CHAPTER 9

SUMMARY AND CONCLUSIONS

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SUMMARY AND CONCLUSIONS

Marine sector helps the nations and their people to share resources and to accelerate the social and economic development. In India this sector has been recognised as a powerful source of foreign exchange. The sector generates employment and it stimulates the growth of a number of subsidiary industries and also ensures food and nutritional security.

The application of modern technology acts as a powerful instrument for understanding the marine ecosystem. At the same time the application of modern technology is linked to its deterioration and overexploitation. As a result of modernisation and developmental process the sustainability of the resource and the livelihood of the fishers are threatened. The issues related to technological developments, institutional and policy failure affect the livelihood of fishers with the stagnating and declining marine resources. The study attempts to deal with the above issues along the coast of Kerala.

8.1 Focus of the Study

The theme of the study throughout has been the concern about the livelihood of traditional fishers and the resource sustainability issues due to the technological changes in the marine fisheries. The researcher is not focusing on technology per se, other factors contributing to the sustainability issues are included. The present study highlights the trends and the reasons behind the sustainability issues in fisheries and in the light of social, economic, ecological, political and institutional contexts in the livelihood of the fishers of Kerala.

8.2 Objectives of the Study

1. To discuss the evolution of fishing technology with special reference to marine fisheries of Kerala.

2. To analyse the economics of fishing in the marine sector.

3. To analyse the trends in marine fisheries landings in Kerala and to synthesise the sustainability issues in the sector.

4. To explore the reasons behind the sustainability issues in marine sector.
5. To investigate the livelihood assets of coastal fishing communities in Kerala.

6. To examine the threats to the livelihood security of fishers.

8.3 Hypothesis

The major hypothesis of this study is that technological changes resulted in the stagnation/depletion of marine landings which affected the livelihood of fishers. Trend for the last 30 years shows fluctuations in landings and the opinion of fishers shows that the species are declining. For the last 10 year period (2001-02 to 2010-11) the trend for all the selected varieties of species, landings are declining. The sustainability issues identified by the researcher include overfishing, institutional factors, pollution and the problem of discards which are directly or indirectly related to technology.

8.4 Methodology of the Study

The research design for this study was formulated after an intensive procedure involving focus group discussions and interviews with the community, social activists, NGOs and government officials to raise the general issues that would help the researcher to identify the factors, especially the community’s response to the introduction of technology and also the stagnation/depletion of resources and also the ecosystem damages. Depending upon the research questions associated with each objective the study includes descriptive, exploratory and confirmatory research. The study was carried out by using survey method, selecting a representative sample from the population considered. Districts Thiruvananthapuram from southern region, Alappuzha from Central region and Kannur from the northern region were selected and from these districts fishing villages were identified. Thayyil in Kannur, Arthunkal in Alappuzha and Adimalathura in Thiruvananthapuram were chosen in order to get the representation of three regions. The selection was in concurrence with the divisions based on the different technological aspects also. After conducting the pilot study the sample size was decided as 620. From Thayyil in Kannur 206 samples, from Arthunkal in Alappuzha 204 and from Adimalathura in Thiruvananthapuram 210 samples were taken.
For the collection of primary data, in-depth interview was conducted with the help of schedules. The households were selected on a random basis. Group discussions were also conducted in order to understand the perceptions, awareness and knowledge about fishing activities and livelihood. Secondary sources of information were used to know the general trend of fisheries and species wise trend along with answers to questions related to the research. Data collected from the three regions were organised using appropriate data structures using SPSS software and analysis done varied from simple descriptive including frequencies to high end methods involving some multivariate and non-parametric methods.

8.5 Summary and Findings of the Study

The study attempts to examine the problems holistically by linking various issues relating to technology, economic, social and ecological aspects. The brief summary of the findings are outlined in the subsequent sections.

In chapter one the design of the research work was formulated by stating the scope and importance, significance, research problem, research questions, objectives, hypothesis, methodology, limitations of the study and the layout of the research work.

In chapter two the literature of the study was reviewed theoretically and empirically which help to lay a sound base and also to know the previous areas of related works and their methodology. Review of the literature helped to understand the concepts of economic, developmental and managerial issues of fisheries. Also sustainability issues in fisheries like overfishing, issues related to technology, livelihood, vulnerability and management have been widely covered. This chapter helped to formulate the objectives and methodology of the study.

Chapter three examines the evolution of fishing technology and its dissemination in the context of global, national and state scenarios. The major technological developments and their diffusion transformed the fisheries sector of many third world nations. Bilateral and multilateral agencies have been instrumental in promoting fisheries development which resulted in the adoption of capital-intensive fishing technology.
In India before independence, fishing was an entirely artisanal occupation with little intervention from the outside world. The modern technological change that occurred in India was with the inception of the five-year plans. FAO played a critical role in the research and developmental activities of the fisheries sector in India and an agreement was accorded in 1953 between Government of India and FAO regarding technical assistance in smaller craft mechanism and technology. Mechanisation became rampant in the fisheries sector of Kerala with increasing technological innovations and internationalisation of fisheries. The lucrative profits by mechanised sector led the traditional sector into abject misery and as a result a series of conflicts erupted which led to alternative technology that would allow them to compete more effectively with the mechanised fleet. This resulted in motorisation and outboard motor boats were introduced which gave a new face to the traditional fishing sector. Within the traditional sector nominal technological changes were adopted which included gears made of nylon, fibre boats, small horse power engines etc. Many technological measures such as sea ranching, open sea mariculture and artificial reefs were also used to replenish stocks with the support of the government. While analysing the selected indicators of fishing technology, economic performance of marine fishing on the basis of technology with respect to economic variables and the manpower needed for operation along the west coast with the all India estimate was discussed. The three categories of fishing classified on the basis of technology namely mechanised, motorised and traditional varied with regard to economic variables like cost and revenue and with respect to crew size. A comparison of actual and estimated optimal marine fishing fleet showed excess capacity in India and also in Kerala.

Recent advances in gear and engine technology helped the fishers. The technology like Global Positioning System provided fishermen with equipment to reach the potential fishing ground accurately. Echo sounder, sonar, acoustic gear monitoring systems detect the presence of fish and monitor the success of capture process acoustically saving the search time and fishing time and hence saving energy.

Even though these technological changes increased fishing capacity it resulted in overfishing, catching of juveniles and damage to ecosystem thus
questioning the sustainability of the sector. Added to this, technological advancement precluded the traditional fishers who were unable to withstand the competition from the mechanised sector resulting in conflicts and social tension. Thus identification of the real beneficiaries has been a debatable issue. Hence an understanding of the issues in the fisheries sector in Kerala with emphasis on livelihood of the fishers after these technological changes is done in the forthcoming chapters.

**Chapter four** analyses the economics of fishing and the livelihood issues. This chapter discusses the general profile of the respondents which includes the social, demographic and employment aspects. The profile of the respondents shows the religion wise details, mode of fishing, and education of the respondents. The religion wise details of the sample shows that 66.8 per cent of the respondents are Christians, 30.5 per cent are Hindus and 2.7 per cent are Muslims. The educational profile shows the level of education and they do not have access to higher education due to vulnerability. In the context of densely populated coastal regions family size is an important factor. In Kannur the size of the family is high due to the fact that they still have joint family system. Traditional fishermen in the sample are classified on the basis of mode of fishing. 22.6 per cent use traditional methods, 64 per cent use motorised crafts and also 12.6 per cent go for fishing using trawl nets.

Due to bad weather and seasonal changes the fishers do not have daily fishing activity. The total monthly income of a household comes from various sources like income from fishing, income from fish related jobs, income from pension and income from other jobs. The economic profile also gives a disturbing picture of fishers. Fishers are of the opinion that the increasing cost of fishing per trip and the decline in the returns per trip have become important constraints affecting the economic returns. The monthly average income during different seasons gives a picture of average income of the fishers during different periods. The fishers told the researcher that they do not get fair price in all seasons. To know the price disparity average highest price and average lowest price for the selected species from the three regions were calculated. The disparity is low for high valued species.
The fishers are interested in using and accessing modern technologies. The increase in horsepower of engines is also considered an improvement in technology. Field discussions revealed that the fishers are interested to go for fishing in boats having the latest technologies. The old technology becomes obsolete in the long run and improvements in horsepower always raise sustainability issues. Who are the real beneficiaries is a debatable question - the capitalists or the fishers?

Disposal of catch is the most important aspect of marketing. 65.2 per cent of the respondents rely on middle men and 20.6 per cent on retail sellers. The disposal of catch through co-operatives is not much beneficial. In Thiruvanthapuram retail sellers form the main outlet of disposing the catch unlike Alappuzha and Kannur. They are not satisfied with the present marketing system.

The same exercise is repeated with different modes of fishing. For traditional fisher folk, the catch disposal is mainly through middlemen and retail sellers; for motorised middlemen only and for motorised with trawl middlemen and cooperatives. Also Chi-square test was done to test whether there was dependence between the mode of fishing and the agents through which they dispose the catch. The result of the test shows that there is dependence between the mode of fishing and the agents through which they dispose the catch, as the Chi-square is significant at 5 per cent level of significance. Regarding the problem faced in disposing the catch, facilities for processing and profit from fishing the chi-square is not significant at 5 per cent.

Work culture gives a picture of fishing and the livelihood activities carried out by fishers. While considering the three regions, 92.9 per cent go for fishing before the age of eighteen. 67.7 per cent of the respondents do not like to discontinue from the occupation. 89.5 per cent do not like their children to continue the job. They want their future generations to do white collar jobs which bring security, power and dignity. The work culture, income and marketing details give a disturbing picture of economics of fishing and the livelihood activities carried out by fishers.
Chapter five analyses the trends in the marine fish landings in Kerala and discusses the sustainability issues in fisheries. This chapter reviews the general, species wise landing trend of selected species. Also the perceptions of fishers region wise and according to mode of fishing are discussed. The trend analysis is done to check whether there is compatibility with the perceptions and the data regarding landings. The analysis shows the trend of marine resources in Kerala with reference to selected pelagic and demersal fishery resources. The perceptions regarding selected species across regions lead to concern over sustainability of marine fisheries. Also the trend of selected species catfish and seer fish shows a decreasing trend whereas all others show an increasing trend with fluctuations in catches. A particular point to be noted is that all the landings of the selected species are stagnant or declining toward the end period though there is massive technological improvements and innovations in the catching sector. Apart from intense exploitation the factors like climatic change, pollution, catching of juveniles by destructive fishing practices using small meshed seines are affecting the landings of marine resources. Field discussions reveal that mini trawlers add to the ecological destruction incurred by the larger mechanised trawlers as they disrupt the sea bottom and overexpolit sea resources.

Chapter 6 analyses the reasons behind the sustainability issues in fisheries. Due to different technological advancements, there are problems relating to overfishing and overcapacity resulting in ecosystem damage. From the study along with the improvements in technology the open-access nature of the seas, institutional factors, pollution and other unpredictable events like climatic changes have an impact on the sustainability issues in marine ecosystem and cause threat to marine ecosystem and livelihood security.

Out of the respondents 85.5 per cent is of the opinion that there is over fishing and overcapacity along the Kerala coast. 57.2 per cent responded that over fishing is prominent in territorial waters. Also the change in government policies allowing foreign fleets affected the livelihood of fishers. 73.9 per cent are of the opinion that the foreign vessels damage the ecosystem and the continuous catch for months deplete the resources. The catching of juveniles and sub adults is a problem and the study reported the discarding of catch was comparatively low in Kerala, as
they gave the discards for manufacturing feeds. This may cause ecosystem damage in the future. The findings of Multi Dimensional Scaling (MDS) technique reveal that the two main reasons for discarding the catch are lack of marketing and storage facilities and small size of the fish. The small sized fish do not have any market. The juveniles are caught due to the use of prohibited gear having small mesh size. There is significant difference across the study regions regarding the reason behind discarding the catch.

Pollution causes harm to marine living organisms and eleven reasons of pollution were identified. The findings of MDS reveal that disposal problems and activities near the sea are important reasons agreed to by the sample at different levels for pollution. Discharge of industrial effluents, agricultural waste, garbages into inland waters will eventually be carried into the sea and have a grave threat. Apart from that natural disasters like tsunami also changed the sea ecosystem. Climatic change results in the rise in the sea level, coral bleaching, more severe weather conditions and the transformation of entire ecosystem. The increase in carbon dioxide levels makes the ocean more acidic rendering water inhospitable to marine species. Due to the above sustainability issues of the ecosystem the livelihood of the fishers are under threat.

The chapter seven discusses the livelihood assets of fishers across the study region. The livelihood assets of fishers are classified as natural assets, physical assets including fishing, housing and durable assets, technological assets, social assets including health and education, financial assets and institutional assets.

For artisanal fishers in Kerala, the living resources of the oceans and seas are their natural assets. The fisher communities share these natural and human assets and depend on these resources as their primary source of subsistence. Natural resources can contribute significantly to sustainable resource use, community empowerment and well-being.

Fish production depends on the type and amount of physical assets available to fishers. The traditional fishers of Kerala use three types of fishing
crafts - plank canoes, dugouts and the Kattamaram. Fishing gear mainly consists of nylon nets.

The livelihood activity of fishing community mainly depends on fishing assets. Main assets of fishing community consist of equipments used in fishing such as nets, crafts, engines and other related items. Depending on the sector in which they are used, small scale or artisanal fishing gears covering a wide variety of traditional low energy systems of fish capture and large scale industrial mechanised fishing systems including purse seining, trawling and automated long lining. The fishing assets like net, craft and other accessories owned by the fishers are low. Durability of fishing assets is very short due to wear and tear and due to navigation in the rough sea. The net will be unfit due to turtle bite and also irreparable damage caused by ships and mechanised trawlers.

In the earlier days fishermen always kept in mind the importance of juveniles and basically they were keen to conserve fishery resources. They bore in mind the sustainable fishing practices. Such practices have vanished and new methods are used by the fisher folk and due to intense competition they can’t go with the old technologies and value systems.

Coming to technologies used, a majority of people now use nylon nets and fibre boats which are durable. The boats and nets which are used are specific to the local ecosystem.

Modern technological equipments were used in fishing and many of them are possessed by fishers as group ownership or by the person who invest in fisheries usually a person like ‘Tharakan’ or by their own means, or with the help of cooperatives, friends etc.

Another important asset that decides the quality of life is on the asset structure like ownership of house, type of house, sanitary facilities, source of water and ownership of consumer goods. Generally they are far behind the mainstream population regarding physical assets.

When we compare with the census results of rural Kerala, the possession of television and mobile phones possessed by the fishers are comparatively high. Advertisement and the home delivery system play a big role in boosting the
extravagant nature of fishers. The lack of adequate sanitation facilities in the coastal regions may lead to severe health and environmental problems. Information regarding the sanitation facilities testifies the absence of hygienic conditions of coast in the study region. The coastal people considered the lack of sanitation as a crucial menace. The coast gets polluted and no one can enjoy the scenic beauty of beach. The problem is high in Adimalathura (Thiruvanthapuram region).

In the study regions 58.7 per cent have own sources of water and 41.3 per cent uses public source. In the survey drinking water is available for the people in Alappuzha and in Kannur due to ‘Theeradesha Kudivella Pathathi’ (Coastal Drinking Water Project). Interviews revealed concern about drinking water facilities in Thiruvanthapuram region. The residents of Adimalathura in Thiruvanthapuram have continued to depend on the one-hour water supply provided by the parish church for their daily needs. Lack of sanitation facilities, drinking water shortage and improper garbage disposal in Adimalathura make fishers vulnerable to epidemics like dengue and chikungunya.

The investment for fishing activities among fishers is high in Kannur. Among the fishers the saving habits are low and liabilities are high and is an indicator of vulnerability.

Education plays an important role in human capital and contributes to the economic growth and the empowerment of the individual and the community in which he lives. It is an important factor and the basic foundation of next generation. Though Kerala’s development experience showed significant increase in literacy, health and education among the general population, there exists wide disparity among fishers. While comparing the educational achievements of respondents and their parents there is an improvement in basic education. Higher education is a dream for the respondents. Due to vulnerability and low economic status they are forced to go for fishing in their young age. The poor and congested habitat, lack of support and encouragement from the family and community forced them to quit their education. Although higher education is a priority in the state, little progress has been made in the education of the respondents.
Apart from the formal education, the human assets include the manpower and also the skills and knowledge acquired and transferred over to generations. The indigenous technical knowledge is a treasure of ancient wisdom, beliefs and traditional knowledge handed down by forefathers. The communities share these assets for their sustenance in the sea. Indigenous knowledge helps the fishers to know the changes in weather. The fishers from the study region shared their knowledge regarding the indication of certain species.

Institutions play an important role in ecosystem management, governance and poverty reduction. Governmental institutions and non-governmental institutions like trade union, church and samajam play a key role. Many unwritten rules and norms exist among the fishers. The technological changes resulted in the disintegration of institutions like kadekkodi (Sea Court).

Though kadekkodi system disintegrated in Kannur, a fishing village in Azhikode where the Hindu groups are dominant, have a structure to protect the resources. In Azhikode the Araya samajam plays a significant role in protecting the sea ecosystem and also helps in the holistic development. Church as an institution in Alappuzha and Thiruvanthapuram helps to protect the beaches in Adimalathura (Thiruvanthapuram) and Arthunkal (Alappuzha). In Alappuzha work sharing system is in practice and they allow the members outside the community to go for fishing.

Government as an institution formulates rules and regulations and also provides security schemes for the betterment of livelihood. The KMFR Act of 1980 empowers the Government to regulate, restrict or prohibit within specified areas of fishing, number of fishing vessels, for specific species specified gear for conserving fish resources and utilization on a scientific basis or for maintaining law and order in the sea. One of the most widely discussed and adjudicated conservation measures was the bottom trawl ban during the monsoon period imposed by the Government of Kerala first in 1988 and followed till date. The ban was not only for conserving resources, but also for ensuring law and order in the sea. The Kerala Monsoon Fishery (PELAGIC) Protection Act,2007 by the Government of Kerala provides for security of life and livelihood of the traditional fishermen and ensures their subsistence by occupying pelagic fishery through
tapping the unique pelagic fishery resources in the state like chakara in monsoon season and to regulate them and for the matters connected with monsoon fishing.

In order to provide social security and livelihood support to the fishermen community the programmes like saving-cum-relief scheme, housing scheme, group insurance to fishermen, insurance coverage for fishing implements were under implementation. The Kerala Fishermen Welfare Fund Board is the implementing agency for welfare and relief schemes to the fishermen in the state. Matsyafed is an apex federation of 666 primary level Fishermen Development Welfare Cooperative Societies. The members participate in the beach level auctions. The saving-cum-relief scheme is for providing assistance to fishermen during lean period by mobilising their savings during the peak season. Though the government propose various measures most of the beneficiaries are deprived and are not aware of the benefits.

The researcher enquired about the benefits they received from government, NGOs and the community. The findings reveal that the benefits given by the government are not received in the grassroot level and they are not satisfied with the present level of institutional set up.

On this context they are asked whether the living standard is low when compared to the main stream class and they unanimously have the opinion that the standard is low. **Chapter 8** examines the threats related to livelihood. The causes of livelihood threat faced by fishers were summarised under the framework for conceptualising the problems in the fisheries sector in Kerala with reference to the drivers causes and threats (impacts). Also the researcher identified thirteen related variables, which are supposed to measure the low standard of living and by conducting factor analysis the important factors related to threats were identified. The new factors identified are work to earn, environmental factors, financial requirement, marketing difficulties and administrative problems. Using these measurements, further analysis was done to determine the possible directions of variation among the three regions of Kerala and the result shows that there exists region wise variation in these determinants.
8.6 Conclusion and Suggestions

Marine fish stocks are under severe threat from over fishing and environmental degradation. Overexploitation of resources using new technologies destroys the resource base and the social foundation of the society. Pressures from the capitalists who invest in fisheries enhance the problem of overfishing. Also pollution, discards, use of destructive fishing techniques posed sustainability issues in fisheries which pose a threat on the livelihood of the fishers. Land based activities, which have an adverse effect on marine and coastal ecosystems should be controlled. High population density in the coastal areas, limited alternative opportunities for other jobs, break down of traditional management system, support given by the middlemen and private money lenders, the destructive use of minitrawlers, increasing or common use of destructive gears, the use of high speed engines, catching of juveniles, stagnating/declining overall catches and income per fisher, break down of traditional management strategies, non-enforcement of management regulations, entry of new fishers with no fishing tradition, and increased competition in the fisheries sector pose threat and in this context the Kerala fisheries is going through the stage of Malthusian overfishing.

Due to institutional and human conditions like open access, greed and competition fishers face greater insecurity. Due to the new technological developments there are problems resulting in ecosystem damages. Indigenous technologies and cultural knowledge of the traditional fishers are neglected. In this context we should promote sustainable development technology. Sustainable Development Technology Unit of Canada defines sustainable development technology as “products that integrate economic viability, environmental stewardship and social equity and meet the needs of the present without compromising the ability of future generations to meet their own needs” a concept borrowed from Brundtland proposition. This will be achieved by blending information and communication technology with indigenous and traditional knowledge. This affects not only the well being of present generation but also the prospects of future generation.

Modern technology competes with the traditional, depriving of the livelihood and depleting resources. In the near future food security issues will
emerge due to the decline in marine resources. Owing to inadequate opportunities for modern employment and inadequate access to basic human rights majority of fishers are marginalised from the mainstream social, political, economic processes of the societies they live.

To solve this lopsided development we should strengthen the societies with secure and satisfying livelihoods along with the sustainable use of ecology and natural resources. The exercise of policy formulation should ensure not merely growth, but that promotes human development and sustainability between ecology and development. In the context of globalisation of trade, growing demand for seafood there is enormous pressure on the resources and there is an urgent need for developing a management regime based on the principles of responsible fishing for ensuring livelihood security, resource sustainability, economic efficiency and ecosystem integrity. The proverb “The wealth of the sea belongs to the dead, the living, and those yet to be born” points to a concrete and meaningful elaboration of the concept of sustainable development. Stewardship, an ethic which has a role in stressing humanity’s responsibility as caretaker is the way for appropriate resource management.

Sustainable management requires partnership among scientists, communities, government and other stakeholders. New institutional set up is needed. The government policies and institutions that determine the social infrastructure of an economy should reorient their priorities. The concept of community based co-management approach is of great relevance where the principle of subsidiarity should be followed. This stewardship should be carried out at the local level. Policies adopted to ameliorate the livelihood conditions of the fishers must be based on the specificity of the need in each particular region. For carrying out this, place suited community centered co-management should be adopted. For the holistic development of the community and to carry out place suited community centered co-management requires understanding and respecting the social and political capacities of local communities. The future research should be carried out in the local level emphasizing the concept of sustainable development technology and place suited community centered co-management.