fish and promoting the survival of marine species. Marine protected areas are places that have been set aside to allow for the ongoing growth of fish. Mesh size limitations are rules in place to protect the lives of juvenile fish. To prevent fishermen from trespassing into deep sea fishing, the engine power of craft is restricted and monitored. All of these techniques are widely utilised around the world. Trawl bans and marine protected areas are two of the most well-known among them.

6.6 Structural Equation Model of Level of the Awareness of Welfare Schemes

The small-scale fishermen are unaware of government programmes that are available to them. The fisherman relief fund is the only government scheme that is more popular among them, according to the indices generated from the opinion of the small-scale fishermen. Among the nine available government schemes, the accidental insurance scheme has the lowest index number. Accidents that occur at work are taken very seriously by all other occupational sectors. The small-scale fishermen, on the other hand, have reaped lower benefits from the insurance plan. During the survey, some of the fishermen pointed out that the programmes were not being implemented properly. The small-scale fishermen who have registered with a neighbouring *Matsyafed* or equivalent governmental agency are entitled to these benefits in principle. The funding granted for the initiatives are sometimes delayed due to bureaucracy and red tapism. The Structural Equation Model on the Awareness of Welfare Schemes explained the interaction between these variables with the livelihood of the small-scale fishermen.

Figure 6.7
Structural Equation Model of Level of Awareness of Welfare Schemes



Source: Calculated from the Primary Data

The table of indices show the suggested value and the obtained value in the Structural Equation Model. The table is formed basing on the standard values which are obtained in the process of SEM in comparison with the suggested values.

Table 6.14

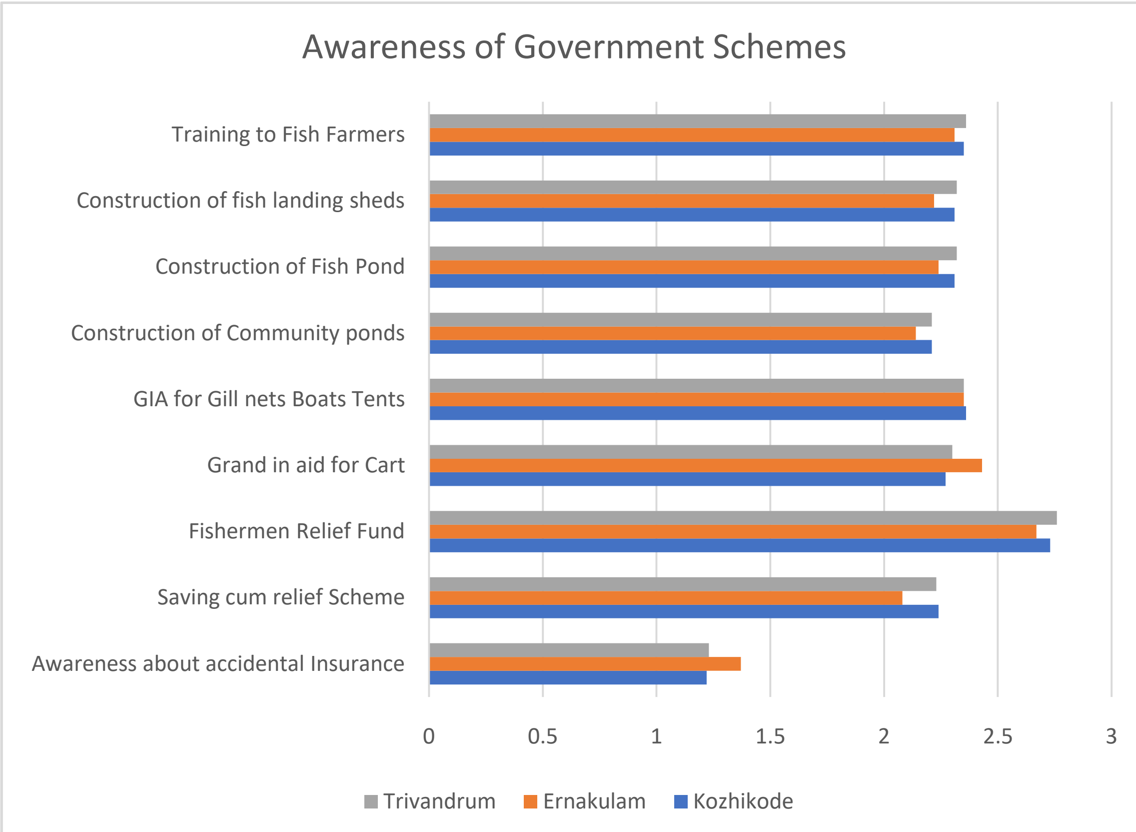
Table of Indices

Indices	Value	Suggested Value
Chi-square value	3.155	-----
DF	1	------
P Value	.076	>0.05 (Hair e al; 1998)
Chi-square value/DF	3.155	<5.00 (Hair et al; 1998)
GFI	0.997	>0.90 (Hu and Bentler, 1999)
AGFI	0.969	>0.90 (Hair e al; 2006)
CFI	0..995	>0.90 (Daire et al; 2008)
RMR	0.006	<0.08 (Hair e al; 2006)
RMSEA	0.066	<0.08 (Hair e al; 2006)

Source: Calculated from the Primary Data

The calculated value of Chi- square /DF is 3.155 which is less than 5.00 which indicates that all the factors identified as problems of Fisheries Management Practices are confirmed and significant as well. The other important indices such as Goodness of Fit Index, Adjusted goodness of Fit, the comparative Fit Index, the Root Mean Square Residuals (RMR) and Root Mean Square error of Approximation are all well within the limits. This indicates that the Factors identified as problems of current Fisheries Management Practices are significant.

Figure 6.8
Awareness on Welfare Schemes



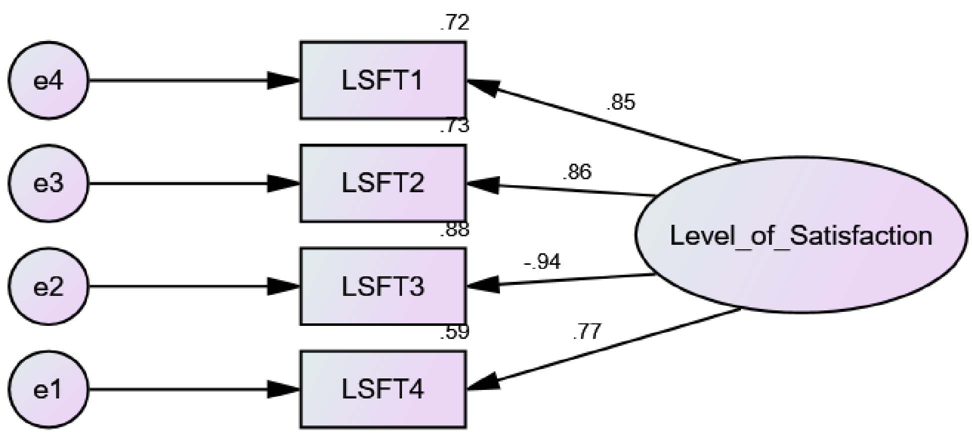
Source: Primary Data

The small-scale fishermen are unaware that subsidies exist to assist them in maintaining their livelihood options. The small-scale fishermen believe that more plans are needed to assist them in obtaining fishing equipment. There is currently only one scheme that facilitates fishermen in obtaining nets and, occasionally, crafts. Since the creditworthiness of the small-scaler fishermen is so low, banks that lend money to general public are reluctant to lend money to them. Given the nature of employment, the plans designed to create alternative employment are non-operational. The funds allocated to construct fish ponds and landing sheds have failed to stimulate enthusiasm in creating alternative employment. Furthermore, the training programmes for small-scale fishermen are poorly executed. The original goal of the scheme was to maintain ecological balance by training fishermen how to fish sustainably. In short, the inadequacy of the social schemes coupled with non-awareness add misery in the livelihood of the small-scale fishermen.

6.7 Structural Equation Model of the Level of Satisfaction in Fish Trade

A Structural Equation Model for the Level of Satisfaction in Fish Trade is generated. The small-scale fishermen are not directly involved in the fish trade. They are just one block in the chain. The middle men reap higher benefits than the small-scale fishermen who are the primary producers. The SEM model explains the interaction of variables in the fish trade and the livelihood of the small-scale fishermen.

Figure 6.9
Structural Equation Model of the Level of Satisfaction in Fish Trade



Source: Calculated from the primary data

The table of indices show the suggested value and the obtained value in the Structural Equation Model. The table is formed basing on the standard values which are obtained in the process of SEM in comparison with the suggested values.

Table 6.15
Table of Indices

Indices	Value	Suggested Value
Chi-square value	5.576	-----
DF	2	------
P Value	.062	>0.05 (Hair e al; 1998)
Chi-square value/DF	2.788	<5.00 (Hair et al; 1998)
GFI	0.995	>0.90 (Hu and Bentler, 1999)
AGFI	0.973	>0.90 (Hair e al; 2006)
CFI	0..998	>0.90 (Daire et al; 2008)
RMR	0.010	<0.08 (Hair e al; 2006)
RMSEA	0.060	<0.08 (Hair e al; 2006)

Source: Computed from the Primary data

The calculated value of Chi- square /DF is 3.155 which is less than 5.00 which indicates that all the factors identified as problems of Fisheries Management Practices are confirmed and significant as well. The other important indices such as Goodness of Fit Index, Adjusted goodness of Fit, the comparative Fit Index, the Root Mean Square Residuals (RMR) and Root Mean Square Error of Approximation are all well within the limits. This indicates that the Factors identified as problems of current Fisheries Management Practices are significant.

Table 6. 16

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	8	5.576	2	.062	2.788
Saturated model	10	.000	0		
Independence model	4	1453.319	6	.000	242.220

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.010	.995	.973	.199
Saturated model	.000	1.000		
Independence model	.397	.386	-.024	.231

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.996	.988	.998	.993	.998
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.333	.332	.333
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	3.576	.000	14.732
Saturated model	.000	.000	.000
Independence model	1447.319	1325.678	1576.326

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.011	.007	.000	.030
Saturated model	.000	.000	.000	.000
Independence model	2.912	2.900	2.657	3.159

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.060	.000	.121	.305
Independence model	.695	.665	.726	.000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	21.576	21.738	55.293	63.293
Saturated model	20.000	20.202	62.146	72.146
Independence model	1461.319	1461.400	1478.177	1482.177

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	.043	.036	.066	.044
Saturated model	.040	.040	.040	.040
Independence model	2.928	2.685	3.187	2.929

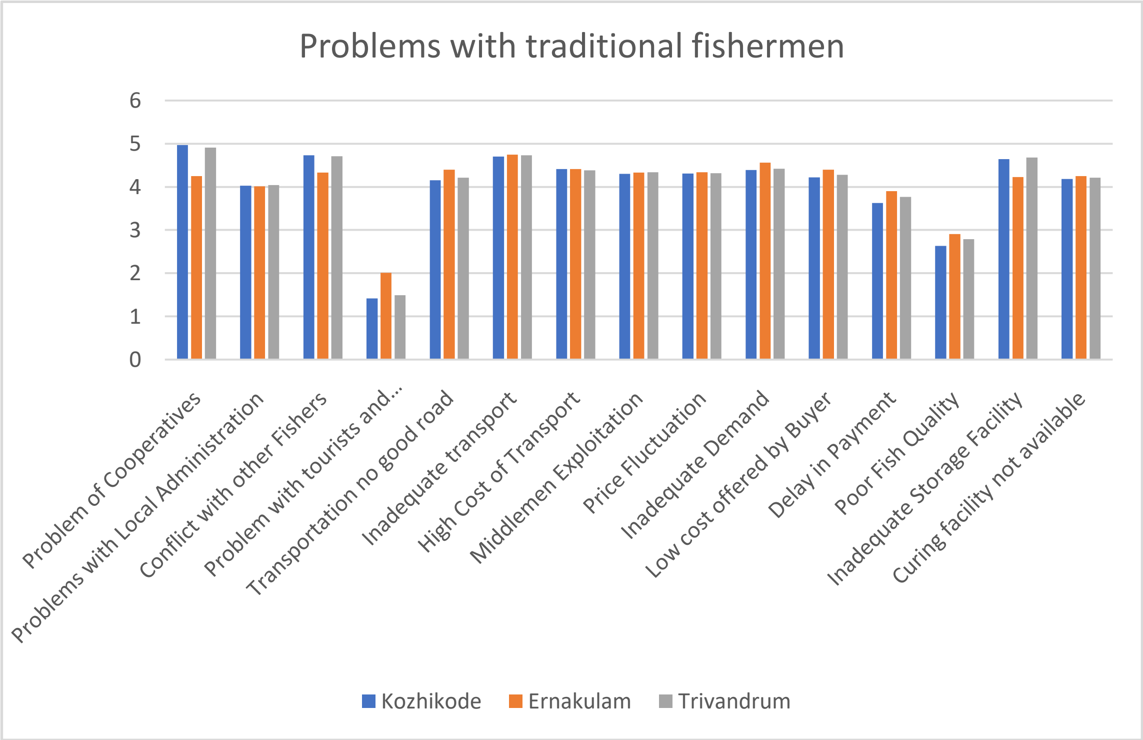
HOELTER

Model	HOELTER .05	HOELTER .01
Default model	537	825
Independence model	5	6

Source: Calculated from the Primary Data

Maximum Likelihood Estimation of Structural Equation Model includes minimizing deviations of the expected covariance and means matrices from the observed data. Here the model fit summary explained the overall fit of the model without any misspecifications. The indices in the model are well below the requirement as indicated in the collective analysis. The Structural Equation Model in the present study is fit for making predictions. Unstandardized coefficients contain information about both the variance and the mean, and therefore are essential for prediction.

Figure 6.10
Problems of the Small-Scale Fishermen



Source: Primary data

The responses from the primary data is also attached with the SEM model for comparison. The responses from the primary survey is reiterated in the SEM model statistically. The interaction of the variables in the SEM confirmed that the small-scale fishermen do have problems in the fish trade which is affecting their livelihood.

6.8 Confirmatory Structural Equation Model for Reasons for Fish Depletion

The small-scale fishermen's livelihood was highly dependent on fish depletion. Climate change, overfishing, unsustainable fishing, depletion of mangroves, trawling, and drudging, are the main causes of fish depletion in the opinion of the small-scale fishermen. The outcomes were nearly identical across regions and rural-urban areas. This indicated that the causes of fish depletion are universal across all locales.

A SEM model was generated to find out the interaction between the variables in fish depletion and the livelihood of the small-scale fishermen.

Table 6. 17
Model Fit Summary

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	9	3.155	1	.076	3.155
Saturated model	10	.000	0		
Independence model	4	427.769	6	.000	71.295

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.006	.997	.969	.100
Saturated model	.000	1.000		
Independence model	.183	.682	.469	.409

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.993	.956	.995	.969	.995
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.167	.165	.166
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	2.155	.000	11.705
Saturated model	.000	.000	.000
Independence model	421.769	357.628	493.317

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.006	.004	.000	.023
Saturated model	.000	.000	.000	.000
Independence model	.857	.845	.717	.989

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.066	.000	.153	.257
Independence model	.375	.346	.406	.000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	21.155	21.338	59.087	68.087
Saturated model	20.000	20.202	62.146	72.146
Independence model	435.7696	435.850	452.627	456.627

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	.042	.038	.062	.043
Saturated model	.040	.040	.040	.040
Independence model	.873	.745	1.017	.873

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	608	1050
Independence model	15	20

Source: Calculated from the Primary Data

Maximum Likelihood Estimation of Structural Equation Model includes minimizing deviations of the expected covariance and means matrices from the observed data. The model fit summary explained the overall fit of the model without any misspecifications. The indices in the model are well below the requirement as indicated in the collective analysis. The Structural Equation Model in the present study is fit for making predictions. Unstandardized coefficients contain information about both the variance and the mean, and therefore are essential for prediction.

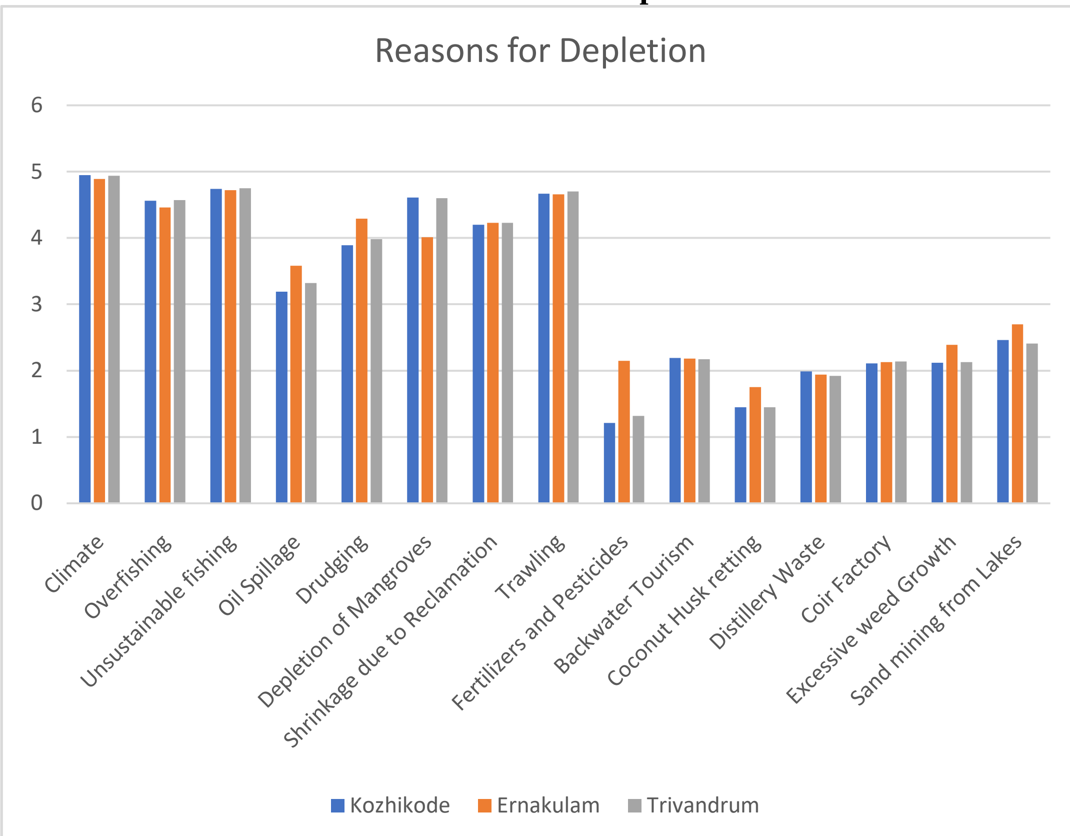
Table 6.18
Validity and Reliability

Factor	Loadings	Item Reliability	Delta	AVE	Sum of FL	Sum of Delta	CR
LSFT1	0.937	0.878	0.122				
LSFT2	0.897	0.805	0.195				
LSFT3	0.874	0.764	0.236				
LSFT4	0.842	0.709	0.291	0.789	3.55	0.845	0.937
AOW1	0.859	0.738	0.262				
AOW2	0.778	0.605	0.395				
AOW3	0.674	0.454	0.546				
AOW4	0.674	0.454	0.546	0.563	2.985	1.748	0.836
FCFM1	0.854	0.729	0.271				
FCFM2	0.762	0.581	0.419				
FCFM3	0.694	0.482	0.518	0.597	2.31	1.208	0.815
LAOFM1	0.828	0.686	0.314				
LAOFM2	0.668	0.446	0.554	0.566	1.496	0.868	0.720
USFM1	0.912	0.832	0.168				
USFM2	0.796	0.634	0.366	0.733	1.708	0.535	0.845
PAFM1	0.849	0.721	0.279				
PAFM2	0.609	0.371	0.629	0.546	1.458	0.908	1

Source: Calculated from the Primary Data

The calculated value of Chi- square /DF is 3.155 which is less than 5.00 which indicates that all the factors identified as problems of Fisheries Management Practices are confirmed and significant as well. The other important indices such as Goodness of Fit Index, Adjusted goodness of Fit, the comparative Fit Index, the Root Mean Square Residuals (RMR) and Root Mean Square error of Approximation are all well within the limits. This indicates that the Factors identified as problems of current Fisheries Management Practices are significant.

Figure 6.10
Reasons for depletion



Source: Primary data

The explanations given by small-scale fishermen were also frequent in international circles, which is a startling truth. All the coastal districts of Kerala are feeling the effects of changed climatic conditions. The water level has increased significantly as a result of changing climatic circumstances, resulting in massive waves during the rainy season. In Kerala, the number of cyclones had been on the rise. Changes in climatic circumstances have an impact on regional fish habitat in the sea. Some pelagic fishes have relocated their habitat to demersal seas, which is unusual. Overfishing is a well-known fact among fishermen. Kerala's maritime boundaries are clogged with big trawlers plying the deep-sea. Unsustainable fishing, such as juvenile fishing and fish discards, adds to the overfishing. The degradation of mangroves harmed the long run viability of the eco-system. The presence of trawlers was also causing a significant reduction in the number of fish in the sea. The small-scale fishermen are the ones that suffer as a result of fish depletion. As the population of fishes declined over time, the volume of fish available for catching decreases dramatically. The small-scale fishermen did not have the same fishing equipment as large trawlers. As a result, the catch of the small-scale fishermen decreased.

6.9 Regression Analysis on the Current Fisheries Management Practices and the Livelihood Challenges of the Traditional Fishermen

By using one or more predictor variables, regression analysis attempts to estimate the value of the dependent variable. The Least Square Method is used to create an equation including the dependent and independent variables.

Simple regression is the method used when the estimation is based on a single independent variable, and multiple regression is the method used when there are multiple independent variables involved in the calculation.

Dependent variable:

Level of Satisfaction from Fish Trade

Independent Variable:

1. Level of Awareness on Fisheries Management Practices
2. Level of Awareness about the Welfare Schemes
3. Flaws in the Current Fisheries Management Practices
4. Unscientific Fisheries Management Practices
5. Pro- active Measures for Improving Fisheries Management Practices

Multiple R value: 0.441

R Square: 0.194

F value: 23.798

P value :< 0.001***

Table 6.19

ANOVA

Model	Sum of squares	Df	Mean square	F	Sig
Regression	507.413	5	101.483	23.798	<0.00***
Residual	2106.579	494	4.264		
Total	2613.992	499			

Source: Computed from the primary data

The ANOVA table explained the significance of the model. The F value is 23.798 with 5 as the Df. The respective mean square values are 101.483 and 4.264 at the regression and residual model.

Table 6.20

Table of Coefficients, Collinearity Statistics and Durbin Watson Value

	Unstandardized Coefficients		Standardized Coefficients	t	Sig	VIF
	B	Std. Error	Beta			
Constant	12.412	1.321		9.399	<0.001	
Level of awareness on Fish trade	0.320	0.063	0.217	5.051	<0.001	1.133
Awareness on welfare schemes	0.156	0.043	0.153	3.391	<0.001	1.253
Flaws in the current fisheries management practices	-0.816	0.080	-0.423	-10.196	<0.001	1.053
Unscientific Fisheries Management Practices	0.134	0.117	0.042	1.144	0.253	1.052
Proactive measures for improving Fisheries Management practices	-0.218	0.104	-0.090	-2.098	0.036	1.129

Source: Computed from the primary data

Durbin Watson value = 1.380

Using unstandardized regression coefficients (B) the model regression equation can be developed as follows:

Level of satisfaction from Fish trade = 12.412 + 0.320 (Level of awareness on fisheries management practices) + 0.156 (awareness on welfare schemes) -0.816 (Flaws in the current fisheries management practices) -0.218 (Proactive measures for improving Fisheries Management practices)

It may be concluded that the above regression equation is quite reliable as the value of R^2 is 0.194 of the total variability regarding the level of satisfaction of the small-scale fishermen from fish trade. In other words, five variables selected in this regression equation explain 19.4 per cent of the total variability regarding the level of satisfaction of the small-scale fishermen from fish trade which is quite good. Since F value for this regression model is highly significant the model is highly significant and therefore it may be interpreted that all the five variables selected in the model, namely, Level of awareness on Fisheries Management Practices, Level of awareness about the welfare schemes, Flaws in the current Fisheries Management Practices, Unscientific Fisheries Management Practices, Pro Active measures for improving Fisheries management practices have significant predictability in estimating the level of satisfaction of the small-scale fishermen from Fish trade.

The Regression Equation Model of the level of satisfaction of the small-scale fishermen from Fish trade, the coefficients of the independent variables such as Level of awareness on fisheries management practices, Level of awareness about the welfare schemes and Flaws in the current Fisheries management practices, Unscientific Fisheries Management practices, Pro-active measures for improving Fisheries management practices are 0.320, 0.156, -0.816, 0.134 and -0.218 respectively. These coefficient values represent the partial effect of these independent variables on the level of satisfaction of the small-scale fisher folk from fish trade.

Among the five predictor variables, three of them have positive coefficients. This means that such effect is positive and that the level of satisfaction of the small-scale fishermen would increase by 0.320 units for every unit increase in level of awareness on the fisheries management practices. The coefficient value is significant at one per cent level of significance except for unscientific fisheries management practices and proactive measures for improving fisheries management practices. The unscientific fisheries mismanagement practices is found to be insignificant while proactive measures for improving Fisheries Management practices is found to be significant at five per cent level.

The coefficient of the level of Awareness on fisheries Management Practices is 0.320. This implies that level of satisfaction from fish trade would increase by 0.320 units for every unit increase in the level of awareness on fisheries management practices holding all other independent variables as constant. Similarly, the coefficient of awareness on welfare Schemes for the fishermen is 0.156. This means, every unit increase in awareness on welfare schemes for fishermen, the level of satisfaction from fish trade increased by 0.156 units. The coefficient of flaws in the current fisheries management practices is -0.816. This means for every unit increase in the flaws in the current fisheries management practices, the level of satisfaction from fisheries trade would decline by 0.080 units.

The coefficient of unscientific Fisheries Management Practices is 0.134 and is found to be statistically insignificant. This implies that unscientific Fisheries management practices is currently prevailing in the Fisheries Management Practices of small-scale fisher folks.

The coefficient value of Proactive measures for improving Fisheries Management practices is -2.18. This implies that the level of satisfaction form fisheries trade would decrease by 2.18 units for every unit decline in the Proactive measures for improving Fisheries Management Practices.

The variance inflation Factor exhibited in the model for each one of the five independent variables were 1.133, 1.253, 1.053. 1.052 and 1.129 respectively. These values are well within the limits of the threshold value 3. This implies that there is no multicollinearity existing in the model. In other words, there exists no high correlation among the five independent variables.

The Durbin Watson value exhibited in the analysis of the model was 1.380. This is well within the threshold limit of 2. Therefore, there exists homogeneity in the variance among the error variables of the model. In other words, there exists no heteroscedasticity in the model and the regression model is a robust model.

6.10 Summary of the Chapter

The influence of the fishery management practices upon the livelihood of the small-scale fishermen was assessed using Factor Analysis, Structural Equation Modelling, Correlation Coefficient and Regression Analysis. An exploratory factor analysis was done in order to ensure dimension reduction and to study the inter relationships among the variables in an effort to find new set of factors. Accordingly, six common factors were extracted to facilitate the study of the relationship of original variables. The factors so extracted were named Level of Awareness on Fisheries Management Practices (LAOFM), Awareness on Welfare Schemes for Fishermen (AWOS), Level of Satisfaction from Fisheries Trade (LSFT), Flaws in the Current Fisheries Management Practices (FCFM), Unscientific Fisheries Management Practices (USFM) Proactive Measures for Improving Fisheries Management Practices (PAMIFM). In the Structural Equation Model, Level of Satisfaction from Fish Trade was taken as the variable representing the livelihood of the small -scale fishermen. The lack of awareness about the fishery management practices, lack of awareness of subsidies and incentives, flaws in the current fishery management practices were found to be leading to unscientific fishery management practices. As the pro-active measures for improving the fishery management practices were enhanced the level of satisfaction in fish trade tend to improve. Five SEM models were individually constructed to identify the interaction of the six variables. In all such models the livelihood of the small-scale fishermen tended to be affected due to the presence of unscientific fishery management practices. The Karl Pearson’s Correlation Coefficient and Regression Analysis confirmed the findings of the SEM models.

CHAPTER – 7

SUMMARY, RECOMMENDATIONS AND CONCLUSION

7.1. Introduction

Kerala, the southernmost state in the Indian sub-continent, is enthroned with a coastline of 590 Kilometers and a continental shelf of 39,139 sq.kms. Being endowed with the most productive area of Arabian Sea, the coastal belt of Kerala is the natural habitat to many commercially important species of fishes. The share of the fishery sector in the Agricultural State Domestic Product of Kerala is increased from 5.18 per cent in the eighties to 9.36 per cent in nineties and thereafter maintained a stable position. The consistent increase in the share of fisheries in the agricultural and allied sectors over the years establishes the significance of this endemic sector. The State has two major fishing harbors at Cochin and Sakthikulangara and about 220 fish landing centers distributed over 335 fishing villages. During 2018-19 total population of the fisher folk of Kerala found to be 10.53 lakhs (Government of Kerala, 2020) Fisheries sector contributes significantly to the national economy while providing livelihood to approximately 14.49 million people in the country. (Government of Kerala,2020). It has been recognized as a powerful income and employment generator as it stimulates growth of a number of subsidiary industries and is a source of cheap and nutritious food besides being a source of foreign exchange (Government of Kerala,2014). Amidst the global recession and economic meltdown, the fisheries sector performed well and the country's seafood trade grew by double digit in quantum as well as value. (Shyam.S.Salim, 2019).For the dwellers of coastal belt, fishing has been regarded as the primary livelihood option. Fisheries play a decisive strategic role in our country by its contribution to national income, foreign exchange, food and employment. The more significant contribution of fisheries worldwide is the supply of highly nutritious animal protein for human consumption and employment and income generation in the remote coastal areas. Coastal urbanization is much facilitated by development in the fisheries sector. The well guided fisheries resources can be used to finance investments within or outside the sector. The beach sides and the fishing activities (eg. ports, fishing boats, landing sites and fish markets) is attractive to many people.

7.2. Major Findings of the Study

The present study was an assessment of the livelihood of the small-scale fishermen and the need for an effective fisheries management practices. In order to find out the problems, four objectives were framed in the study. They are as follows:

1. To identify the trend and structure of the fishery management practices in Kerala.
2. To estimate the Sustainable Livelihood and to analyse the challenges of the small - scale fishermen of Kerala.
3. To find out the factors of fisheries management that influence the livelihood of small-scale fishermen of Kerala.
4. To analyze alternative livelihood strategy and suggest appropriate measures for sustainable fisheries management for small-scale fishermen of Kerala.

7.2.1Trend and Structural Composition of Fish Production and the Role of Fisheries Management

- The contribution of India to the world fisheries has been remarkable since 1950. In certain periods there are some fluctuations. The percentage of contribution of the marine fisheries shows a decrease till the 1970's, thereafter a marginal increase can be seen since the 1980's and in 2010 it got increased to 3.42per cent. In 2020, the marine fish production rose to 4.43 per cent. The increase in the fishing effort has contributed significantly to the increase in the fish production. The mechanization of the Indian marine fisheries sector which started off in 1970 was instrumental in the tremendous increase in fish production.
- Fish landings of India has shown a steady growth since 2015. It grew from 10.76 metric MT in 2015-16 to over 14.16 metric MT in 2019-20. In the initial years, the marine sector contributed more to total fish production than the inland sector. In the 1950-51, marine production contributed about 71 per cent, but fell gradually to 43 per cent in 2005-06, while the inland sector contributed 29 per-cent in 1950-51 and rose to about 57 per cent in 2005-06. In fact, by the year 2000, its share reached 50 per cent and the sector continued to increase its share further in the coming years.
- Increase in the capacity of the vessels, improvements in mechanization and rapid growth in the trade led to explosive growth in the exploitation of marine fisheries through the 1960s, 1970s and 1980s. But from the late 1990s onwards, marine Fisheries production has reached a plateau and it seems that it can show only a marginal increase in the near future. With most wild Fisheries near maximum sustainable exploitation levels, capture Fisheries will most likely grow slowly.

- The analysis of the data pertaining to the last 40 years have shown that the average annual growth rate in marine sector is 4.24. The marine sector has registered a growth of 3.24 per cent and the inland sector has contributed a growth of 6.2 per cent. The growth in the inland sector showed a steady growth of 3 per cent on an average every year and the marine sector grew only at a rate of 2 per cent every year. In 2000-2001 and 2004-2005, the marine sector registered a negative growth. The trends in the production revealed that 90 per cent of the marine fish production is from 50-70 m depth and the remaining 10 per cent is from 200 m depth. While artisanal and motorized sectors have contributed 93 per cent of the production, the remaining seven per cent comes from deep sea fishing fleets, continuing their operation mainly to the shrimp grounds on the upper east coast. Hence, to enhance and sustain the contribution from this sector, it should target the untapped potential of the deep sea, supported by enhanced investment in mechanized vessels, capacity strengthening of artisanal sector, and, probably, a proper institutional structure to share the benefits.
- An assessment of the data pertaining to fish stock indicated that the health of major commercially important species has been deteriorating over the years. The analysis further noted that the burden of resource crisis had been quite intense among artisanal fishermen than their mechanized counterpart as the later has better options to migrate to distant grounds. The analysis of economic viability of major fishing methods of artisanal and mechanized fishermen revealed disturbing signals for management. For instance, viability analysis of artisanal non-motorized fishing units recorded nominal positive net profits while motorized ring seine fisheries incurred heavy loss in Ernakulam district. The artisanal mechanized ring seine fisheries in Ernakulam district on the other hand experienced wide fluctuations in net profit between 2004 and 2007. The costs and earnings analysis of different class of mechanized trawlers operating in Ernakulam district recorded huge economic loss in the last decade. Purse-seine sector faced tough competition from the newly evolved mechanized artisanal ring seine sector. Results indicated ruining of modern purse-seine fisheries due to effectual competition posed by the newly evolved artisanal mechanized fishing vessels. In other words, the study confirmed that

mechanized fishing industry has been experiencing serious economic problems due to escalation of input prices, scarcity of resources to harvest, lack of remunerative prices for landings, increase in searching time and tough competition from the mechanized artisanal sector. The results also indicated that artisanal fishermen are more vulnerable to such economic and resource crisis.

- Production trends of important pelagic and demersal fisheries were examined using appropriate statistical methods. The analysis clearly revealed that except few species, marine fisheries output has been rising in Kerala due to mechanization. This finding simply means that the fishing industry has been growing as mechanized boats brought more fish landings from distant fishing grounds which now stretch beyond Kerala's territorial waters towards western and eastern
- The study found out that yield from marine resources increased in Kerala State due to the introduction of the trawl ban from 1988. However, the 5-point moving average graph unmistakably shows that the positive impact on fishery yields was present only up to 1997 (9 years), and thereafter, the fishery yields were declining and the net decline being more than one lakh tonnes after 2000. This indicates that the benefit in terms of yield was not sustained. The economic analysis explained that in value terms the benefit of the trawl ban was present only up to the year 2000, after which there has been a decline in real value of the fisheries and ultimately incomes to fishermen in spite of increase in nominal value. The growth rate analysis also clearly brought out that growth rate in the mechanized sector was negative after the year 2000, and the benefit of the trawl ban was not sustained after 2000.
- The export revenue from marine resources accounts for approximately 8 per cent of the country's total fish output, making it a significant source of revenue in terms of foreign currency. It accounts for about 16per cent of all agricultural exports. Marine goods, including fish, shellfish, and other marine species, are shipped worldwide. In 2019-20, the export value of goods amounted to ₹ 46,662.85 crore which is 1per cent of India's total exports (Handbook of Fisheries Statistics, 2020). India exported 12,89,650.90 tonnes of marine products in 2019-20 (Hand Book of Fisheries Statistics, 2020). There was a rise of 60.23per cent in rupee terms, 5.98 per cent in

volume, and a gain of 42.60 per cent in US $ compared to the previous year. The export profits surpassed $5 billion in 2018-19, the most recent year for which data is available. Frozen shrimp which has been the most valuable export of India accounted for 64.1 per cent of export revenue in dollar terms. The sharp rise in the output of shrimp, rise in the productivity of “Black tiger shrimp”, and rise in the price of products such as Cuttlefish, Prawn, and Calamaries have contributed to a substantial export turnover. Frozen finfish, frozen cuttlefish, and other seafood products also brought in foreign exchange to India.

7.2.2. Sustainable Livelihood Approach and the Socio-Economic Conditions of the Small -Scale Fishermen

Approximately ten lakh fishermen in Kerala rely on marine fisheries for their livelihood. it is an occupation practiced by several coastal towns of the State. Progressive methods in fish harvesting and accessibility to investment funding resulted in sharp rise in capture fisheries in the late 1960s. The advent of motorized "trawlers and purse-seiners" in the early 1960s increased fishing effort, albeit at the expense of "small-scale fisherman". Their reaction was to implement OBMs in indigenous crafts, that allowed them to maximize output and capture. Despite the rise in pressure on natural resources over the last 15 years, official records of the fish landings showed that output has remained stable at roughly 5.5 lakh tonnes. In the opinion of the researchers, "the open-access" nature of marine fisheries and the deployment of strong fishing technology led to biophysical and socio - economic overfishing, resulting in "stagnation" in fish landings and decreasing earnings for "small-scale fishermen".

Sustainable Livelihood approach was the scientific base on which the “livelihood of the small- scale fishermen” was based. Sustainable Livelihood approach presupposes accessibility to “physical capital, natural capital, human capital, financial capital and social capital”. The study assessed the accessibility of the small-scale fishermen to these assets. The findings are as follows:

- 98.7 per cent of the households in the study area depend on the income from the fishery resources. The households who pursue non-fishing activities are less than 2 per cent.

- According to government data, the yearly capture of fish stocks in Kerala region has risen significantly to around 6 lakh tonnes, compared to a "maximum sustainable yield (MSY)" of 5.7 lakh tonnes. If this scenario persists, the "marine sector" may face a significant resource deficit. The main cause for the expansion "in fish production" is the proliferation of fishing vessels, that too the big vessels and the increase in the catch rate. Illegal fishing and indiscriminate fishing also play a crucial role. This trend was aided by advantageous business conditions, appealing cost, and government regulations that favoured exports.
- Individual captures and earnings continued to "level off" as fishing intensity grew, and "the small-scale sector", particularly non-motorized craft owners, saw their proportion of the market collapse.
- The fishery resources are collectively referred to as the natural resources. The open access nature of the fishery resources makes them accessible to all. Nevertheless, the proliferation of the trawlers and the depletion of fishes make the things worse for the small-scale fishermen. The accessibility to natural resources is limited for the small-scale fishermen due to the proliferation of the trawlers and the depletion of resources. The management restrictions which prevent them from going beyond 30 nautical miles deprives them of their normal catch. The recent changes in the climatic conditions and the rising sea level temperature have resulted in depletion of the resources. These factors have collectively contributed to inaccessibility of the small-scale fishermen to the natural resources.
- The study found that the small – scale fishermen cannot access physical capital which affects their livelihood. 56.6 per cent of the small-scale fishermen do not own their own land. 45.6 per cent of the small-scale fishermen do not possess a house of their own.
- The average percentage of literacy among "small-scale" fishermen is below the State average. 45 per cent of the fishermen from the district of Thiruvananthapuram, 30 per cent of the fishermen from Ernakulam district and 35 per cent of the fishermen from Kozhikode district are illiterate. Nevertheless, it has been discovered via observations and interviews of the residents that even among those with an elementary education, majority are unable to read or write. Parents,

on the other hand, are keen to provide their children with quality education within their means, although there are numerous dropouts among children aged 5 to 14. The children of the small-scale fishermen who undergo regular schooling can afford education up to higher secondary level. The study found that the low profile in education affect the occupational opportunities of the community.

- According to "survey data", the households of the fishermen had an average monthly per capita income of ₹ 1363 (as indicated by monthly consumption expenditure (MPCE)). This amount may seem to be higher comparing it with the average monthly income of the rural household of Kerala. However, these high earnings must be viewed in the context of the fishermen's daily earnings, which are highly volatile and uncertain, as well as the risk of accidents and environmental disasters to which they are exposed. According to the survey data, the MPCE for roughly 10 per cent of households is less than ₹350, and for about 1per cent, it is less than ₹ 500.
- The principal earnings for the households was found to be fishing and fish-related activities after an assessment of the income structure. Fishing income comes from the possession and use of fishery assets, as well as the employment of family members in fishing and related activities. 15 per cent of the small-scale fishermen earned income from allied activities of fishery. The fishermen who have switched the employment between fishing and other alternative employment are 2 per cent. The overall percentage of fishermen who have completely switched over to other employments are less than one per cent.
- The major impediments faced by the small-scale fishermen are open access nature of the marine resources multi-species catch, lack of control over market, limited mobility and lack of alternative employment opportunities. Traditional barriers to entry have broken down under population pressure and introduction of more efficient technologies. These, combined with limited occupational and geographical mobility reduce the opportunity cost of fishing, increase dependence on fishing, discouraging exit and encouraging new entry. The situation may lead to increasing resource depletion and further impoverishment of small-scale fisherfolk.

7.2.3. Livelihood Challenges of Small-Scale Fishermen and the Faulty Fishery Management Practices

- The livelihood of the small-scale fishermen depends on the sustainability of the fishery resources. The unsustainability of the fishery resources is the result of the ineffective fishery management practices. So, it can be concluded that the unscientific fishery management practices detrimentally affect the livelihood of the small-scale fishermen. The exploratory factor analysis showed that the level of awareness about fishery management practices, prevalence of unscientific fishery management practices and the ineffective fishery management practices together affect the livelihood of the small - scale fishery.
- The level of satisfaction form fish trade is taken as the outcome of the effective fishery management practices. In the confirmatory Structural Equation Model, Level of awareness on Fishery management Practices, Level of Awareness on the welfare schemes, and Flaws in the current fishery management practices collectively lead to Unscientific Fishery Management Practices. By promoting the proactive fishery management practices, the level of satisfaction in fish trade was ensured. The primary data analysis revealed that the level of awareness about the welfare schemes, level of awareness about fishery management practices were lower than the average level. It has also been proved that the prevalent fisheries management practices are inefficient.
- Incentives and subsidies are inherent mechanism in a system which motivate people not to degrade or destroy the natural habitat. In marine fishery the degradation happens due to increased effort of fishing. The fishermen are forced to increase the fishing effort as the level of catch goes on decreasing. The government can reduce the fishing effort by subsidizing the fishing families by way of incentives and grants. The incentives and subsidies can be of two types. The first one is the grant in aids which are given for the promotion of the fish catch. There are governmental schemes which empower the fishermen to adopt new methods for fishing. The second one is the grant in aid given for alternative employment opportunities. In the second method the employment burden on the fishery sector can be reduced thereby ensuring sustainability.

- The Pro-active fishery management practices are conceived to be the major driving force behind the successful implementation of the fishery management practices in Kerala. In the SEM model, the interaction between the Proactive measures and the level of awareness about fishery management practices were found to be positive. The estimated positive sign implies that such effect is positive and that the Proactive Measures for improving the Fisheries management Practices would increase by 0.381 units for every unit increase in level of awareness on fisheries management practices. This coefficient value is significant at 1per cent level of significance.

7.2.4. Alternative Livelihood Opportunities of the Small-Scale Fishermen

- The number of people who pursue fishing as a profession is declining day by day. Fishing is a community-based activity in Kerala. 52 per cent of the households cited irregular income source as the reason for not engaging in fishing. This is nearly identical in all three regions. 33 per cent of the small -scale fishermen opt out of fishing as it is labelled as an occupation with low social status.
- During times of low revenue, fishermen were obliged to seek alternative sources of money in order to survive. Construction field was the obvious and feasible option for small-scale fishermen. Because opportunities are transient, various categories were given a second chance. Agriculture, dairying, and aquaculture ranked third, fourth, and fifth, respectively. The results clearly demonstrated that the most readily available options were daily wage employment. These were also transitory. The small-scale fishermen were unable to commit to any work for the long term due to the instability in the fishing industry. Alternative occupation provided them with almost no advantage. Their existing educational qualifications and skills prevented them from pursuing other professional opportunities. The poor income was result of the low productivity of alternative employment possibilities. The small-scale fishermen's livelihood chances were insecure in any situation.

7.3. Recommendations

- Fishery Management Practices should be implemented effectively in all the coastal districts of Kerala in order to check the illegal and indiscriminate fishing. The effective implementation of the measures will check depletion and thereby attaining sustainable growth of marine resources.

- The Marine Institutes across the State can make use of the local fishing practices and customs of the small-scale fishermen. Regardless of the present Fishery Management Practices, the local fishermen of Kerala had developed community-based fishery management practices which were very effective. The scientific community of the present times can combine the local knowledge of the fishermen for better collaboration
- The small-scale fishermen should be given effective incentives to pursue alternative employment. There must be measures for skill development for the children of the fishermen to come up in life. The incentives for alternative employment can decrease the fishing pressure and can bring sustainability.
- The growth of aquaculture in Kerala has been rather slow. Aquaculture is a useful method to sustainably protect the marine resources. It can be suggested as a viable alternative employment for the fishermen. The Government can subsidize the initial costs for small-scale fishermen as a first step. Andhra Pradesh and Goa are best examples before us in aquaculture.
- Alternative employment in the allied activities of fishing had been decreasing over time. In the coastal districts of Kerala, the investments in fishing industry is done by the outsiders at the cost of the primary producers of the marine resources. The government can take necessary steps to allow loans for the small-scale fishermen to invest in fishery industry.
- The online trade in fishing is a business with large possibilities. It is quite unfortunate that the fishermen who are the primary producers are not coming up in online trade. The younger generation can take up this as a startup business with necessary governmental help.
- Coastal Regulation Zone (CRZ) is the fishery management practice which affect the settlements of the small-scale fishermen. Even though the objective of the rule is to protect the bio diversity, the small-scale fishermen have always been at the receiving end. There should be effective mechanism to accommodate the fishermen who are displaced due to CRZ regulations.

7.4. Contribution of the Researcher and the Policy Implications

The major thrust of the study was to assess the livelihood challenges of the small-scale fishermen at the backdrop of the Sustainable Livelihood Framework. The study found out that the small-scale fishermen have limited access to natural, physical, social, financial and human capital. The findings were reflected in low level of literacy, low savings, reduction in the ownership of physical assets and fishing assets, low income, rising liabilities and increasing marginalization. 52.6 per cent of the fishermen who were interviewed were illiterate. The profile of education of the children of the fishermen showed that 75.2 per cent of them reach only up to higher secondary education. This revealed that their accessibility to human capital is limited. The accessibility of the small-scale fishermen to natural capital was also reduced in terms of ownership of land. 50 per cent of the small- scale fishermen from the study area do not possess their own land. 45.7 per cent possess only less than 3 cents of land. The ability of the small-scale fishermen in acquiring the physical and fishing assets was also limited. Only 15.3 per cent of the small - scale fishermen own craft and gear. The small- scale fishermen who own a house are 50.8 per cent. The study found out that the level of savings among the small-scale fishermen is very low. The total volume of savings among the small- scale fishermen is between ₹ 50000 and ₹100000. The small-scale fishermen who save between ₹50000 and ₹ 100000 were 54.5 per cent. The financial liability of the small-scale fishermen is reflected in their loans and borrowings. 86.7 per cent of them owe a debt of ₹100000 or above. The study found out that the average monthly income of the small-scale fishermen is between ₹5000 and ₹ 8000. Irregularity and fluctuations in the income affect the level of savings, expenditure and loans and borrowings. The decreasing opportunities of alternative employment and low educational profile of the children further worsened the situation. Fishing which is the mainstay of their livelihood was found to be unprofitable due to the ineffective fishery management practices prevalent in the country. There were significant factors in the fishery management practices which affected the livelihood of the small-scale fishermen. Lack of awareness about the fishery management practices, lack of awareness about the welfare schemes, flaws in the current fishery management practices gave rise to unscientific fishery management practices which affect the sustainability of fish stock and the sustainability of the livelihood. The study calls for proactive management measures such as alternative employment opportunities and effective implementation of fishery management practices for sustainable livelihood of the small-scale fishermen.

- The study found out that the creation of alternative employment opportunities is the solution to build up the livelihood of the small-scale fishermen. This was also found to be the pro-active fishery management practice to avoid crowding in the fishery sector. The Government of Kerala should provide additional funds for the small-scale fishermen to take up new employment opportunities.
- The exploratory factor analysis revealed that awareness about the social and welfare schemes was a significant variable in determining the livelihood of the small- scale fishermen. Livelihood of the small-scale fishermen was enhanced through social security schemes such as grant-in aid, grant for education, insurance schemes and aid for alternative employment opportunities. Government can take initiatives for implementing the social schemes so that the small-scale fishermen may get additional financial and social aid for building up their livelihood
- The analysis of the secondary data explicated that the marine fish landings have not registered a positive growth rate after 2000 even after the introduction of trawl ban. The government should appoint a committee to review the effectiveness of trawl ban and should scientifically implement trawl ban in the future.
- Trawl ban or closed season is the only fishery management practice which is popularly known among the small-scale fishermen. The other methods, namely, regulation of mesh size, specifications in gear, Marine Protected Areas are unfamiliar to them. The unfamiliarity is due to the non-implementation of these techniques effectively. The government should authorize Central Marine Fisheries Institute (CMFRI) to study about the economic and empirical viability of the present fishery management practices.

7.5. Areas of further research

- Sustainable Livelihood Approach is a useful tool in understanding the socio-economic conditions of the vulnerable communities. The same framework can be used to do research on specific problems of the small-scale fishermen like poverty and inequality.

- Scientific research on the economic viability of Fishery management practices can be beneficial and contextual. The study should specifically review the performance of the fishery management techniques in major coastal districts of Kerala.
- Livelihood diversification among the fishermen is a prominent research topic which needs immediate attention. Diversification of occupation and alternative employment techniques can be the focus of the research.
- The fishermen are often displaced from their original coastal settlement due to sea erosion and CRZ rules. The effectiveness of groins and sea walls are serious topics of research and study.

7.6. Conclusion

The small-scale fishermen of Kerala are economically backward and socially marginalized even in this century. The backwardness and marginalization are rooted in their inability to overcome the vulnerabilities present in their community. The fishery resources which formed the backbone of their economy is experiencing depletion. The income from fishing has come down drastically. In such a dynamic sector as small-scale fisheries, "the sustainable livelihood approach" is a valuable analytical technique for identifying "what assets the fishers possess, what shocks and trends influence their daily lives and livelihoods, which are the main structures and processes influencing, and what are their livelihood strategies". This method also allows researchers to investigate how different livelihood methods affect "livelihood outcomes", as well as how this affects livelihood assets. The concept has mostly been employed as a practical instrument for poverty reduction programmes as a result of this and its comprehensive perspective. The focus of the study is on the inability of the small-scale fishermen in finding alternative employment opportunities to overcome the challenges of the livelihood. The study shed light on the inaccessibility of the small-scale fishermen in procuring the natural, physical, social and financial assets. The fishery resources which is the mainstay of the small-scale fishermen are on the decline due to over fishing and illegal practices. The ineffective fishery management practices resulted in unsustainable fishing practices which further worsened the situation of the fish stock. Alternative livelihood strategies for the small-scale fishermen are the only solution in this context. The alternative livelihood strategies take away the pressure of fishing as well as build up the livelihood of the small-scale fishermen.

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APPENDIX 1

QUESTIONNAIRE

Questionnaire

Alternative Livelihood Strategies and Fisheries Management Practices of the Small - Scale Fishermen of Kerala

The survey is carried out as part of the research work leading to the award of PhD Degree in Economics from Calicut University, Kozhikode. The Information collected through this survey will be used only for research purpose and not for any other purpose. Your kind co-operation is requested.

Celestine P.F.
Research Scholar,
Panampilly Memorial Government College,
Chalakudy

Part 1 A
Socio-Economic profile

Socio-Economic Profile

1. Name :
2. Age: - Please specify (in years) :
3. Gender :
   i) Male ☐ ii) Female ☐ iii) Transgender ☐
4. Educational Qualification :

1) Illiterate ☐
2) Under Matriculate ☐
3) Graduate ☐
4) others ☐

5. Marital Status :
   1) Married ☐ 2) Unmarried ☐
   3) Single ☐ 4) Widower ☐
6. Type of Family :- 1) Nuclear ☐ 2) Joint ☐
7. No. of Family Members: - Please specify…………………
8. No. of Household earners: -
9. Dependents: - Please specify
10. Religion :
    1)Hindu ☐ 2) Christian ☐ 3) Muslim ☐

11. Category :

1) General ☐ 2) SC ☐ 3) ST ☐ 4) OBC ☐

12. Place of residence :

1) Rural ☐ 2) Urban ☐

13. Region :

1)Kozhikode ☐ 2) Ernakulam ☐ 3) Thiruvananthapuram ☐

14. Annual Income (Including all Sources)

a) Below Rs. 50,000/- ☐ b) Rs. 50,000 to 100,000/ ☐

c) Rs. 100,000 to 150, 000/ ☐ d) Above Rs. 200,000/ ☐

Part 1 B

Livelihood conditions and assets

I. Natural Assets

1. Land ownership : Yes ☐ No ☐
2. Mode of Inheritance
   1) Inherited ☐
   2) Purchased ☐
   3) Granted by Government ☐
   4) Others ☐
3. Present value in Rs. :
4. House ownership
   1) Owned ☐
   2) Rented ☐
   3) Others ☐
5. Electrified : Yes ☐ No ☐
6. Type of Structure
   1) Temporary shed ☐
   2) Kutcha ☐
   3) Semi pucca ☐
   4) Pucca ☐
   Old and dilapidated
7. Type of roof
   1) Thatched ☐
   2) Tiled/Tinned/Asbestos ☐
   3) Concrete ☐
8. Type of floor
   1) ud ☐
   2) Stone/Tile/Cement ☐
   3) Mosaic /Granite/Ceramic ☐
   Others
9. No. of separate rooms(excluding kitchen) :

10. Kitchen type

☐
☐
☐

1) Separate kitchen
2) Common Kitchen
3) No Kitchen

11. Latrine Facility
1) Water sealed ☐
2) Bore hole ☐
3) Open Pit ☐
4) No latrine ☐

II. Fishing Assets

1. Craft	: Yes ☐	No ☐
2. Engine	: Yes ☐	No ☐
3. Gear	: Yes ☐	No ☐
4. Hook and line	: Yes ☐	No ☐
5. Other equipment	: Yes ☐	No ☐

6. Value of the equipment / Assets in Rs.

III. Other Assets

1. Radio	: Yes ☐	No ☐
2. T V	: Yes ☐	No ☐
3. V CR	: Yes ☐	No ☐
4. Mixer cum grinder	: Yes ☐	No ☐
5. Bicycle	: Yes ☐	No ☐
6. Motor cycle	: Yes ☐	No ☐
7. Car	: Yes ☐	No ☐
8. Refrigerator	: Yes ☐	No ☐
9. Fan	: Yes ☐	No ☐
10. A C	: Yes ☐	No ☐
11. Washing Machine	: Yes ☐	No ☐
12. Gold	: Yes ☐	No ☐
13. Telephone	: Yes ☐	No ☐
14. Mobile phone	: Yes ☐	No ☐

15. Value of other assets in Rs.

IV. Expenditure on food like Rice, wheat, milk, meat, fish, vegetables etc. per month

1. Upto Rs. 5000 ☐
2. 5001 to 10000 ☐
3. 10001 to 15000 ☐
4. Above 15000 ☐

V. Loans and borrowings

1. Upto 20000 ☐
2. 20001 – 40000 ☐
3. 40001 – 60000 ☐
4. 60001 – 80000 ☐
5. 80001 – 100000 ☐
6. Above 100000 ☐
7. Rate of interest ☐

VI. Source of credit

1. Bank ☐
2. Govt. financial institutions ☐
3. Chitties and kuries ☐
4. Gold loan ☐
5. Money lenders ☐
6. Others ☐

VII. Savings

1. Upto 50000 ☐
2. 50001 – 100000 ☐
3. 100001 – 150000 ☐
4. 150001 – 200000 ☐
5. Above 200000 ☐

VIII. Financial institution where money is saved

1. Bank ☐
2. Chitties and kuries ☐
3. KSFE ☐
4. Post office ☐
5. Others ☐

IX. Educational Profile of children

1. Upto 12th standard ☐
2. Graduation ☐
3. Post-graduation ☐
4. Professional ☐

X. Occupational status of children

1. Fishing ☐
2. Private firm ☐
3. Govt. job ☐
4. Self employed ☐
5. Own business ☐
6. others

Part 2

The effect of fishery management practices on the livelihood of the traditional fishermen

1. How long have you been to fishing? (in years) :
2. Which fishing category you belong to? Traditional

   Trawler ☐ Pursiene ☐ Ring seine ☐

   Mini Trawlers ☐ Other artisanal ☐
3. Specify reason to join fishing? Traditional Unemployment

   Poverty ☐ Job with low investment ☐
4. Number of household members working with you? One

   Two ☐ not at all ☐
5. Do your children wish to join fishing? Yes ☐ No ☐

   If no what is the reason?

   a) Irregular income source ☐ b) disrespectful job ☐

   c) religious factor ☐ d) risky job ☐
6. Total investment on fishing inputs? Owned ☐ Borrowed ☐
7. Do you practice any other occupation other than fishing?
8. In which of the following you experience a change? Target species

   Bottom animals &plants ☐ habitat ☐ by catch ☐

1. Level of awareness of fishery management practices

	Not at all aware	Slightly aware	Somewhat aware	Moderately aware	Extremely aware
Trawl Ban					
Marine protected areas					
Mesh Size regulation					
HP regulation of engine					
CRZ					

2. Income of the household

	Fishing asset	Fishing labour	Fish vending	Fish processing
January				
February				
March				
April				
May				
June				
July				
August				
September				
October				
November				
December				

3. Reasons for fish depletion

	SA	A	N	DA	SDA
Climate					
Overfishing					
Unsustainable Fishing					
Oil Spillage					
Drudging					
Depletion of mangroves					
Shrinkage due to reclamation					
Trawling					

Fertilizers and pesticides					
Backwater Tourism					
Coconut husk retting					
Distillery waste					
Coir factory					
Excessive weed growth					
Sand mining from lake					

4. Fishery management practices and employment generation

		SA	A	N	DA	SDA
A	Helpful in generating employment					
B	Fishery industry has increased more employment opportunities in the following areas:					
	a) Own retail outlet/ Fish Booth.					
	b) Establish own feed mill unit					
	c) Ornamental fishes production and marketing					
	d) Integrated fish farming					
	e) Repair & maintenance of fishing inputs					
	f) Transportation of fish					
	g) Riverine fishery					
	h) Manufacturing and sale of fishing inputs					
	i) Aqua culture					
	j) Ice distribution					

5. The problems faced by the traditional fishermen during fishing

		SA	A	N	DA	SDA
A	Problems regarding fishing cooperatives					
B	Problems with local administration					
C	Conflict with other fishers					
D	Conflict with tourist / tourism dept.					
E	Problems in Transportation					
	a) No good road approach					
	b) Inadequate transport facility					
	c) High cost of transport					
F	Problem in Marketing					
	a) Over exploitation by middlemen					
	b) Fluctuation in price					
	c) Inadequate demand					
	d) Low cost offered by buyer					
	e) Delay in payment					
	f) Quality of fish					
G	Problem in preservation					
	a) Inadeqaute storage facility					
	b) Curing facility not available					

6. Level of satisfaction in fish trade

	SA	A	N	DA	SDA
Price of fish					
Government intervention					
Right to sell					
Storage facility					
Auction of fish					
Subsidies					
Basic price					
Discount rate to the middlemen					
Timely payment					

Part 3

Alternative Livelihood Strategy for the traditional fishermen

1. Is the earning from fishing sufficient?

   Yes ☐ No ☐

2. Do you think that continuing in fishing is feasible in the future?

   Yes ☐ No ☐

3. Are you a member of any of the cooperatives related to fishermen?

   Yes ☐ No ☐

4. Why did you join cooperatives?

   a) To get governmetal aids b) to get better price

   c) to avoid bureaucratic problems d) compulsory e) All the above

5. Do you think that fishing as an occupation has eliminated poverty in your locality?

   Yes ☐ No ☐

6. Has your income levels increased being a fisherman? ☐

   Yes ☐ No ☐

7. If not, what kind of job do you think you can take in addition to fishing?

   Agriculture Aquaculture construction

   dairying others

8. Do you feel that your social status has increased as a fisherman?

   Yes ☐ No ☐

9. Fishery practices and level of income from other sources

	SA	A	N	DA	SDA
Fishing spares sufficient time to earn income from following heads:					
Agriculture income					
Dairy income •					
Business income					
Professional income					
Aquaculture					
Poultry					
Construction work					
Driving					
Plumbing/Electrical works					

10. Awareness about the welfare schemes.

Schemes	Awareness Level		
	Fully aware	Partially Aware	Not aware
Fishermen accidental insurance scheme			
Saving-cum relief scheme			
Fishermen relief fund scheme			
Grant-in-Aid for purchase fish cart			
Grant-in Aid to purchase Gill nets, boats and tents			
Construction of community ponds			
Construction offish pond			
Construction of fish landing centre sheds			
Training to fish farmers			

APPENDIX 2

THE KERALA MARINE FISHING REGULATION ACT

GOVERNMENT OF KERALA

THE KERALA MARINE FISHING REGULATTION ACT

FISHERIES DEPARTMENT

1983

ACT 10 OF 1981

THE KERALA MARINE FISHING REGULATION ACT, 1980

An act to provide for the regulation of fishing by fishing vessels in the sea along the coastline of the state.

Preamble – WHEREAS it is necessary to provide for the regulation of fishing by fishing vessels in the sea along the coastline of the state.

BE it enacted in the Thirty –first Year of the Republic of India as follows :-

CHAPTER I

Preliminary

1. **Short title, extent and commencement –** (1) This Act may be called the Kerala Marine Fishing Regulation Act, 1980.

   (2) It extends to the state of Kerala.
   (3) It shall be deemed to have come into force on the 24th day of November, 1980.

2. **Definitions**. – In this Act, unless the context otherwise requires, -

   (a) "adjudicating officer" means any officer of the Fisheries Department not below the rank of an Assistant Director of Fisheries, authorized by the Government, by notification in the Gazette, to exercise the powers conferred on, and discharge the duties imposed upon, the adjudicating officer by this Act for such area as may be specified in the notification.

   (b) "Appellate Board" means an Appellate Board constituted under section 18.

(c) “authorized officer” means such as the Government may, by notification in the Gazette, authorize in respect of the matter to which reference is made in the provision of this Act in which the expression occurs;

(d) “fishing vessel” means a ship or boat, whether or not fitted with mechanical means of propulsion, which is engaged in sea fishing for profit and includes—

(i) a catamaran,

(ii) a country craft, and

(iii) a canoe,

Engaged in sea fishing,

(e) “Port” means the space within such limits as may from time to time be defined by the Government, by notification in the Gazette, for the purposes of this Act,

(f) “prescribed” means prescribed by rule made under this Act,

(g) “registered fishing vessel” means –

i) a fishing vessel registered under section 11 of the Marine Products Export Development Authority Act, 1972 (Central Act 13 of 1972), or

ii) a fishing vessel registered under section 9,

(h) “Specified area” means such area in the sea along the entire coastline of the state, but not beyond territorial waters, as may be specified by the Government, by notification in the Gazette.

(i) “State” means the state of Kerala and includes the territorial waters along the entire coastline of that State.

3. **Authorisation of officers for the purposes of any provision of this Act** –The Government may, by notification in the Gazette, authorize –

(a) any officer of the Government, not being an officer below the rank of a Gazetted officer , or

(b) any officer of the Central Government, not being an officer below the rank of a Gazetted officer or a Commissioned officer in the Armed Force of the Union, with the consent of that Government.

To exercise the powers conferred on, and discharge the duties imposed upon an authorized officer under this Act in such area as may be specified in the notification.

………………

CHAPTER II

Regulation of Fishing

4. **Power to regulate, restrict or prohibit certain matters within specified area** - (1) The Government may having regard to the matters referred to in sub – section (2), by order notified in the Gazette, regulate, restrict or prohibit –

(a) the fishing in any specified area by such class or classes of fishing vessels as may be prescribed, or

(b) the number of fishing vessels which may be used for fishing in any specified area ; or

(c) the catching in any specified area of such species of fish and for such period as may be specified in the notification, or

(d) the use of such fishing gear in any specified area as may be prescribed

(2) In making an order under sub – section (1), the Government shall have regard to the following matters, namely:-

(a) the need to protect the interests of different sections of persons engaged in fishing, particularly those engaged in fishing using traditional fishing craft such as Catamaran, Country craft of canoe,

(b) the need to conserve fish and to regulate fishing on a scientific basis,

(c) the need to maintain law and order in the sea,

(d) any other matter that may be prescribed.

5. **Prohibition of use of fishing vessel in Contravention of any order made under section 4.** – No owner or master of a fishing vessel shall use, or cause or allow to be used , such fishing vessel for fishing in any manner which contravenes an order made under section 4 :

Provided that nothing in such order shall be construed as preventing the passage of any fishing vessel from, or to , the shore, through any specified area to, or from, any area other than a specified area for the purpose of fishing in such other area of for any other purpose :

Provided further that the passing of such fishing vessel through any specified area shall not in any manner cause any damage to any fishing nets or tackles belonging to any person who engages in fishing in the specified area by using any traditional fishing craft such as catamaran, country craft or canoe.

6. **Licensing of fishing vessels**.—(1) The owner of fishing vessel may make an application to the authorized officer for the grant of a license for using such

fishing vessel for fishing in any specified area. – The license shall either be granted or refused within a period of one month from the date of receipt of application.

(2) Every application under sub-section (1) shall be in such form, contain such particulars, and be accompanied by such fees, as may be prescribed.

(3) The authorized officer may, after making such enquiry as he deems fit and having regard to the matters referred to in sub-section (4), either grant or refuse to grant to the owner of the fishing vessel, a license for using such fishing vessel for fishing in the specified area or specified areas mentioned in such licence.

(4) In granting or refusing licence under sub-section (3), the authorized officer shall have regard to the following, namely:------

(a) whether the fishing vessel is a registered fishing vessel;

(b) the condition of the fishing vessel including the accessories and fishing gear with which it is fitted.

(c) Any order that may be made under section 4;

(d) Any other matter that may be prescribed.

(5) A licence granted under this section shall be in such form and subject to such conditions, including conditions as to payment of such fees and furnishing such security for the due performance of the conditions, as may be prescribed.

Provided that different fees, and different amounts by way of security, may be prescribed in respect of licences for different classes of fishing vessels.

(6) A licence granted under this section shall be valid for the period specified therein or such extended period as the authorized officer may think fit to allow in any case.

7. **Prohibition of fishing using fishing vessels which are not licenced-**

No person shall, after the commencement of this Act, carry on fishing in any specified area using a fishing vessel which is not licenced under section 6:

Provided that nothing in this section shall apply to any fishing vessel, which was being used for fishing immediately before the commencement of this Act, for such period as may be specified by the Government by notification in the Gazette.

8. **Cancellation, suspension and amendment of licences**,----(1) If the authorizes officer is satisfied, either on a reference made to him in this behalf of otherwise, that-

(a) a licence granted under section 6 has been obtained by mis-representation……………………….

(b) the holder of a licence has, without reasonable cause, failed to comply with the condition subject to which the licence has been granted or has contravened any of the provisions of this Act or any order or rule made there under,

Then, without prejudice to any other penalty to which the holder of the licence may be liable under this Act, the authorized officer may, after giving the holder of the licence a reasonable opportunity of showing cause, cancel or suspend the licence or forfeit the whole or any part of the security, if any, furnishing for the due performance of the conditions subject to which the licence has been granted.

(2) Subject to any rules that may be made in this behalf the authorized officer may also vary or amend a licence granted under section 6.

9. Registration of Vessels.- (1) The owner of every vessel used or intended to be used for purposes of fishing and kept in the state, not being a fishing vessel registered under section 11 of the Marine Products Export Development Authority Act, 1972 (Central Act 13 of 1972), shall register such vessel under this Act.

(2) Every application for registration of such vessel shall be made by the owner thereof to the authorized officer in such form, and shall be accompanied by such fees, as may be prescribed –

(a) before the expiration of one month from the date on which he first became the owner of such vessel; or

(b) before the expiration of three months from the commencement of this Act.

Which ever is later;

Provided that the authorized officer may, for sufficient reason to be recorded in writing, extend the time-limit for registration by such period as he thinks fit.

(3) The authorized officer shall issue to the owner of the vessel registered by him a certificate of registration in the prescribed form and shall enter in a register to be kept by him, in such form as may be prescribed, the particulars of such certificate.

(4) Registration once made shall continue to be in force until it is cancelled by the authorized officer.

(5) Every vessel registered under this section shall carry a registration mark, assigned to it by the authorized officer, displayed in the prescribed manner.

(6) No vessel other than a registered fishing vessel, shall be entitled to a licence under section 6.

10. Information to be given to the authorizes officer about movement of fishing vessels ---Where a registered fishing vessel moves from the area of one port to the area of another port, the owner of such fishing vessel shall give information

to that effect, in the prescribed manner, to the authorized officer by whom such fishing vessel was registered and also to the Port Officer having jurisdiction over the area where to such fishing vessel has been moved.

11. Returns to be made by owners of registered fishing vessels –(1) Every owner of a registered fishing vessel shall furnish to the authorized officer at the prescribed time and in the prescribed manner such returns as may be prescribed.

(2) The authorized officer may inspect any registered fishing vessel at any time to verify the accuracy of any return made under this section.

12. Finality or orders under section 6,8 and 9 – Every decision of the authorized officer under section 6, section 8, or section 9, granting or refusing to grant licence for a fishing vessel or canceling, suspending, varying or amending such licence or registering, or canceling the registration of a vessel shall subject to any right of appeal under section 13, be final.

13. Appeals against orders refusing grant of licence etc. –(1) Any person aggrieved by an order of the authorized officer refusing to grant licence for a fishing vessel or canceling, suspending, varying or amending such licence or refusing to register a vessel or canceling the registration of such vessel may, within thirty days from the date on which the order is communicated to him, prefer an appeal to such authority as may be prescribed (hereafter in this section referred to as the appellate authority):

Provided that the appellate authority may entertain the appeal after the expiry of the said period of thirty days if it is satisfied that the appellant was prevented by sufficient cause from filing the appeal in time.

(2) On receipt of an appeal under sub-section (1), the appellate authority shall, after giving the appellant a reasonable opportunity of being heard pass such orders there on as it deems fit as expeditiously as possible.

(3) Every order passed by the appellate authority under this section shall be final.

CHAPTER – III

Penalties

14. **Power to enter and search fishing vessels**.- The authorized officer may, if he was reason to believe that any fishing vessel is being, or has been, used in contravention of any of the provisions of this Act or of any order or rule made thereunder or any of the conditions of the licence, enter and search such vessel and impound such vessel and seize any fish found in it.

15. **Disposal of seized fish** --- (1) The authorized officer shall keep the fishing vessel impounded under section 14, in such place and in such manner as may be prescribed.

(2) In this absence of suitable facilities for the storage of the fish seized the authorized officer may, if he is of the opinion that the disposal of such fish is necessary, dispose of such fish and deposit the proceeds thereof in the prescribed manner in the office of the adjudicating officer.

16. **Adjudication** ---(1) Where any authorized officer referred to in section 14 has reason to believe that any fishing vessel is being, or has been, used in contravention of any of the provisions if this Act or any order or rule made thereunder or any of the conditions of the licence, he shall make a report thereof to the adjudicating officer.

(2) The adjudicating officer shall hold an enquiry into the matters mentioned in the report in the prescribed manner, after giving all the parties concerned a reasonable opportunity of being heard.

17. **Penalty** – (1) The adjudicating officer shall, after the enquiry under section 16, decide whether any person has used, or caused or allowed to be used, any fishing vessel in contravention of any of the provisions of this Act or of any order or rule made there under or any of the conditions of the licence and any such person, on being found guilty by the adjudicating officer, shall be liable to such penalty not exceeding –

(a) five thousand rupees, if the value of the fish involved is one thousand rupees or less,

(b) five times the value of the fish, if the value of the fish involved is more than one thousand rupees; or

(c) five thousand rupees, in any other case, being a case not involving any fish,

As may be adjudged by the adjudicating officer.

(2) In addition to any penalty that may be imposed under sub- section (1), the adjudicating officer may direct that –

(a) The registration certificate of the fishing vessel which has been used, or caused or allowed to be used, in the manner referred to in sub-section (1) or the licence, any condition of which has been contravened, shall be –

(i) cancelled or revoked, as the case may be; or

(ii) suspended for such period as the adjudicating officer deems fir; or

(b) The fishing vessel or fish that may have been impounded or seized as the case may be, under section 14 shall be forfeited to the Government.

Provided that no fishing vessel shall be forfeited under clause (b) if the adjudicating officer after hearing the owner of such vessel or any person claiming any right there to is satisfied that the owner or such person had exercised due care for the prevention of the commission of such offence.

18. **Constitution of Appellate Board and Appeal to Appellate Board** ---- (1) The Government may, by notification in the Gazette, constitute one or more Appellate Board or Appellate Boards.

(2) The Appellate Board shall consists of three members of whom one shall be a person who is or has been a District Judge, who shall be appointed as the Chairman of the Appellate Board.

(3) Where only one appellate board is appointed, the Appellate Board shall have jurisdiction throughout the state, and where more than one Appellate Board is appointed, the Government may, by notification in the Gazette, define the jurisdiction of each appellate Board.

(4) Any person aggrieved by an order of the adjudicating officer may, within thirty days from the date on which the order is made, prefer an appeal to the Appellate Board having jurisdiction to here such appeal;

Provided that the appellate board may entertain any appeal after the expiry of the said period of thirty days, but not after the expiry of sixty days from the date aforesaid, if it is satisfied that the appellant was prevented by sufficient cause from filing the appeal in time.

(5) No appeal under this section shall be entertained by the appellate board unless the appellant has, at the time of filing the appeal, deposited the amount of penalty payable under the order appealed against:

Provided that, on an application made by the appellant in this behalf the appellate board may, if it is of the opinion that the deposit to be made under this subsection will cause undue hardship to the appellant, by order in writing dispense with such deposit either unconditionally or subject to such conditions as it may deem fit to impose.

(6) On receipt of an appeal under sub-section (4), the appellate board may, after holding such enquiry as it deem fit and after giving the parties concerned a reasonable opportunity of being heard, confirm, modify or set aside the order appealed against and the decision of the appellate board shall be final ; and

(a) If the sum deposited by way of penalty under sub-section (5) exceed the penalty directed to be paid by the appellate Board, the excess amount, or

(b) If the appellate Board sets aside the order imposing penalty, the whole of the sum deposited by way of penalty, shall be refunded to the appellant.

19. **Revision by appellate Board**.—The appellate Board may call for and examine the records of any order passed by an adjudicating officer under section 17 and against which no appeal has been preferred under section 18 for the purpose of satisfying itself as to the legality or propriety of such order or as to the regularity of the procedure and pass such order with respect there to as it may think fit;

Provided that no such order shall be made except after giving the person affected a reasonable opportunity of being heard in the matter.

19. **Powers of Adjudicating officer and Appellate Board in relation to holding enquiry under this Act**.--- (1) The Adjudicating officer and the Appellate Board shall, while holding an enquiry, have all the powers of a civil court under the Code of Civil Procedure, 1908 (Central Act 5 of 1908), while trying a suit in respect of the following matters, namely:-

(a) summoning and enforcing the attendance of witnesses;

(b) requiring the discovery and production of any document,

(c) requisitioning any public record or copy there from any court or office;

(d) receiving evidence or affidavit; and

(e) issuing commissions for the examination of witness or documents,

(2) The adjudicating officer or the appellate Board shall, while exercising any power under this Act, be deemed to be a civil court for the purpose of sections 345 and 346 of the Code of Criminal Procedure, 1973 (Central Act 2 of 1974).

20. **Offences by companies**: -- (1) Where an offence under this Act has been committed by a company, every persons who, at the time the offence was committed, was in charge of, and was responsible to, the company for the conduct of the business of the company, as well as the company, shall be deemed to be guilty of the offence and shall be liable to be proceeded against and punished accordingly:

Provided that nothing contained in this sub-section (1), where any such person liable to any punishment, if the proves that the offence was committed without his knowledge or that he had exercised all due deliguance to prevent the commission of such offence.

(2) Notwithstanding anything contained in sub-section (1), where any offence under this Act has been committed with the consent or connivance of, or is attributable to any neglect on the part of, any director, manager, secretary or other officer, such director, manager, secretary or other officer shall be deemed to be guilty of that offence and shall be, liable to be proceeded against and punished accordingly.

Explanation—for the purposes of this section,---

(a) **"Company"** means any body corporate and includes a firm or other association of individuals and
(b) **"director",** in relation to a firm, means a partner in the firm.

CHAPTER IV

Miscellaneous

21. **Exemptions** – (1) Nothing contained in this Act shall apply to survey vessels belonging to the Central Government or any State Government or any public under taking.

(2) If the Government are of the opinion that, having regard to the purposes of this Act, it would not be in the public interest to apply all or any of the provisions of this Act to any class or classes of fishing vessels used for fishing in any specified area or specified areas, they may, by notification in the Gazette exempt, subject to such conditions as they may think fit to impose, such class or classes of fishing vessels used for fishing in such specified area or specified areas, as they may specify in the notification, from the operation of all or any of the provisions of this Act.

22. **Protection of action taken in good faith**.—

(1) no suit, prosecution or other legal proceeding shall be against the Gove. Or any officer or authority for anything which is in good faith done or intended to be done in pursuance of the Act or any order or rule made ther under.

(2) No suit or other legal proceeding shall lie against the Govt. or any officer or authority for any damage caused or likely to be caused by anything which is in good faith done or intended to be done in pursuance of this Act or any order or rule made thereunder.

23. **Power to make rules**.- (1) The Govt. may, by notification in the Gazette, make rules for carrying out the provisions of this Act.

(2) In particular and without prejudice in the generally of the foregoing power, such rules may provide for all or any of the following namely:-

(a) the matters to which regard shall be had in making an order under sub-section (1) of section 4;

(b) The form of application for licence under sub-section (1) of section 6, the particulars which it shall contain and the fees which shall accompany it ;

(c) The matters to which regard shall be had in granting or refusing a licence under clause (d) of subsection (4) of section 6, the fees ……………………………………of the conditions of the locence;

(d) The procedure to be followed in granting or refusing a licence under section 6 or canceling, suspending, varying of amending such licence or in registering a vessel under section 9 or canceling such registration;

(e) The form of application for registration of a vessel under section 9, the particulars which such application shall contain and the fees which shall accompany the application, the form of the certificate of registration and the form of the register referred to in sub-section (3), of that section and the manner in which the registration mark referred to in subsection(5) of that section shall be displayed.

(f) The manner in which the information referred to in section 10 shall be given;

(g) The time and manner in which the returns to in sub-section (1) of section 13;

(h) The authority to whom appeals shall be preferred under sub-section (1) of section 13;

(i) The place and the manner in which an impounded fishing vessel shall be kept under sub-section (1) of section 15 and the manner in which the proceeds of the disposal of the seized fish shall be deposited with the adjudicating officer under sub-section (2) of that section;

(j) The procedure of the enquiry by the adjudicating officer under sub-section (2) of section 16;

(k) The qualification of the members of the Appellate Board other than the Chairman the fees and allowances payable to the Chairman and other members of the Appellate Board, and the procedure of the Appellate Board;

(l) The fees payable for the supply of copies of documents or orders or for any other purpose or manner involving the rendering of any service by any officer or authority under this Act.

(m) Any other matter which is to be or may be provided for by rules under this Act.

(3) Every rule made under this section shall be laid, as soon as may be after it is made, before the Legislative Assembly, while it is in session, for a total period of fourteen days which may be comprised in one session or in two successive sessions, and if before the expire of the session in which it is so laid or the session immediately following the Legislature Assembly makes any modification in the rule or decides that the rule should not be made, the rule shall thereafter have effect only in such modification or amendment shall be without prejudice to the validity of anything previously done under that rule.

24. **Repeal and saving**--- (1) The Kerala Marine Fishing Regulation Ordinance, 1980 (12 of 1980), is hereby repealed.

(2) Not withstanding such repeal, anything done or any action taken under the said Ordinance shall be deemed to have been done or taken under this Act.

……………………………………………………………………………………………………

GOVERNMENT OF KERALA

Fisheries and Ports (L) Department

NOTIFICATION

G.O. MS. 141/80/F&PD. **Dated, Trivandrum,29th November, 1980**

S.R.O. No.1141/80,--In exercise of the powers conferred by sub-section (1) and (2) of section 24 of the Kerala Marine Fishing Regulation Ordinance, 1980 (12 of 1980), the Government of Kerala hereby make the following rules, namely:-

RULES

1. **Short title and commencement**,-- (1) These rules may be called the Marine Fishing Regulation Rules 1980.

   2. They shall come into force at once

2. **Definitions**—In these rules, unless the context otherwise requires:-

   (a) **"Form"** means a form appended to these rules,

   (b) **"Ordinance"** means the Kerala Marine Fishing Regulation Ordinance, 1980 (12 of 1980)

   (c) **"Section"** means a section of the Ordinance.

3. Class of Fishing Vessels, fishing by which may be regulated restricted or prohibited.--- Fishing by a ship or boat fitted with mechanized means of propulsion may be registered, restricted or prohibited in any specified area under clause (a) of sub-section (1) of section 4.
4. Kinds of fishing gear, the use of which may be regulated, restricted, or prohibited.—Use of the following kinds of fishing gear may be regulated, restricted or prohibited in any specified area under clause (d) of sub-section (1) of section 4, namely:-

   (a) Purse- seine;
   (b) Ring seine;
   (c) Pelagic trawl;
   (d) Mid water trawl; and
   (e) Bottom trawl.

5. Application for the grant of licence.--- (1) Every application for the grant of a licence for using fishing vessel of the class specified in column (1) of the Table below shall be accompanied by the fees specified in the corresponding entry in column (2) of the Table. The applicant shall also furnish such security for the

due performance of the conditions of the licence as specified in column (3) of the Table.

TABLE

Class of the fishing vessel	Amount of fees Rs.	Amount of security to be furnished. Rs.
(1)	**(2)**	**(3)**
1. Country fishing crafts fitted with mechanical means of propulsion.	5	50
2. Mechanised fishing boats up to 30' in length.	50	500
3. Mechanised fishing boats of more than 30' but less than 37' in length.	75	1000
4. Mechanised fishing boats of 37' and above but less than 56' in length.	100	1500
5. Mechanised fishing vessels of 56' and above in length.	150	2000

6. **Grant of licence**:- (10 a licence granted under section 6 shall be in form II and shall be subject to the conditions specified in the licence.

(2) Where the application for the grant of licence is refused, the reasons for refusl shall be recorded in writing and a copy of the same along with the order or refusal shall be furnished to the applicant, where the order refusing the grant of licence has become final the security furnished and one half of the amount of fees paid by the applicant, shall be refunded to him.

7. **Application for registration of vessels**:- (1) Every application for the registration of a vessel under section 9 shall be in form III obtainable from the office of the authorized officer on payment of rupee one for each form.

(2) Every application under sub-rule (1) for the registration of a vessel of the class specified in column (1) of the Table shall be accompanied by the fees specified in the corresponding entry in column (2) of the said Table.

TABLE

Class of vessel	Amount of fees
(1)	**(2)**
1. Non-mechanised country crafts.	Rs. 1
2. Country crafts fitted with mechanical means of propulsion	Rs. 5
3. Mechanised fishing boats upto 36' in length	Rs. 20
4. All other kinds of vessels	Rs. 50

8. **Grant of registration certificate** :- (1) On receipt of an application under rule 7, the authorized officer, shall after making such enquiry as he deems necessary, register the fishing vessel or by order refuse such registration.

(2) Where the application for registration is refused, the reasons for such refusal shall be recorded in writing and a copy of the same along with the order of refusal shall be furnished to the applicant.

(3) Where the application of registration is not refused a certificate of registration shall be granted in Form IV and shall be subject to the conditions specified in the certificate.

(4) Every certificate of registration issued by the authorized officer shall be entered in a register to be kept by him in Form V.

(5) The registration mark assigned to a vessel by the authorized officer shall be displayed by painting the mark in white colour on yellow background on the fore-bow of the vessel.

9. **Furnishing of information about movement of Fishing vessel**: - The information to be furnished about the movement of a registered fishing vessel from the area of one port to the area of another port under section 10, shall be in writing and shall be sent by registered post or delivered in person before the vessel moves from the area of the former port.

10. **Appellate Authority** :- An appeal under section 13 shall, if the authorized officer who passed the order is an Assistant Director of Fisheries, be preferred to the Deputy Director of Fisheries having jurisdiction over the area and in other cases to the Director of Fisheries.

11. **Impounding of fishing vessel**:- A fishing vessel impounded by the authorizes officer under section 14 shall be kept in the nearest Boatyard under the control of the Fisheries Department and the vessel shall be under the control of the officer in charge of the yard.

12. **Manner of holding enquiry by the adjudicating officer** :- (1) on receipt of a report from the authorized officer under sub-section (1) of section 16, the adjudicating officer shall issue notice thereof in the parties concerned directing them to file objections if any and to appear before him on a specified date or being heard.

(2) The objections filed if any to the report of the authorized officer shall be considered by the adjudicating officer, before an order is passed by him,

By order of the Governor,

D. BABU PAUL,

Special Secretary.

Explanatory Note.

(This note is not part of the rules, but is intended to indicate their general purport)

The Kerala Marine Fishing Regulation Ordinance, 1980 formulated by the Governor on 22-11-80 provides in section 24 for the making of rules by the Govt. for various matters envisaged in the Ordinance and for carrying out the provisions of the Ordinance.

These rules are intended for the above purpose.

FORM I

(see rule 5)

Form of application for Licencing of Fishing Vessels

1. Name and address of owner /s :
2. Occupation of owner/s :
3. Place of permanent residence of owner/s :
4. Name of the fishing vessel :
5. Registration No and date :
6. Place of registration and agency/ Office with which registered :
7. Whether previously licensed and if so,No. of licence and period for which licenced :
8. Particulars of fishing vessel :
   (a) Length :
   (b) Breadth :
   (c) Draft :
   (d) Make and HP of engine :
   (e) Type of vessel :
9. Place where constructed :
10. Year of construction :
11. How & when acquired :
12. No. of Crew :
13. Particulars of trained crew and their qualification :
14. Type of fishing gear proposed to be operated :
15. Specified area of operation for which licence is applied for :
16. Period for which licence is requested :
17. Amount of fees remitted and mode of remittance :

Place:

Date:

Signature of owner/s

Declaration

I/we ……………………………………………………………………by this declaration subscribed by me / us pursuant to and in compliance with section 6 of The Kerala Marine Fishing Regulation Ordinance 1980 do hereby certify and declare that I am /we are the owner, owners of the fishing vessel…………………………………above described and that I/we fully understand all the provisions of the said Ordinance and Rules and Orders issued there under and agree to abide by them.

As witness, I/we set my hand / our hands this ……………………date of …………………………19.

Witness: Signature of owner/s.

FORM II

(see Rule 6)

Licence Granted for Using Fishing Vessel for Fishing

Specified Area.

1. No. and date of Licence :
2. Name and address of the person /s to whom the licence is issued :
3. Particulars of the fishing vessel licenced :
4. Fishing gear licenced :
5. Specified area for which the licence is issued :
6. Period for which the licence is issued :

Place: Signature of the Authorised Officer

Date: (Seal)

Conditions of the Licence

1. This licnce is granted subject to the provisions of the Kerala Marine Fishing Regulation Ordinance 1980 (12 of 1980), and the rules and orders issued there under.
2. The fishing vessel should be operated only within the specified area for which Licence is granted.
3. Any change in the layout, design, capacity of the vessel should be effected only with the prior approval of the Authorised Officer.
4. Any change in the type of gear licenced shall be effected only with the prior approval of the Authorised Officer.
5. It shall be competent for the Authorised Officer or any Officer authorized by him to enter the fishing vessel for the purpose of inspection whether in the waters on shore.
6. This licence is liable to be cancelled or suspended and the security if any furnished shall be liable to be forfeited in whole or in part for failure to comply with the conditions subject to which the licence has been granted or for contravention of any of the provisions of the Kerala Marine Fishing Regulation Ordinance, 1980 or the rules or orders issued there under.
7. This licence is also liable to be cancellled or suspended if the licence has been obtained by misrepresentation as to an essential fact.

FORM III

(See Rule 7)

Application for registration of fishing vessel

1. Name and address of the Owner /s full :
2. Name of the fishing vessel :
3. Particulars of registration, if any done previously :
4. Where and when the fishing vessel was secured :
5. Particulars of fishing vessel :
   (a) Length :
   (b) Breadth :
   (c) Draft :
   (d) Make and HP of engine :
   (e) Type of vessel :
6. Place where constructed :
7. Year of construction :
8. How & when acquired :
9. Base of operation :
10. Number of crew :
11. Particulars of trained crew and qualifications :
12. Details of life saving appliances provided in the vessel :
13. Amount of fees remitted and mode of remittance :

Place:

Date: Signature of the Owner/s.

FORM IV

(See Rule 8)

Certificate of Registration

1. Number and date of certificate of registration :
2. Registration mark assigned :
3. Name and address of the person/s to whom the certificate of registration is issued :
4. Particulars of fishing vessel :
   (a) Length :
   (b) Breadth :
   (c) Draft :
   (d) Make and HP of engine :
   (e) Type of vessel :
5. Base of operation :

Place:

Date: Signature of the Authorised Officer

(Seal)

Conditions of the certificate of registration

1. This certificate of registration is granted subject to the provision of the Kerala Marine Fishing Regulation Ordinance 1980 and the rules and orders issued there under.

2. Any change in the layout, design, capacity of the vessel should be effected only with the prior approval of the authorized officer.

FORM V

(See Rule 8 (4)

Register of Certificate of Registration

Office of the ....

(Authorised officer)

Sl. No.	Regn. No.& Date	Name, address & occupation of Owner/s	Particulars of fishing vessel				Base of operation	Amount of fee remitted and mode of remittance	Remarks
			Length	Breadth	Draft	Make & HP of Engine.			

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KERALA GAZETTE

EXTRAORDINARY

PUBLISHED BY AUTHORITY

15th March 1986

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24th Phalguna 1907

GOVERNMENT OF KERALA

Fisheries and Ports (B) Department

NOTIFICATION

G.O. (P) 21/86/F&PD Dated, Trivandrum.\, 18th February, 1986

S.R.O. No. 448/86- In exercise of the powers conferred by clause (d) of sub-section (1) of section 4 of the Kerala Marine Fishing Regulation Act, 1980 (10 of 1981) read with rule 4 of the KMFR Rules, 1980 and in supersession of the notification G.O Rt.No.854/83/TF & PD dated the 29th October 1983, published as S.R.O. No. 1556/83 in the Kerala Gazette Extra ordinary No. 1340 dated 3rd November 1983 the Government of Kerala hereby **prohibit the use of bottom trawl gears having less than 35 mm mesh size also for fishing in the specified** area mentioned in the notification G.O.(P) 136/84/PW, F&PD dated the 30th November, 1984, published as S.R.O. No. 1496/84 and consequently make the following amendment to the notification G.O.(P) No. 138/84/PW, F&PD dated the 30th November, 1984 published as S.R.O No. 1498/84/ in the Kerala Gazettee Extraordinary No.1055 dated 3rd December 1984, namely:-

AMENDMENT

In the said Notification, in the third paragraph, after the words “and midwater trawl gears”, the words “and the use of bottom trawl gears having less than 35mm mesh size in stretched condition” shall be inserted.

By order of the Governor,

R.C.CHOUDHURY,

Secretary to Government.

Explanatory Note

This note is not part of this order but is intended to indicate its general purport.)

Section 4 of the Kerala Marine Fishing Regulation Act, 1980 (10 of 1981) empowers the Govt. to regulate restrict or prohibit the use of such fishing gear in any specified area. This order is intended to prohibit the use of all bottom trawl nets which have less than 35 mm meshes in stretched condition for fishing in the territorial waters in the sea along the entire coastline as a conservation measure and also to maintain law and order in the territorial waters of the state.

GOVERNMENT OF KERALA

Law (Legislation –B) Department

NOTIFICATION

No.11112/Leg.B2/86/Law Dated , Trivandrum 4th August 1986.

The following act of the Kerala state Legislature is hereby published for general information. The bill as passed by the legislative assembly received the assent of the Governor on the 4th day of August 1986.

By order of the Governor,

E.J.ANTONY PANJIKARAN,

Special Secretary(Law).

ACT 8 of 1986

THE KERALA MARINE FISHING REGULATION (AMENDEMENT) ACT 1986

An act further to amend the Kerala Marine Fishing Regulation Act 1980.

Preamble- WHEREAS it expedient further to amend the Kerala Marine Fishing Regulation Act 1980 for the purpose herein after appearing.,

IT be enacted in the thirty –seventh year of the republic of India as follows:-

1. Short title and commencement – (1)This Act may be called as the Kerala Marine Fishing Regulation (Amendment) Act, 1986, (2) It shall be deemed to have to come into force on the 15th day of October, 1985.
2. Amendment of Section 17 – In section 17 of the Kerala Marine Fishing Regulation Act 1980 (10 of 1981) herein after referred to as the Principal Act. (1) to sub-section (1), the following provision shall be added namely
   "provided that there the adjudicating officer after the enquiry under Section 16 decides that any person had used, or caused, or allowed to be used , any fishing vessel in contravention of the provisions of section 5 or section 7, such person shall, on being found not be less than 25,000 rupees but which may extend 50000 rupees as may be adjudged by the adjudicating officer."

(2) in sub-section (2) for the proviso, the following proviso shall be substituted namely.,

"provided that where the penalty under the proviso to sub-section (1) is imposed on a person for the second or subsequent time the adjudicating officer shall direct that the fishing vessel or fish that may be impounded or seized, as the case may be, under section 14 shall be forfeited to the Government."

(3) Repeal and saving – (1) The Kerala Marine Fishing Regulation (2nd Amendment) Ordinance, 1986(32 of 1986 is hereby repealed.

(2) notwithstanding such repeal, anything done or deemed to have been done or any action have deem to have been taken under the principal Act as amended by the said Ordinance shall be deemed to have been done or taken under the Principal Act as amended by this Act.

KERALA GAZETTE

EXTRAORDINARY

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GOVERNMENT OF KERALA

Law (Legislation –B) Department

NOTIFICATION

No.17815/Leg.B2/86/Law. Dated, Trivandrum, 30th November, 1986/

9th Agrahayana, 1908

The following Act of the Kerala State Legislature is hereby published for general information. The bill as passed by the Legislative Assembly received the assent of the Governor on the 30th day of November, 1986.

By Order of the Governor,
E.J. ANTONY PANJIKARAN,

Special Secretary (Law).

ACT 28 OF 1986

THE KERALA MARINE FISHING REGULATION (SECOND AMENDMENT) ACT, 1986.

An Act further to amend the Kerala Marine Fishing Regulation Act, 1980.

Preamble – WHEREAS it is expedient further to amend the Kerala Marine Fishing Regulation Act, 1980, for the purposes herein after appearing;

BE it enacted in the Thirty-seventh Year of the Republic of India as follows:-

1. Short title and commencement:- (1) This Act may be called the Kerala Marine Fishing Regulation (Second Amendment) Act ,1986.
   (2) It shall be deemed to have come into force on the 9th day of August, 1984.

2. Amendment of Section 2:- In section 2 of the Kerala Marine Fishing Regulation Act, 1980 (10 of 1981) (herein after referred to as the Principal Act), clause (b) shall be omitted.

3. Substitution of new section for section 18:-

For section 18 of the Principal Act, the following section shall be substituted, namely:-

“18. Appeal – (1) any person aggrieved by an order of the adjudicating officer may, within thirty days from the date on which the order is made, prefer an appeal to the District Collector having jurisdiction over the area for which the adjudicating officer exercises powers;

Provided that the District Collector may entertain an appeal after the expiry of the said period of thirty days, but not after the expiry of sixty days, from the date aforesaid, if he is satisfied that the appellant was prevented by sufficient cause from filing the appeal in time.

(2) No appeal under this section shall be entertained by the District Collector unless the appellant has, at the time of filing the appeal, deposited the amount of penalty payable under the order appealed against;

Provided that on an application made by the appellant in this behalf , the District Collector may, if he is of the opinion that the deposit to be made under this sub-section will cause under hardship to the appellant, by order in writing, dispense with such deposit either unconditionally or subject to such conditions as he may deem fit to impose.

(3) On receipt of an appeal under sub-section (1), The District Collector may, after holding such enquiry as he deems fit and after giving the parties concerned a reasonable opportunity of being heard, confirm, modify or set aside the order appealed against; and –

(a) if the sum deposited by way of penalty under sub-section (2) exceeds the penalty directed to be paid by the District Collector the excess amount, or

(b) if the District Collector sets aside the order imposing penalty the whole of the sum deposited by way of penalty, shall be refunded to the appellant”.

(4) Where the District Collector entertains appeal after dispensing with the deposit under the proviso to sub-section (2) and if the order appealed against is not set aside or as the case may be, if the order appealed against is modified involving the depositing of penalty the appellant shall deposit such amount by way of penalty as may be ordered by District Collector”.

4. Amendment of section 19 – In section 19 of the Principal Act,-

(a) in the marginal note, for the words "Appellate Board" the words "District Collector" shall be substituted:

(b) for the words "Appellate Board" , the words "District Collector" shall be substituted;

(c) for the word "itself", the word "himself" shall be substituted.

(d) For the word "it", the word "he" shall be substituted.

5. Amendment of section 20 – In section 20 of the Principal Act –

(i) In the marginal note, for the words "Appellate Board", the words "District Collector" shall be substituted;

(ii) In sub-section (1), for the words "Appellate Board", the words "District Collector" shall be substituted.;

(iii) In sub-section (2), for the words "Appellate Board", the words "District Collector" shall be substituted;

6. **Amendment of Section 24**, - in sub- section (2) of section 24 of the Principal Act, for clause (k), the following clause shall be substituted, namely:-

"(k) the procedure to be followed by the District Collector under section 18"

7. **Transitory provision** – All appeals from the orders of adjudicating officers under section 18 of the Principal act and pending before the Appellate Board at the commencement of this Act shall be transferred to the District Collector having jurisdiction and the District Collector shall dispose of such appeals under the Principal Act as amended by this Act.

8. **Repeal and saving** – (1) The Kerala Marine Fishing Regulation (Second Amendment Ordinance, 1986 (62 of 1986), is hereby repealed.

(2) Notwithstanding such repeal, anything done or deemed to have been done or any action taken or deemed to have been taken under the Principal Act as amended by the said Ordinance shall be deemed to have been done or taken under the Principal Act as amended by this Act.

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GOVERNMENT OF KERALA

Fisheries and Ports (B) Department

NOTIFICATION

G.O.(P) 18/87/F&PD. Dated, Trivandrum, 23rd April 1987

S.R.O. No.569/87 – In exercise of the powers conferred by section 24 of Kerala Marine Fishing Regulation Act, 1980 (10 of 1981), the Government of Kerala hereby make the following rules further to amend the Kerala Marine Fishing Regulation Rules, 1980 namely –

Rules

1. Short rule and commencement – (i) These rules may be called the Kerala Marine Fishing Regulation (Amendment) Rules 1987.

   (ii) they shall come into force at once.

2. Amendment of Rules – In the Kerala Marine Fishing Regulation Rules, 1980 –

   (i) In sub-rule (10 of rule 6 the following shall be inserted at the end, namely –
   "The licence shall either be granted or refused within a period of one month from the date of receipt of the application".

   (ii) In sub-rule (1) of rule 8, following shall be inserted at the end namely:-
   "Such registration or refusal, as the case may be, shall be made within a period of one month from the date of receipt of application."

   (iii) For sub-rule (1) of rule 12, the following sub-rule shall be substituted, namely:-

"(1) on receipt of a report from the adjudicating officer under sub-section (1) of section 16, the adjudicating officer shall issue notice thereof to the parties concerned directing them to file objections, if any, and to appear before him for being on a specified date which shall not be later than ten days from the date of impounding".

By Order of the Governor,
R.C.CHOUDHURY,
Secretary to Government.

Explanatory Note

(This is not part of this notification, but is intended to indicate its general purport).

There is at present no time limit prescribed for the issue or refusal of licence to the fishing vessel on receipt of applications therefor.

Similarly no period is fixed from the date of impounding to the date of appearing before adjudication or filing objection. To enable the adjudicating officer to issue adjudication orders most expeditiously it is necessary to have a prescribed time limit.

The amendment is not to achieve the above purpose.

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GOVERNMENT OF KERALA
Fisheries and Ports (B) Department

NOTIFICATION

G.O.(P) 46/88/F&PD. Dated, Trivandrum, 8th December 1988

S.R.O.No. 1658/88 – In exercise of the powers conferred by sub – sections (1) & (2) of section 24 of the Kerala Marine Fishing Regulation Act, 1980 (10 of 1981), the Government of Kerala hereby make the following rules to amend the Kerala Marine Fishing Regulation Rules 1980 namely:-

RULES

1. **Short Title and Commencements**:- (1) these rules may be called the Kerala Marine Fishing Regulation (Amendment)Rules,1988.

   (2) They shall come into force at once.

2. **Amendment of the Rules**: In the Kerala Marine Fishing Regulation Rules, 1980 in rule 11, the following shall be added at the end namely:-

   The 'fuel pump' of the vessel impounded shall be removed by the authorized officer with the help of a Mechanic and hand over the same to the nearest Fishery Office, to avoid the forcible escape of such vessel from the custody.

By Order of the Governor

R.C. CHOUDHRY

Secretary to Government

Explanatory Note

(This note is not part os the notification, but is intended to indicate its general purport).

This amendment is incorporated to avoid the forcible escape of the impounded fishing boat from the custody of authorized officers.

LIST OF PUBLICATIONS

Sikkim Model: The Future of Organic Farming in India m Economics of Organic Farming in India- Celestine P.F, Shanlax Publications, edited by Dr. Sinitha Xavier, ISBN: 978-93-89146-56-1, August 2019, pp 64-74

Export of Fish and Fishery Products – An Evaluation of Trend and Growth- Celestine P. F. and Dr. Sinitha Xavier, Sambodhi (UGC Care Group 1 Journal), ISSN: 2249-6661, Vol-44No. 01(XVI):2021

Indian Marine Fisheries and Climate Change - Celestine P. F. and Dr. Sinitha Xavier, NIU International Journal of Human Rights, ISSN: 2394-0298 Vol 8 (XIII), 2021 (UGC CARE Listed Category I)