INSTITUTIONAL ANALYSIS OF MARINE FISHERIES MANAGEMENT PRACTICES IN KERALA, INDIA

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By

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Dedicated to

"Unknown living martyrs of struggles to protection of rights and livelihood in marine fisheries in Kerala"

Certificate

This is to certify that the thesis entitled ***"Institutional Analysis of Marine Fisheries Management Practices in Kerala, India"*** *is an authentic record of the research work carried out by Mr. Baiju.K.K under my supervision and guidance at the school of Industrial Fisheries, Cochin University of Science and Technology, in partial fulfilment of the requirements for the degree of Doctor of Philosophy and no part thereof has been submitted for any other degree at any other institution.*

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Declaration

I hereby declare that the present work entitled ""**Institutional Analysis of Marine Fisheries Management Practices in Kerala, India"** is based on original work done by me under the guidance of **Dr. K.T. Thomson**, Professor in Economics, School of Industrial Fisheries, Cochin University of Science and Technology, and has not been included in any other thesis submitted previously for the award of any degree.

Cochin **Baiju.K.K.**

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ABBREVIATIONS

AITUC	All India Trade Union Congress
CIFT	Central Institute of Fisheries Technology
CITU	Center of Indian Trade Union
CMFRI	Central Marine Fisheries Research Institute
CPI	Communist Party of India
CPI (ML)	Communist Party of India (Marxist Leninist)
CPIM	Communist Party of India (Marxist)
CPUE	Catch Per Unit Effort
DFID	Department for International Development
EBFM	Ecosystem based Approach to Fisheries Management
EU	European Union
FAO	Food and Agricultural Organisation
GOI	Government of India
GOK	Government of Kerala
Hp	Horse Power
IAD	Institutional Analysis Development
ICLARM	International Center for Living Aquatic Resource Management
IFQ	Individual Fishing Quotas
INC	Indian National Congress
INTUC	Indian National Trade Union Congress

IQs	Individual Quota System
ITQ	Individual Transferable Catch Quota
KMFRA	Kerala Marine Fisheries Regulation Act
KSMTF	Kerala Swathanthra Masyathozhilali Federation
Lo_A	Length of Overall Fishing Vessel
LOP	Letter of Permit
MATSYAFED	Kerala State Co-operative Federation for Fisheries Development Ltd
MSVPA	Multispecies Virtual Population Analysis
MSY	Maximum Sustainable Yield
QMs	Quota Management System
SIFFS	South Indian Federation of Fishermen Society
SLA	Sustainable Livelihood Approach
TAC	Total Allowable Catch
TUCI	Trade Union Center of India
TURFs	Traditional Use Rights in Fisheries System

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Chapter 1

Introduction

Fisheries management, in broad sense, is a dynamic process where fishing communities and the society at large take careful decisions to regulate the use of resources for sustaining the ecological, economic and social viability of fisheries. In traditional maritime Asian communities, management decisions were taken within the society itself after reviewing relevant ecological and socio economic issues (Thomson 1989 and 2002; Bavinck 1996 and 2001; Bavinck and Karunaharan 2006; Kurien 2000 and 1994; Rajan 2002; Ramchandran 2004; Paul 2005; Ramchandran and Sathiadhas 2006; Srinivasan 2006). However, these community-based management systems have been undergoing significant swings, especially during the modernisation era, in an attempt to resolve the management challenges of mechanisation (Sen and Nielsen 1996; Berkes et al. 2001; Jentoft and McCay 2003; Symes and Phillipson 1999; Bavinck 1998, 2003 and 2005). The inadequacy of traditional community-based management systems to reassure socio economic viability and ecological sustainability when external economic forces impinge on their ecosystems and production processes demanded an intrinsic comprehensive management approach that carefully addresses the challenges and opportunities of modernisation. As a response, many of the traditional management regimes that were locally designed and controlled by fishing communities got replaced by state-centric

hierarchical governance in many parts of the world (van Vliet and Dubbink 1999; Dryzek 1997; Thomson 2006). Such countries adopted market principles to manage their fisheries with limited success (Gray 2005; Young and McCay 1995; Adelaja, McCay and Menzo 1998; Newell, Sanchirico and Kerr 2005; OECD 2006). Hegemony of formal management mechanisms not only silenced but even superseded, community based management institutions in many coastal societies.

Surprisingly however, many indigenous management institutions refused to diffuse and continue to coexist with formal management institutions. Limitations of bureaucratic modes of market governance prompted many developing maritime nations to resort to alternate governance regimes such as participatory forms of fisheries management (Gray 2005; Mikalsen and Jentoft 2003; Pomeroy 1995 and 2006). Social scientists argued that an approach which combines the best components of traditional/customary marine tenure systems with appropriate interventions and advice from the state could provide an enabling environment for better management of the small scale fisheries (Christy 1982; Hviding and Ruddle 1991; Pomeroy 1994; Doulman 1995). Following this advice, a series of management models that allowed a wide array of collaborative arrangements among various resource users, state and civil society were later evolved to deliver the required management functions and services (Pinkerton 1987; Berkes and Turner 2006; Thomson and Berkes 2006; Ostrom 1990 and 2010; Thomson and Gray 2009; Kooiman et al. 2005).

The transformation of the Indian marine fisheries management scenario during the last five decades clearly reveals a gradual renunciation of local communities from the management decision making process by State's administrative fishery bureaucracy. Although local communities could attend to their management problems quite successfully through community based institutions during the pre-modernisation era, these institutions malfunctioned miserably during the post blue revolution period (Bavinck 2005; Paul 2005; Kurien 1995 and 2001). For instance, economic disparities emerged between artisanal fishermen and mechanised counterpart, social conflicts, the economic crisis of the newly emerged mechanised fishing fleet, illegal fishing, the intrusion of foreign fishing vessels into national fishing grounds, the problem of overfishing, the emerging ecological crisis and environmental problems caused by the development of shipping industry etc. are clearly beyond the capacities of local communities to manage.

In a recent study, Sathiadhas (2009) argued that despite attaining reasonably good rate of growth in primary production and exports, the marine fisheries sector in India faced severe management crisis[1]. Over capitalization in the mechanized and motorized sectors of the fishing economy[2], reduction in capital investment in the artisanal non-

[1] The total fish production in India has grown at an annual average compound growth rate between 3.35 to 4.62 percent during 1950-51 to 1990-91 (Sathiadhas, 2006: 349).

[2] The gross capital investment on fishing units in Indian marine fisheries sector during 2003-04 works out at RS.10,532crore in which mechanized sector constitutes about Rs.9,049 crore, more than a three-fold increase from 1997-98 (I.bid.: P351).

mechanized sector[3], declining annual per capita production in the artisanal, motorized and mechanized sectors, reduction in the ownership on means of production by artisanal fishermen, and the declining artisanal fisheries are the major issues that need to be immediately managed to sustain marine fisheries as a viable occupation in India. The author however pointed out that both the mechanized and non-mechanized fishing vessels gained positive net operating income from fishing.

The livelihood vulnerability of artisanal fishermen increased during the post modernisation era and repressed their financial ability to take part in resource management. The annual per capita catch of fisher folk in mechanized segment is more than twice as those of the per capita catch of the motorized segment and nine times of the per capita catch of the non mechanized (traditional sector) segment clearly signifying growing inter-sectoral disparity in distribution of economic gains. Average annual per capita earnings of fishing laborer range from Rs. 13,200 for a motorized canoe *(dingi)* with bag net to R.s. 1, 27,200 for a mechanized purse seiner. Significant variation is also observed even within groups of crafts namely trawlers, gill netters, purse seiners, motorized, and traditional crafts. "The analysis indicates that there is high incidence of poverty in the coastal rural sector explicitly revealing that majority of these people still could not get much of the benefits of the economic development taken place in our country"(Sathiadhas,2009:774).

[3] The non-motorized sector has shown a decline in investment from RS.923 crore during 1996-97 to Rs.622 crore during 2003-04 in tune with their decline in production and diminishing returns (I.bid., P351).

The artisanal fishing communities responded to the emerging management failures in a number of ways. Initially, the communities were not ready to shoulder the responsibility of fisheries management as the nature of problems emerged were obviously much larger than they could successfully manage. In many areas where weak communitarian management regimes existed, local communities voluntarily withdrew as both problems and solutions became extremely complex for them to solve. The high costs of management, social differentiation within communities and slow evolution of modern community-based institutions to manage the upcoming problems of modernization were the major bottlenecks that constrained communities to shape management institutions of their own. Hence they resorted to organized social action with the help of nongovernmental organizations to control the activities of the dominant mechanized sector, which according to them were solely responsible for the larger sets of management issues in the fishery sector. Second, they objected the operations of the mechanized sector through formal legal processes. Finally they influenced state policies to introduce formal management regimes to regulate access of the mechanized sector to various fishing grounds.

The industry on the other hand refuted the allegation that they are solely responsible for the management crisis in the sector. Contrary, they argued that the artisanal sector, by upgrading their technologies constantly and procuring modern fishing vessels to compete the mechanised sector, also contributed to the resource crisis. Therefore they demanded a formal solution that takes a scientific approach, rather than emotional favours to the artisanal sector, to the emerging management

crisis in the sector. The litigation process between the artisanal and mechanised sectors favoured the former and compelled competing users to press for evolving scientific management regime for fisheries management.

This argument was acceptable to the state and it appointed a number of scientific committees to build the knowledge base for managing common property fisheries (Paul et al 1981; Kalawar et al 1985; Nair et al 1987, 1990 and 1999; James et al 1992; Silas 1994; Singh et al 2007). State on the other hand, endeavoured to fill the management vacuum aroused due to the withdrawal of communities by developing and strengthening formal institutions and organisations to execute and enforce strong management measures. In the special context of the federal nature of the Indian Republic, the Central Government rarely intervened in fisheries regulations especially within the limits of the territorial waters. Since fisheries governance within territorial waters was mainly a state subject, the Central Government directed individual maritime states to regulate fishing activities within their territories. Accordingly, federal states crafted formal institutions to control fishing activities within their territorial waters.

One of the first responses towards this direction mainly came from the state of Kerala in the early 1980s. The formal management scenario changed around early 1980s with the introduction of the Kerala Marine Fishing Regulation Act (1980)[4]. The Act henceforth prohibited the use of

[4] The Act proclaimed that "In the context of the rapid expansion of marine fishing activities through the introduction of an increasing number of mechanized fishing

purse-seines, ring seines, pelagic trawl, mid-water trawl and bottom trawl within the territorial waters of Kerala coast. The state introduced a number of command and control measures to manage marine fisheries off the coast, including prohibiting the operations of mechanized trawlers during monsoon months since 1988 (Govt. of Kerala, 1988)[5]. This regulatory exercise however, was limited to certain pockets where mechanized trawlers operated; majority of the artisanal non mechanized/ mechanized vessels with excessive harvesting capabilities were allowed to continue operations. In other words, the formal regulatory regime did not provide the much awaited comprehensive management platform to resolve the ecological, economic and social crisis that endured in the post-mechanized fishery economy. Hence the management crisis persisted and the ecological, economic and social concerns in marine fisheries intensified further. The need for an inclusive management regime that could comprehend the concerns of the artisanal

boats and deep sea fishing trawlers, there is conflict of interests between the operators of mechanized boats and trawlers and traditional fishermen using non-mechanized boats. Agitations by traditional fishermen in the Cochin area against Purse seine boat operations in the Kerala coast have almost created many law and order situations in those areas. The need for a legislation to safeguard the interests of the traditional fishermen and the fishing resources of the State has also been keenly felt. It is therefore considered necessary to enact a legislation providing for the regulation of fishing vessels in the sea along the coast line of the State.

[5] The prophets of trawl ban proclaimed that "the ban led to the enhancement of marine fish production from an annual average of 3.3 lakh tonnes during pre-ban period to 5.7 lakh tonnes during ban period and benefited all sectors of the fishing community in terms of increased catch and revenue. The average annual value realized from first sales (landing center level) increased from Rs. 446 crores in pre-ban period to Rs. 1240 crores in the ban period (phase I) and further to Rs. 2198 crores in ban period (phase II). There was steady increase in average annual foreign exchange earnings from marine exports from Rs. 126 crores in pre-ban period to Rs. 491 crores in phase I and Rs. 1040 crores in phase II of the ban period". (Singh et al 2007: pp 263).

and industrial sectors and deliver management services in a satisfactory manner persisted.

The state also realized that the present management regime and regulations are highly insufficient to handle the social ecological complexities of the modern marine fisheries off the Kerala coast, although it was quite unsure as to how to proceed further to refine and improve its regulatory regime. It also knew that collaborative modes of governance could act as a better practical option to improve the conservation and socio economic benefits of monsoon trawl ban along the Kerala coast. The learning experiences of formal fisheries administrators and policy makers while working with various informal organizations of artisanal fishermen and industrial fishing fleet, political party/ trade union leaders have shown the pathways of collaborative fishery management as a better option to solve the complex problems faced by maritime communities and their ecosystems. What is surprising however, is the fact that both formal and informal institutions coexist and interact in an attempt to resolve the fundamental problems that face them today. The thesis seeks to examine the nature of this coexisting institutions and their effectiveness to address the challenges of marine fisheries management in Kerala.

1.1 Objectives

As explained above the growth of international markets and the consequent modernisation of fishing industry in the state of Kerala, India have resulted in serious resource crisis, livelihood vulnerability,

economic disparities and social conflicts between modern entrepreneurs and traditional communities. Resolving these issues therefore emerged as the most pressing management problem in Kerala fisheries. A detailed analysis of these issues is required for evolving appropriate management regimes and systems. While, resource conservation is an important objective of marine fisheries management, in doing so we must also ensure that various groups of primary producers and modern enterprises do not conflict each other and also guard and protect the livelihood interests of local primary producers. Accommodating all these concerns of fisheries management, the objectives of the study are:

1. To identify and analyse the major management concerns in marine fisheries of Kerala.
2. To examine the organizational issues of community based and state centric marine fisheries management systems during the post modernisation era.
3. To study the interaction of various state and non-state management institutions in the marine fisheries sector and
4. To identify socially acceptable practices of marine fisheries management in Kerala

1.2 Scope and significance of the research

The study is important for the fact that it places the management dynamics of marine fisheries sector in the context of growing unrest of local communities over the emerging resource conflicts and degradation. Economic crisis in small scale marine fisheries due to high operating cost continue to hinder the efforts towards conservation in many ways. The

migration of mechanised fleet as a response to profit maximisation strategy of enterprises continues to be a threat to resource management. Therefore this study explores how to revamp the small scale mechanized sector effectively and profitably to ensure rational allocation of resources. The thesis attempts to examine how livelihood vulnerabilities of artisanal fish workers influence the crafting of management institutions. Finally by combining insights of an institutional framework, the study establishes the need for recognising the role of both formal and informal institutions in the management of marine fisheries in Kerala.

The thesis maintains that sustainable solutions to resource crisis are possible when state and resource users collaborate in a platform where individual stakeholders respect one another and shoulder the responsibility of management. The thesis relies primarily on the institutional theories of natural resource management and illustrates how to manage socially and ecologically diverse marine fisheries in a globalising world. The study reveals how various political parties and fisher organisations together cooperate and negotiate conflicting objectives in a manner that is acceptable to various interest groups.

1.3 Limitations of the study

This study has some limitations. First of all, the research was mainly concentrating on fishing activities and regulatory mechanisms in the Ernakulam region although other regions like Sakthikulangara in Quilon district also have the active presence of formal regulatory institutions. This was because Ernakulam region significantly influences fishery

policies and legislations in Kerala through democratic process of political negotiations. Second, case studies on community based management systems in the southern region (Thiruvanathapuram district) were excluded due to lack of time and financial resources. Third, trust worthiness among fishermen, leaders, and bureaucrats were the major considerations for including them in the study for eliciting their opinion on various aspects of fisheries regulations and management. Fourth, fishermen leaders and bureaucrats were not available as per prior appointments. Finally, approaching the fishermen was not always easy; it took more time and effort to convince the fishermen that researcher is not working for the government, political parties or any primary producer organisation.

1.4 Scheme of the thesis

This thesis is divided into eight chapters. The first chapter introduces the context and objective of the study. 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 elaborates the theoretical and conceptual framework, methodology and the ecological and social setting of the study districts. Fourth chapter provides information regarding the major actors and activities in study area. Fifth chapter provides a detailed description of the core problems in Kerala's marine fisheries for which resolutions are attempted. These issues include resource degradation, economic crisis of various fishing units and the livelihood crisis of

artisanal communities. Chapter six examines how local communities addressed these problems and sought solutions outside the domain of the state by examining an informal/non-state community based management system called *Kadakkodi* in the northern district of Kasaragod. Chapter seven provides information regarding how the core fishing problems are addressed through the collective action of local communities and the state in one of the highly commercialised marine fishing centres of Kerala, *viz*. Ernakulam. It is argued in this chapter that the formal management plans alone are not effective enough to resolve the problems faced by the fishing communities of Kerala. It is further argued that the effective solutions to the core problems that fishing communities face today could be achieved mainly through an interactive process of collaboration between local producer groups and the state, a process which has been popularly described as co management in marine fisheries management literature. Chapter eight summarises major findings of the study and provides suggestions and recommendations for negotiating collaborative strategies of marine fisheries management in Kerala.

Chapter 2
Review of literature

Fisheries management is a broad term that describes the process of administering control of fishing for exploited fish stocks (Dankel and Skagen 2008). The concept got refined later to include a wide spectrum of economic, social and institutional processes in fisheries (Caddy and Cochrane 2001). Hence, there evolved a vast body of literature detailing how to manage fisheries. Management of marine fisheries has been one of the major issues that attracted the attention of policy makers and academicians. In fact, the problem has been deeply investigated by marine biologists and later by ecologists, economists and other social scientists. They proposed theories and strategies for prudent use of various fishery resources. Maritime nations in turn have been relying on these management models to resolve their fishery crisis with limited success. The objective of this chapter is to review the 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 insights for managing marine fisheries in Kerala, India. The chapter is divided into three sections. In the first section a review is made covering major theoretical approaches proposed by natural and social scientists. In section two a review of various studies that highlighted the practices of marine fisheries management in India and Kerala is presented. The third section provides a summary of these.

2.1 The science behind fisheries management

Degradation of fisheries wealth has been one of the major fields of scientific inquiries of marine biologists and ecologists for many decades. Natural scientists argued that degradation of marine stocks, particularly overfishing could be regulated if the critical biological and genetic characteristics of the biomass and the ecosystem dynamics were scientifically understood. Economists, on the other hand, emphasized the role of economic processes that expedite the process of economic overfishing. The tragedy of commons has been attributed to the unlimited freedom of entry into fishing grounds. Marine ecologists later intervened and proposed an ecosystem approach for fisheries management. Since most of these discipline-bound approaches could not desist degradation of resources as expected by fisheries administrators, both natural and social scientists shifted their attention to a detailed collective examination of uncertainties in fisheries management. Precautionary approaches and code of conduct for responsible fishing hence evolved as management strategies. In this section an attempt is made to detail the efforts made by natural and social scientists to develop various theories of fisheries management.

2.1.1 Biological processes in fisheries management

Marine biologists, pioneers in stock assessment methods, maintained that since fisheries are a growing resource, it should be harvested at the level of Maximum Sustainable Yield (MSY). This principle activated by classical biologists like Russel (1931), Hjort et al (1933) and Graham (1935) has been convincingly articulated by Schaefer (1954). These

studies concentrated on the biological processes of single species to formulate scientific management strategies. Single-species assessments typically attempted a historical reconstruction of the stock to establish key parameters and relationships, described the current stock status and proposed scientific actions that would steer the stock towards a desired status. These models even made long-term predictions of the likely future status of the stock under various management scenarios to establish desirable states and advised on the robustness of management procedures. The advantage of single species models was that they simplified biotic relations to derive fishery control parameters like fishing effort, catch and choice of techniques.

From the management perspective however, these models ignored interactions with other species and the wider environment and could produce overly optimistic management advice. Added to these, there were serious estimation problems, appropriateness of MSY as a management goal, and the ability to effectively implement harvest strategies based on MSY (Larkin 1977; Sissenwine 1978; Punt and Smith 2001). Dynamic multispecies models on the other hand attempted to conceptualise the functional relationships among individual species in a fishing system. These models considered predator–prey interactions and evaluated interactions between a subset of the species in the ecosystem (Yodzis 1994). Early dynamic multispecies models that addressed species interactions like predation mortality and prey-related growth, stemmed from the ecosystem model of Andersen and Ursin (1977). It was claimed that these models provided improved estimates of natural mortality and recruitment; better understanding of spawner – recruit relationships,

variability in growth rates, alternate views on biological reference points and even a framework for evaluating ecosystem properties (Hollowed et al 2000). However, these analytical models with full biological interactions were complicated, hard to optimize control for all species simultaneously and need to accept some tradeoffs. Dynamic system models of the ecosystem attempted to model bottom-up and/or top-down forces in a dynamic framework. Compared with dynamic multispecies models, dynamic system models have a higher level of detail at the species level and included more detailed coupling of physical forcing and its effect on biological interactions.

Quinn, II .T and Collie (2005) reviewed the concept of sustainability with regard to a single-species, age-structured fish population with density dependence at some stage of its life history. Two notions of sustainability were proposed by these scholars. The classical view that dominated fisheries policies prior to 1970s, suggested that fishing mortality has been the most important control variable in managing a fishery and claimed that fish population at a low level could rebuild quickly to the optimal MSY level. Modern view of sustainability on the other hand focused on preservation of spawning biomass and production at all life stages than ever before. Generally, the assessment science would determine the levels of fishing efforts that were safe to preserve spawning biomass and avoid risk to allow sustainable harvest. Nevertheless, there were many situations in which uncertainties in the information made it difficult to formulate prudent management decisions.

The single species approach to fisheries management possessed obvious limits. These models and approaches showed that the definition and understanding of sustainability had been intimately associated with biological processes of survival, growth and reproduction. At least some of these processes were necessarily density dependent, for a population to be regulated within the perimeters of its environment. Biological processes must also necessarily be stochastic to explain the observed fluctuations of natural populations related to environmental and other factors that could not yet be explained. It was pointed out that assessment models were biased because they did not incorporate the predation by other species, searched only for equilibrium solutions, such as MSY, failed to account for environmental changes, especially in the context of a multispecies fisheries off tropical maritime nations.

Nakken (1998) examined discrepancies between advised, agreed and actual annual catches in the Barents Sea and concluded that actual catches frequently exceeded the advised ones. The findings called for more caution when total allowable catches (TACs) are fixed in future as compared with past and present experience.

Moreover "biological fisheries management (mesh size regulations, total allowable catch, area closures, nursery ground protection, etc.) might conserve and even enhance fish stocks but fail to improve the economic situation of the fishery due to the failure to impose appropriate shadow cost of harvesting on the fishing firms". As a result, the fishing firms would respond to a successful biological management simply by

expanding fishing effort, thus eliminating any temporary gains generated by the management measures (Arnason (2000 and 2009a).

2.1.2 Economics of fisheries management

Economists argued that rates of harvesting have been influenced not only by biotic and ecological variables as conceptualised by marine biologists and ecologists but also by economic forces. Therefore fisheries management has to take into account the influences of these variables seriously to enhance predictability of management models. In a classic attempt to include economic forces, Gordon (1954) maintained that common property fisheries attracted excess fishing effort, misallocation of effort between grounds of differing quality leading to depletion or extinction of the basic resources. This tragedy, he argued could lead to poverty and even immobility of fishermen. Since fisheries in the real world were dynamic, economists questioned the adequacy of static models as these models could not explain the apparent decline in some fishery stocks. By 1970s, they started developing models for analyzing the behavior of bio-economic fishery systems under uncertainty with the help of biologists and mathematicians. Clark (1973 and 1976), Clark and Munro(1975), and Munro (1982) argued that society's basic resource management problem was to determine the optimal harvest time path with the objective to maximize social utility from the stock, based on the assumption that society was willing to make current sacrifices to benefit future generations.

Relying on the strengths of bio economic models, fishery economists developed a variety of direct economic regulations such as limitations on days at sea, fishing time, engine size, holding capacity of the vessels, etc. and indirect economic management methods such as corrective taxes or subsidies and property-rights based instruments such as licenses, sole ownership, territorial use rights, individual quotas, and community rights for the scientific management of fishery resources **(**Arnason (2000 and 2009a).

Ganguly and Chaudhiri (1995) studied the stability and optimal use of a single species fishery by imposing a suitable tax per unit biomass of landed fish. Pradhan and Chaudhiri (1999) extended the analysis to include multiple species and derived stability conditions.

Arnason (1990) argued that since resource managers did not have capacity to gather the required data for calculating optimal tax rates, catch quotas, etc., management systems based on such approaches were of little practical use. The study showed that Individual Transferable Share Quota system could be an ideal alternative market-based management system that could ensure economic efficiency in using common-property resources with minimal information. Shepherd (2003) argued that the system of managing fisheries using TACs and quotas had not been sufficiently effective, and was no longer adequate. Direct control of fishing effort has always been a possible alternative, but has not been implemented except in special cases because of the difficulties of measuring and comparing the fishing effort of different vessels and fishing gears, and ensuring fair sharing of the resources available. Smith

(2004) analyzed the effectiveness of limited entry in the Californian red sea urchin fishery. It explored the dynamics of heterogeneity in catch and revenue by applying duration analysis and found that the fleet was becoming not only more homogenous but also more potent and spatially mobile. Regulation such as size limits and season restrictions increased attrition. Huppert (2005) provided an overview of fishing rights as an alternate management regime and analyzed limited entry permits, individual fishing quotas (IFQs), and local community-based or co-operative harvesting in relation to economic efficiency of fisheries. He noted that all three types, particularly IFQs, might initiate radical changes in the economic organization of the fishery, ultimately changing who fished, where and when they fished, the products sold incentives to support conservation, the size of incomes from fishing, and the location of shore-side economic activity.

Townsend (1990) attempted a detailed review of entry restrictions in fisheries and found an inverse relationship between the complexity of a fishery and the success of management, ceteris paribus. Cautioning policy maker the author argued that limited entry could only be one of the elements in a broader program of fisheries management. Townsend and Pooley (1995) examined the role of fractional licenses for the optimal harvesting of fishery resources. Under fractional licensing system, the management authority would determine the optimal number of licenses to be issued and separately fix the number of boats (fishers) for those licenses. A fraction of a license was then issued to each fisher. License shares could be freely exchanged to generate the effect of the full license to fish. Sanchirico (2002) examined the manner in which the

establishment of a marine reserve in a limited-entry licensing system might affect fishermen and noted that area licensing could be a better alternative to fishery-wide regulations to optimize effort, catches, and biomass distribution.

Social scientists and economists explored whether evolving private property rights would resolve tragedy of the commons. One of the early proposals was to evolve sole ownership in marine fisheries for economic efficiency (Scott, 1955). Following this line of inquiry, Christy (1982) emphasized the importance of traditional use rights (TURF) in fisheries management. McCay (1995) provided an overview of the social and ecological implications of individual transferable catch quotas (ITQs) in fisheries management. Eythorsson (1996) pinpointed some of the economic and social effects of fisheries management by individual transferable catch quotas in Iceland. Symes (1998) examined the role of property rights as regulatory systems with reference to European fisheries. Eggert (1998) discussed the relevance of bio economic analysis and different management strategies in fisheries. He suggested that both common property resource management and individual transferable quotas could be fruitful strategies in different settings. Batstone and Sharp (1999) discussed the effectiveness of quota management system (QMS) in New Zealand and concluded that the mechanism was not economically efficient. He also raised the difficulties faced at different stages of the enforcement of this strategy and cautioned that rights-based fisheries management has been most exposed to the influences of politics which could threaten the stability of the mechanism. Arnason (1993) described the evolution and current structure of the Individual

Quota System (IQ) in the Iceland fisheries. Discussing the social and economic impetus for adopting individual transfer quota system the author stated that introduction of ITQ system in the herring fishery had produced dramatic increase in efficiency. Palsson and Helganson (1995) discussed inequality in the Icelandic cod fishery, focusing on changes in the actual distribution of fishing quotas and found that ITQs had been increasingly concentrated in the hands of the biggest companies. Many of the small-scale boat owners still holding ITQs were increasingly found contracting for larger ITQ holders. Symes (1995) examined evidences from New Zealand, Canada and Iceland for common tendencies and unresolved issues in the implementation of ITQ system of management. The paper concluded that, this management strategy needs to be repeatedly tested in complex developed fisheries if the system had to play a vital role in the development of a sustainable management strategy. Sharp (1997) examined how transferable harvesting rights provided alternate institutional structure for fisheries management and identified important institutional variables for achieving a transition from command-and-control management to tradable rights in New Zealand. Similar studies were also undertaken by Dewees (1998), and Borch (2010).

Shotton (2000) summarized various aspects of rights based approach to fisheries management including perspectives of fishing industry, government policy makers and administrators, legal implications and communities. Scott (1955) briefly sketched a theoretical discussion on the historical emergence of property rights from ancient open access to modern licensed regulatory regimes while Arnason (2000) discussed the

role of property rights in organizing economic activities at the level of production and productivity. Kearney (2001) explored how property rights over commercial and recreational fisheries led to conflicts in New Zealand. Arnason (2005) narrated the experience of Iceland with respect to the introduction of ITQs and compared it with the systems prevailed in New Zealand and Norway. The distributional effects of ITQs have been summarized by Brandt (2005). He noted that no segment of the industry was adversely affected by the regulatory change, although, the study noted the emergence of a new sector in the industry, which was predominantly made up of former small-scale harvesters. Mansfield (2006) emphasized the relevance of market-based regulations, which rely on economic incentives and property rights, for fisheries management. Synthesizing results of previous research on political economy of the North Pacific Pollock fishery, the study provided evidence to contradict hypotheses derived from the logic of market approaches. Lack of property rights was not the sole reason for problems in the fishery, but instead problems were created by the institutional context of fishery development. Steinshamn (2005) reviewed incentive based and command and control management systems. Providing an overview of bio economic models of marine reserves, Armstrong (2007) claimed that the economic analysis had been more pessimistic with regard to the potential of marine reserves as a fisheries management tool, than what pure ecological analysis due to the neglect of issues such as discounting and economic incentive behaviour. Arnason (2009b) provided a guideline to compare efficiency of various fishery management systems. Pinkerton and Edwards (2009) reminded the hidden costs of leasing

individual transferable quotas and cautioned that the approach might not be socially optimal. Arnason (2000: 747, and 2009a: 745) reminded that since setting and enforcing biological and economic restrictions in fisheries had been invariably costly, these measures could not generate enough net economic benefits. Consequently, bio economic fisheries management methods might be worse than no management at all.

2.1.3 Ecosystem based fisheries management models

Marine ecologists argued that since exploited stocks of different species interacted and were integral parts of ecosystems, analytical models of marine fisheries management must take an ecosystem approach. The approach carefully ventured to plan, develop and manage fisheries in a manner that addressed multiple needs and desires of societies, without jeopardizing the options for future generations to benefit from the full range of benefits provided by marine ecosystems (FAO 2003). It was argued that these models considered the level of knowledge and uncertainties of the biotic and human components of marine ecosystems and represented a wide range of technological and ecological processes affecting species within ecosystems. Following this argument, several generic approaches to multispecies ecosystem analysis have been proposed in recent times (Walters et al 1997).

The first variant of this school of thought, the *multispecies virtual population analysis* (MSVPA), used extensive time series of catch-at-age data to produce natural mortality rates and population estimates for the exploited part of ecosystems (Helgason and Gislason 1979; Pope 1979). It

linked predator fish stocks and prey fish stocks and estimated the age-specific rate of predation mortality each predator inflicted on each prey. It also made prognosis of the impact of changes in fishing intensity, mesh sizes, etc on marine ecosystems (Sparre 1991; Christensen, 1998). Rice and Gislason (1996) explored the hypothesis that regulation of the community structure in the North Sea arose from trophic interactions. Livingston and Jurado-Molina (2000) concluded that predation plays an important role in explaining the recruitment dynamics of Pollock in the Eastern Bering Sea. Vinther (2001) made an attempt to assess multispecies VP dynamics for the North Sea whiting (*Merlangius merlangus*) and the Baltic Sea sprat (*Sprattus sprattus*) and found that multispecies assessment performed best when there was a clear temporal trend in the estimated natural mortality. Molina-Jurado and Patricia et al (2005) estimated suitability coefficients and suggested that multispecies forecasting model could be considered as a tool to advice fisheries managers in a multispecies context. Xiao (2007:479-80) provided a detailed list of marine ecosystems where MVPA was applied to assess the ecological and biological significance including food production, effective use and management of fisheries resources, conservation, and the maintenance of a healthy aquatic environment. Tyrrell et al (2008) highlighted the importance of accounting for predation on forage species in the context of changes to the fish community in the Northwest Atlantic and concluded that time and age-varying predation mortalities could be incorporated into stock assessments while improvements to MSVPA and other multispecies ecosystem models were made.

The second variant of this approach applied differential equation models for understanding biomass dynamics. Punt (1995) evaluated the performance of a production model by means of Monte Carlo simulation. Several factors (initial depletion, historic catch trajectory, extent of recruitment variability, level of noise about the abundance index, and values for other population model parameters) which impacted the performance of management procedures were considered. The author concluded that performance improved by restricting the extent of inter-annual change in catch, although the improvement was at the expense of lesser recovery of overexploited resources and lesser utilization of resources which were initially virtually pristine. Prager et al (1996) made a detailed examination of how an estimate of MSY from a production model compared with the theoretical value derived from the stock-recruitment curve, growth curve, and other biological factors and how a realistic change in gear size-selectivity affected both the theoretical and the estimated values of MSY using simulations designed to mimic the stock of swordfish in the northern Atlantic Ocean. The study concluded that for stocks similar to swordfish, the presence of strong age structure and moderate changes in selectivity should not proscribe the application of simple production models. Prager (2002) made assessments of swordfish in the North Atlantic Ocean. Estimates from the generalized model were found of comparable accuracy to those from the logistic model, but the generalized model was quite sensitive to outlying observations. The author cautioned researchers that the generalized production model should be used with scepticism and only in conjunction with the more robust logistic form. Jensen (2005) studied

relations between optimal yield and abundance in a fluctuating environment using the Fox surplus production model and compared with those for the logistic surplus production model. Environmental variation was included in the optimization of harvest with the Fox surplus production model to obtain a relation in which the maximum sustainable yield and biomass at the MSY varied as the environment varied. The relation could be applied for management of fisheries at the optimum levels in a fluctuating environment. For both models there was only one maximum sustainable yield under equilibrium conditions, but in a variable environment the maximum sustainable yield and optimum biomass and effort varied as environment varied. Similar approaches and methods were used by ecologists like Mueter and Bernard (2006) and Thiaw et al (2009) in the Eastern Bering Sea/Aleutian Islands region and in the Gulf of Alaska and Senegal respectively.

The third group of marine ecologists relied on bioenergetics models to derive relationships among dominant variables like fish stocks, populations, food webs, and ecosystems. These models estimated the intensity and dynamics of predator-prey interactions, nutrient cycling within aquatic food webs of varying trophic structure, and food requirements of single animals, whole populations, and communities of fishes using both laboratory and field measurements. Hansen et.al (1993) claimed that bioenergetics models were based on an energy balance equation that equated energy consumed with energy expended and gained. They summarized the uses of this method and how the approach could be operational under varying conditions. In another attempt Hansson (1995) compared four different methods for estimating

predation rates by North Sea cod (*Gadus morhua*) using a bioenergetics model and concluded that bioenergetics model predicted rates intermediate to those of the three evacuation rate models. Meka and Margraf (2007) used a bioenergetics model to predict the potential effects of feeding cessation caused by catch-and release capture in southwest Alaska, USA. Study found that rainbow trout were most vulnerable to decreases in growth when salmon were abundant.

The fourth group of ecologists resorted to ecological modeling and statistical packages like *ECOPATH, ECOSIM* and *ECOSPACE* to describe the marine ecosystem dynamics (Pauly et al 2000; Walters et al 1997, 1999, 2000; Walters et al 2005). The ecopath approach allowed for the construction of static, mass- balanced snapshots of the network and biomass pools and activities of fishing fleets in an ecosystem. Ecosim approach on the other hand took the snapshot as an initial condition and then added time-dynamic components to allow for scenario simulation and policy exploration. The ecospace, added a spatial dimension to ecosim simulations and was designated for exploring spatially explicit fisheries questions (Smith and Fulton et al 2007). Several empirical studies were conducted both in temperate and tropical water fisheries using these approaches. Christensen (1998) constructed two mass-balance tropic models to describe the Gulf of Thailand ecosystem dynamics and argued that *ecosim* model could be used to predict ecosystem level changes following changes in fishing pressure.

Natural scientists demonstrated that this approach could be used for managing marine fisheries. Relying on an ecosystem approach to

conservation, Agardy (2000) argued that better information were needed on the true, ecosystem-wide impacts of fishing activity, particularly where new fisheries emerged or major gear modifications and expansion of fishing effort occurred. The study concluded that from the conservationists' perspective, the solution to fisheries crisis lied not in closing down fisheries but rather in modifying the type of management by using public awareness to help raise political will for taking responsibility for the conservation of marine systems. Sumaila et al (2000) argued that this approach could be used as a powerful tool for managing marine protected areas. Witherell et al (2000) and Lenselink (2002) explained that ecosystem-based approach involved public participation, reliance on scientific research and advice, conservative catch quotas, comprehensive monitoring and enforcement, by-catch controls, gear restrictions, temporal and spatial distribution of fisheries, habitat conservation areas, and other biological and socioeconomic considerations. A number of empirical and theoretical papers that demonstrated the advantages of ecosystem based fisheries management approaches were later appeared in various scientific journals. Studies by Latour et al (2003), Hall and Mainprize (2004), Rudd (2004), Babcock et al (2005), Scandol et al (2005), Boesch (2006), Christie et al (2006), Francis (2007), Heron et al (2008), Douvere (2008), Pomeroy et al (2010), Powers and Melissa (2010), Fletcher et.al (2010) and Olson (2011) are worth mentioning. Hilborn (2011) noted that the existing interpretations of ecosystem management had proved disastrous due to lack of social and economic goals

2.1.4 Uncertainties in fisheries management

So far we have explained how economists developed various approaches and measures for the management of marine fisheries. One of the reasons for low predictability of bio-economic models has been the omission of uncertainty in modeling fisheries dynamics. Consequently, a number of attempts have been made by economists to incorporate uncertainty into dynamic bio economic modeling of fisheries. Lewis (1981) analyzed the optimal management of the Eastern Pacific yellow fin tuna fishery using the Markov Decision Process model and concluded that optimal cyclical fishing was possible when returns to scale efficiencies existed in the fishery, fishing strategies differed with risk bearing attitudes and finally, allocation of effort and the expected catch remained constant or decrease as catch rates became more uncertain for risk neutral social planners. Andersen and Sutinen (1984) provided a detailed survey of basic bio economic models which incorporated uncertainty. They noted that in several cases, optimal policy under stochastic conditions is qualitatively different from optimal policy under deterministic conditions. A recent review of literature dealing with uncertainty in bio economic modelling of fisheries is done by Nostbakken and Conrad (2007). Bjorndal and Munro (1998) provided a detailed survey of the economics of fisheries management and affirmed that ill-defined property rights could lead to dissipation of rent. Weeks and Berkeley (2000) argued that the presence of uncertainties necessitated a precautionary approach to manage overcapitalized marine fisheries. Harwood and Stokes (2003) emphasized the need for developing computer aided models, so that the uncertainties and risks

associated with different outcomes of management could be quantified. Sethi et al (2005) argued that both biological and economic behaviors are stochastic processes that complicated decision-making. The study developed a bio economic model with stock growth uncertainty, stock measurement uncertainty, and harvest implementation uncertainty and concluded that high degree of uncertainties destabilised the constant-escapement rule. Inaccurate stock estimation affected policy in a fundamentally different way than other sources of uncertainty while optimal policy led to significantly higher commercial profits and lower extinction risk than the optimal constant escapement policy. Singh et al (2006) developed a dynamic model of fishery which simultaneously incorporated random stock growth and costly capital adjustment. Numerical techniques were used to solve for the resource-rent-maximizing harvest and capital investment policies. Capital rigidities brought diminishing marginal returns to the current period harvest, and introduced an incentive to smooth the catch over time. With density-dependent stock growth, however, catch smoothing increased stock variability resulting in reduced average yields. Charles (1998) reviewed the various forms of uncertainty in fisheries, the methods available for analyzing them, and the particular challenge posed by structural uncertainty. The study found that to reduce uncertainty over time, better use must be made of traditional ecological knowledge held by fishers and coastal communities. Flaaten et al (1998) provided an overview of fisheries management under uncertainties and remarked that advances in the physical, biological and social sciences were needed to reduce some of these uncertainties. Myers and Mertz (1998) detailed how meta-

analysis could be used to address the fundamental problems of population biology and management. Stephenson et al (1999) suggested an ''in-season management approach'' to manage uncertainties in the Canadian fishery for herring (*Clupea harengus*). Lara and Martinet (2009) demonstrated the use of stochastic viability analysis to analyze uncertainties in marine fisheries**.** Sarkar (2009) derived the optimal fishery harvest policy in a real option model with a stochastic logistic growth process, harvest sensitive output price, and both fixed and variable harvesting costs with data from the Pacific Halibut Fishery and found that the optimal policy recommended harvesting when the fish stock raised to about three quarters the environmental carrying capacity. Kotani et al (2011) analyzed growth and measurement uncertainty to identify how they affected optimal strategies and value functions and found that a rise in growth uncertainty could be beneficial, while a rise in measurement uncertainty brought about an adverse effect. Grafton et al (2005a) used a stochastic optimal control model with two forms of ecological uncertainty. Study demonstrated that reserves created a resilience effect that allowed for the population to recover faster, and could also raise the harvest immediately following a negative shock. Grafton and Kompas (2005b) reminded that marine reserves could be increasingly used to mitigate uncertainty in fisheries. Dame and Robert (2006) recommended the ecological network analysis (ENA), for an ecosystem based fisheries management. Pitchford et al (2007) argued that a Marine Protected Area could buffer stochasticity and alleviate the propensity to collapse.

Fulton et.al (2011) noted that uncertainty generated by unexpected resource user behaviour was critical as it had unplanned consequences including unintended management outcomes. Hoel (1998) explored how political uncertainties influence fisheries management, as environmental politics had become a driving force of change in fisheries regimes. Hilborn (2002) explored appropriateness of reference-points for management and concluded that the key to successful fisheries management was not better science, better reference points, or more precautionary approaches but rather implementing systems of marine governance that provided incentives for individual fishermen, scientists, and managers to make decisions in their own interest that contributed to societal goals. Stefansson and Rosenberg (2005) compared the performance of alternate control measures and recommend that multiple control methods be used wherever possible and that closed areas should be used to buffer uncertainty. To be effective, these closed areas must be large and exclude all principal gears to provide real protection from fishing mortality.

The studies described above clearly revealed that both natural scientists and economists agreed on the fact that fisheries management would be effective only if the uncertainties were properly understood.

2.1.5 Precautionary approach to fisheries management

The application of Precautionary Principle for fisheries management originated due to the nature of various kinds of uncertainties in the natural and socio economic an approach "which may require action to

control fishing activities even before a causal link has been established by absolutely clear scientific evidence . . . " He then reviewed the available information on the concept in terms of its analytical, scientific, technical and legal implications for fisheries and proposed elements for precautionary fisheries management strategies. Gray and Bewers (1996) attempted to develop a definition that was more compatible with a scientific approach to marine environmental protection. They suggested that precautionary principle involved precautionary action to safeguard the marine environment by preventing and reducing emissions of hazardous substances at source and minimizing physical disturbance caused by human activities using appropriate technologies and measures. Richards and Maguire (1998) argued that the absence of adequate scientific information could no longer be a reason for postponing or failing to take conservation measures. Future harvest strategies will be based on stock-specific reference points and predefined decision rules. The study also suggested a number of major steps in applying precautionary approach to fisheries management: (*i*) collect basic data on fish and fisheries, (*ii*) share these data to ensure a transparent process, (*iii*) establish reference points where possible, and establish conservative catch, effort, and capacity limits in data-poor situations, (*iv*) agree on decision rules that acknowledge uncertainty, and (*v*) initiate or enhance research to minimize impacts of fishing and other activities on the marine ecosystem. The approach had been widely used to manage both the tropical and temperate water fisheries across the world (Darcy and Matlock 1999; Restrepo and Powers 1999).

Similar attempts towards evolving an appropriate definition had also been undertaken by Laxe (2005). Hauge et.al (2007) discussed the varieties of technical definitions of reference points and their uses in the management advisory process. The study suggested that comprehensive dialogue between science and management and explicit reflection on their respective roles would prove more effective at enhancing precautionary and transparent advice on fisheries than adhering to the ideal of strict separation.

2.1.6 Social issues in resource management with special reference to small scale fisheries in developing countries

Although theoretical models developed by natural and social scientists within their respective individual disciplines or using interdisciplinary methods have provided useful insights for fisheries management, these models could not fully address and resolve the complex issues faced by the small scale fisheries of developing countries. Command and control measures of management enforced from above by the fishery bureaucracy could not effectively tackle the bio-ecological, economic and social concerns of these fisheries. This section summarizes these issues in an attempt to highlight the need for developing an alternate theoretical and conceptual framework for the management of small scale fisheries in developing countries like India.

A number of development economists and social scientists have made serious efforts to examine the management problems of small scale fisheries. They argued that the ecological and socio economic issues of fisheries management have been the product of their integration into

growing international markets. Hence modern management strategies should seriously weigh the influences of such external drivers seriously Berkes et al (2001). Johnson (2006) argued that the power of small scale fisheries as an analytical category rest on the values of social justice and ecological sustainability. Andrews et al (2007) suggested a general scheme for diagnosing and managing small scale fisheries. Chapman et al (2008) compared seven case studies from small-scale fishing communities in Latin America to discover which informal institutions were most strongly related to resilient management. It was reported that monitoring and cooperation were the characteristics highly correlated with resilient management since both could occur exclusively in resilient cases compared to other principles. Salayo et al (2008) examined various approaches to managing excess fishing capacity in small-scale fisheries in Southeast Asia. The paper analyzed the perceptions of various stakeholders to manage the problem of excess capacity and suggested for an integrated approach to develop coordination and partnerships among various stakeholders. Pomeroy et al (2009) reviewed the policies towards small-scale fisheries in Vietnam from 1945 to 2003 and recommended actions to improve fisheries statistics for a coordinated and integrated approach of resource management, resource restoration, economic and community development, and new governance arrangements.

Social scientists argued that livelihood vulnerabilities and poverty of coastal communities resulted in management failures in small scale fisheries. Allison and Ellis (2001) pointed out that incomplete understanding of livelihood vulnerabilities resulted in management

directives incompatible with resource conservation and social and economic goals of management. Technical report of DFID examined fisheries dependent livelihoods constraints in Kenya and Tanzania DFID (2003). The study identified lack of access to capital, poor fisheries resource management, decline of fisheries resources, and habitat destruction as the major constraints to the sustainable development of fisheries-dependent livelihoods. Similar analysis conducted by DFID in Malawi and Indonesia concluded that fisherfolk's livelihood strategies had already influenced fisheries management policy. Kebe et.al (2009) applied the sustainable livelihoods framework to understand livelihoods of coastal communities in Mauritania, Senegal, Guinea and Ghana. Results indicated that artisanal fishers had been generally involved in informal fisheries management, which coexisted with formal measures initiated by the fisheries administration. Formal fisher involvement was mostly through consultation for the formulation of fisheries laws and regulations, whereas informal involvement consisted of formulating and actually implementing local regulations made by community fisher committees under their own initiative. Allison and Horemans (2006) emphasized the relevance of Sustainable Livelihoods Approach (SLA) to study livelihood vulnerabilities of coastal communities in developing countries. Gezelius and Hauck (2011) addressed how states could best promote citizens' compliance with laws that regulate livelihoods of fishing communities in Norway, Canada, and South Africa and identified enforcement, empowerment, and civic identity as the leading preconditions for better compliance. Bene (2003) reminded that the relationship between poverty and small scale could be analyzed using

basic needs approach, food and entitlements approach, empowerment approach, right based approach, livelihood approach etc. The author argued that socio-institutional mechanisms governing people's access to fisheries resources, rather than the resources themselves, played critical role in vulnerability to poverty. Coulthard et al (2011) made an attempt to explore the extent to which a social wellbeing approach could offer a useful way of addressing the policy challenge of reconciling poverty and environmental objectives for development policy makers and claimed that this approach offered space for improving fisheries governance.

Another concern that repressed effective enforcement of management strategies in developing countries refers to the nature of fishery conflicts. Social scientists explored in depth the nature of conflicts in the use of marine fisheries resources in both industrial and small scale fisheries. Munro (1979) analyzed conflicts arising from differences in perceptions of the social rate of discount, fishing effort costs, and consumer preferences in the choice of management strategies of two states using Nash's theory of two-person co-operative games and concluded that side payments greatly ease conflict resolution. There have been numerous international conflicts regarding fishing rights. Levhari and Mirman (1980:133) studied fishery conflicts between two nations using the concept of Cournot-Nash equilibrium and reported that "it is possible for the stock of fish to tend to extinction in the Cournot-Nash equilibrium, while with a cooperative regime the stock of fish tends to infinity". Smith (1995) studied how the New England Regional Fisheries Management Council managed fisheries in its area. The study noted that conflicts in the perceptions of "nature" between resource users and

managers complicated management decisions seriously. It also noted that making explicit these underlying cognitive modes would provide more "common ground" for addressing management problems. Claytor (2000) demonstrated how cooperation among industry, managers, and scientists broke down barriers among these groups and provided guidelines to develop decision rules. The process was transferable to other fisheries and provided means for resolving fisheries management crises.

Charles (1988) presented an integrated framework for the analysis of fishery conflicts based on a set of fishery paradigms reflecting the philosophical basis of conflicts. The author argued that the constraints to balance the conservationist, wealth maximization and community well being objectives, most often, had been instrumental for the development of various types of conflicts in the fisheries sector. Bennet et al (2001) studied the nature of conflicts in Ghana, Bangladesh and the Caribbean due to institutional failures. The study demonstrated how conflicts emerged and managed under various circumstances. The paper concluded that local level management of conflicts could be successful, only with the support of Government (policy makers and managers) and State institutions (law enforcement, stable markets and clear political processes). In another attempt, Bavinck (2001 and 2005) analyzed conflicts in the context of marine capture fisheries in Tamilnadu, India using a legal pluralism framework. The author argued that conflicts between artisanal and mechanized fishermen in developing countries like India were due to the coexistence of different sea tenure systems.

The role of sea tenure systems for the management of artisanal fisheries in Sri Lanka has been detailed by Alexander (1977), Papua New Guinea by Adjaya (2000), Solomon island by Aswani (1999) and in Asia Pacefic regions of Papua New Guinea and North Sulawesi, Indonesia by Cinner (2005). These studies indicated the existence of a wide variety of traditional community based institutions for the management of marine fisheries at various maritime communities around the world.

In recent years, social scientists have been exploring whether community based management could be effective in the context of modernization. A few studies argued that community based management systems could still manage external drivers reasonably well, while a few other studies claimed that modern management institutions ruined communitarian management institutions. Another group of analysts argued that communities needed the assistance of the State to manage their resources in a globalizing world. Adding to this vast literature on community based fisheries management, Pomeroy et al (1995) discussed the relevance of community based co-management for the sustainable governance of coastal fisheries in Southeast Asia. The author noted that planning and implementation of these management systems would require development of new legal administrative and institutional arrangements at both national and community levels to complement contemporary political, economic, social and cultural structures. Veitayaki (1997) reminded that with the continued failure of contemporary management methods, traditional resource users should play a more significant role in the proper utilization of marine resources in the Asia Pacific region. Ruddle (1998) addressed some of the broader

contextual issues that should be appreciated in policymaking with respect to a potential modern role for traditional management systems. The author observed that future of traditional community-based marine resource management systems over the Pacific Island Region depended on evolving a consensus regarding national development goals, priorities and processes. Policy-makers should be aware that replacing a traditional system with open access would lead to mismanagement of fisheries. In another paper Ruddle (1998a) demonstrated the continued existence of a traditional community-based system of management called *van chai*, despite modernisation. Crean (1999) demonstrated that the evolution of management controls and access arrangements in coastal fisheries was not a uni-directional process and found to swing between community-based and centralized management regimes. Mulekom (1999) described the development process for the establishment of a community based co-management system in the Philippines.

Wiber et al (2004) argued that effective community-based management required managers to pose and address social issues. The paper emphasized participatory research involving true cooperation of local communities in all stages to develop community based management strategies. In another paper Wiber et al (2009) reported the outcomes of a project that engaged researchers and fishers together in adapting participatory social science approaches to the purposes and the constraints of community- based fisher organizations and concluded that true participatory fishery research, utilized in support of community-based management, could be a particularly powerful tool. Wilson, L; and Wiber (2009) addressed the missing dimension of maritime communities

in Canadian Integrated Coastal Management (ICM). Community members reported that government was more interested in forming partnerships with the corporate sector than with the people who relied on local resources. From the community perspective, dealing with the resulting power imbalances must involve revisiting the ''core values'' that underpinned regulation and resource exploitation. Studying the evolution and effectiveness of a community-based management effort to establish, monitor, and enforce a marine reserve network in the Gulf of California, Mexico, Bueno and Basurto (2009) found that even though locally crafted and enforced harvesting rules could increase resource abundance, news about such increase resulted in poaching from outsiders and a subsequent rapid surge in fishing and local management institutions. The authors argued that fishing communities required incentives with formal cross-scale governance recognition and support to maintain their management efforts.

2.2 Marine fisheries management in India: A review of theory and practices

Scientists and policy makers admonished that the Indian marine fishery resources have been showing the signs of degradation and the sector would succumb to the economic, ecological and social pressures if the evolving crisis were not arrested immediately. This section reviews the concerns of academics and policy makers regarding the nature of fishery crisis in the marine fishery economy of India.

Alagaraja et al (1986) argued that mesh selectivity studies could identify the fishable segment of commercially important species and assess the

effect of fishing effort. He noted that change in the cod end mesh size in trawls over the years at centres like Kakinada, Andhra Pradesh had resulted in considerable variations in production, catch composition and size distribution of shrimps. Instances of heavy landings of undersized prawns had been noticed during the peak landing period along the coast of Kerala particularly at Sakthikulangara due to the use of small mesh size of the trawl nets. The study emphasised the urgent need to revise the existing cod end mesh size of 20 - 25 mm to at least 30 mm to save the fishery from the danger of depletion. James (1992) discussed the primary objectives and the order of priorities of the Marine Fishing Regulation Acts of different coastal states and stated that the foremost motive of these rules had been to protect the interests of traditional fishermen by regulating industrial fishing to ensure conservation of fisheries and removal of social conflicts. Vijayakumaran (1993) noted that bio economic models were useful tools of management as they brought together both the biological characteristics of the fish population as well as the economic aspects of the industry. He favored the collection of such data on a regular basis. Murthy et al (1996) recommended different types of biological, technological, and social measures for marine fisheries management in India. These indicators included maximum sustainable yields of commercially important species, closed seasons / areas, regulation of length of fish, technical regulation of fishing effort, fishing zone demarcation, prohibitions and regulation of gears, artificial recruitment or sea ranching, environmental protection, ecological improvement, conservation of biodiversity in critical ecosystems and mariculture. Antony (1996) explained guidelines for the conservation

and management of coastal water bodies. She pointed out that a status report and an action plan were essential for conservation of coastal fisheries.

James et.al (1998) made few general remarks to implement regulations for marine fisheries management in India. He noted that over the years, a number of changes have taken place in the fishing methods and resources. Intensive fishing operations, like trawling and purse-seining were causing anxiety in some quarters for some resources. The study concluded that estimates of MSY of commercially important species on all India level were the need of the time to postulate management measures (I.bid:155). Detailing the core fishing issues in India at end of 20th century, Devaraj and Vivekanadan (1999) observed that there were several biological, economic, social and political factors for the non existence of effective management policies and for the inadequate implementation of existing policies. He favored the concept of responsible fishing to sustain coastal fisheries. Menon et al (2000) emphasized that management regulations had been severe and complex in tropical countries like India and therefore the entry should be restricted through input controls or output controls to achieve MSY of gear used. Pillai and Ganga (2004) summarized the basic management strategies used to manage fisheries in India as reduction of fishing effort, mesh size regulations, licensing or quota regulations, closure of a fishery, diversification of vessels and targeting specific resources, gear impact assessment, and marine protected areas (MPAs). Vivekanadan (2005) favored introduction of eecosystem-based approach to fisheries management (EBFM) by developing necessary protocols to deal with

complex interactions of institutions and societies. Developing a food-web based model for each ecosystem had been one of the prerequisites. Delineation and implementation of no-fishing zones offered promise not only for fisheries sustainability but also for resource enhancement. Implementing EBFM had been a challenging task that would yield both immediate and long-term benefits. He noted that establishing large scale marine reserves and other forms of rigorous protection of fisheries in non-reserves were essential. This major shift in management strategy needed support from all institutions and stakeholders.

Pillai (2006) reminded policy makers, after analyzing fluctuation in the landings and stock assessment of major pelagic species, that there was no further scope for increasing the production of pelagic fishery resources from the inshore waters and therefore there was an urgent need to bring the pelagic/ meso pelagic realm of oceanic waters to increase and diversify exploitation. He suggested that awareness creation among all stakeholders against non sustainable fishing practices with a participatory management approach had become inevitable in fisheries management. Sivadas and Wesley (2006) recently documented some useful dimensions for evolving participatory modes of governance of Indian marine fisheries. They observed that traditional community based management practices related to fishing were still practiced with a view to conserve the resource and avoid conflicts by the fishing communities of Minicoy, Lakshadweep islands in India. Ramchandran and Sathiadhas (2006) explored the structure and functions of a community based management system called kadakkodi, along the Malabar Coast of North Kerala. The study explained that its persistence

depended on a multiplicity of factors and so defied any bureaucratic duplication in its institutionalization. The role of the state should be to enable political contexts that nurtured the genesis and co-evolution of people's own resource management initiatives and institutions. What was required was to lean on new political ethos built on the foundations of ecology and ethics

Vivekanandan (2004) reminded that most fishing was unsustainable under the existing management regime because of rapid growth of human population, increase in demand, development of mechanized fishing technologies and quick transportation to fishing grounds. A few researchers in the Central Marine Fisheries Research Institute pointed out that ecosystem based fisheries management would be useful to manage Indian fisheries. Mohamed (2010) further argued that eco system based fisheries management focused on natural structure and function of ecosystems, including the biodiversity and productivity of natural systems. The approach was superior as these models placed ecosystems dynamic and central to establishing objectives for use and management.

Bavinck (1996) examined the way in which fishing communities along the Coromandel Coast of Tamil Nadu in India banned fishing gears. Bavinck argued that such gear regulations by local communities had been rooted in their ecological perceptions and notion of social justice. Bavinck (1998) examined how two coexisting legal systems emanating from different loci of authority-one stems from the state, the other from institutions in the fishing community- determined conditions of fishing rights in Tamil Nadu, India. Both legal systems consisted of rules rooted

in a particular knowledge of marine ecology and the effects of human intervention. Fishermen law generally had greater legitimacy among fishermen while official law backed by the power of the state dominated the formal landscape. In another paper, Bavinck (2001) made a pioneering attempt to exhume the role of non-state institutions in the management of marine fisheries in Tamil Nadu. He investigated how fishermen caste panchayats were involved in regulating access to and use of fish resources and noted various ways through which local communities regulated access to resources. Bavinck (2003) further demonstrated how state law, contrary to its articulated purpose of uniformity, took various shapes across space. Adopting a legal pluralism approach to the context of the marine fisheries of Tamil Nadu, India, the author asserted that a more complete 'geography of law and rights' would examine the interrelationship of social and physical space much better. Bavinck (2005) related conflicts to the livelihoods of small scale and industrialized fishers and to their varied social and legal systems. The author noted that in the legal pluralism perspective, conflicts between these groups of fishermen were related to the different sea tenure systems followed.

Bavinck and Karunaharan (2006) examined the way in which fishing communities along the Coromandel Coast of Tamil Nadu in India regulated the innovation of fishing gears. They found that the nongovernmental fisher councils in this region had strong authority to restrict or prohibit gear types which they consider particularly harmful. Sonak et.al (2006:300) detailed a case study of the monsoon fishing ban implementation in Goa, India, and provided insight into conflicts arising

as a consequence of various institutions and institutional arrangements affecting local fisheries management and their effectiveness in protecting the ecosystem and marine resources. The fishing ban in the study noted severe misfit between ecosystem boundaries and the management regimes, issues of scale arising out of differences in the legislations enacted by the different provincial governments in India, interplay between the different institutional arrangements occurring at the same level of organization, competing interests between the traditional fishers and the industrial fleet and policy distortions by the powerful political elites. These problems called for a uniform closed season by the Federal Government, for the coastal states along the two coastlines, the East Coast and the West Coast of India.

In another collective research a multi disciplinary team of economists, sociologists, geographers and political analysts made an attempt to document the diverse management systems (formal and informal) at different locations in India and Srilanka. Reporting the findings of the study, Bavinck and Karunaharan (2006a, 2006b) concluded that a situation of legal pluralism in Ramnad District had evolved towards a form of co-management, whereby the various parties coordinated their regulatory activities. This act of coordination, the author noted, had emerged only after significant conflicts and power struggles. The study noted that there was no explicit structure of co-management in place. Johnson and Sathyaplan (2006) observed that resource management received a low priority in the State of Gujarat. Thomson (2006) argued that the systems of management in Tamil Nadu and Kerala differed considerably. Informal co management in Kerala had been steered

forward by the politics of negotiation between artisanal fishermen and industrial fishers at the district and state level. This had resulted, throughout the years, in significant government attention and in a process of strong and politicized co-management.

Bavinck et al (2008) explored the socio economic impacts of trawl ban in seven harbor locations in Tamil Nadu, India and concluded that the success of the ban rest on cooperation between government and local fisher associations. Bavinck and Salagrama (2008) examined the governability of Indian maritime fisheries in the Bay of Bengal Large Marine Ecosystem and suggested useful concepts for management. Johnson and Bavinck (2004) showed how export-led strategy led to conflicts between mechanized and non mechanized sectors and intensified pressures on marine living resources in Tamil Nadu and Gujarat. Using a social justice perspective, they suggested that allocation grounded in social justice alone could sustain high levels of employment without further depleting the biomass.

Jentoft et al (2009) detailed how the issue of co management of marine fisheries became an institutional issue in contexts where legal pluralism existed. Drawing on examples and insights from a comparative research project in South Asia, four basic types of legal pluralism and co-management were distinguished. The authors concluded that co-management was a process that brought legal systems, and their constituent organizations and groups, together within a single framework. For fisher organizations, which frequently had distinct legal perspectives, co-management was an essential path to legitimacy. For the

state, other legal systems were a resource that management could draw upon. Southwold (2010) made an attempt to understand the multiple non-state and state legal systems and their interactions in East Godavari coast, India. The study highlighted normative rules, actual practices, heterogeneity of stakeholders and the potential problems of establishing alternative management organisations in the study area.

2.2.1 Marine fisheries management in Kerala: A brief overview

Kurien (1978) described how traditional, modern and ultra-modern sectors got involved in the marine fisheries sector of Kerala and noted that sophisticated technologies led to disaster for the future of both fishing and fishermen. Kurien and Thankappan Achari (1990) and Kurien (1991) described the history of marine fisheries development in Kerala and argued that technological revolution and development of markets had complicated the management processes in the state. Open access in fishery, use of inappropriate technology, high market demand, state subsidies and population pressure on inshore waters were the major deciding factors that prompted overexploitation of fishery resources. Kurien (1994) pointed out that a community based integrated fisheries management approach should better solve such issues in Kerala. On the impact of joint ventures on fish economy Kurien (1995) commented that the new policy on joint ventures in fisheries would invite enterprises interested only in short-run profits. Kurien and Vijayan (1995) examined the case of an income spreading mechanism which was practiced in Kerala for about half a century ago. The study highlighted how a combination of inappropriate technology choices emerged in the

wake of free market policies created open access conditions in common property resources and thus put eminently desirable communitarian systems of sharing and caring under great strain. The study noted that modernization and the consequent gross over investment in the fishery had broken down community institutions particularly the karanila system. Kurien (1998a) reminded that fisher organizations could play a crucial role in the management of small scale fisheries in Asia. Kurien (1998b) examined the role of traditional ecological knowledge in fisheries management. Kurien (2000) emphasized the role of community property rights for a secure future of fishing communities. Similar suggestions were made by him in other studies also (Kurien 2003 and 2005). Paul (2005) addressed the question of how institutions evolved, innovated, or disintegrated to facilitate marine fisheries management in Kerala using a detailed case study of the kadakkodi system in North Malabar, Kerala, India. The paper argued that in the wake of increasing resource-related, technological, cultural and institutional heterogeneities, traditional management institutions might fail to perform and hence could offer no panacea to problems of resource management.

2.3 Summary and conclusions

The survey of literature presented above clearly indicated that the resource crisis which evolved in the global maritime economy has serious implications to conservation, wealth maximization and human well being. The available studies revealed that industrial fisheries and small scale fisheries addressed different sets of issues. Discipline-bound approaches to marine fisheries management, although useful to understand various individual causal relationships in depth, needed

drastic improvements to address the biologically diverse and socially intrinsic problems of Indian fisheries. The ecosystem approach on the other hand appeared to have received only a casual welcome in policy circles as the resource managers concentrated more on resolving social conflicts between the artisanal and mechanized fishermen, rather than resource conservation.

A critical evaluation of the empirical studies on the management of marine fisheries in India with special reference to Kerala revealed many interesting insights that guide the development of the thesis. First, the explanatory and predictability powers of the biological and ecological models suggested by the Indian scientific community are very low. Second, the studies conducted by various natural scientists on the issue of fisheries management in India have made only peripheral and sporadic suggestions. Most of the recommendations of these studies were casually drawn without making a systematic assessment of the socio economic and conservation related issues of the sector. However, both natural and social scientists have agreed that a socio-institutional framework is necessary to analyze the complex management problems. The next chapter is designed to develop such a conceptual framework for the management of marine fisheries in Kerala, India.

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Chapter 3

Theoretical framework and Methodology

Marine fisheries management has always been a major concern in most of the maritime nations ever since the Second World War. Apart from the academic curiosity for studying the natural and human ecosystems of maritime communities, the concerns for good fisheries governance and management possessed greater practical relevance due to the increased importance of these ecosystems to global food security, livelihoods to artisanal fisherfolk and economic significance to the nations through exports. It is revealed that the academic concerns for fisheries management have been shouldered initially by natural scientists and later on by economists and social scientists. They reminded policy makers about the limitations of the commonly adopted approaches for managing small scale fisheries (Garcia and Grainger, 1997; Mahon, 1997; Cochrane, 2000; Welcomme, 2001; FAO, 2003; Cochrane and Doulman, 2005). It is now well known that diversity and complexity of small scale fisheries in developing countries would constrain formal management initiatives to sustain resource health, economic profits and livelihood security (Berkes et al., 2001; Berkes, 2003; Jentoft, 2006; 2007). This chapter presents the framework and methodology for understanding and analyzing the problem of fisheries management in the small scale fisheries of Kerala, India. It is divided into three sections. The chapter

begins by presenting the theoretical and conceptual framework of the study; followed by a detailed account of the methodology adopted to conduct the study in section two and summary in section three.

3.1 A Conceptual Framework for Understanding and Analysing Marine Fisheries Management in Kerala, India

The impacts of technological changes in fisheries have been manifold. From a global perspective, the blue revolution has resulted in an enormous increase of fish harvests and an improvement of food security. "Globalization of markets and the increase of fish prices contributed to economic wealth"(Bavinck, 2011:271**)**. As already mentioned in the introductory chapter, post independent changes, introduced with active state sponsorship of modern fishing and processing programs in the Indian small-scale marine fisheries have created serious management crisis (Kurien, 1985; Klausen 1998; Bavinck, 2011). Fish stocks declined economic disparities between non-mechanized and mechanized fishermen increased and conflicts between groups of fishermen, as well as between fishermen and other coastal/marine users increased considerably. Despite these changes, millions of people are still employed in this sector. In short, external drivers and pressures on the marine ecosystem have been responsible for effecting changes in the ecological and socio economic relationships. The crisis thus evolved needed to be analyzed and managed scientifically to sustain resources, economic efficiency and social equity. This section details the framework used to examine the nature of management crisis in Kerala's small scale

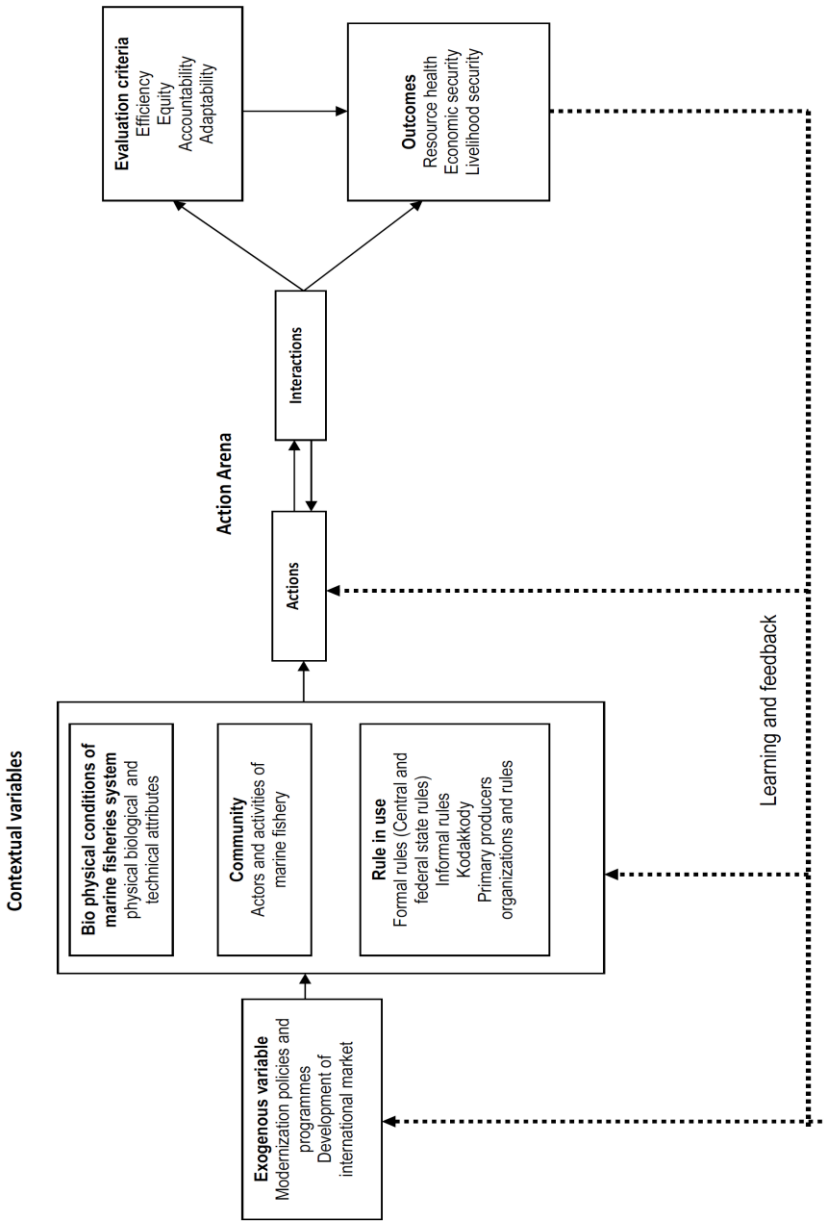
marine fisheries in an attempt to suggest plausible ways of resolving them.

One of the most useful approaches that addressed the above mentioned issues in terms of their inter-connections has been provided by Elinor Ostrom. Ostrom et.al (1994: 34-50) demonstrated how the Institutional Analysis and Development (IAD) framework could be usefully employed to identify and analyze interactions between the physical environment and socio-cultural and Institutional realms. The framework has its origin in the general systems approach to policy processes, in which inputs are processed by policymakers into outputs that are evaluated with feedback effects. It provides for a structured approach to document and evaluate the origin, current status, operation, impact, and performance of fisheries management institutions. The IAD framework has been modified to suit to the empirical context of Kerala marine fisheries and presented in figure 3.1.

The IAD framework links characteristics of the bio-physical realm of marine fisheries with the general socio economic setting, the specific rules that affect incentives individuals confront in particular situations; the outcomes of these interactions: and the evaluative criteria applied to these patterns and outcomes such as economic efficiency, equity and sustainability. Since Kerala marine fisheries have been subject to severe resource crisis, economic crisis and livelihood vulnerability, the approach is expected to provide better understanding of their inter-connectivity so that rational solutions are developed to manage small scale marine fisheries.

The analysis of contextual variables (biological, socioeconomic and institutional issues) of the marine fisheries of the Kerala coast begins by contemplating the *biophysical conditions*. It may be noted that this is an essential pre requisite as management strategies, institutions and approaches could very well be influenced by these features. Influenced by west flowing rivers and back waters, Kerala's marine fisheries are diverse and have been harvested using a variety of artisanal and modern fishing technologies.

Figure 3.1 Institutional Framework for Understanding Marine Fisheries Management in Kerala



Source: Modified framework Ostrom (2011)

Pido(1997:189) elaborated that physical attributes consist of resource use, climatic data, physiographic features, physical oceanography, water quality etc.; biological and habitat attributes consist of seaweeds/sea grasses, mangroves, coral reefs and technical attributes consist of craft/gear/technical knowledge. The second contextual variable is attributes of the community. The relevant categories consist of non-mechanised/artisanal and mechanised fishermen, demographic and occupational status, tenure and economic status, various fisher organisations, and resource conflicts. The third contextual variable, rules-in-use composed of attributes for institutional and organizational arrangements external to the community. These are variables at the national, regional, district, or municipal levels for the processes of policymaking, legislation, governance, and law enforcement that authorize and support community-level institutional and organizational arrangements. There may be nested, multiple layers of organizations at different political and administrative levels.

According to Ostrom the core component of the IAD framework, *action situation*, is a social space where individuals interact, exchange goods and services, solve problems, dominate one another or fight (Ostrom, 2011: 11). The author further lists the common set of variables used to describe the structure of an action situation including (i) the set of actors-artisanal and mechanized fisher groups engaging different craft gear combinations-, (ii) the specific positions they uphold, (iii) the set of allowable actions and their linkage to outcomes, (iv) the potential outcomes that are linked to individual sequences of actions, (v) the level of control each participant has over choice, (vi) the information available

to participants about the structure of the action situation, and (vii) the costs and benefits—which serve as incentives and deterrents—assigned to actions and outcomes. The working components of action situation specify the nature of the relevant actors as well as the resource and options they face, and serve as generalization of the "rules of the game". The rules are classified as position rules, boundary rules, authority rules, aggregation rules, scope rules, information rules and payoff rules. Position rules specify a set of positions, each of which has a unique combination of the resources, opportunities preferences, and responsibilities. Boundary rules specify how participants enter or leave these positions. Authority rules specify which set of actions is assigned to which position. Aggregation rules specify the transformation function from actions to intermediate to final outcomes. Scope rules specify set of outcomes. Information rules specify the information available to each position. Payoff rules specify how benefits and costs are required, permitted, or forbidden to players.

One of the distinct features of the IAD framework is the incorporation of external forces and their influence on both contextual and action arena. These attributes are external factors beyond the control of the local, and at times, national levels. These variables are exogenous surprises or sudden shocks to the management system which bring changes or affect the survival of the system. They include modernization/globalization, development of international markets, political elections or inflation. These variables indicate how well the management system is functioning, through its resiliency or capacity to accommodate sudden changes.

Depending on the structure of an action situation, outcomes need to be predicted or generated. In addition to predicting outcomes, the institutional analyst may evaluate the outcomes that are being achieved as well as the likely set of outcomes that could be achieved under alternate institutional arrangements. Evaluative criteria are applied to both the outcomes and the processes of achieving outcomes. The framework listed resource health, economic security and livelihoods as the major outcomes of an effective fisheries management.

Further these outcomes are scrutinised or evaluated to determine which aspects of the observed outcomes are deemed satisfactory and which aspects are in need of improvement. The first evaluative criterion is designed to examine efficiency in use of resources, especially to explore economies of scale. The equity criterion ensures distributional outcomes and processes, legitimacy ensures involvement of participants in decision making processes, accountability fixes responsibility to direct users of resources and adaptability/resilience/robustness reveal the capacity to sustain shocks, recover, and continue to function and, more generally, cope with change.

Finally, the system draws feedbacks and learning based on the information and processes the actors are able to observe and process. Feedback may impact any component of the IAD framework, and different levels of learning loops may be used to distinguish more extensive processes or reconsideration.

Recognizing the importance of this framework, policy makers and analysts have applied this model to examine the effectiveness of common

property resource management programs in many countries. The International Centre for Living Aquatic Resource Management noted that the dynamics of fisheries development and management could be better understood using this framework (ICLARM,1996). Since then, the framework has been applied to a number of situations (Pido et.al,1997; Imperial,1999; Hess and Ostrom,2003; Ostrom, 2005; Clement, 2010; McGinnis, 2011). Imperial and Yandle (2005) examined some of the common problems that analysts faced when institutional arrangements such as bureaucracy, markets, community, and co-management were used to manage fisheries. Yandle (2008) made an attempt to assess the development, strengths and weaknesses of New Zealand's fisheries co-management during 1999-2005 using IAD framework. The study revealed that despite limitations, co management had improved monitoring, congruence, information costs, fiscal equity, economic efficiency, and adaptability. Cinti et.al (2010) addressed the question of whether the formal institutional structure of Mexican fishing regulations was effective in promoting responsible behaviour by small-scale fishery stakeholders and argued that granting secure rights to resources to those actively involved in the fishery is a necessary step for promoting sustainable fishing practices. Garces et.al (2010) examined how coastal fisheries of Aceh province, Indonesia were affected by tsunami using a modified IAD framework. The study concluded that widespread nature of the tsunami damaged and threatened the continued use of fisheries resources by coastal communities. Fidelman et.al (2012) applied the Institutional Analysis and Development framework to highlight the diverse contextual factors that challenge governance of a large-scale

marine common in the Coral Triangle region. The study concluded that governance of large marine ecosystems required recognizing the heterogeneous, multi-scale and interlinked nature of these systems. Therefore, large-scale marine commons should be managed simultaneously at multiple levels. Coping with contextual complexity will require innovative approaches that strive to be inclusive, organize and link institutional arrangements at multiple scales, enable and support effective collective-choice arrangements at lower levels of organization, and employ diverse types of institutions. It will also involve a great deal of experimentation and regular adjustments to take into consideration the dynamic nature of commons governance.

Using IAD framework to examine the dynamics of marine fisheries management in Kerala has some definite advantages. As already mentioned, this framework is widely used to analyse fisheries policy and its influence on resource management. It gives spontaneous picture on what affect the ecological and humanly constructed changes than any other method. The framework allows examining efficiency, equity, accountability and adaptability. It draws attention to the contextual conditions (e.g., physical, biological, social, economic, cultural, etc.) that could influence institutional design and performance. It recognizes the full range of transaction costs associated with implementing policies. It contains no normative bias with respect to the institutional arrangement used to implement these programs. It suggests using a variety of criteria to identify the strengths and weaknesses in the different institutional arrangements that could be used to implement policies. IAD framework argues that inter organizational relationships will be influenced by the

attributes of the community where the actors are located. Institutional approach to fisheries management facilitates critical examination of important cross-cutting issues, including assumptions regarding what comprises sustainability and how market, government and civil society organizations use strategic investments on capital assets and institutions to achieve sustainability objectives.

3.2. Methodology

This section details the methodology adopted in conducting the study. The analysis begins by introducing the study areas and presents the salient geographical/ecological features of the areas. This is followed by a description of the study communities, the nature of data base and modes of data collection.

3.2.1 Study areas

Since regulations are enforced by the fishery bureaucracy within the administrative jurisdiction of districts, the research takes district as the unit of analysis. Further to articulate the coexistence of both community-based and formal bureaucratic regulatory regimes two districts viz. Ernakulam and Kasaragod, are selected for detailed analysis. Among these regions selected, the former represents highly modernised fisheries and the latter signifies slow pace of mechanisation and active presence of community-based management institutions.

The first study district, Ernakulum has been selected due to its economic and geographic dominance in marine fisheries. Seawater entering through the Cochin and Munambam bar mouths divide Ernakulam

coastal district into two distinct zones (see map Appendix 3.1). The northern portion of the study region, known as Vypin Island, has a coastal shore of twenty five kilometres while the southern coastal zone (Chellanam) has a length of twenty kilometres. Fishing has been the sole occupation of local fishing communities till the introduction the state sponsored technological programme that spurred the "blue revolution" in the country in 1954. Since then, the mechanised fishery has grown substantially and weakened traditional fisheries in the district. There are four major mechanized fish landing centres within the coastal boundaries of Ernakulam district; two under Government control and the rest in the private sector. Compared to other fishing villages of this region, fishing villages of Ernakulam District possess reasonably good infrastructure and are well connected one another and also with other urban centres. Artisanal fishermen are still engaged in traditional fisheries both in the southern and northern stretches of the Ernakulam coast even today.

The second area Kasaragod is located at the northern end of Kerala state and shares coastal boundaries with Karnataka state. Despite five decades long experience of mechanised fishing in Kerala, Kasaragod fisheries are predominantly artisanal even today. Fishermen here use medium ring seines with medium plank built canoes for fishing. There are fifteen fish landing centres[1] in the second study district.

[1] Hosdurg S. Bella, Ajanoor N. Bella, Chittari, Pallikkara, Bekkal, Kottikkulam, Keezhoor, Kasaba, Thaikadappuram, Adakath Bail, Mogral, Koipadi, Uppala, Hosabettu Udaivar and Kunzhathur) and two fishing harbours (Cheruvathoor and Thaikadappuram

3.2.2 Spatial and geographical characteristics of study areas

Marine fisheries off the Ernakulam coast are typically tropical and multi-species. The productivity of the fisheries of this region has been largely influenced by two major bar mouths -Cochin and Munabam- through which inter-mixing of fresh and saline water occurs. The coast line of Ernakulam district which once was inhabited by active fishing communities has undergone distinct changes today due to environmental degradation and beach erosion. Huge seawalls constructed to protect the shore from rough seas have affected fishing activities in many villages along the coastal belt. However, there are certain stretches of the coast left out from where fishermen could still launch their traditional non-mechanized crafts. The beach and inshore waters up to twelve nautical miles are sandy and clayish. Local marine fishermen also depend on the nearby estuary, during times of economic crisis in the lean season. Compared to other coastal districts, the maritime economy of Ernakulam is highly commercial and influenced by the presence of an active fish processing industry. Major fish markets- Ernakulam, Aluva, Mattanchery and Muvattupuzha- are well connected by roads. Post harvest facilities are relatively better than those existing in other areas.

In Kasaragod, Neeleswaram estuary, Chadragiri bar mouth and Karanataka estuary together influence local marine fisheries. Bekal fort, Onaam kodi and Pandyan kallu are ecological land marks of this district. The entire coastal areas of Kasaragod are rocky and play crucial role in breeding of the fishes. The accumulation of soil sediments called *'cheru'*

decides the presence of *chakara* along this area. In monsoon season artisanal fishery is possible only in Pallikkara landing center. Coastal erosion due is an important issue along the marine coastal villages.

3.2.3 Selection of Study Villages, Units and Communities

In order to identify artisanal landing centres in the 1970's a 'beach walk' was undertaken along the 45 kilometre coastal area of Ernakulam district. The Key informants above eighty years old in Munambam, Pallipuram, Aniyil kadappuram, Kuzhuppully, Puthuvaippu and Ambalakkadavu at Vyppin Island, Saudi, Manassery, Cheriyakadau, Kandakkadavu, Maravukkad, Kannamali and South Chellanam were consulted after developing confidence among them. Further, continuous interactions with trade unions, producer organizations, fisheries department and fishing community helped to improve quality of data used in the thesis. These groups with conflicting interests were convinced that the study is not intended for any political mileage to political parties or individuals. Triangulated primary data collection using methods like key informant interviews, focus group discussions, participant observations and secondary data from various organizations helped to ensure the reliability and validity of data. After the analysis of data, effective marine fisheries management was proposed before various users like policy makers, trade unions, and primary producer organizations and fisheries department officers. Validated conclusions are presented in the thesis.

In the case of Ernakulam, selection of villages was done on the basis of geographic and social differentiation. The southern zone (Chellanam) is

inhabited by Latin catholic fishermen while the northern zone (Vypin) is dominated by Arayas. Three artisanal fishing villages each in the north (Nayarambalam, Njarackal and Ambalakkadavu) and south (South Chellanam, Kandakkadavu, and Saudi-Manassery) were selected for detailed examination. From Kasaragod district four artisanal fishing villages (Kasba beach/Kasaragod, Keezhoor, Kottikkulam, and Bekkal) were selected.

3.2.4 Distribution of samples in study area

Basic demographic features of fishing units in the selected villages are presented in table 3.1. Six percent of the total active full - time marine fishermen in the state of Kerala operate in Ernakulam district; while 5.5 percent of the active fishermen operate in Kasaragod district (GOI, 2005). Table 3.2 shows the distribution of artisanal fishing vessels operating in the study districts and the sample selected for detailed examination. It is evident that 7.8 percent of the motorised vessels, 12.5 percent of the non-motorised, 35.23 percent of trawlers, 74.77 percent of gill netters and 15 percent of ring seines are operating in Ernakulum belt. Compared to Ernakulam, only 4.6 percent of the trawlers are operating in Kasaragod coasts as against 6.3 percent of motorised artisan crafts in this district. It may be noted that 82 percent of the artisanal non-motorised crafts, 52 percent of motorized artisanal crafts and 71 percent of the ring seines in Ernakulam district are located along the northern coast while 18 percent, 43 percent and 29 percent of the respective crafts mentioned above are operating in the southern zone. Fifteen percent of these vessels in

Ernakulam and 20 percent in Kasaragod have been selected for detailed examination.

Table 3.1 Distribution of fishermen in the study area 2005

District	Region	Classification of Fishermen			
		Full time	Part time	Occasional	Total
Ernakulam	Vyppin	4509 (58.51)	779 (47.56)	317 (86.14)	5605 (57.68)
	Chellanam	3065 (39.77)	855 (52.20)	51 (13.86)	3971 (40.87)
	District total**	7707 (6.21)	1638 (15.62)	368 (6.54)	9717 (6.93)
Kasaragod	Selected villages (Kottikulam,Bekkal , Kizhoor, Kasaragod beach)	3081 (44.85)	90 (13.89)	73 (36.14)	3244 (42.03)
	District total**	6869 (5.53)	648 (6.18)	202 (3.59)	7719 (5.50)

Source: Marine fisheries Census 2005 part – III (6) – Kerala, Government of India, Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries, Krishi Bhavan, New Delhi

Figures in brackets represent Percentage to district total
***Figures in brackets represent Percentage to State total*

Table 3.2 Distribution of artisanal fishing vessels and samples selected in the study area 2005

District	Region	Non motorized		Motorized		Ring seiners		Total	
		Total	Sample selected	Total	Sample selected	Total	Sample selected	Total	Sample selected
Ernakulam	Vyppin	970	12	60	12	50	12	1080	36
	Percentage to district total	81.86	1.24	51.72	20.00	71.43	24.00	78.77	3.33
	Chellanam	212	16	50	13	20	13	282	42
	Percentage to district total	17.89	7.55	43.10	26.00	28.57	65.00	20.57	14.89
	Ernakulam district total	1185	28 (2.37)	116	25 (22.73)	70	25 (35.71)	1371	78 (5.73)
Kasaragod	Selected villages (Bekkal, Kottikulam, Kizhoor, Kasba beach)	143	16	179	48	0	0	322	64
	Kasaragod district total	294	11.19	890	26.82	0	0.00	1184	19.88

Source: Marine fisheries Census 2005 part – III (6) – Kerala, Government of India, Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries, Krishi Bhavan, New Delhi

Table 3.3 shows the distribution of mechanised fishing vessels and samples selected for the study.

Table 3.3 Distribution of mechanized fishing vessel and samples selected in the study area 2005

District	Trawlers		Gill netters		Purse seiners		Others	
	Total	Sample selected	Total	Sample selected	Total	Sample selected	Total	Sample selected
Ernakulam district total	1403	44	320	4	50	7	58	0
Percentage	35.23	3.14	74.77	1.25	92.59	14.00	9.88	0
Kasaragod district total	183	4	0	0	0	0	0	0
Percentage	4.60	2.19	0.00	0.00	0.00	0.00	0.00	0

Source: Marine fisheries Census 2005 part – III (6) – Kerala, Government of India, Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries, Krishi Bhavan, New Delhi

3.2.5 Selection of sample in the study area

Stratified random sampling methods have been used for data collection. From the study area 90 artisanal fishing vessels were surveyed during the research period. In Ernakulam 78 artisanal fishing vessels were selected as sample. From Vyppin region, 12 artisanal mechanized fishing vessel with inboard engine and large ring seine and 12 artisanal fishing vessels with outboard engine were selected. Five artisanal mechanized

fishing vessels with inboard engine in Njarackal and seven of the same type in Nayarambalam and 12 artisanal fishing vessels from Ambalakkadavu were selected. From Chellanam region, 13 artisanal mechanized fishing vessel with inboard engine and large ring seine and 13 artisanal fishing vessel with outboard engine, and 16 artisanal fishing vessels without engine were selected. From Chellanam, one of the oldest fishing villages in Kerala, 16 artisnal fishing vessels without engine were selected from different artisanal fish landing centres. From Kandakkadavu seven artisanal fishing vessels with outboard engine and from South Chellanam six vessels in the same category were selected, in the case of artisanal fishing vessel with inboard engine seven were selected from Kandakkadavu and six from Saudi-Manassery were selected.

Mechanised boats are mainly operating from Thoppumpadi and Munambam harbours. A few boats also operate from Murikkumpadam and Pallipuram mini fishing harbours. 55 mechanized fishing vessels were surveyed during the study.

3.2.6 Method of data collection

The thesis used both secondary and primary data. Primary data were collected through both quantitative and qualitative methods using semi-structured interview schedules. Primary data has been collected through personal interviews, key informants' interviews, focus group discussions and participant observation. The researcher participated in various general body meetings of primary producer organizations like Kerala

State Boat Operators Coordination Committee, Kerala State Fishing Boat Operators Association, Deep Sea Fishing Boat Operators Association, Trawl Net Boat Operators Association, Purse seine Boat Owners Association, Fishing Boat Relief Organization, Kerala State Fisheries Coordination Committee, District Fisheries Coordination Committee and Kerala State Fisheries Department etc. Consultations with state administered regulatory bodies especially during the trawl ban periods were also conducted. The researcher also participated as an observer in various advisory committees of the state and non state organisations to gain first-hand information about various management decisions.

Key informants' interview method followed by McGoodwin (2001), Campbell (2001) and Robert (1994) was used in the study. Key informants' interview was started with well experienced and knowledgeable fishermen above eighty years old. This interview helped to ascertain the socio - economic and political environment during the pre motorized fishery era in the study area. Identification of the management concerns are important in the study, after understanding the pre motorization period documentation, second round key informants' interviews were conducted in the study area. Altogether, the survey covered 382 respondents belonging to the two study districts in Kerala.

Trade unions play dominant roles today in the mobilization of artisanal fishermen along the Kerala coast. Building confidence was a heroic task for arranging interactive sessions. This is systematically developed through participation of trade unions in research. 69 sittings were done

with different trade union leaders. Six mechanized primary producers organization located at Ernakulum were selected for the key informants' interview. Others are omitted because of the non-cooperation. 40 sittings were done with various organization representatives. See table 3.4 for details.

Focus group discussion method developed by Agar and MacDonald (1995); Krueger (1994); and Morgan (1996) is applied in the study. The intent of the focus groups was to initiate conversation in a group setting that might be difficult to discuss on an individual level. Through this method thoughts and ideas that come from one person would spark additional comments from others and help to uncover cultural norms and underlying ideologies (Bernard 1998). Total of 33 focus group discussions were conducted during this study. In mechanized sector 9 focus group discussions were conducted and twenty four focus group discussions were conducted in artisanal sector. The number of participants in the focus group discussion varied from eight to twelve. See table 3.5

Table 3.4 Key informants interview with different fishing units, trade unions, primary producers organizations.

	Ernakulam		Kasargodu				Total
	Chellanam	Vyppin	Kasba beach	Kizhoor	Kottikulam	Bekkal	
Above eighty years old fishermen	8	11	3	5	3	6	36
Artisanal sector	62	86	12	9	10	16	195
Mechanized sector	58	84	9	0	0	0	151
Total	128	181	24	14	13	22	382
State fisheries department staff							
	Ministerial staff	Additional Secretary	Deputy Director	Assistant Director	Marine Enforcement Officers	Liaison officer	
Frequency	3	5	9	17	8	24	66
Trade unions							
	KSMTF(CITU)	KSMTF(AITUC)	KSMTF(TUCI)	KSMTF(INTUC)	KSMTF	KSMTF(CPIML)	
Frequency	14	5	28	3	12	7	69
Mechanized producers organizations							
	Kerala State Boat Operators Coordination Committee	Kerala State Fishing Boat Operators Association	Deep Sea Fishing Boat Operators Association	Trawl net Boat Operators Association	Purse seine Boat Owners Association	Fishing Boat Relief Organization	
Frequency	17	6	4	4	6	3	40

Table 3.5 Focus group discussions in the study area

Sector	Ernakulam		Kasaragod				Total
	Chellanam	Vyppin	Kasba beach	Kizhoor	Kottikulam	Bekkal	
Artisanal	5	7	3	3	3	3	24
Mechanized	4	4	1	0	0	0	9
Total	9	11	4	3	3	3	33

Participant observation method is another qualitative data collection method used in this study (Iacono and Holtham 2009). The participant observations conducted among the primary producers' organization revealed how they act under different situations and protect interests. As far as producers' organizations are concerned, there are both mechanized and artisanal organizations. See table 3.6.

Table 3.6 Meetings attended producers' organizations

Year	Primary producer organization mechanized sector	State fisheries coordination committee	District fisheries coordination committee	Government consultation	Joint council for artisanal fishermen	Study committee sitting	Total
2004	2	6	8	4	8	2	30
2005	3	8	10	3	5	0	29
2006	1	4	9	8	4	0	26
2007	0	0	6	9	0	5	20
2008	0	0	5	12	0	2	19
2009	0	0	6	7	4	3	20
2010	0	0	4	4	0	3	11
Total	6	18	48	47	21	15	155

For collecting detailed evidences, minutes of meetings of different primary producers' organizations were referred to. In addition, Fisheries Department files, and judgements connected with fishing were collected for the study. Data on the activities of the state with respect to formal rules, enforcements etc. were collected from the Fisheries Department and from the Marine fisheries enforcement wing of the Department. Secondary data from CMFRI, SIFFS etc are also used for comparison.

3.2.9 Types of Data

Resource data: The resource crisis was analysed with the help of secondary data of the Central Marine Fisheries Research Institute, (CMFRI) Cochin. All data used in this thesis are collected from various sources published by CMFRI and it was encoded using Microsoft Excel. The trend analysis was done in the Table Curve 2D and 3D software by employing simple equations to draw the graph.

Livelihood data were collected from artisanal fishermen and fish workers using semi-structured interview schedules prepared according to the "Sustainable Livelihoods Framework" of Scoones (1998). Costs and earnings data to highlight the economic crisis of the fishing industry were collected using established methods (Kurien and Willmann,(1982; Sehara and Kanakkan, 1993; Hasaan and Sathiadhas, 2009) (See appendix 3.2). Data were collected separately for mechanized (trawlers, purse seiners, and gill nets) and artisanal sectors (non motorized, motorized and mechanized artisanal sector). Data were collected from primary producers, middlemen, merchants, auctioneers and fishermen

development welfare cooperative societies. Data on management institutions: Since primary task was to document and describe the management institutions, with special reference to economic sustainability, viability and livelihoods, samples representing various craft-gear combinations both from the mechanised and artisanal sectors were chosen for detailed examination. A total of 66 interviews were conducted on the bureaucratic functionaries of Fisheries Department. The involvements of political parties and nongovernmental organizations were separately documented.

3.3. Summary and conclusions

The conceptual framework for analyzing the practice of marine fisheries management in Kerala, India was detailed initially. The institutional analysis and development (IAD) framework provided the necessary conceptual/theoretical concepts and inter connections that are essential for understanding the manner in which both state and non state actors engage and interact in fisheries management at different scales. This was followed by the details of methodology used in the study. The study areas, spatial and geographical characteristics, selection of villages, units and communities, classification, distribution and selection of samples, types of data collected and method of data collection were also described. The results of the analysis are presented in chapters that follow.

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Chapter 4

Marine Fishery Resources Users and Activities in Kerala

The process of mechanisation introduced in the marine fisheries of Kerala has made definite influences on the sustainability and availability of resources. It has also produced serious economic and social crisis in the coastal villages across the state. In order to analyse these substantive issues in depth and to develop comprehensive managerial solutions, we shall introduce the nature of the bio-physical features of Kerala fisheries, discuss how various groups (actors) of resource users harvest resources and examine various roles they play in fisheries management. This chapter undertakes the task of presenting the nature of the bio-physical characteristics of Kerala marine fisheries and discusses how different users harvest these resources. The first section details the nature of major fisheries on which fishermen organise economic activities. Second section describes the process of mechanisation with special reference to Kerala marine fisheries. Third section introduces the structure and activities of various artisanal fisher groups in the study district. Section four deals with the nature of the mechanised sector operations in the study districts. A summary is given in the fifth section.

4.1 A General Description of Marine Fisheries of Kerala

The boundaries of Kerala marine fisheries stretch from $8^{0}18^{1}$, 12^{0} 48^{I} north latitude 74^{0} 521, $77^{0}22^{1}$ east longitudes. Fisheries within the territorial waters of Kerala have been enriched every year by the heavy south-west monsoon and the subsequent inflow of waters from the 41 rivers flowing towards the Arabian Sea. Not surprisingly therefore that local fisheries are more diverse than the east coast fisheries of India. In fact, Kerala region has been noted as one of the most biologically diverse fish pool regions of tropical fisheries. Major fisheries off Kerala are classified broadly as demersal and pelagic. Table 4.1 shows the distribution of the pelagic and demersal group of fishes in Kerala during 1960- 2005.

Table 4.1 Quantity and percentage distribution of pelagic and demersal group of fish landings in Kerala

(Quantity '000 tonnes)

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
2000-2005	379.71	200.98	580.69	65.39	34.61	100

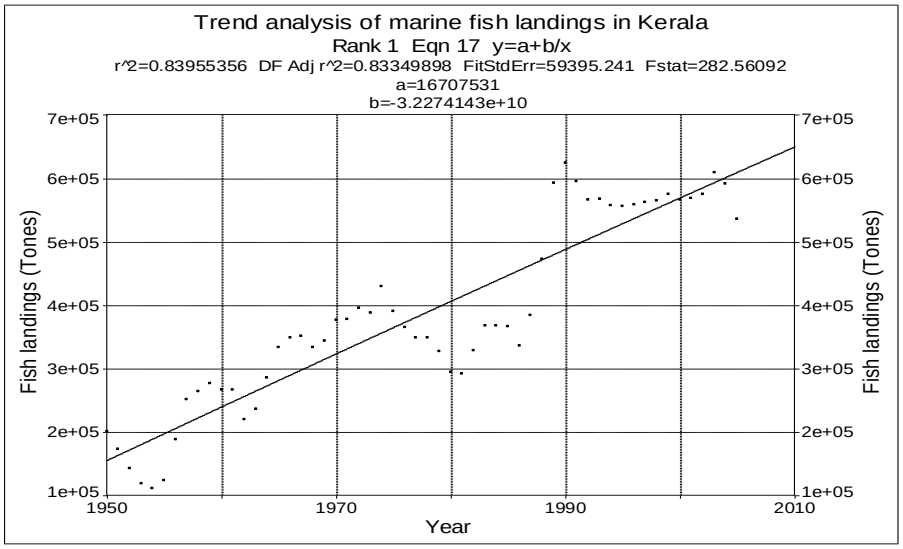
Source: Compiled data CMFRI various years

Fishing industry in Kerala has shown remarkable growth ever since the introduction of modern fishing methods. The average total landings have increased from 301 thousand tonnes during 1960-1970 to 581 thousand

tonnes during 2000-2005; an increase of about 93 percent. Figure 4.1 shows the trend of total marine fish landings in Kerala during 1950-2005.

It may be further noted that pelagic groups contributed 78 percent of the total landings during 1960-1970, which reduced to 65 percent during 2000-2005. On the other hand, demersal fisheries increased steadily and improved its share from 22 percent to 35 percent during this period. The analysis of the constituent fisheries reveals substantial growth in demersal catches than pelagic groups. Figure 4.2 shows the trend of demersal fish landings in Kerala during 1950-2005.

Figure 4.1 Trend of total marine fish landings in Kerala 1950-2005



Major demersal varieties landed in Kerala are elasmobranches, cat fish, lizard fish , perches, croakers, silver bellies, big jawed jumper, flat fishes, penaeid prawns, cephalopods, goatfish and other demersals. The percentage contribution of these varieties is shown in table 4.2

Figure 4.2 Trend of demersal fish landings in Kerala during 1950-2005.

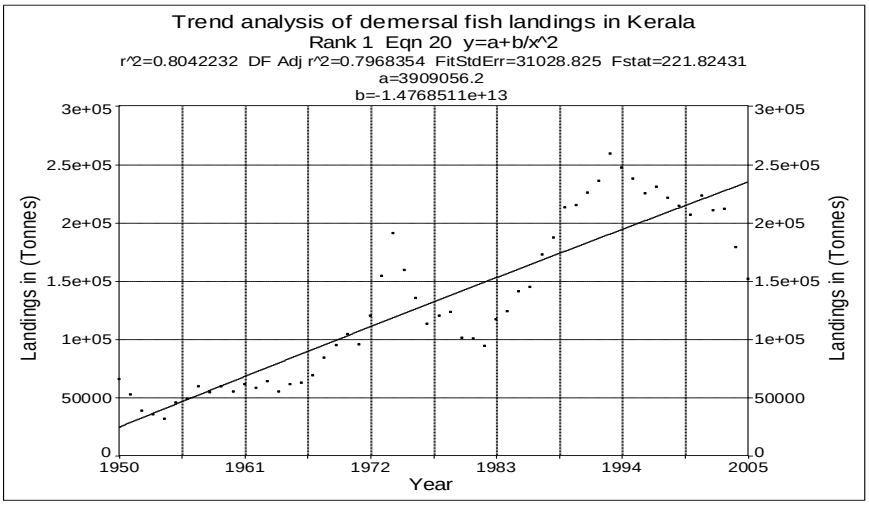


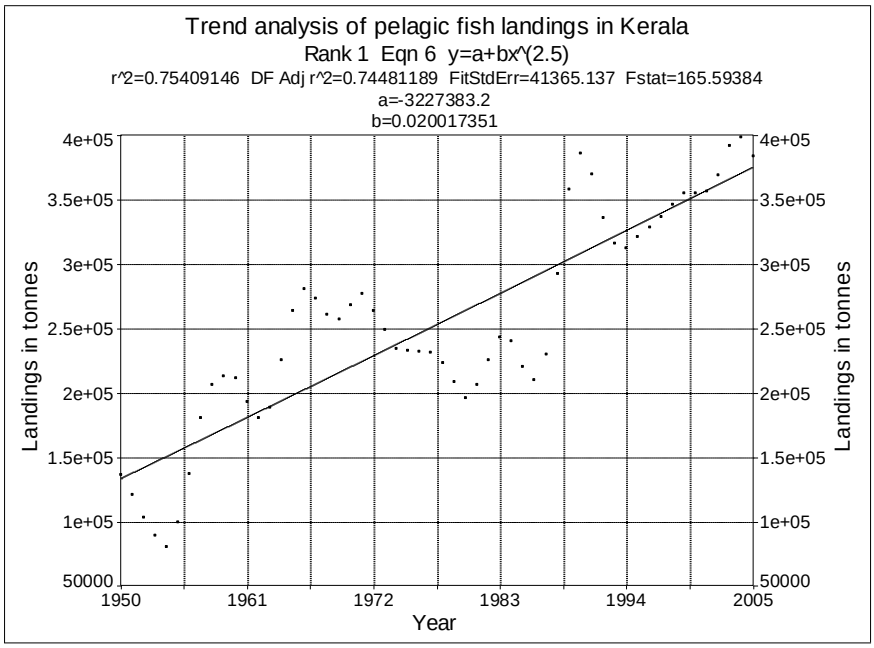
Table 4.2 Quantity and percentage distribution of demersal group of fish landings in Kerala

Demersal species	Quantity 000's tonnes					Quantity in percentage				
	1960-1970	1970-1980	1980-1990	1990-2000	2000-2005	1960-1970	1970-1980	1980-1990	1990-2000	2000-2005
Elasmobranches	6.86	7.82	6.21	4.48	4.00	2.28	2.06	1.64	0.78	0.69
Cat fish	4.76	16.89	9.24	0.80	0.22	1.58	4.44	2.44	0.14	0.04
Lizard fish	0.22	4.20	6.92	10.89	9.28	0.07	1.10	1.83	1.90	1.60
Perches	1.43	1.187	26.24	54.25	50.58	0.48	3.12	6.93	9.46	8.71
Croakers	3.29	9.16	7.81	12.54	7.07	1.09	2.41	2.06	2.19	1.22
Silver bellies	8.68	8.81	5.64	5.16	5.42	2.88	2.32	1.49	0.90	0.93
Big jawed jumper	2.40	2.11	1.13	1.49	0.701	0.80	0.55	0.30	0.26	0.12
Flat fishes	8.14	7.45	11.50	18.92	18.15	2.70	1.96	3.04	3.30	3.13
Penaeid prawns	21.46	47.51	40.44	52.29	41.58	7.12	12.49	10.68	9.12	7.16
Cephalopods	0.35	2.21	8.74	31.62	30.56	0.12	0.58	2.31	5.52	5.26
Goatfish	0.68	1.34	1.74	3.71	0.066	0.23	0.35	0.46	0.65	0.01
Subtotal demersal	58.27	119.37	125.61	196.12	167.62	19.33	31.39	33.17	34.21	28.87
Other demersal	9.39	11.04	14.40	35.31	33.35	3.11	2.90	3.80	6.16	5.74

Source: Complied data CMFRI various years

Trend in pelagic fish landings in Kerala also shows positive trend. Figure 4.3 shows the trend of pelagic fisheries in Kerala.

Figure 4.3 Trend of pelagic fish landings in Kerala during 1950-2005



The major pelagic fishes landed along Kerala coasts are oil sardine, other sardine, ribbon fish, carangids, mackerel, seer fish, tunnies, and other pelagic. Table 4.3 shows the distribution of major pelagic group of fishes landed in Kerala.

Table 4.3 Quantity and percentage distribution of pelagic group of fish landings in Kerala

Pelagic fish	Quantity (000's tonnes)					Quantity in percentage				
	1960-1970	1970-1980	1980-1990	1990-2000	2000-2005	1960-1970	1970-1980	1980-1990	1990-2000	2000-2005
Oil sardine	173.52	129.13	107.18	74.94	221.02	57.57	33.95	28.30	13.07	38.06
Other sardine	10.06	23.44	8.39	21.03	9.216	3.34	6.16	2.22	3.67	1.59
Ribbon fish	5.70	16.71	10.71	11.94	19.17	1.89	4.39	2.83	2.08	3.30
Carangids	6.93	9.83	25.72	69.44	39.60	2.30	2.58	6.79	12.11	6.82
Mackerel	19.30	31.38	24.91	77.46	36.27	6.40	8.25	6.58	13.51	6.25
Seer fish	1.90	3.54	6.26	5.55	6.65	0.63	0.93	1.65	0.97	1.15
Tunnies	2.027	6.40	10.57	16.72	18.52	0.67	1.68	2.79	2.92	3.19
Sub total	219.44	220.41	193.73	277.08	350.44	72.81	57.96	51.16	48.33	60.35
Other pelagic fishes	14.31	29.49	44.96	64.74	29.27	4.75	7.75	11.87	11.29	5.04

Source: Complied data CMFRI various years

The trends of various fisheries within the demersal and pelagic groups are presented in annexure 4.1 to 4.18.

4.2. Mechanization of marine fisheries and growth of marine fishing fleet in Kerala

Till early nineteen fifties, artisanal fishermen in Kerala were using non mechanised methods for fishing within its territorial waters which obviously constrained their capacity to catch and supply enough fish to meet the growing demand in international markets. It was in this context that the government decided to modernise marine fisheries by introducing modern technologies. Mechanization of Indian fisheries started with the introduction of the Indo– Norwegian project in the state of Kerala way back in 1954 (Kurien, 1985, Pilla and Katiha 2004). The first generation mechanized boats were engaged in gill net fishing while trawling and purse-seine fishing became popular much later. New investors, especially from agricultural and business sectors, invested in marine fisheries and introduced mechanized trawlers, purse seiners and gill netters. The competition posed by mechanised vessels to the artisanal fisheries had been so tough that it became inevitable for the traditional fishermen to modernise their traditional crafts using outboard motors. During the first phase of motorization, traditional fishermen modernized their indigenous crafts with outboard engines and fishers could extend their activities to more distant and deeper waters. In the latter half of the 1980s artisanal fishermen further intensified their fishing operations using large purse-seine like net (ring seines) for exploiting pelagic resources which largely replaced traditional boat seines. The motorized sector grew rapidly and in 1988 it became the most important sector yielding the maximum catch. Thus a new sector called motorized sector

was added to the existing mechanized sector and the remaining being non-mechanized indigenous sector.

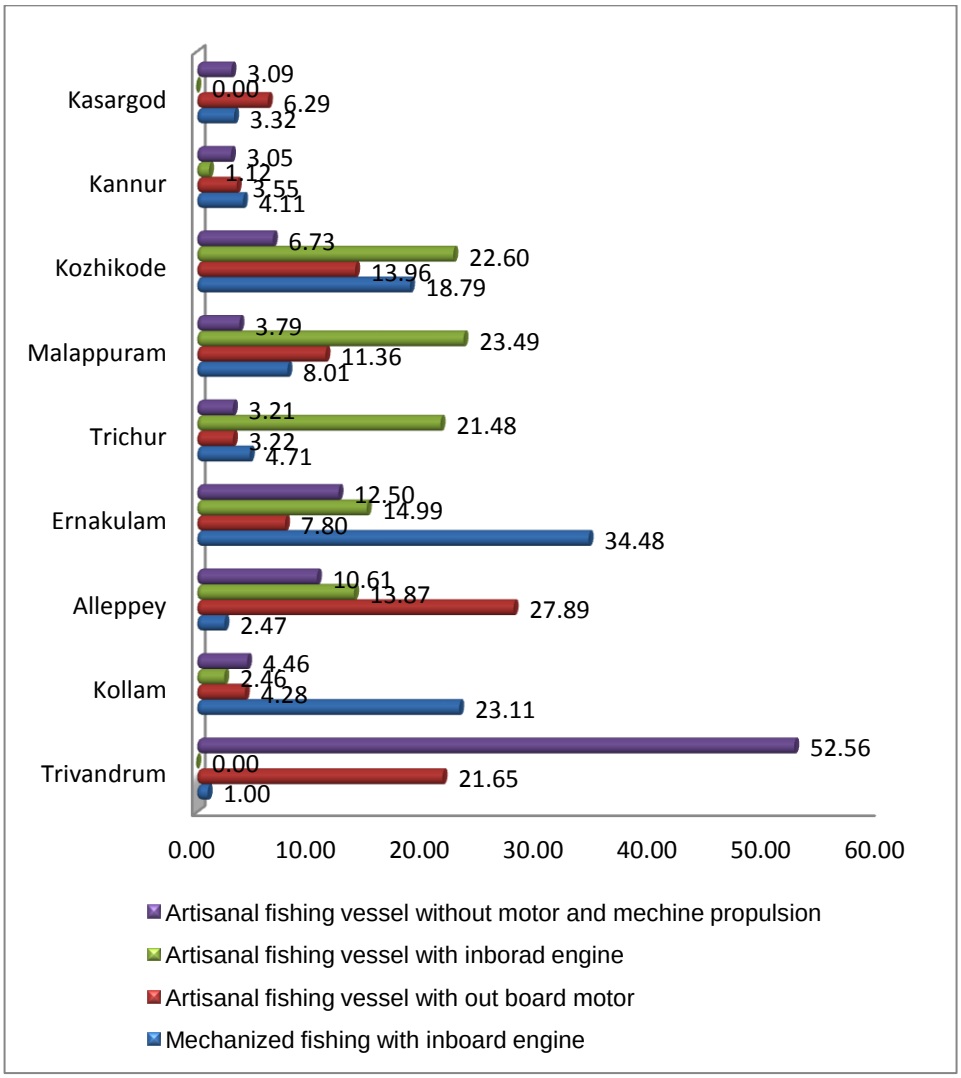
During 1990's, mechanized marine fisheries witnessed further technological intensification. Motorised artisanal fishermen replaced outboard motors and installed inbuilt engines in an attempt to compete with the mechanised vessels. Mechanised trawlers became more mobile by redefining their fishing territories/grounds which stretched between Kanyakumari in the south and Gujarat in the North. Modern navigation and communication equipments such as eco - sounder, wireless and GPS were being used which prolonged fishing expeditions between 11 to 14 days. Table 4.4 gives growth of fishing vessels in Kerala from 1973 to 2005.

Table 4.4 Growth of fishing fleet in Kerala: 1973 -2005

Fleet	1973-77[a]	1980[b]	1998[c]	2002-03[d]	2005[e]
Mechanized trawlers		745	4484	**na**	3982
Other mechanized vessels (Gill netters +Hook and lines+ Purse seines)		238	604	**na**	1522
Sub-total **mechanized**	1026	983	5088	4510	5504
Artisanal vessels with outboard motors	na	na	14662	29395	14151
Artisanal Vessels with Inboard engines					**650**
Non-motorised vessels			25383	21956	9522
Sub-total	21718	26271	40045	51351	23673
Grand total	**22744**	**27254**	**45133**	**55861**	**29177**

Source: a: Marine Fisheries Survey (Frame Survey) 1973-77 (CMFRI)
b: All India Marine Fishermen Census 1980 (CMFRI)
c: Rapid Census 1998 (CMFRI)
d: Marine Fisheries at a Glance 2003 (Department of Fisheries, Kerala)
e: Marine Fisheries Census 2005 (CMFRI)

Figure 4.4 Distribution of marine fishing vessels in Kerala



Source: Marine fisheries Census 2005 part – III (6) – Kerala, Government of India, Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries, Krishi Bhavan, New Delhi

The table 4.4 and figure 4.4 clearly reveal the coexistence of different modes of technologies in the marine fisheries sector of Kerala today.

4.3 Activities of Artisanal Fishermen Groups in Cochin

Marine fisheries off Cochin contributed 10 percent of fish to the state's total marine fish landings in 2004-05 (GOI, 2005). A large proportion of these landings were contributed by pelagic species followed by demersal groups and shrimp and other shellfishes. Both mechanised and non mechanised vessels target these species today. Shrimp and other table fishes contributed the major portion of the total value. This section provides a detailed description of these actors and their activities and explains how they involve themselves in the appropriation and management of resources.

The artisanal fishermen of Ernakulam district: Pre-mechanised era

Till the introduction of mechanised fishing vessels, the marine fisheries were operated by fishing communities belonging to Latin Catholics, Arayas, Dheevaras and Muslims. Artisanal fishermen along this coast were primarily engaged in beach seine fishing, collective fishing using boat seines (*thadathipidutham)*, gill net fishing (neettu vala) and hooks and line fishing. The most widely used fishing method in the southern zone was shore seines (kambavala[1]). Around 32 such shore seines were functioning at the eve of mechanization and more than 60 people could work at a time in one fishing team. This was the major source of income and livelihood of about 1920 workers.

[1] *Kambavala* is the beach seine/shore seine, which was very popular along the south central coast of Kerala. There has been a significant decrease in the number of shore seines in Kerala with increased motorization, which had caused severe employment problem in many fishing villages. Chellanam panchayath had a strong and active beach seine fishery mostly under individual ownership. Beach seine owners were relatively wealthy and considered as the most prominent leaders in fishing societies. They controlled large number of active workers and surplus money Known as *Tharakans*, they were also the leading businessmen who controlled fish trade in the past..

Table 4.5 Artisanal marine fishing crafts and workers in the southern zone of Ernakulam District in 1950

Fishing village	Numbers				
	Beach seine	Large plank canoe	Dugout canoe		Fish workers
			Medium	Very small	
Pallikadavu	11	20	30	85	1625
Pullekadavu	0	30	12	40	812
Vachakkalkadavu	4	18	40	38	994
Gunduparambu	5	22	45	Na	966
Velamkannikadavu	10	20	30	Na	1140
Chalakkadavu	1	18	42	Na	636
Kandakadavu	1	22	18	Na	564
Puthenthodukadavu	0	42	64	Na	1140
Kannamali kadavu	0	19	32	Na	534
Cheriyakadavu	0	12	28	Na	384
Total	**32**	**223**	**341**	**163**	
Total fish workers	1920	4014	2046	815	8795

Source: primary survey

Most of the shore seines of Chellanam were individually owned. Beach seine (kambavala) operations required a well defined space from where the team could launch the net. Apart from this shore space for *kambavala* fishing, each owner *(jenmy)* also controlled a fixed area equivalent to the length of his shore seine towards the sea. Such customary rights enabled fishermen to exclude others from intruding into their areas. The *jenmies* who owned *Kambavalas* were very rich and powerful and managed their economic activities and social affairs through a variety of communitarian institutions and organizations. *Thadathipidutham*[2] fisheries employed the

[2] "Thadathipidutham" was one of the major fishing methods in Chellanam during pre-mechanisation period. The method engaged six crafts at a time to catch of pelagic fish schools at a depth of 30 to 45 marru. Since the craft employed five workers, it was known as "anchallum vanchi". The leader of the *thadaathipidutham* team, known as "*asan*", controlled information and knowledge about fish/prawns shawls, seasons and sea rise. "Amarakkaran" who directs the crafts in to sea guided the fishing team. The entire team obeyed his directions. In addition to these two positions there was also

maximum number of workers in Chellanam coast. 223 large plank canoes employed about 4014 workers, 341 medium sized canoes employed 2046 workers and 163 small vallams employed 815 workers. On the whole, 8795 workers in the village could make their living from the local fisheries. Hook and line fishing provided livelihood to only a limited number of fishermen in this area.

In the northern belt of Ernakulam district, local communitys' involvement in marine fisheries was weak as most of them were recent entrants who settled in this coastal strip from other interior places. Around 1698 fishermen were directly involved in marine fisheries in the Northern zone. (See Table 4.6).

Table 4.6 Artisanal marine fishing crafts and workers in the north zone of Ernakulam District in 1950

Fishing village	Numbers			
	Large plank canoe	Dugout canoe		Fish workers
		Medium	Very small	
Pallippuram	6	18	>40	278
Kuzhippully	12	36	>60	516
Edavanakad	6	12	>40	388
Nayarambalam	6	18	>50	348
Njarakkal	6	12	na	168
Elamkunnupuzha	na	na	na	na
Total	36	96	>190	1698

Source: Primary survey

another person called "Srank" who was directing the canoe as per the instructions from amarakaran.

It was under such circumstances that the state introduced the "blue revolution package" into coastal fisheries in Kerala. The early responses of fishing communities in Ernakulam district towards the modernisation package had been quite mixed. Unlike their counterpart in Needakara, Latin catholic fishermen of the southern zone of Ernakulam district did not welcome the mechanisation process. In fact, they objected the introduction of mechanised boats into marine fisheries and even joined hands with the anti-trawler movement organised by the independent fish workers association, the Kerala Swathanthra Matsya Thozhilali Federation (KSMTF)[3]. The araya fishermen along the northern belt of Ernakulam district on the other hand supported the mechanisation process and became the first generation beneficiaries of the programme. Despite initial resistance to modernisation, the state decided to go ahead with the mechanisation drive in an attempt to increase fish production for export. The liberalisation policies of the state and the non cooperation of local fishers to participate in the modernisation programme encouraged entry of private entrepreneurs into marine fisheries of Ernakulam in a big way. Cochin fisheries harbour soon became the hub of mechanised boats. More boats from Tamil Nadu and Karnataka shifted their operations from their state boundaries to Ernakulam district

[3] KSMTF was formed due to the Joint efforts of the Latin Catholic clergies of the three southern most districts of Kerala. Fishermen belonging to the Thiruvanthapuram Roopatha Malsya Thozhilali Union, Kollam Jilla Swathantra Malsya Thozhilali Union, Allpuzha Catholical Malsya Thozhilali Union, Allpuzha Jilla Ulnadan Mahla Malsya Thozhilali Union and Vijaypuram Roopatha Malsya Thozhilali Union in ajoint meeting decided to form a federation of fisher associations to strengthen their resistance against mechanization. This network was initially named as Kerala Lateen Catholica Malsya Thozhilali Federation (KLCMTF). This network was later renamed as Kerala Sothandra Matsya Thozhilali Federation (KSMTF) in an attempt to secularizes the federation.

with the help of traders and merchants (Thomson, 1989). The pressure increased considerably and two more fishing harbours were commissioned to accommodate these incoming vessels. Hence, the common property fisheries once operated by the artisanal fishermen became open access as there were no institutions regulating access to resources in this region. The competition posed by mechanised sector to the artisanal sector was so intense that the latter had been gradually losing its control on its traditional fishing grounds/ territories. Economic disparities increased manifold and artisanal methods of fishing became non viable. The struggle against mechanisation has slowed down and mechanised sector stabilised its base in the marine fisheries of Ernakulam district.

Artisanal fishermen using OBM's

Artisanal communities soon realised the need for upgrading the level of technology and worked forward towards rapid diversification of fishing methods. By early 1980's traditional fishermen started using outboard motors on their traditional crafts in an attempt to catch more fish. Motorization in artisanal fishery was the product of traditional fishing community's response to the challenges of mechanized sector (Panicker et al, 1985). Government also supported the initiative through liberal credits. Today, 360 motorized crafts (177 in south and 183 in the north) using 546 out-boards motors (235 in the north and 311 in the south) operate from Cochin zone using gillnets, mini ring seines and hooks and lines. The sector provides direct employment to 2500 to 3000 fishing

families today. Table 4.7 shows the distribution of motorized crafts and gears in the district in 2002.

Table 4.7 Distribution of motorized crafts and gears in Ernakulam in 2002

S.No	Panchayath	Outboard motors	Motorized crafts	Motorized gear
1	Pallipuram	16	14	34
2	Kuzhuppilly	19	17	6
3	Edavanakad	46	33	83
4	Nayarambalam	71	42	42
5	Njarakkal	43	41	174
6	Elamkunnupuzha	40	36	133
North Zone		**235**	**183**	**472**
7	Kochi corporation	66	48	43
8	Chellanam	245	129	122
South Zone		**311**	**177**	**165**
Total		**546**	**360**	**637**

Source: Primary survey

With the installation of outboard motors in traditional crafts, the artisanal sector improved its technical capability and obtained propensity to compete the mechanised counterpart for more space.

Mechanized artisanal sector

Although motorisation enhanced the technical capabilities of artisanal fishers, the growth of technology was not sufficient enough to provide any tangible level of competition to the mechanised sector which occupied/monopolised most of the fishing grounds/territories.

Therefore, local fishermen were engaged in finding ways to further improve their fishing methods. The search for a modern technology resulted in traditional fishermen modifying their country crafts by installing highly powerful inboard engines. The sector hence evolved became the artisanal mechanized sector. A number of fishermen cooperatives have been assisting fishermen groups to reshape/purchase large canoes with inboard engines. These boats (locally called *"thangu vallams"*) started using large ring seines of more than 1500 meters and a crew of 35 to 50 fishermen to catch large volumes of pelagic species. Today about 65 such crafts are engaged in marine fishing, employing around 3200 people. In general, medium and small gillnets followed by mini trawl nets are popular in the artisanal motorized marine fishery of Cochin today employing around 12000 fishermen directly in fishing operations. There is no doubt that the growth of modern fishing fleet and subsequent adaptations of the artisanal fishermen have brought in a number of massive changes into Cochin fisheries and made governance highly complex (Edwin and Hridayanathan, 1996; SIFFS, 1999; Vijayan et al., 2000). With the introduction of inbuilt engines, artisanal fishermen were differentiated into three groups namely those who continue to use non-mechanized crafts, another group using outboard motors and those who modified their traditional crafts with mechanized inboard engines. In the next section we examine the structure of non mechanised fishermen in Ernakulam district.

The Non-mechanised artisanal fishermen

Table 4.8 shows the distribution of artisanal craft and gear combinations operated in Ernakulam district in 1998.

Table 4.8 Distribution of non mechanised crafts and gears in the traditional sector in Ernakulam District in 1998

Panchayath/ Zone	Crafts		Total
	Dugout canoes	Plank built canoes	
Pallipiuram	52	31	83
Kuzhuppilly	16	31	47
Edavanakkad	35	56	91
Nayarambalam	69	41	110
Njarakkal	42	25	67
Elamkunnupuzha	170	22	192
North Zone	**384**	**206**	**590**
Kochi corporation	1	138	139
Chellanam	0	189	189
South Zone	**1**	**327**	**328**
	385	**533**	**918**

Source: SIFFS (1999)

There are 918 non mechanised crafts in the region today (590 operating from north zone and 328 from south) employing around 2500 fishermen directly. These crafts together operate 2386 gears in this region.

Artisanal migrant sector

The artisanal migrant sector in Ernakulam district consists of fishermen from southern districts of the State including Kanyakumari district of Tamil Nadu. This migration is seasonal and does not cause serious problems for local population as they use non-mechanized craft gear

combinations for fishing. A few of the migrants also resort to fishing using out board motors.

4.4 Activities of mechanised fishermen groups in Ernakulam

Ever since the introduction of modern technologies into Kerala's marine fisheries, the Ernakulam coastal zone has been undergoing remarkable changes. First, modernization programs led to the development of mechanized gill netting, trawling and purse-seine fishing in the region. Major proportion of the mechanized fleet engaged in trawling and other deep sea fishing operations in Kerala operate from the fishing harbors of the district as state opened up access way back in 1950s. Today there are more than 1327 mechanized boats of various categories operating off Ernakulam which provide employment for 15000 workers. Second, very few local fishermen invested on mechanised boats. Finally, as the local capital has not been forthcoming, migrant boats from other states like Tamil Nadu and Karnataka encroached into this region in a very big way. This section details how the process of mechanisation has progressed in this region.

4.4.1The trawl fishery

Trawling started in Ernakulam around 1957 with the active support of the state. Government introduced cooperatives, trained fishermen in mechanized fishing operations and encouraged local fisher groups to invest on mechanized boats.

Table 4.9 Mechanized fishing boats in operation in Kerala in 1966-67

	Classification								
Horse power Range	**Below 25 ft**	**25 ft**	**25-30 ft**	**30 ft**	**30-35 ft**	**35-37 ft**	**Above 37 ft**	**N.A**	**Total**
Below 10	28	8	5	0	0	7	0	0	41
10--15	1	7	7	1	0	0	0	0	16
16-20	8	47	23	9	0	0	0	0	87
21-30	0	27	18	240	3	1	0	0	289
31-40	0	1	2	166	45	1	0	0	215
41-50	2	0	0	43	51	6	0	0	102
51-60	0	0	0	8	35	7	0	1	51
Above 60	0	0	0	10	4	52	10	0	76
N.A	3	4	5	24	9	4	1	16	66
Total	**42**	**94**	**60**	**501**	**147**	**71**	**11**	**17**	**943**

Source: Directorate of Fisheries, Govt. of Kerala, Trivandrum – Kerala Fisheries Facts and Figures 1966-67, P.5.

The cooperative sector soon collapsed due to managerial problems and individual ownership replaced collective investments of local fishermen. Despite institutional support, only a few local fishermen (20 boats) invested on mechanised boats in Ernakulam. Instead, majority of mechanised boats were owned by entrepreneurs from agriculture and service sectors. As there were no formal norms on size, capacities and application of effort applicable to these boats, a variety of technologically diverse trawlers based their operations at Ernakulam. For instance, small-sized trawlers were of wooden construction ranging in size from 8.5 m to 9.7 m L_{OA}. These boats are quite old today (say 20 years) and are deployed for shrimp trawling in peak season, operating up to 20-30 m depth. Medium-sized trawlers Type I, are of both wood and steel construction and range in size from 9.7 m to 12.1 m L_{OA} and 90-108 hp,

operating in grounds up to 60-70 m depth. Medium-sized trawlers (Type–II) are mostly of steel construction and range in size from 12.1 m to 16.7 m L_{OA} with an engine power of 108 -124 hp, operating up to 250 m depth. It is reported that out of 4960 bottom trawlers operated in Kerala, 50 percent was based at Kollam district, 31 percent in Ernakulam and 25 percent in Calicut (Kurup and Rajasree, 2007).

4.4.2 Purse seine fishery

The purse seiners were of about 13 m in length with nets measuring 500-600 m in length and 50-60 m in depth with mesh size ranging from 13 to 20 mm (Jacob et.al, 1982). Purse seines mainly catch oil sardine and mackerel and lesser quantities of other sardines, carangids, seer fishes, cat fishes, tunas and prawns (Nair, 1990). Purse seine fishing was first introduced in this region by Mangalore fishermen (Jacob, et. al, 1982). Attracted by huge catch and lucrative profits, a number of private entrepreneurs invested on purse-seine fishing in early 1980s. Number of purse seines operated from Cochin harbour increased from 10 in 1980 to 60 in 1981 and to 114 by 1994. The number of purse seines declined to 78 in 2000 and further to 22 in 2004.

Unfortunately only a few local fishermen from the south zone could invest on purse seine fishery. Majority of these boats were owned by outsiders. However, these boats employed around 3000 workers mainly from South zone villages.

4.4.3 Mechanized migrant fishery

The presence of an active migrant mechanized sector is the most crucial feature of mechanized fishery around Ernakulam. This migrant sector is composed of mechanized boats from Kolechal, Tamil Nadu and a few from Mangalore. Over the period of five decades, the sector has grown significantly and today private entrepreneurs from other communities, control major portion of the investments on mechanized fishing.

The mechanized migrant vessels started their operations from Ernakulam with the blessings of the fish processing/traders/merchants lobby around the early phases of mechanization. These boats are located at Cochin, Murikkumpadam and Elamkunnapuzha. Mechanized boats from neighbouring states of Tamil Nadu and Karnataka visit Ernakulam periodically and sell their catches to the local merchants who in turn sell these catches to the processing sector. The fleet size of mechanized migrant boats increased substantially over the last four decades and today 350 migrant trawlers and 340 gill netters base their operations at Ernakulam. This lobby exercises its own power and interests in the management of fisheries.

4.4.4 Gillnet and hook and line fishery

The third category of mechanised boats popular in Ernakulam district has been engaged in mechanized gillnetting or hooks and line fishing. Most of these boats are owned and operated by migrants from Southern Tamil Nadu. Around 314 gillnet boats are working at present in Cochin and Munambam harbours. One of the major features of migrant fishing

is transboundary fishing. They target shared stocks of pelagic species and offshore resources and contradict both sea tenure systems of traditional fishermen and the formal legal institutions and regulations. At the same time the volume of employment and value of landings the sector produces are highly significant. These boats are also controlled by local *tharakans*.

4.4.5 Industrial fishing fleet

The development of industrial offshore fishing from Ernakulam has been the product of the deep-sea fishing policy of the Central Government announced in the early nineties. This policy allowed the operations of foreign fishing fleet/joint ventures and made their easy entry into Indian fisheries. Their encroachments into the Indian waters and the pressure exerted by native mechanized boats resulted in high level of economic instability and livelihood insecurity to artisanal fishing communities.

4.5 Summary and conclusions

In this chapter an attempt has been made to introduce the nature of marine fisheries in Kerala on which various groups of fishermen organised their economic activities. Trends of important pelagic and demersal fisheries were examined using appropriate statistical methods and the analysis clearly revealed that except few species, the general tendency of marine fisheries in Kerala has been rising due to mechanisation. This finding simply means that the fishing industry has been growing as mechanised boats brought more fish landings from

distant fishing grounds which now stretch beyond Kerala's territorial waters to the western and eastern fishing grounds. This finding also reinforces the need for managing resources for better use. Increases in fish production have been the result of the blue revolution technology programme introduced into the marine fisheries with active state support. From a management perspective, however, the process has generated two disturbing tendencies. First, mechanisation led to the development of multi-day fishing which most often took place beyond the territories of the state. Second, the process ruined the artisanal sector further and later led to an effective economic and technological differentiation of the traditional marine fishermen. Finally, mechanisation led to technological intensification and diversification in the artisanal sector which further increased fishing effort and rate of exploitation. These management concerns need to be addressed properly and will be taken up in the chapters that follow.

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Chapter 5

Management Concerns of Marine Fisheries in Kerala

Marine fishing has been an ancient occupation of the economically and socially deprived groups of Kerala society till mid nineteen fifties. Five decades long mechanised fishing along the fishing territories off Kerala coast has undoubtedly left clear and deep concerns which called for judicious use of resources in the marine fisheries sector. The economic boom produced by the mechanisation of marine fishing could not sustain resource health. But it intensified economic crisis and escalated livelihood vulnerabilities. Moreover, the sea witnessed violent clashes between artisanal fishermen and mechanized boat owners. It is unfortunate, however, that no serious attempt has been so far made to examine the nature of recent resource crisis, economic crisis, strains and stresses to livelihoods of artisanal fishermen and social conflicts. This chapter describes the nature of ecological and economic crisis in the marine fisheries sector of Kerala with special reference to the selected study areas. In section one the nature of resource crisis in Kerala marine fisheries is highlighted. Section two details the present nature of economic crisis of various artisanal and mechanized fishing enterprises in Kerala. A summary of the chapter is portioned in third section.

5.1 Resource Degradation: Emerging Scenarios in Kerala Marine Fisheries

There is a general consensus among the academic and policy making circles that the fishery resources in Kerala have been widely fluctuating especially after the mid 1980's. The growth of major export species has been declining over these years resulting in a debate on the choice of sustainable fishing methods. By targeting mainly on export species the mechanized sector successfully excluded the artisanal counterpart from the benefits of expanding international markets. This concern has been categorically expressed by the Kalawar Committee Report which examined the impact of mechanisation of the artisanal fisheries of Kerala. The 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 percent which was higher than the fishermen growth of 4.73 percent. For the 1968 – 80 period, however, the production curve has shown a declining trend at an annual rate of 3.34 percent resulting in very poor household incomes which began to manifest in the form of general social unrest". Since the publication of this report, a number of attempts have been made by natural scientists to explore trends in fish production and to fix accountability to actors responsible for this crisis. The third Balakrishnan Nair Committee also reported that both the pelagic and demersal fisheries in Kerala were badly affected by mechanized fishing and monsoon trawl ban has positively resulted in the revival of these fisheries (Nair 1999).

5.1.1 An analysis of yield, effort and catch per unit effort in the marine fisheries off Kerala: Signs of resource degradation in the artisanal sector

To examine resource crisis, we rely mainly on the data on catch, effort and catch per unit effort (CPUE) of various fishing craft gear combinations in the artisanal and mechanised marine fisheries sectors in Kerala published by the Central Marine Fisheries Research Institute. Table 5.1 shows the trend of catch per unit effort by various artisanal craft gear combinations in Kerala. An attempt has been made to analyse the trends of these crucial variables using 3D Table-curve statistical package. These trends are shown in figures 5.1 to 5.4. Table 5.2 summarises the trend values of catch per unit effort of major artisanal craft gear combinations. The table reveals that two major artisanal craft gear combinations (Canoe + OBM + gillnet and canoe + OBM+ ring seine) show increasing trend of CPUE while the remaining two combinations (Canoe + OBM + Hook and lines and Canoe + OBM + boat seine) show declining trend during 1985-2005.

Table 5.2 Trend equations on catch per unit effort of major artisanal craft –gear combinations in Kerala

S.no	Craft and gear combinations	Equations Y= cpue t= year	Values
1	Canoe+OBM + gillnet	$Y=a+bt^{\wedge 3}$	**a= (-) 567.97 ; b=8.109e-08** $r^{\wedge 2}$= 0.173, Adj $r^{\wedge 2}$= 0.081 Std error =13.45, F stat =3.98
2	Canoe+ OBM + ring seine	Exponential (a,b,c)	**a= 564.73; b= 1.15; c= - 14.59** $r^{\wedge 2}$= 0.67, Adj $r^{\wedge 2}$= 0.60 Std error =86.96, F stat =17.29
3	Canoe+OBM + Hook and lines	$Y=a+bt^{\wedge 3}$	**a=746; b=(-) 8.53** $r^{\wedge 2}$= 0.28, Adj $r^{\wedge 2}$= 0.20 Std error =10.28, F stat =7.57
4	Canoe+OBM+ boat seine	$Y=a+bt^{\wedge 3}$	**a= 12693.83; b= (-) 1.55** $R^{\wedge 2}$= 0.64, Adj $r^{\wedge 2}$=0.60, Std error =87.91, F stat = 34.34

Table 5.3 summarises the regression results of yield on effort by various artisanal craft-gear combinations. The results also reiterate our earlier findings. See plates 5.5 to 5.9

Table 5.1 Distribution of Effort (Fishing days), Yield (Tonnes) and CPUE (kilogram) by Artisanal sector using Outboard Motors 1985-2005

Year	Gillnet			Ring seine			Hook and line			Boat seine		
	Yield	Effort	CPUE	Yield	Effort	CPUE	Yield	Effort	CPUE	Yield	Effort	CPUE
1985	23345	349000	67	na	na	na	7487	139000	54	92002	203000	453
1986	34263	467000	73	22498	29000	775	9701	105000	92	118433	329000	360
1987	21074	318000	66	31558	8000	394	7054	111000	63	48416	170000	295
1988	31166	450000	69	81886	129000	634	16803	219000	77	87800	196000	444
1989	58397	600000	97	270903	323000	838	16427	223000	73	51477	96000	536
1990	55541	560000	99	257853	250000	1031	18888	158000	119	42162	68000	620
1991	36558	453000	81	226330	278000	814	7720	109000	71	24973	53000	471
1992	28095	468500	60	196416	251100	782	11674	118100	99	18898	36800	513
1993	36755	542426	68	159772	274981	581	11288	152144	74	13075	19955	655
1994	35026	561729	62	154619	219664	703	6850	130345	52	13733	50922	270
1995	32358	598000	54	213502	191000	1118	15837	246000	64	13963	48000	291
1996	49934	785000	63	180432	234000	771	21100	306000	69	25071	72000	348
1997	48801	726000	67	163335	251000	650	17170	263000	65	19372	42000	461
1998	54031	1203354	45	171325	211472	810	22763	426304	53	9346	25512	366
1999	67492	1028034	66	234272	256370	914	24480	310311	79	5933	26345	225
2000	61000	675261	90	247943	240433	1031	17527	324488	54	5136	48661	106
2001	34886	428164	81	191877	196557	976	17502	339846	51	9510	66792	142
2002	49878	616755	81	204922	187992	1090	18461	315486	59	10264	71783	143
2003	75094	624935	120	233001	219213	1063	17569	268919	65	12578	45779	275
2004	55926	577025	97	205018	189977	1079	10348	199704	52	3764	189977	20
2005	47912	514120	93	163245	160809	1015	13648	217242	63	11506	60668	190

Source: Compiled from CMFRI various years

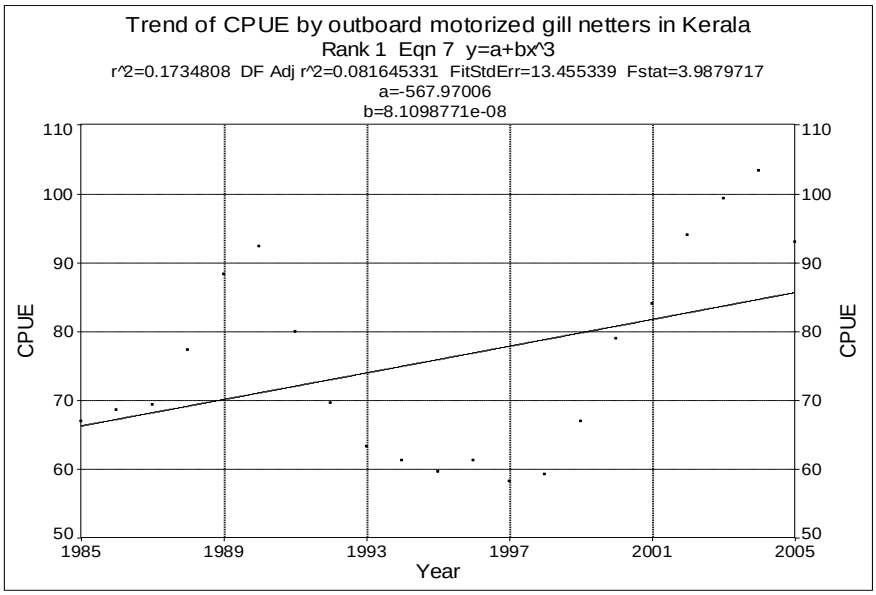
Trend of CPUE by outboard motorized gill netters in Kerala
Rank 1 Eqn 7 y=a+bx^3
r^2=0.1734808 DF Adj r^2=0.081645331 FitStdErr=13.455339 Fstat=3.9879717
a=-567.97006
b=8.1098771e-08
CPUE
Year
110
100
90
80
70
60
50
1985
1989
1993
1997
2001
2005

Fig.5.1

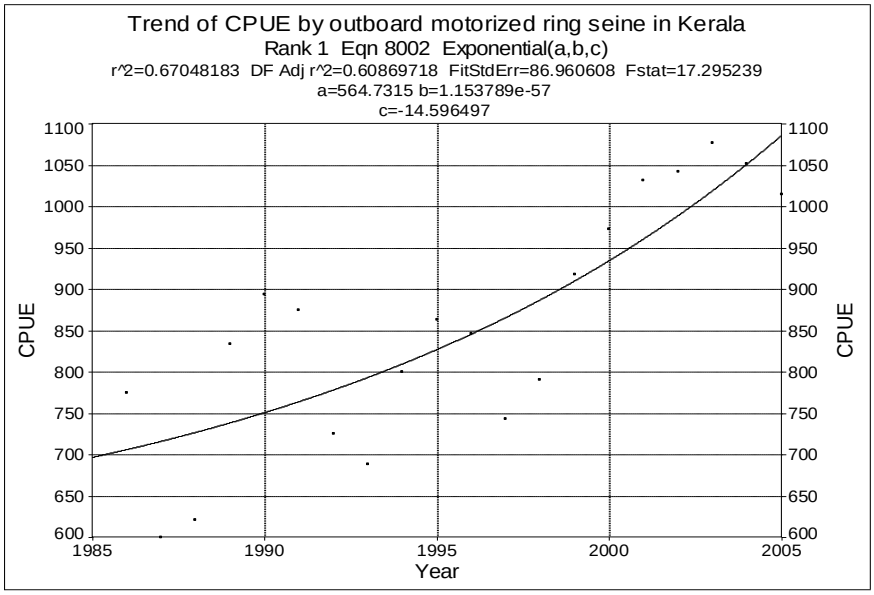
Trend of CPUE by outboard motorized ring seine in Kerala
Rank 1 Eqn 8002 Exponential(a,b,c)
r^2=0.67048183 DF Adj r^2=0.60869718 FitStdErr=86.960608 Fstat=17.295239
a=564.7315 b=1.153789e-57
c=-14.596497
CPUE
Year
1100
1050
1000
950
900
850
800
750
700
650
600
1985
1990
1995
2000
2005

Fig.5.2

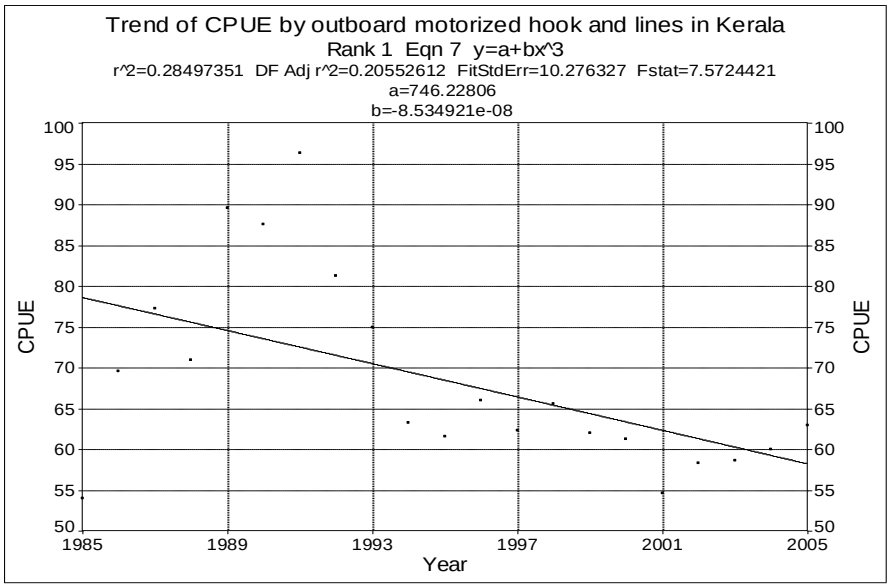
Trend of CPUE by outboard motorized hook and lines in Kerala
Rank 1 Eqn 7 y=a+bx^3
r^2=0.28497351 DF Adj r^2=0.20552612 FitStdErr=10.276327 Fstat=7.5724421
a=746.22806
b=-8.534921e-08
CPUE
Year
1985
1989
1993
1997
2001
2005

Fig.5.3

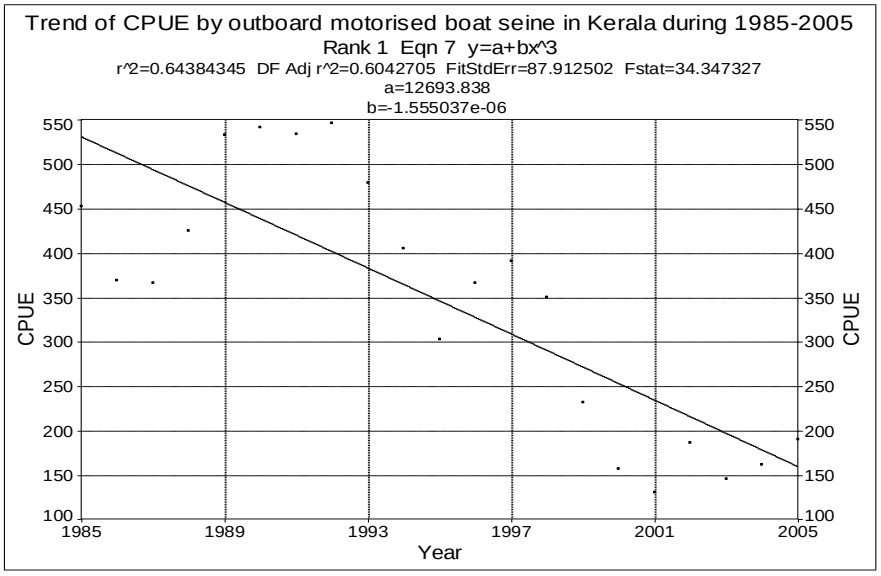
Trend of CPUE by outboard motorised boat seine in Kerala during 1985-2005
Rank 1 Eqn 7 y=a+bx^3
r^2=0.64384345 DF Adj r^2=0.6042705 FitStdErr=87.912502 Fstat=34.347327
a=12693.838
b=-1.555037e-06
CPUE
Year
1985
1989
1993
1997
2001
2005

Fig.5.4

Table 5.3 Regression of yield on effort by different artisanal craft gear combinations during 1985-2005 in Kerala

S.No	Craft and gear	Equation	values
1	Canoe + OBM + Gillnets	$Z = a + be^{\wedge(x/wx)} + c/y$	**a=53846.35, b=1.43e^{-27} c= (-)1.61e^{+10}** $r^{\wedge 2}$= 0.64, Adj $r^{\wedge 2}$= 0.58, Fit std error = 9267.87, F stat =16.39
2	Canoe + OBM + Ring seines	$Z = a + be^{\wedge(x/wx)}$cylny	**a=3892.09, b= 1.08 c=0.05** $r^{\wedge 2}$= 0.80, Adj $r^{\wedge 2}$= 0.76, Fit std error = 31851.59, F stat =34.75
3	Canoe + OBM + Hook and lines	$Z = a + be^{\wedge(x/wx)} +$ clny	**a= (-)130573.96 ; b=(-)6.91e^{-23};c= 12475.22** $r^{\wedge 2}$= 0.77, Adj $r^{\wedge 2}$= 0.73, Fit std error = 2664.19, F stat =30.35
4	Canoe + OBM + Boat seine	$Z = a + be^{\wedge(x/wx)} + ce^{\wedge(y/wy)}$	**a= (-) 17903.83; b=3.10,c= 6656.16** $r^{\wedge 2}$= 0.91, Adj $r^{\wedge 2}$= 0.89, Fit std error =9930.93, F stat =96.57

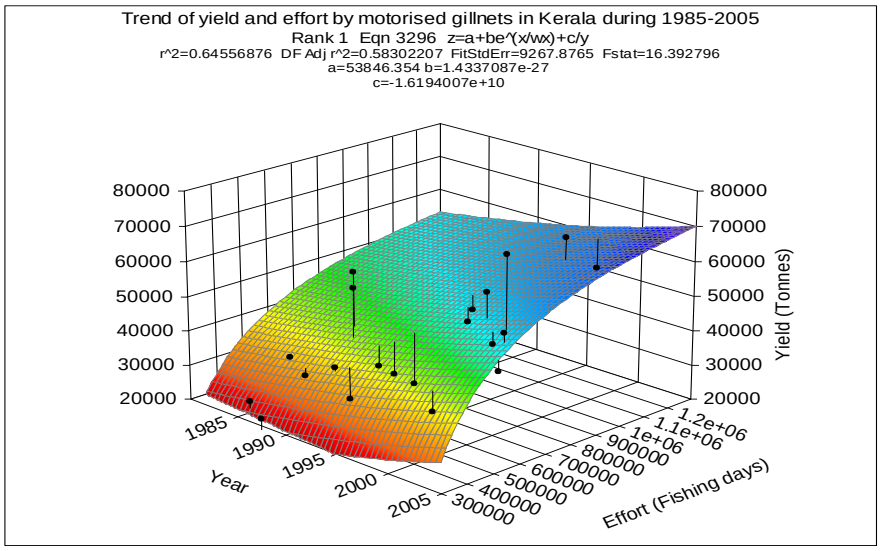

Fig.5.5

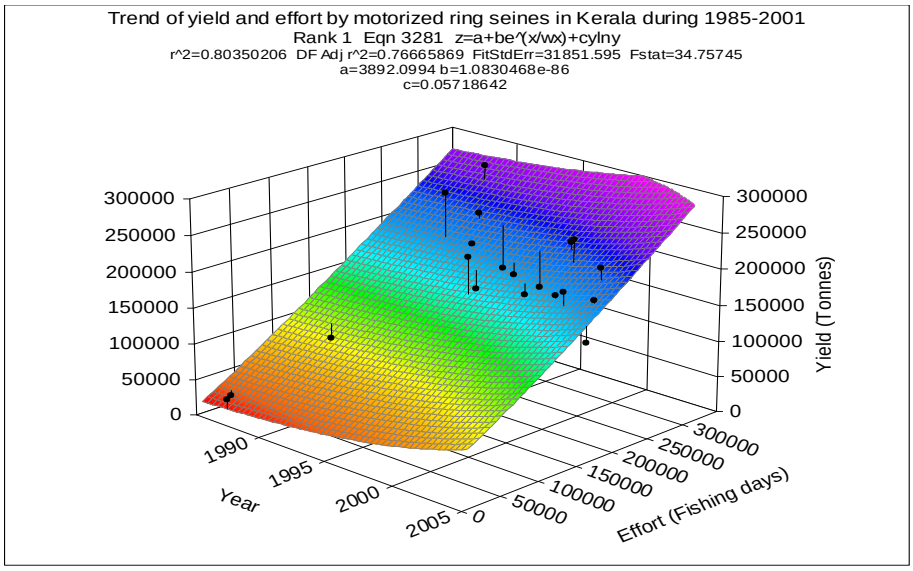
Trend of yield and effort by motorized ring seines in Kerala during 1985-2001
Rank 1 Eqn 3281 z=a+be^(x/wx)+cyIny
r^2=0.80350206 DF Adj r^2=0.76665869 FitStdErr=31851.595 Fstat=34.75745
a=3892.0994 b=1.0830468e-86
c=0.05718642
300000
250000
200000
150000
100000
50000
0
1990
1995
2000
2005
Year
0
50000
100000
150000
200000
250000
300000
Effort (Fishing days)
Yield (Tonnes)

Fig.5.6

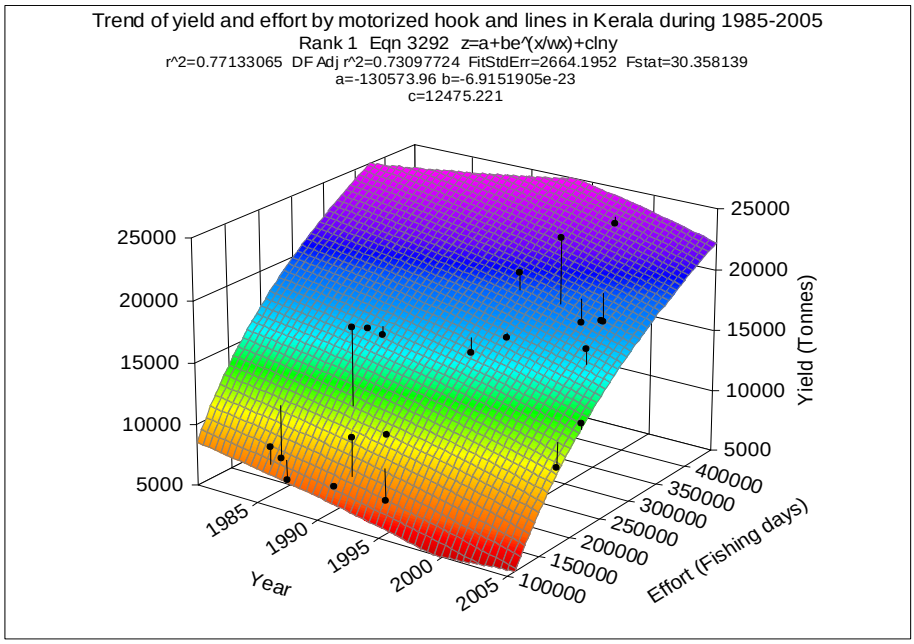
Trend of yield and effort by motorized hook and lines in Kerala during 1985-2005
Rank 1 Eqn 3292 z=a+be^(x/wx)+clny
r^2=0.77133065 DF Adj r^2=0.73097724 FitStdErr=2664.1952 Fstat=30.358139
a=-130573.96 b=-6.9151905e-23
c=12475.221
25000
20000
15000
10000
5000
1985
1990
1995
2000
2005
Year
100000
150000
200000
250000
300000
350000
400000
Effort (Fishing days)
Yield (Tonnes)

Fig.5.7

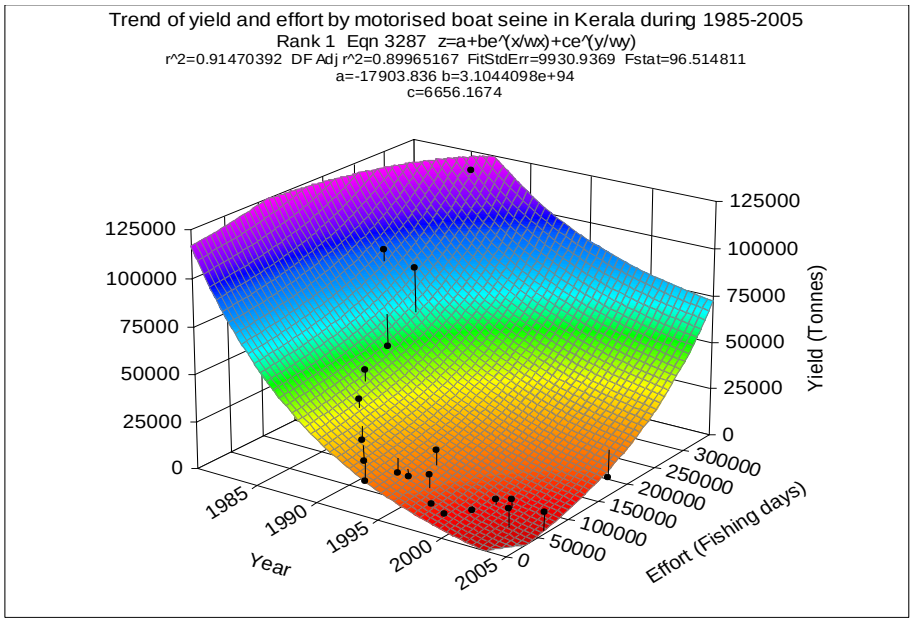

Fig.5.8

Examining the overall trends of major fishing methods in the artisanal sector indicates that two major combinations that show positive trends are mainly located along the southern coastal districts of Kerala and have been subjected to high degree of informal community based management.

5.1.2 An analysis of yield, effort and catch per unit effort in the marine fisheries off Kerala: Signs of resource degradation in the mechanized sector

Table 5.4 shows the distribution of yield, effort and catch per unit effort with respect to the major mechanised fishing methods off Kerala coast during 1980 and 2005. During the period 1980-1989, the average yield of

mechanized trawlers was 113.11 thousand tonnes which increased to 249.26 thousand tonnes during 1990-99 and further decreased to 206.28 thousand tonnes during 2000-2005. The average fishing efforts during the corresponding periods were 440.6, 572.4 and 345.1 thousand fishing days respectively. The catch per unit effort of mechanized trawlers therefore had steadily increased from 255.4 kg during 1980-1989 to 437.1 kg during 1990-1999 and to 602.3 kg during 2000-2005.

The average yield of mechanised gill netters was 9.8 thousand tonnes during 1980-89 period which declined to 1.9 thousand tonnes during 1990-99 and increased slightly to 2.7 thousand tonnes during 2000-2005. However, the effort declined steadily during these three decades (i.e. 67.6 to 11.9 and to 4.1) leading to an increase in CPUE. (142.7 kilogram in 1980, 89,173.1kilogram in 1990-99 and 714 kilogram during 2000-05).

In the case of mechanised hook and line fishing average yield increased from 0.57 thousand tonnes to 1.58 thousand tonnes and to 3.45 thousand tonnes during the periods under examination. Effort did not vary considerably during this period (declined slightly from 3.9 during 1980-89 to 3.5 thousand fishing days during 2000- 05). As a result, the CPUE increased steeply from 172.90 kilograms during 1980-89 to 417.6 Kg during 1990-99 and to 1068.7 kilograms during 2000-05.

Table 5.4 Distribution of Yield, Effort and CPUE by mechanized sector 1980-2005

Year	Mechanized trawlers			Mechanized gillnetters			Mechanized hook and line			Mechanized purse seiners		
	Yield (000's tonnes)	Effort (000's days)	CPUE (Kg.)	Yield (000's tonnes)	Effort (000's days)	CPUE (Kg.)	Yield (000's tonnes)	Effort (000's days)	CPUE (Kg.)	Yield (000's tonnes)	Effort (000's days)	CPUE (Kg.)
1980	106.06	310.00	342	9.81	68.00	144	2.43	22.00	110	16.48	5.00	3296
1981	49.31	268.00	184	6.02	50.00	120	0.05	3.00	16	17.67	9.00	1963
1982	62.32	300.00	207	11.32	80.00	141	0.05	1.00	51	11.50	9.00	1277
1983	67.91	393.00	172	15.78	87.00	181	0.11	1.00	108	14.27	7.00	2039
1984	93.84	319.00	294	14.71	88.00	167	0.30	1.00	300	20.80	7.00	2971
1985	97.04	370.00	262	12.36	84.00	147	0.06	0.30	206	11.48	5.00	2296
1986	115.51	402.00	287	9.38	70.00	134	0.25	1.30	189	4.65	2.50	1859
1987	143.91	586.00	245	5.34	45.00	118	1.01	4.00	252	0.90	1.10	822
1988	196.02	863.00	227	8.56	71.00	120	0.73	2.64	276	0.76	0.57	1333
1989	199.22	595.00	334	5.13	33.00	155	0.69	3.10	221	8.80	3.70	2932
1990	221.96	532.00	417	4.04	29.00	139	0.93	1.68	553	4.65	2.00	2324
1991	212.74	553.00	384	1.84	14.00	131	0.99	3.88	256	4.11	3.00	1369
1992	248.36	542.00	458	1.78	11.00	161	0.51	2.20	238	6.20	3.00	2065
1993	299.30	605.73	494	1.60	10.63	151	0.89	2.80	317	6.84	3.98	1718
1994	317.29	725.00	438	0.99	8.32	118	0.85	3.21	265	6.16	3.73	1645
1995	215.29	509.00	423	1.38	11.00	125	0.96	4.00	239	4.23	1.60	2643
1996	249.69	474.00	527	1.60	11.00	145	0.96	2.30	418	8.13	4.20	1936
1997	273.86	689.24	397	1.85	6.80	273	2.34	4.30	543	5.63	2.80	2010
1998	247.38	606.99	408	1.99	7.19	277	3.03	4.94	613	2.99	2.04	1471
1999	206.70	486.90	425	2.13	9.73	219	4.38	5.96	734	6.05	3.08	1966
2000	217.09	384.82	564	3.85	6.29	611	6.25	7.69	813	6.22	3.09	2013
2001	208.14	342.81	607	2.74	5.60	488	5.31	4.97	1068	5.36	2.92	1839
2002	220.56	371.18	594	2.09	3.23	646	2.58	2.53	1019	2.91	1.20	2435
2003	188.49	374.42	503	1.27	3.77	338	4.50	3.40	1325	1.24	0.56	2203
2004	226.00	311.52	725	2.89	3.02	954	0.92	0.88	1051	1.06	0.81	1305
2005	177.40	285.58	621	3.63	2.91	1247	1.40	1.23	1136	0.15	0.09	1670

Source: Compiled from CMFRI various years

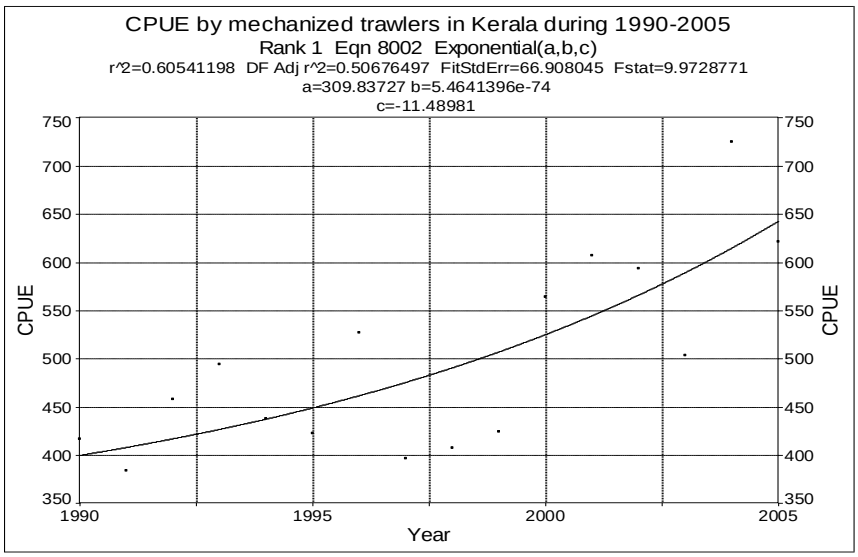

Fig.5.9

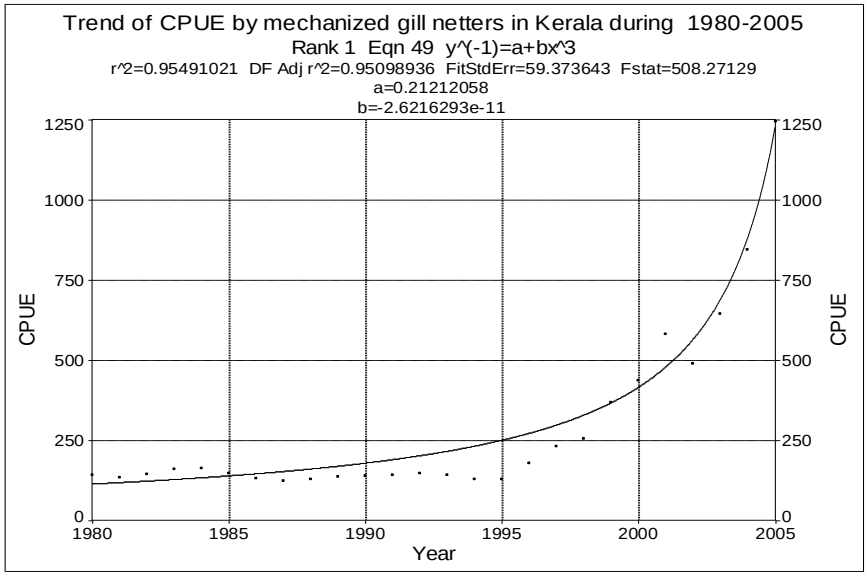

Fig.5.10

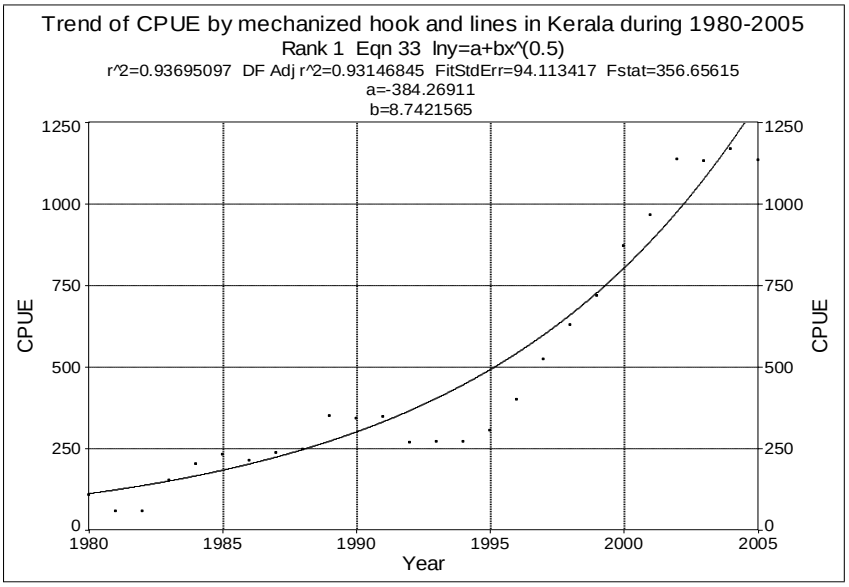

Fig.5.11

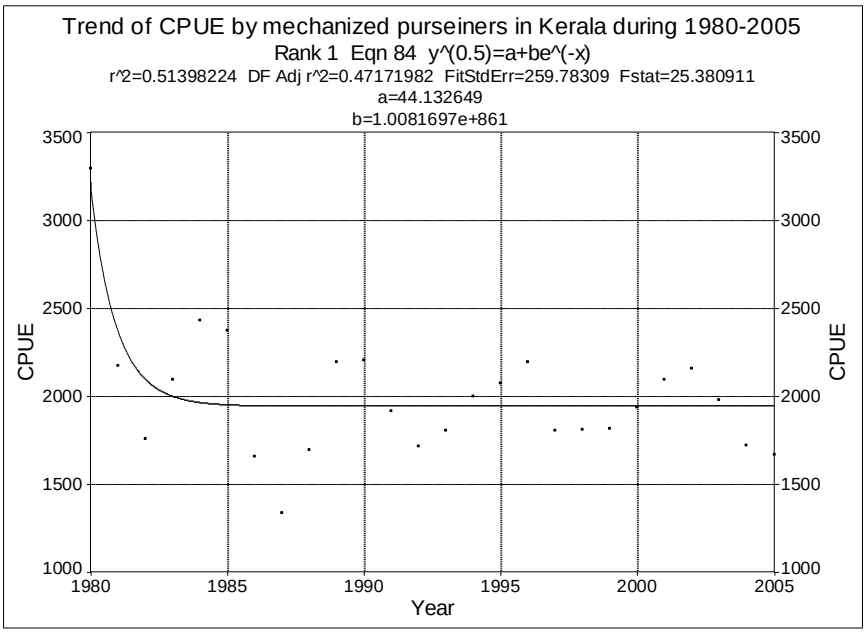

Fig.5.12

Average yield of mechanized purse seine fishery was 10.7 thousand tonnes during 1980-89, which declined to 5.5 thousand tonnes in 1990-99 and to 2.8 thousand tonnes in 2000-05. Effort reduced considerably due to the evolution of artisanal ring seine fisheries (4.99 thousand tonnes during 1980-89; 2.94 thousand tonnes during 1990-1999 and 1.44 thousand tonnes during 2000-05). The CPUE of mechanized purse seine fishery hence declined from 2078.8 kilograms in 1980-89 to 1914.70 kilograms in 1990-99 and to 1910.83 kilograms in 2000-05. These findings are further confirmed in the analysis of trend of CPUE of mechanised fishing methods in Kerala (See: Table: 5.5).

Table 5.5 Trend equations of catch per unit effort of major mechanised fishing methods in Kerala

S.No	Mechanized vessel	Equation	values
1	Trawlers	Exponential (a,b,c)	**a=309.83; b=5.46e$^{-74;}$ c= (-)11.48** $r^{\wedge 2}$= 0.60, Adj $r^{\wedge 2}$= 0.50, Fit std error = 66.90, F stat =9.97
2	Gillnetters	$y^{\wedge (-1)} = a+bx^{\wedge 3}$	**a= 0.21; b= (-) 2.62e^{-11}** $r^{\wedge 2}$= 0.95, Adj $r^{\wedge 2}$= 0.95, Fit std error = 59.37, F stat = 508.27
3	Hook and lines	$\ln y = a+bx^{\wedge (0.5)}$	**a= (-) 384.26; b= 8.74** $r^{\wedge 2}$= 0.93, Adj $r^{\wedge 2}$= 0.93, Fit std error = 94.11, F stat =356.65
4	Purse seiners	$Y^{\wedge (0.5)} = a+be^{\wedge (-x)}$	**a= 44.13; b= 1.008^{e+861}** $r^{\wedge 2}$= 0.51, Adj $r^{\wedge 2}$= 0.47, Fit std error = 259.78, F stat = 25.38

Table 5.6 summarizes the regression of yield on effort by major mechanized fishing methods during the period 1980-2005.

Table 5.6 Regression results of yield on effort by major mechanized fishing methods during the period 1980-2005

S.No	Mechanized vessel	Equation	values
1	Trawlers	$\ln z = a + b\ln^{x/x^2} + c/x^2$	**a= (-) 11050.97; b= 8.81e^{+10}; c= (-)6.25e^{+11}** r^2= 0.60, Adj r^2= 0.50, Fit std error = 66.90, F stat =9.97
2	Gillnetters	$z = a + be^{(y/wy)} + c/y^{(1.5)}$	**a= (-) 3214.95; b= 4114.29; c = 2.88e^{+08}** r^2= 0.96, Adj r^2= 0.96, Fit std error = 859.38, F stat = 324.38
3	Hook and lines	$\ln z = a + bx^3 + c\ln y$	**a= (-) 73.44; b= 9.14; c = 1.01** r^2= 0.95, Adj r^2= 0.95, Fit std error = 370.80, F stat =261.16
4	Purse seiners	$z = a + by^{(2.5)} + cy^3$	**a= 1037.70; b= 2.02^{e-05}; c=(-) 1.4e^{-07}** r^2= 0.89, Adj r^2= 0.87, Fit std error = 1884.55, F stat = 94.16

The trawl fisheries off Kerala, which increased till 2000, declined later on both in yield and effort leading to a sharp decline in catch per unit effort. Yield and effort of mechanized gill nets on the other hand declined sharply. Hook and lines increased while purse seines collapsed with the emergence of artisanal mechanized pelagic fishery. See plates 5.9 to 5.13.

It may be mentioned that while formal regulations imposed to ban monsoon trawling by the state have resulted in reduced effort, diversification into fisheries like octopus, kilimeen cuttle fish etc has also contributed to increase in CPUE (See table 4.2 for details). Therefore, a reduction in the yield indicates an evolving crisis. Mechanized gillnetters on the other hand become more mobile during this period and shifted their operations towards deeper waters in an attempt to overcome the

evolving crisis. The hook and line units also followed an appropriate migration to tide over the resource crisis.

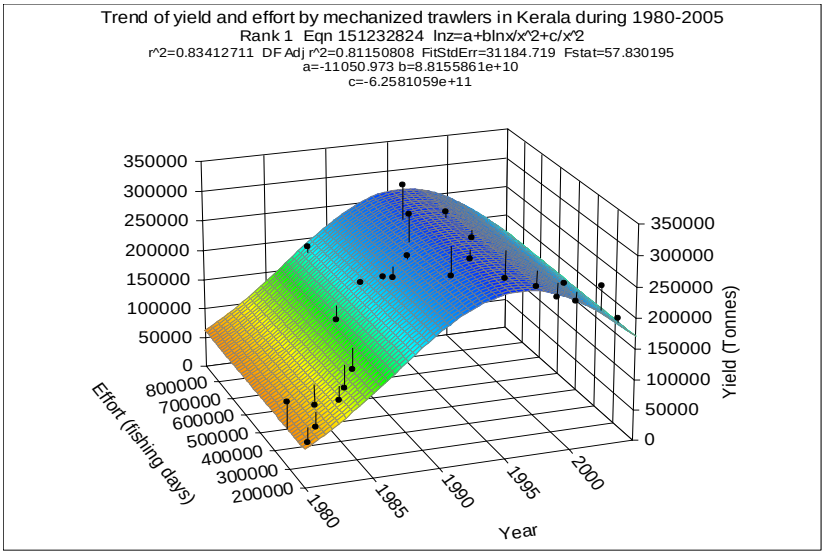

Fig.5.13

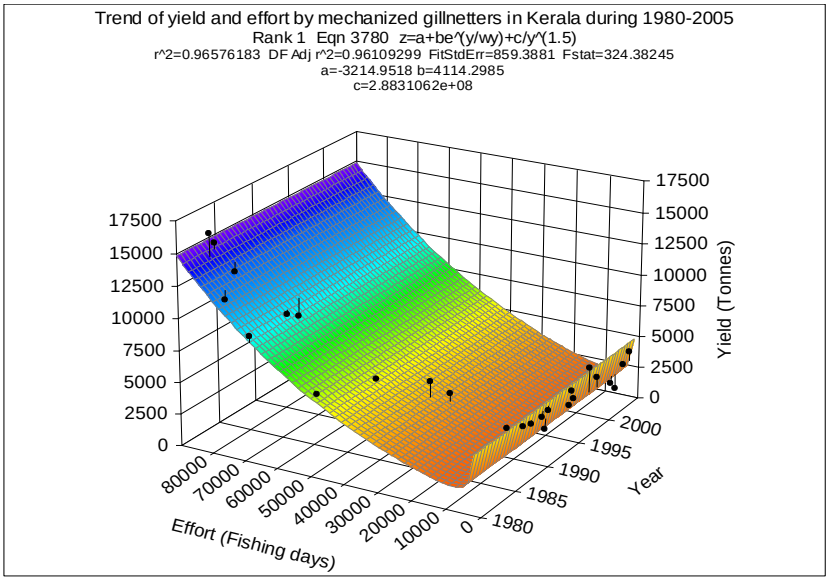

Fig.5.14

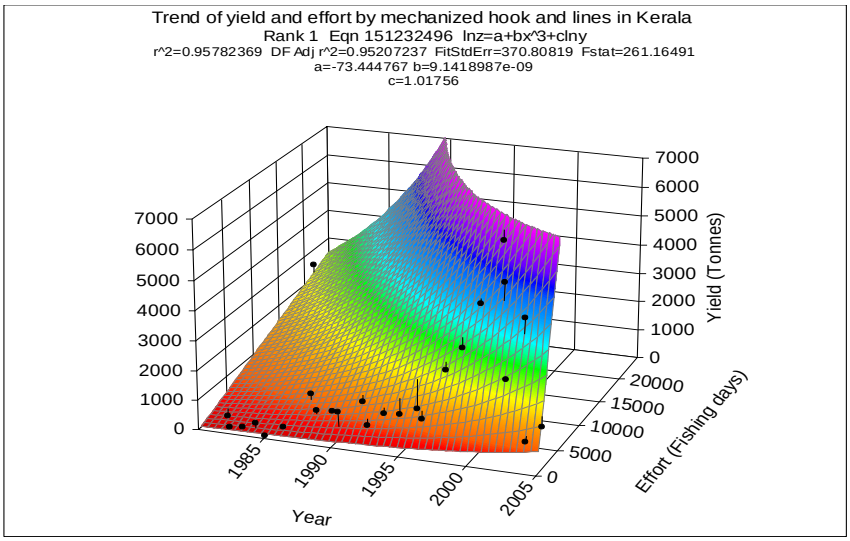

Fig.5.15

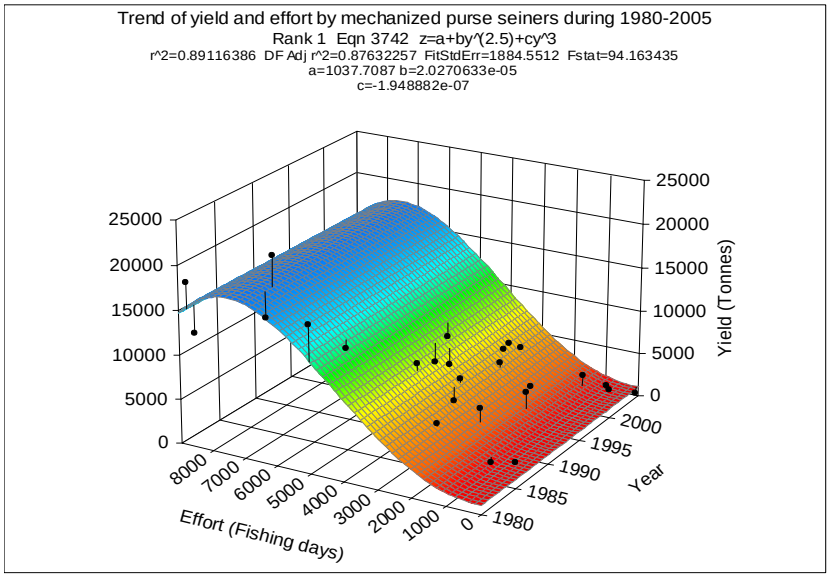

Fig.5.16

5.2 Economic crisis

Another major concern that calls for active management intervention is the declining profits of various fishing units. Economists argued that

Indian sea fishing industry of late has been experiencing severe economic crisis primarily due to reduced catch and escalation of costs. Sathiadhas (2006) pointed out that despite a reasonably good rate of growth in primary production and exports, the marine fisheries sector in India has been subjected to severe overcapitalization, reduction in capital investment in the artisanal non-mechanized sector, declining annual per capita production in the artisanal, motorized and mechanized sectors and reduction in the ownership on means of production by artisanal fishermen. Kerala fisheries have also witnessed similar tendencies. This section details the nature of economic crisis of the artisanal and mechanized fishing boats from selected sampling stations.

5.2.1 Economic analysis of artisanal non motorized and motorized fisheries

With the development of an advanced mechanized sector, only a handful of artisanal fishermen of Ernakulam district could invest on mechanized boats. Most of them were workers in mechanized boats and the remaining fishermen continued their traditional fishing practices. Table 5.7 shows the costs and earnings of two major active categories- non motorized gill net fishery and motorized ring seine fishery along the Ernakulam coast. Results indicate that non motorized gill net fisheries recorded nominal positive net profits and the motorized ring seine fisheries incurred heavy net loss of Rs. 455038/-. It may be noted that the pelagic fishery region in which non motorised and motorised fishermen normally operate has been showing a declining trend in the average catch per haul.

Table 5.7 Costs and earnings of artisanal craft gear combinations in the study area: 2005

		non motorized gill net fisheries	Motorized ring seines
Capital costs		**Rs/**	
A	Planck canoe	25000	800000
	Ring seine/ Gillnets	4500	150000
	Float and Rings	500	25000
	Rope	1500	25000
	Miscellaneous	1000	50000
	Total	**32500**	**1050000**
B	**Operational cost**		
	Diesel/ Petrol/ Kerosene	0	321333
	Oil	0	6025
	Tea	0	10042
	Ration charge	0	18075
	Bata	0	30125
	Crew share	9000	68744
	Total operational cost	**9000**	**454344**
C	**Fixed cost**		
	Depreciation		
	Planck canoe	2500	80000
	Ring seine/ Gillnets	1500	50000
	Float and Rings	100	2500
	Rope	1500	25000
	Interest	3250	105000
	Miscellaneous	100	50000
	Total Fixed cost	8950	312500
	Total Cost	17950	766844
	Returns	20000	311806
Profitability indicators			
	Gross profit	11000	-142538
	Net Profit	2050	-455038
	ROI	6.31	-43.34
	Return on fixed cost	22.91	-145.61
	Return on variable cost	22.78	-100.15
	Return on total cost	11.42	-59.34

5.2.2 Economic performance of artisanal mechanized sector

Table 5.8 shows the costs and earnings of artisanal mechanized ring seine fisheries off Ernakulam district. Results indicate that net profit declined from Rs. 40972/- in 2004-05 to Rs 1361/- in 2005-06 and further shoot up to Rs. 162438/- in 2006-07 due to the use of modern high horse power engines.

Table 5. 8 Cost and earnings of artisanal mechanized ring seine fisheries in Ernakulam, 2004-07

S.no	Variables	Year		
		2004-05	2005-06	2006-07
	Capital investment			
A	Planck canoe with engine	1800000	1800000	2250000
	Ring seine	400000	500000	600000
	Float and rings	60000	80000	120000
	Rope	40000	60000	100000
	Fish finder/wireless	0	0	75000
	Miscellaneous	100000	115000	140000
	Total capital investment	2400000	2555000	3285000
	Variable cost			
B	Diesel cost	392000.00	564000	672000
	Travel allowance	248000.00	255000	275000
	Ration allowance	142000.00	163000	190000
	Crew share	1055398	1219717	1620065
	Auction Commissions	131925	152465	202508
	Miscellaneous	60000	75000	159200
	Total operational cost	**2029323**	**2429182**	**3118773**

Table continued5.24….

	Fixed cost			
C	Depreciation on Planck canoe with engine (10%)	180000	180000	225000
	Depreciation on ring seine (33%)	132000	165000	198000
	Depreciation on float and Rings (2)	1200	1600	2400
	Depreciation on rope (20 %)	8000	12000	20000
	Depreciation on fish finder/Wireless	0	0	3750
	Depreciation on miscellaneous	5000	5750	7000
	Interest @ 8% p.a	192000	204400	262800
	Insurance	50000	50000	50000
	Total fixed cost	**568200**	**618750**	**768950**
	Total cost	**2597522.79**	**3047931.97**	**3887722.63**
	Returns	**2638495.08**	**3049293.26**	**4050161.4**
D	**Profitability Indicators**			
	Gross profit	609172.30	620111.30	931388.77
	Net profit	**40972.30**	**1361.30**	**162438.77**
	ROI	1.71	0.05	4.94
	Return on fixed cost	7.21	0.22	21.12
	Return on variable cost	2.02	0.06	5.21
	Return on total cost	1.58	0.04	4.18
	Average revenue per cruise	31041.12	23637.93	32144.14
	Net profit per cruise	482.03	10.55	1289.20

The analysis made above clearly indicates an evolving economic instability and crisis in the post mechanised fishery economy of Ernakulam. It also reconfirms that some artisanal fishermen adapt to this crisis by modernising their artisanal vessels with high power inboard engines, a process that has been successfully adopted by the fishermen of Ernakulam.

5.2.3 Economic analysis of mechanized fish production systems

We have already indicated that the fisheries sector in Kerala has been undergoing a phase of transformation due to technological intensifications, diversifications and growth of international markets. The mechanized sector has been complaining that profits from fishing have declined considerably in recent years particularly due to high input costs and the failure of the state to monitor and regulate the activities of foreign fleets and joint ventures. In order to verify this concern we made an attempt to estimate the costs and earnings of different classes of mechanized boats operating off Ernakulam district and found that there are signs of economic overfishing in this sector.

5.2.3.1 Economic viability of mechanized trawlers in Cochin fisheries

Table 5.9 summarises the costs and earnings analysis of different class of mechanised trawlers operating off Ernakulam district during the study period. The table reveals that all the class of vessels studied showed economic losses. Net loss per cruise of mechanised trawlers below 40′ was Rs. 6568/-. Vessels (40′-45′), (46′-50′) and (51′-55′) incurred a loss of Rs. 9,367/-, 14,637 and Rs. 9618 respectively.

Table 5.9 Costs and earnings of selected class of mechanized trawlers in Cochin.

			Below 40'	40 -45'	46-50'	51 – 55'
A	Initial investment	Craft	900000	1650000	1725000	1850000
		Gear	45000	70000	85000	90000
	Total		945000	1720000	1810000	1940000
B	Total Returns (Rs)		618025	2094132	2565030	2839511
C	Number of fishing expeditions		32	41	31	45
D	Operational expenses (Rs)	Fuel*	488320.3	1410780	1684014	1449991
		Percent	**79.01**	**67.37**	**65.65**	**51.06**
		Crew share	68519	224826	287497	410985
		Auction charges	4796.33	146589	256503	168343
		Bata	25600	205000	215000	225000
		Repair and maintenance	18000	75000	116000	125000
		Food allowance, and others	27200	61500	85000	90000
	Total operational cost		**632436**	**2123695**	**2644014**	**2469319**
		percent	**102.33**	**101.41**	**103.08**	**86.96**
E	Depreciation	Craft (10%)	90000	165000	172500	185000
		Gear (25%)	11250	17500	21250	22500
		Interest (10%)	94500	172000	181000	194000
		Total fixed costs	195750	354500	374750	401500
F	Total cost (D+E) (Rs)		828186	2478195	3018764	2870819

Table 5.25 continue….

	Percent	**134.01**	**118.34**	**117.69**	**101.10**
G	Gross profits (B-D) (Rs)	-14411	-29563	-78984	-31308
H	Net profits (G-F) (Rs)	**-210161**	**-384063**	**-453734**	**-432808**
I	Rate of return	-22.24	-22.33	-25.07	-22.31
	Return on investment	-22.23	-22.32	-25.06	-22.30
	Return on fixed cost	-107.36	-108.33	-121.07	-107.79
	Return on variable cost	-33.23	-18.08	-17.16	-17.52
	Return on total cost	-25.37	-15.49	-15.03	-15.07
	Net profit per cruise	**-6567.53**	**-9367.39**	**-14636.6**	**-9617.96**

Source: Primary survey 2004 -05

5.2.3.2 Economic viability of mechanized Purse seiners in Cochin

Table 5.10 shows data on costs and returns of purse-seine boats for two periods, 1998-99 and 2004-05. During 1998-99, purse-seines operating off Cochin were making positive profits and by 2004-05, their operations became non viable. The major reason for this scenario is the steep rise in operational costs, mainly due to the rise in diesel prices. The proportion of fuel costs of 13 percent in 1998-99 has increased to 36 percent in 2004-05. Apart from escalating fuel prices, the purse-seine sector has faced tough competition from the newly evolved mechanized artisanal ring seine sector. Competition for the same production more or less in same fishing territories by these competing vessels declined their catch rates and returns form fishing. See table 5.10 for details.

Table 5.10 Cost and Earnings of purse-seine boats in 2004-05

			2004 – 05
A	Investment	Craft	1850000
		Gear	1650000
	Total		3500000
B	Catch Value (Rs)		2404901
C	Number of fishing expeditions		38
D	Operational expenses	Fuel	870389
		Percentage	**36.19**
		Crew share	597913
		Auction charges	168343.1
		Bata	60800
		Repair and maintenance	180000
		Food allowance	57000
	Total operational expenses		1934445
		Percentage	**80.44**
E	Depreciation	Craft(10%)	185000
		Gear (25%)	412500
		Interest (10%)	350000
		Total fixed costs	947500
F	Total cost (D+E) Rs		2881945
		Percentage	**119.84**
G	Gross returns (B - D) (Rs)		470455.9
H	Net returns (G- F) (Rs)		-477044
I	Rate of return		-13.6298

5.2.3.3 Economic viability of mechanized gill netters in Cochin fisheries

Table 5.11 shows the costs and earnings of mechanized gill nets operating off Ernakulam. In this case too, the operational costs as a proportion to revenue have spiralled up during 1998-99 and 2004-05. Escalation in fuel prices, scarcity of fishes increase in searching time etc are all responsible for the escalation input costs of mechanized gill net

operations. In other words, the study confirms that mechanised fishing industry has been experiencing serious economic problems due to escalation of input prices, scarcity of sufficient raw materials to harvest, lack of remunerative prices for landings, increase in searching time and tough competitions from the mechanised artisanal sector.

Table 5.11 Cost and Earnings of mechanized gill-netters, 2004-05

			2004 - 2005
A	Initial investment	Craft	1650000
		Gear	139285
	Total		**1789285**
B	**Returns (Rs)**		**40285.71**
C	Average days cruise		9
D	Operational expenses (Rs)	Fuel	31189.3
		percentage	**77.42**
		Crew share	16114.28
		Auction charges	2820.00
		Bata	2928.57
		Repair and maintenance	4000
		Food allowance, and others	2928.57
		Ice, water, toll etc	10012
		Total operational cost	**38803.42**
		percentage	**96.32**
E	Depreciation on fixed costs	Craft (10%)	13860
		Gear (25%)	3899.98
		Interest (10%)	15029.99
		Total depreciation	**32789.97**
F	Total cost (D+E) (Rs)		71593.40
	percentage		**177.71**
G	Gross returns (B-D) (Rs)		-18682.29
H	Net returns (G-F) (Rs)		-31307.68
I	Rate of return		-3.58

5.4 Summary and conclusions

Resource degradation is one of the prime issues in marine fisheries in Kerala. To highlight the present nature of resource crisis/degradation, a detailed analysis of trends on yield, effort and catch per unit effort in the artisanal and mechanized sectors of Kerala was undertaken in this chapter. The analysis confirmed fluctuations, variability and declining catch per unit effort in various artisanal and mechanized craft gear combinations.

Economic efficiency analysis, (cost and earnings) shows that artisanal non-motorized gillnets fisheries are profitable while motorized ring seine fisheries show heavy loss. Mechanized artisanal marine fisheries show wide fluctuation during 2004-05 and 2006 to 2007. Cost and earnings analysis of mechanized fish production systems shows that mechanized trawlers, purse seines and gillnetters in Ernakulam shows heavy loss. In the chapters that follow, we will discuss how various communities overcome these crises through proper management of resources.

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Chapter 6

Community Based Management of Marine Fisheries in Kasaragod District

The demand for scientific fisheries management asserted by fishing communities and modern fishing enterprises before various policy making forums has not been adequately conceded by the state for its own reasons. Although state has taken over fisheries administration, community based fisheries management persists in many countries, especially in regions where State's authority is weak (Townsend, 1995; Townsend, et.al.,2008; Berkes, 1986; Gray, 2005; Kurien, 2003). As a result, a variety of localized communitarian management regimes persist even today in many parts of the world. Kerala state is not an exception to this global phenomenon. Intensive case studies on community based fisheries management confirmed that community organisations could regulate members' access to various fishing grounds, synchronize multiple gear operations and resolve fishing conflicts even today in spite of the competition from state sponsored top-down management systems (Thomson and Gray, 2009; Bennett et.al., 2001; Charles, 1992). State bureaucracy, most often, disparaged community organisations and their contributions to fisheries governance. Apart from these internal management challenges, transnational developments and the subsequent spatial restructuration within coastal communities have also challenged the smooth functioning of these systems (Thomson, 2011). Amidst these challenges, community-based governance systems survive and continue

to supplement fisheries governance (Paul, 2005). In regions where state's authority is strong, community based management regimes are either weakened or forced to keep a low profile. The practice of fisheries management hence has taken diverse trajectories depending on the interactions between the state and local fisher communities. In other words, the practices of effective fisheries management had been the product of an interactive action between local community organizations and the state.

Viewing fisheries management in such perspective, we could observe that traditional (informal) and formal institutions coexist and interact in marine fisheries management in Kerala. The *Kadakkodi* system of fisheries management in the northern coastal district of Kerala is a classic example of how communities manage their coastal fishery resources even today with the help of communitarian institutions (Baiju, 2011). Kadakkodi is essentially a village court crafted by the artisanal fishing communities of Kasaragod district for the management of marine fisheries[1] (Paul, 2005; Kurien, 2000; Ramachandran, 2004). It is the living example of an active community based fisheries management system that endured decades of state interventions and intensive mechanization. Kadakkodi expounds management goals after making careful examination of both the ecological and socio-economic inter-relationships. These institutions perform both legislative and executive functions of governance. They enact rules and regulations to carry out fishing operations effectively and enforce them carefully to ensure a fair distribution of benefits to various sections of resource users. They regulate access to resources, protect

[1] The word *Kadakokodi* is derived from two Malayalam words kadal (sea) and kodathy (court). It is rooted in the culture and belief systems and the attitude towards social, economic and ecological perceptions of fishermen.

livelihoods and mediate social conflicts. The purpose of this chapter is to examine the contemporary practices of marine fisheries management in the Kasaragod district of Kerala. The chapter is divided into four sections. Section 1 introduces the location and ecological setting of the study region and villages. Section 2 provides a detailed description of the social organization of coastal fisheries in the district. Section 3 presents the structure and functions of community based marine fisheries management practices in the region. In section four, summary and conclusions are depicted.

6.1 Location of study area and ecological setting of villages

Kasaragod district lies at the extreme northern end of Kerala state and shares boundary with Karnataka state. The shore length of this coastal district is 45 kilometres and is divided into sixteen marine fishing villages[2]. Marine fisheries have been the traditional enterprise of artisanal fishermen of Kasaragod district since time immemorial. Fishing has been carried out using medium type plank-built canoes and ring seines during June to November followed by small plank-built canoes with gill nets during the rest of the year. Catches are landed on the shore of respective villages, including two recently constructed fishing harbours, Cheruvathoor and Thaikadappuram. There are fifteen beach-landing centres for artisanal fishing. Four fishing villages- Kasba beach, Keezhoor, Kottikulam, and Bekkal - were selected for detailed investigation and analysis (See the location map.)

[2] Ajanur, Hosdurg, Kadangode, Kottikulam, Padannakadappuram, Pallikkara, Poonjakadappuram, Thaikadappuram, Thrikkarippur Kadappuram, and Valiaparamba in Hosdurg taluk, Kalanad, (Keeshoor), Kasba beach (Kasaragodu beach), Kavungoli Koyipady and Shriya in Kasaragodu taluk and Bangara in Manajeswar taluk.

The primary data used in this study were collected in 2009-10 in two phases. During the first phase, baseline data on the physical, ecological social and economic characteristics of the study villages and communities were generated. This was followed by a second phase of information gathering on various issues related to the institutional, and governance issues of artisanal marine fisheries management in the region. The study used participatory approaches and methodologies including case studies and in–depth interviews. Persons of 3 artisanal fishing vessels with outboard engine from each of the selected villages were interviewed to document the operations of marine fisheries of this region. Organisational level interviews included political parties, trade unions and officials and members of the traditional management institution, Kadakkodi.

6.2 Social organization of marine fisheries

The total number of fishing households in Kasaragod district is 4777 and the population is 33866, spatially spread along the 16 coastal villages (GOI, 2005: pp: 8-11). From these, only Kottikulam, Bekkal, Keezhoor and Kasaragod Kadakkodis are selected for detailed study. Kottikulam has 275 fishing households with a population of 2098; Bekkal has 440 households with 3516 people; Keezhoor has 325 households and 2352 people and Kasaragod beach has 675 households and 5279 members. Except a few Muslim households in Keezoor, majority of fishers in Kasaragod district are Arayas. The active fishing population in Kottikulam Bekkal Keezhoor and Kasaragod beach were respectively 67,21,017 and 47,81,077 (GOI,2005:pp:61).

Table 6.1 Distribution of fishermen population in Kasaragodu districts

Village	Hosdurg Taluk									
	Households	Adults			Children			Population		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
Ajanur	275	678	725	1403	230	250	480	908	975	1883
Hosdurg	200	462	503	965	166	126	292	628	629	1257
Kadangode	234	489	494	983	144	115	259	633	609	1242
Kottikulam	275	788	786	1574	274	250	524	1062	1036	2098
Padannakadappuram	316	817	763	1580	235	224	459	1052	987	2039
Pallikkara	440	1320	1313	2633	460	423	883	1780	1736	3518
Poonjakadappuram	300	716	773	1489	186	229	415	902	1002	1904
Thaikadappuram	219	446	536	982	145	146	291	591	682	1273
Trikaripur Kadappuram	128	345	331	676	75	88	163	420	419	839
Valiaparamba	169	353	344	697	86	68	154	439	412	851
Sub total	2556	6414	6568	12982	2001	1919	3920	8415	8487	16904
Kasargod										
Bangara-Manjeswar	408	874	861	1735	703	648	1351	1577	1509	3086
Kizhoor	325	805	852	1657	353	342	695	1158	1194	2352
Kasba Beach	675	1756	1897	3653	836	790	1626	2592	2687	5279
Kavungoli	132	349	404	753	119	117	236	468	521	989
Koyipady	375	978	1067	2045	649	635	1284	1627	1702	3329
Shriya	306	658	719	1377	285	267	552	943	986	1929
Sub total	2221	5420	5800	11220	2945	2799	5744	8365	8599	16964
Grand Total	**4777**	**11834**	**12368**	**24202**	**4946**	**4718**	**9664**	**16780**	**17086**	**33868**

Source: GOI (2005)

The sea bed of fishing grounds off Kasaragod where artisanal fishermen fish is rocky and offer the most productive breeding habitats for marine fishes. Marine fisheries off Kasaragod are predominantly (95 percent) pelagic followed by demersal fisheries. The coast is also known for the occurrence of "*chakara*" during the monsoon months which brings good fortunes to the local communities.

Motorisation, introduced during mid eighties improved efficiency of fishing and fishermen in the district today practice motorized fishing using medium plank-canoes with medium ring seines and gillnets. Inspite of the high cost of the outboard engines and other inputs, motorized fishery is the most predominant fishery in Kasaragod now. A few fishermen have also invested on mechanized inboard engines and large ring seines. The district does not have modern fishing harbors, which acts as the basic constraint especially to the operations of mechanized trawlers. Table 6.2 provides a summary of various fishing methods used in the region.

Table 6.1 Craft, gear combinations and fishing calendar

Craft-Gear combinations	Bekkal	Kottikulam	Keezhoor	Kasaragod	Operating month and Major fishes
Artisanal motorised fisheries					
Paith fishing (4 Canoes + Ring seine	12	8	3	16	June – November Sardine, Mackerel, Prawns
Medium canoe + mid-water gill nets	160	80	102	260	October – June Mackerel,Sardines, Pomfrets
Fiber Canoe + Gill/Drift net\Kanathavala)	20	Nil	60	2	October – June Seerfishes, Whitefish, Vallia sravu
Large Canoe + Hook and line	6	Nil	Nil	4	November – June Sharks, Rays
Artisanal mechanized fisheries					
Artisanal fishing vessel with inboard engine + Large ring seine	Nil	2	Nil	Nil	All time Sardines, Mackerel, Prawns
Mechanized fisheries					
Mechanized Trawler + Trawl net	4	6	Nil	25	November – June Prawns, Crustaceans

The major fishery in the region, locally known as *"paith",* is conducted using a small purse-seine called '*raani vala'* with the active cooperation and collective action of four canoes and 40 workers. High value species of shrimp (like karikadi chemmen, poovalan, kaan chemmeen chitta chemmeen, Naran etc) are caught during June and August. Gill net

fishing is undertaken during October and June. Artisanal mechanized fishery using inbuilt engines is popular in Kottikulam. The mechanized trawler fishery begins in November and phases out in June.

6.3 Structure and functions of *Kadakkodi*

This section provides a detailed account of the structural features of Kadakkodi, especially its transformation from a caste organisation to a democratically guided management institution. The section then details how the organization prioritizes management concerns and resolves them to the satisfaction of local communities.

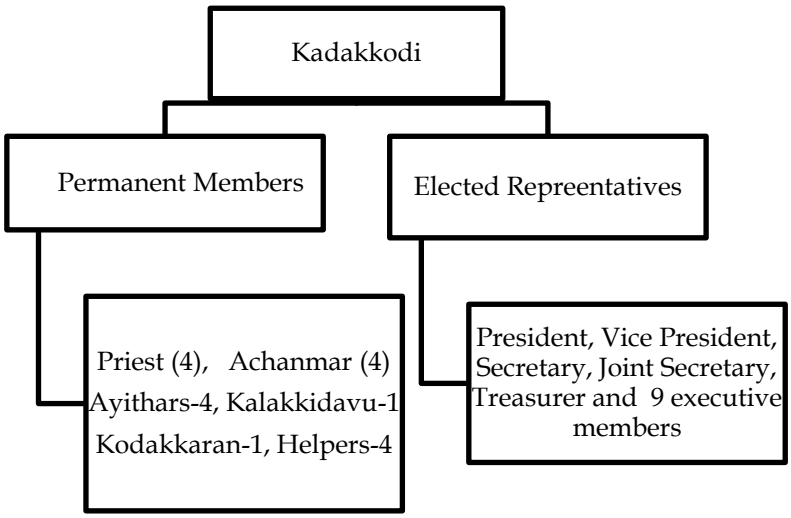
6.3.1 Organisational structure of *Kadakkodi*

Evolved originally as a cast organisation, Kadakkodi primarily carried out socio-religious services for local fishing communities. Elders recalled that the organisation was controlled by the Priests in the past. At the top of the hierarchy, there were four chief priests (karanavanmar) who represented four sub castes. They were assisted by four junior priests (Achanmars) representing Goddess, four oracles (ayathars), an assistant (kodakkaran), one messenger (kalakkidavu), one light carrier (Anthithiriyan) and fourteen helpers acting as enforcement staff.

After independence and particularly during the early seventies, Kadakkodi system has undergone some crucial structural changes. During this period, the authoritarian structure of the traditional Kadakkodi got refined by including elected members from member communities for better governance and delivery of services. Although the Priest continued to act as the chief of the organisation, the

management of fisheries was supervised by an elected body of local leaders. Since the priests experienced difficulty to manage resources, they slowly withdrew from attending the mundane management problems during early seventies and their powers got shared by elected representatives from various fishing groups. Apart from the religious leaders the present system of Kadakkodi includes President, Secretary, Vice-president, joint Secretary, treasurer and nine executive members, who are all elected in the general body meeting. The present hierarchical structure of Kadakkodis is shown in chart. 6.1

Figure 6.1 Structure of Kadakkodi



It may be mentioned that Kadakkodi has always been a male centric organisation. Although executive committee members of Kadakkodi are members in various political parties like Communist Party of India (Marxist), Indian National Congress and the Bharatiya Janatha Party/RSS, they do not impose their political ideologies and decisions on

the Kadakkodi. The present structure demonstrates how local fishing communities democratically reformed their traditional management system by fusing socio-cultural and economic objectives of management. These modifications and reforms brought in transparency, accountability and reliability in fisheries governance.

Sea court, as an indigenous authority, integrates the legislative, judicial and executive functions of fisheries governance. On receipt of notice from individual fishermen, the executive committee summons Kadakodi in front of the Sree Kurumba temple to discuss and resolve the major management concerns raised. Apart from temple officials, Kadakkodi officials and the public could also participate in the proceedings of the court and argue in support or against complainant. After hearing different arguments, the temple officials and Kadakkodi officials discuss the issues collectively and judgment is delivered by the eldest Karanavar of the temple. All actors accepted verdicts of the village court although they could approach formal courts for justice in case not satisfied. Kadakkodi rules are crafted on the basis of detailed discussions on the merits of various issues raised by resource users. Since crafting of rules, monitoring and enforcement were pretty rigorous and continuous, the chances of violations were remote. The system is highly transparent and accountable to the members. People brought fishing disputes and other issues to the Kadakkodi and sought solutions. Kadakkodi is also convened to discuss and finalise crafting of appropriate institutions for fisheries management.

6.3.2 Management functions of Kadakkodi

For the traditional communities in Kasaragod district, fisheries management has been a self-governing assignment aimed to protect common property resources and livelihoods; for which they craft diverse sets of institutions, monitor compliance and if necessary enforce them and impose sanctions against their own members. These tasks are accomplished through mutual consultations and negotiations and also by resolving conflicts in the sharing of fishing grounds/territories between neighboring communities. We shall now examine how these tasks are performed by the management authority.

a. Crafting Kadakkodi institutions for marine fisheries regulations

Fishing communities of this region treated coastal fishery as common property resource and individual members of all four villages would access resources according to the access rules crafted from time to time. Fishermen from other fishing villages within Kasaragod district are also permitted to land their crafts and catches on these village shores while fishermen from other districts do not have permission to land their catches. Table 6.3 summarizes some of the major operational rules crafted by local Kadakkodis.

Table 6.3 Major operational rules of Kadakkodi

Operational rules: Member and access rules
a. Fishing grounds/territories off the coast of Kasaragod district are the common property and members belonging any one of the six Kadakkodis' in the district have access to these territories.
b. Every fishing household has to take membership in the respective village Kadakkodi and renew it every year. This membership guarantees access to fishing territories.
c. Fishing units have to pay two percent commission to the Kadakkodi for its activities and services.
d. Although fishermen could freely choose to work in any fishing unit, those who borrowed money from a boat owner should work only in that fishing unit. He could change fishing unit only after reimbursing the loan.
e. Recognition of rights of external agents: prepare and finalise fishing calendar for community.
Operational rules: Appropriation, withdrawal and provision rules
a. The major pelagic fishery called paithu fishery has been allowed to operate medium size plank canoes and a medium size ring seine between 6 am and 4 pm during June and November.
b. No other fishing methods would be allowed during monsoon season.
c. Fishing using small/medium plank-built canoes and mid water gillnets could fish after mid September.
d. Mechanized trawlers could begin fishing by the last week of November and continue operations till the commencement of monsoon.
e. Mono filament gill net is banned and users would be heavily fined.
f. Local fishermen who borrowed money from merchants and intermediaries should sell catches only through them.

Tables 6.4 and 6.5 presents the monitoring and sanctioning rules and collective choice rules respectively.

Table 6.4 Major monitoring and sanctioning rules

Monitoring and sanctioning rules
Each Kadakkodi is responsible for upholding laws within the community. *a) Fishing has been prohibited during the local temple festival, death of a fishermen, on the day of the general body of the sea court, or any auspicious day as decided by the temple committee.* *b) Night fishing between 10 pm to 6 am is banned during Chakara season and during natural calamities like depression or Tsunami.* *c) If an individual Kadakkodi violates common rules, severe penalties are imposed.*

Table 6.5 List of collective choice rules prevailing at present

Collective choice rules
a) The Kadakkodi assures the livelihoods, security and social life of community members. *b) Fishing conflicts among individual members are resolved by the Kadakkodi.* *c) Conflicts involving members of different Kadakkodis are settled by the collective action of all the concerned Kadakkodis through participatory meetings and discussions.* *d) The fishing calendar and Kadakkodi rules could only be changed in the general body meeting.* *e) Members could appeal to the formal judicial process in case they do not accept the decisions of the Kadakkodi.* *f) General body meeting of Kadakkodi should be conducted once in an year* *g) The general body would elect the executive body and office bearers through democratic process.* *h) Approval of the general body to the income and expenditure statement should be obtained once in three years.*

The system of rules listed above provides the informal legal framework for communities to regulate diverse array of fishing methods/ technologies and access to common property fisheries and to sustain livelihoods

b. Regulating access to local fishing territories/fishing grounds

As already mentioned the primary function of the Kadakkodi is to regulate various fishing methods, a task it executes on a daily basis. During monsoon months, fishing becomes difficult in this region and many fishermen between Kasaragod and Kanjagad seek permission to Bekkal Kadakkodi to use its shore for 'paithu' fishing. Permissions are usually granted to migrant fishermen from nearby villages under the supervision of Bekkal Kadakkodi. Special rules are drawn to regulate access to outsiders. According to these rules, fishing operations should commence early morning at six 'o' clock and terminate at four 'o' clock in the evening. Kasaragod fishermen who reach early to commence fishing operations before the stipulated time were blocked by Bekkal fishermen. This resulted in physical violence between the local fishermen and migrants. A combined meeting of the Kadakkodis was convened and it was resolved that all immigrants should abide by the rules of Bekkal Kadakkodi while using its shore.

c. The defender of common property and protector of livelihoods

Keeping fishing grounds/territories as common property has always been a challenge to local Kadakkodis, especially in a fast globalizing economy. Various groups exert frequent pressure to expedite the process

of privatization. Such tendencies and conflicts are sorted out by Kadakkodis through negotiations and consultations. The following incidents are recorded during the survey period

The conflict occurred between Kottikulam Kadakkodi and the rest of the Kadakkodis over the issue of leasing of fishing grounds to traders is worth mentioning. Since the rocky sea beds in front of Kotikulam village offered productive habitats for crab, oyster and molluscan fisheries, local fishermen were fishing in these grounds immediately after the "paithu" season. In 2002, however, Kottikulam Kadakkodi leased out these rocky territories known as Pandyan Kallu for 10000 rupees to a Muslim trader from Kanhagad who engaged outsiders to harvest these fishing grounds. Other Kadakkodis prevented the lessee's molluscan collection near Pandyan Rock and evicted him from these grounds without giving any compensation. These Kadakkodis together warned Kottikkulam Kadakkodi that the later has no exclusive right to lease out fishing territories to outsiders as these grounds are the common property of all member Kadakkodis. Realizing the risks of such transfers on local livelihoods, Kottikulam Kadakkodi decided to terminate the contract and evicted the lessee from this area.

The role played by Kadakkodis to evict migrant fishermen from Trivandrum and Kanyakumai districts who fished in the fishing grounds off Kasaragod coast has reaffirmed their commitments to defend common property resources and community livelihoods.

By the 1980's Kasaragod district witnessed a slow but steady inflow of migrant fishermen from southern districts of Kerala in anticipation of higher catches and better returns. These groups were initially brought in by the Muslim traders who charged higher commission. Immigrants were fishing near Palikkara coast of Bekal kadakodi targeting species not caught by local fishermen using fishing methods- hook and lines- not used by the locals. Migrants fished in local waters till early 2000 without much local resistance. During this period the migrants purchased four to five acres of coastal land/sea shore from the Muslim community. Twenty immigrant families settled in this area and also procured ration cards. The elders reported that the migrant settlement expanded slowly and in 2000 there were 750 fishing households and five thousand migrant fishermen in pallikkara region. They even built a Christian church in an attempt to consolidate their social and economic power in the local village.

Gradually, migrants started targeting pelagic stocks using modern gill nets. As pelagic fisheries were the major source of livelihood of local fishermen, the latter opposed the operations of migrants which resulted in physical violence and damage to fishing assets. Following this communal violence, district authorities called a meeting to resolve the crisis. Office bearers of Bekal, Kottikulam, Keezhoor and Kasaragod Kadakkodis, temple priests, fish merchants, and Christian priests from Trivandrum attended peace talks. The meeting decided that all the migrant fishermen should vacate the shore in a phased manner. Following this ruling, all the migrants, except, twenty migrant fishing households, vacated the shore.

Another instance aimed to secure livelihoods relates to the intervention made by the Kottikulam Kadakkodi in the realm of micro credits.

Most of the Kadakkodis in Kasaragod district used to disburse micro credits to local fishermen on liberal conditions. This was organized using funds collected by the Kadakkodis from members and was intended to support the livelihoods of people. Although, most of the beneficiaries repay loans in time, very few cases of non repayment were also reported. Once such incidents occur, the concerned Kadakkodi committee intervenes and make arrangements to collect money. In one such incident of a loan of Rs. 20000 to a leading fishing group in Kottikulam village in 2004, the committee banned the operations of the fishing boat when the team failed to make prompt repayments. Since the borrower refused to repay the loan, the committee confiscated and demanded sufficient guarantee for repayment. The boat was later released after securing the necessary guarantee from the Karanavar and collecting Rs. 2000 as the first instalment of repayment.

d. Kadakkodi as mediator of social conflicts

Kadakkodi mediates social conflicts between local Araya fishermen and outsiders. Some cases are documented below

In the year 2004, there occurred a communal clash between Muslim and Araya communities over an alleged harassment of women fish vendors during the sales at Bekkalam. Riots spread coastal areas and a number of fishermen houses were demolished by rioters. Police maintained law and order quickly. Police ordered emergency in the riot areas and took on custody both Araya fishermen

and Muslims. Kadakkodi and Muslim organizations jointly called urgent meeting in the village for settlement and negotiation. Persons affected were given right compensation, although the police registered cases against two communities. The frequency of communal riots between local fishermen and Muslim communities has increased in recent times and Kadakkodi assists the local administration to maintain the law and order by evolving consensus among various social groups.

e. Kadakkodi mediates economic opportunities

Another interesting function of the Kadakkodi is its role to provision and regulate economic opportunities of globalisation. Kadakkodi makes remarkable influence in deciding the potential of coastal tourism in Kasaragod district. Coastal tourism projects are normally cleared by the regulatory bodies only if they procure the necessary social sanctions from local Kadakkodis. This involvement acts as a filtering process that benefits local communities.

Similar instances are also reported in the case of Kottikulam Kadakkodi in negotiating modern economic opportunities. Compared to other fishing villages, Kottikulam has benefitted more from the liberalization process. Ninety percent of the households in Kottikulam have their family members working abroad either in Gulf countries or in merchant navy or in foreign ships as sailors and crew. The money earned by them is not invested in fisheries due to poor infrastructure and economic profits. Instead, the new generation has opted out from fishing and invests their income in the share market. Kadakkodi now collects a specific amount from all gulf employees every year to run their economic

and social activities. The process of economic liberalization and improved economic conditions of Kottikulam fishermen has inflicted changes in the structure of Kadakkodi and attitude towards fisheries governance. Office bearers were drawn from economically well off households who made money from foreign countries and merchant navy. The organizational priorities of Kottikulam Kadakkodi also changed subsequently. For instance, the request made by fellow Kadakkodis to take action against a priest who violated operational rules in "paithu" fisheries was set aside by Kottikulam Kadakkodi. Retaliating on the inactive behavior, other Kadakkodis collectively decided to impose a social ban and to exclude it from their common functions.

f. Equality before Kadakkodi law

Although economic liberalisation has widened the economic and social differentiation among artisanal fishing communities, Kadakkodi law guarantees equality to all members irrespective of their hierarchical positions. The following incidents demonstrate the principle of equality of law practised by the local communities.

Case 1

One of the responsible priests (Pannan karnor) was caught red hand by members when he went for fishing even after he was informed of the death of one of his close relatives. As per the Kadakkodi rules, fishing is prohibited when member fishermen dies. The issue was discussed at the Kadakkodi meeting where the priest agreed his mistakes and paid fine imposed by the Kadakkodi.

Case 2

In this case even senior priests are not spared with.

As per Kadakkodi rules, paithu fishery is the only fishing activity during monsoon in this region. In 2009, one of the senior priests of Kottikulam Kadakkodi with his relatives violated this ruling and carried out gill net fishing using single small canoe. Bekkal Kadakkodi gave a written complaint to the Kottikkulam Kadakkodi. Unfortunately Kottikulam Kadakkodi did not address the issue with proper seriousness. In the year 2010 another priest violated this rule. All the other three Kadakkodis assembled and decide to punish Kottikkulam Kadakkodi for its inaction and mismanagement of Kadakkodi institutions. As a result Kottikkulam Kadakkodi was out casted from their common social functions.

Case 3

After the Tsunami of 26th December 2004, the Kadakkodi warned fishermen not to engage in fishing based on the information supplied by state authorities. Unfortunately, three members neglected these rulings and engaged in fishing. Other fishermen complained to Kottikkulam Kadakkodi authorities which was verified and found true by the Kadakkodi officials. Kadakkodi assembled near the beach fined them five thousand rupees each for violating the rulings.

g. Economic performance

One of the outcomes of these communitarian interventions has been its influence on the economic performance of various artisanal fishing methods. To highlight the nature of these issues we shall present a brief evaluation of the economic performance of *paithu* fishing in selected Kadakkodis below. Table 6.6 depicts the indicators of economic performance of *paithu* fisheries.

Table 6.6 Indicators of socio economic performance of major marine fisheries in selected Kadakkodis (Rupees)

	Regions			
	Kasaragodu	**Bekkal**	**Keezhoor**	**Kottikulam**
Type 1	**Paithu fisheries: 4 canoes + ring seine + 40 workers**			
Value of landings per canoe	1472000	1349766	754416	443800
Number of fishing trips	116	90	81	67
Value per trip	12689	14997	9313	6624
Owner share per cruise	2538	2999	1863	1325
Crew share per cruise	254	300	186	132
Total Commission of agent	117760	107981	60353	35504
Agent commission per cruise	1015	1199	745	529
Total levy to Kadakodi	63011	63683	33681	24487
Kadakkodi levy per cruise	543	707	415	365

Source : Primary survey 2010

Economic indicators reveal that Kasaragod and Bekkal Kadakkodis are economically stronger than other two village Kadakkodis. The value of fish landings per trip, crew and owner shares are higher in Bekkal

followed by Kasaragod and Keezhoor. The economic crisis in Kottikulam village emerges clearly from this analysis. In this village, the number of cruise undertaken during the survey period was only 67. The value of fish landed per cruise was only Rs. 6624; owners share Rs.1325 and crew, Rs 132. Survey revealed a steady decline in the average household income in Kottikulam village in recent years. As a result, the younger generations in this village has been shifting their occupation from active marine fishing to other maritime related activities like joining in merchant navy, sailors, ship-breaking industry, even migrating to gulf countries and so on.

h. Kadakkodi and formal management authority

Although the community's capability to self regulate local marine fisheries has been eroding over these years due to internal challenges and impacts of globalization, it is interesting to note that the formal management authority, State Fisheries Department, implements development programs and management institutions through the Kadakkodi system. For instance, the Department has no mechanism to enforce the monsoon trawl ban in Kasaragod district at all. To overcome this lacuna the Department circulates the trawl ban order to Kadakkodi committee which displays the notice on the notice board and communicates the same to member fishermen. As a matter of fact, trawl ban is not a major issue in Kasaragod because of the low presence of trawlers. Similarly the state also procures the necessary sanctions from Kadakkodi committees to finalize the list of beneficiaries of its various social welfare programs and kerosene permits. In other words the

Fisheries Department has already recognized the Kadakkodi system as its partner in fisheries management and governance. What prevails today in Kasaragod fisheries is an informal form of co management through which the local communities and the state work together to manage local fisheries.

6.4 Summary and Conclusions

The analysis revealed that Kadakkodis in Kasaragod district are primarily community-based organizations which integrated marine fisheries management and the community's diverse socio-cultural needs under a single organizational roof. Despite weaknesses, they continue to serve local fishermen in many ways. We argued that being informal community based organizations, Kadakkodis acted as regulatory bodies. It shouldered the task of defending common property institutions and even acted as agency for conflict resolution. At the same time, they were capable of adapting to the modern challenges of globalization. Both endogenous and exogenous factors influenced the existence and performance of Kadakkodis in Kasaragod coastal zone. As observed, state informally allies with these institutions for the smooth implementation of development and welfare programs and even for resource management.

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Chapter 7

Institutional Dynamics and Marine Fisheries Management Practices in Ernakulam District

Marine fisheries off Ernakulam district have been experiencing consistent growth in technology and developed as the hub of industrial fisheries in India. The district today possesses the most modern fisheries infrastructure and houses the most modern fishing fleet. Moreover, the district also entertains operations of multi day boats from neighboring southern states. The growth of commercial fishing activities and the active presence migrant fishing vessels and workers have made significant impacts on resource health, economic viability of fishing operations and livelihoods of local communities in many ways. It is even observed that the artisanal fishermen have been slowly moving out of fisheries due to the heavy competition from the mechanised sector. Traditional management institutions that regulated local fisheries in the past lost their relevance as they failed to address and resolve the new challenges of modernisation. The newly evolved mechanised sector on the other hand has miserably failed to develop necessary collective action and institutions for the management of resources. Conflicts between the artisanal and mechanised sectors and lack of trust between them contributed to such management failures. This antagonism reinforced the need for greater role of the state to craft regulatory institutions for

management. Given these circumstances, management of marine fisheries in this region has always been extremely complex compared to regions like Kasaragod district in North Kerala where local communities continue to play an active role in management.

The objective of this chapter is to present the dynamics of marine fisheries management practices in Ernakulam district with special reference to institutional interaction among various actors. The chapter is divided into five sections. In section one of this chapter we introduce the major actors and agents involved in fisheries management. These groups obviously consist of the formal fishery bureaucracy, artisanal fishing communities, mechanised fishing enterprises and the major formal and informal organisations. Section two presents the attributes and positions of different actors. Section three examines how various state and non state actors/organisations interact and evolve management institutions/organisations under various socio-economic contexts. Section four details the management outcomes derived through the process of community- state- industry interaction and undertake a critical evaluation of these outcomes. Summary and conclusions are enriched in the last section.

7.1 Actors in marine fisheries management in Ernakulam district.

According to Ostrom (2005: pp: 38), actors in an action situation are decision-making entities assigned to a position and capable of selecting actions from a set of alternatives made available at nodes in a decision making processes. She further pointed out that strategic institutional arrangement to coordinate complex chains of actions among actors

involve multiple organizations competing with one another according to a set of rules. From the perspective of resource management, three major actors - local artisanal fishing communities, industrial fishing boat entrepreneurs and the state - actively participate in fisheries management. In this section we present these actors and their organizations.

7.1.1 State and fisheries management

From the perspective of formal fisheries management, fishing territories within the Indian exclusive economic zone have been managed collectively by the Central and the respective coastal States. While the territorial waters fall within the administrative authority of state government, territories beyond territorial waters are under the authority of central government. The primary duty of the state is to craft institutions, enforce state laws and monitor how various actors respond to formal institutions. It also mediates conflicts and design and distribute welfare measures to marginalised fishing households. The State claims that it has created the best arrangements not only to regulate fisheries but also to provide other services to various fishing communities. Kerala government has started a separate Department, subsidiary organisations and a special management wing for implementing effective fisheries management plans.

7.1.2 Artisanal fishermen organisations

Artisanal fishermen and their organisations are the primary actors and the major beneficiaries of modern fisheries management. Field studies

confirmed the active presence of various fisher organisations as actors influencing fisheries policies and management strategies. Since mechanized fishing led to a decline in fish catches and income of traditional fishermen, communities felt the need to strengthen collective action against overfishing, economic disparities and livelihood vulnerabilities. Accordingly they formed a variety of organisations to participate and present their demands on the use of resources.

The first non political fisher organisation known as the Kerala Swathnathra Matsya Thozhilali Federation (KSMTF) was hence formed in 1980 with the help of catholic priests[1] (Erthayil, 2002). Artisanal fishermen, who joined as workers in Purse seine boats, formed the Purse-seine Boat Workers Union in 1994. The Union started its activities by organizing workers in about 114 boats and had an active membership of 3000 workers. During the past 12 years of its activities, the union has organized many agitations to protect the rights of fish workers, especially those who work on distant multi-day purse-seine fishing vessels. Today, only 500 workers are enrolled in this union. The number of purse-seine boats has also declined to around 12. Although the Kerala

[1] KSMTF was formed due to the joint efforts of Thiruvanthapuram Roopatha Malsya Thozhilali Union, Kollam Jilla Swathantra Malsya Thozhilali Union, Allpuzha Catholical Malsya Thozhilali Union, Allpuzha Jilla Ulnadan Mahla Malsya Thozhilali Union and Vijaypuram Roopatha Malsya Thozhilali Union. This network was initially named as Kerala Lateen Catholica Malsya Thozhilali Federation (KLCNTF). The KLCNTF intensified the struggle against mechanized fishing by involving the fisher folk in various modes of protest- hunger strikes, picketing, dharnas, public meetings and submission of memorandums. Soon after the leadership of the movement felt the need to secularise and broaden the federation and renamed the organization as Kerala Swathantra Malsya Thozhilali Federation (KSMTF).

Swathnathra Matsya Thozhilali Federation (KSMTF) could pressurise the state to craft formal management institutions, its influence on policy making declined considerably over the years.

In addition to these organisations, active fishermen also formed organisations under the banner of various political parties and radical groups. For instance, the Communist Party of India (Marxist) floated Matsya Thozhilali Unions in different fishing villages and affiliated them with its state level federation called the Kerala State Matsya Thozhilali Federation (CITU). Organizations like the Matsya Thozhilali Union (AITUC) and Kerala State Matsya Thozhilali Congress (INTUC) were started by Communist Party of India (CPI) and the Indian National Congress (INC) respectively. For the leading political parties fisher organizations under their labels are channels to address the fundamental problems of the working classes in fishery sector. These associations therefore demanded introduction of welfare funds, social welfare schemes, pension, work protection projects and subsidised fuel for outboard engines etc.

Critics pointed out that organizations affiliated to political parties could not effectively address local problems of fishing communities which necessitated in the formation of micro level organisations to address these issues. For instance, the artisanal small gill net fishermen of Ambalakadavu fishing village in Vyppin Island floated an organisation called the Swathathra Matsya Thozhilali Union in 2003 under the banner of a radical political party CPI (M-Red flag). The association was formed with the sole intension of objecting pelagic and mini trawling in local

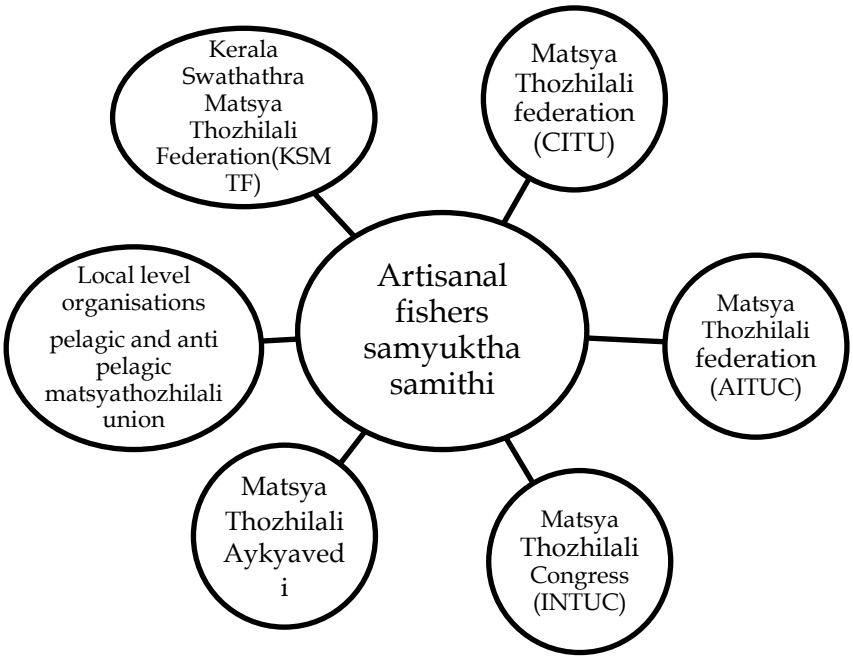
area. To retaliate, the rival groups engaged in mini trawling formed another union called the Vyppin Artisanal Transom (Swathantra) Fishermen Union and organized many local level agitations to protect their fishing rights. Since these organisations could not resolve all the mundane gear conflicts among various resource users, left radical parties also organised local fishermen under their banner. The party formed the Matsya Thozhilali Aykyavedi in 1982 and launched its basic struggle to sustainable livelihoods to fishermen. Needless to say, this organization has ground level support of artisanal fishermen especially along the northern coastal belt of Ernakulam coast. Some fishermen formed cooperative enterprises and pooled their economic resources to overcome the pressure of mechanised fishing[2].

Although the above mentioned organizations embodied the diverse economic and socio-political interests of artisanal fishing communities none of these individual organisations could influence fisheries management and governance in any significant scale. Hence, these individual organisations formed apex associations at the district and state levels to put up effective pressure on fisheries policies and governance. This led to the formation of artisanal fishers Samyuktha Samithi (Joint Council of Artisanal Fishermen). Figure 7.1 shows the

[2] There are 24 cooperative societies in the Ernakulam district of which 11 are active. Although cooperatives are formal organizations for the development of artisanal fishermen, it may be mentioned that society members are also members of various informal organizations that are affiliated either to political parties or nongovernmental sector. Further these organizations do not undertake any management functions directly.

basic network of artisanal fisher organisations, called the "Artisanal Fishermen Samyuktha Samara Samathi" in Ernakulam district.

Figure 7.1 Artisanal Fishermen Samyuktha Samathi in Ernakulam District



Artisanal Fishermen Samyuktha Samathi has a democratic system of functioning. Office bearers, secretary and the president are elected from member associations every year. The main objective of the samthi is to protect the rights of artisanal fishermen in the Ernakulam marine fisheries zone. The main function of the samithi is to evolve a political consensus among member organisations on various demands (livelihood security, economic profits and resource conservation) they bring to the negotiating table.

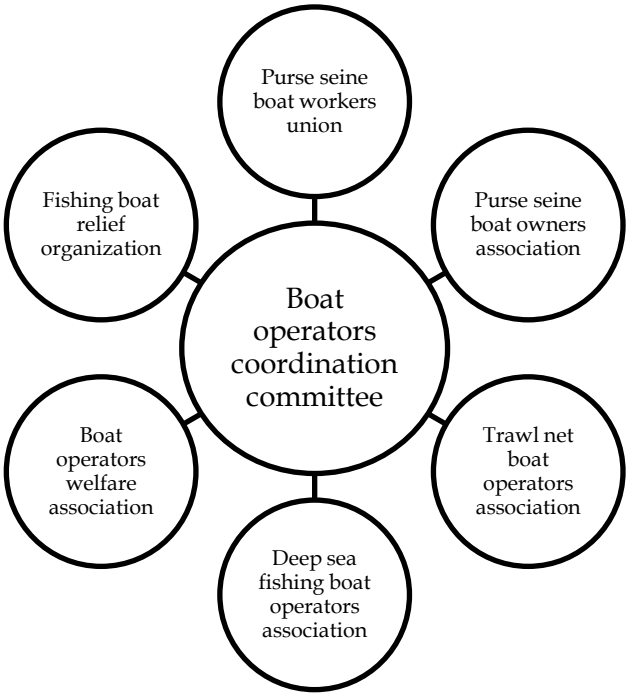
7.1.3 Organisations of small scale industrial fishing fleet

Artisanal fishermen and their organisations blamed mechanised sector for fisheries crisis and demanded their active cooperation to resolve problems. The mechanized boat owners responded to the allegations in many ways. During the early decades of mechanisation, they approached the courts for solving fisheries conflicts. Later, they formed gear-specific organisations to effectively scale up defence and resistance against the allegations raised by the artisanal sector. The first organisation of the mechanised boat owners named Fishing Boat Owners Association was hence formed in 1982. The organization provided financial assistance to members, responded to the allegations rose by the artisanal sector and formulated defensive strategies. Since this organization did not provide services to majority of its members, 30 boat owners left the parent association and formed the "Munambam Fishing Boat Operators Welfare Association" in 1989. This association was formed with the sole intention of providing self protection and security to capital. After the split, the parent association was renamed as Fishing Boat Relief Organization in 1992. Activities were redesigned to effectively resist anti-mechanization movements of artisanal fishermen. The association which had a membership of 150 initially retains only 100 members today. In purse-seine fishery most of the owners were from outside fishing communities. As there were heavy resistance to the operations of these boats purse-seine owners floated a strong association known as the "Purse seine Boat Owners Association" in 1994. In addition to the above mentioned organisations, mechanised fishermen operating from different fishing harbours within the district formed specific organisations. For instance, boat owners located in Munabam floated the

"Fishing Boat Operators Welfare Association" in 1990; the trawl net fishermen formed the Munabam Trawl net Operators Association in 1996 and the deep sea fishermen formed Deep Sea Fishing Boat Operators Association in 1999.

Although the mechanised fishermen floated a variety of organisations to address their internal problems, none of these could effectively participate and contribute to resource management in any significant manner. To overcome this limitation and to improve bargaining capacity, they formed an apex organization called the Boat Operators Coordination Committee. See figure 7.2.

Figure 7.2 Boat operators' coordination committee in Ernakulam District



7.2 Attributes and positions of actors in marine fisheries management

Attributes are the acquired characteristics of actors that are influenced by set of rules structuring an action situation (Ostrom, 2005 pp: 40). Positions, on the other hand, refer to "anonymous slots" into and out of which actors move and connect participants and actions (I.*bid:pp*). In this section an attempt is made to highlight the positions taken by various actors in fisheries management. This section presents a detailed account of diverse characteristics and positions of various actors- state, communities and enterprises- with special reference to fisheries management in Ernakulam.

7.2.1 Attributes

State's engagement in fisheries sector has undergone distinct shifts during the last five decades of development. Shouldering the responsibility for the emerging resource crisis in fisheries as an outcome of its own development agenda, the state has crafted policies and formal institutions to manage the outbreak of violence/conflicts between traditional fishermen and modern fishing enterprises over the sharing of fishing grounds/territories and resources during the 1980's (Kurien, 2003, 2005 Thomson, 2006). The fishing communities who participated in resource management represented diverse cultural backgrounds and community characteristics. The communities along the southern coast of the district were traditionally fishermen while majority of those who settled along the north zone were the offspring of imigrants who settled along this coastal strip from neighboring districts. Mechanization has

sharpened the economic disparities between these communities and their modern counterpart. These communities are highly organized into various political parties, although caste/religious organizations and other non - governmental organizations also influence some sections of these communities. The mechanized counterpart which competes for resources in the district consists of both natives and migrants. As already noted in chapter four, only twenty percent of mechanized boats are owned and operated by native fishermen; the rest are migrants from Kanyakumari district in Tamil Nadu. Migrants undertake multiday fishing using migrant workers. These groups are also politically organized.

7.2.2 Positions

Most of the management concerns in fisheries sector have been the outcome of an active development intervention by the state. However, the state shifted its position from a development catalyst to a resource manager by the early 1980's due to the mounting pressure from resource users and started mediating fishery conflicts between the artisanal and modern actors. The artisanal fishermen and their organisations that were united under the banner of non political civil society organisations later got transformed and reorganised under the banner of various political parties. The mechanised fishing operators have also got reorganised under the banner of various political parties. In other words the non - governmental organisations which influenced fisheries management policies lost their superiority and the social movements in fisheries sector got highly politicised by the beginning of 1990's.

7.3 Interactions for marine fisheries management

So far we introduced the leading actors and positions they take to achieve various management objectives. For instance, artisanal fishermen demanded institutions to sustain resource health and livelihoods through political struggles and agitations while the mechanised sector demanded legitimate space and economic profits to operate mechanised boats. The state on the other hand supervised these individual and collective initiatives. We shall now examine how various actors interacted to craft management institutions in Kerala fisheries. Table 7.1 presents a typology of plausible interactions among state, community and industry to develop institutions for the management of marine fisheries in Ernakulam district. First row of the matrix represents state led formal initiatives to regulate marine fisheries in the state of Kerala. The discussions show how state connects artisanal communities and mechanised boat owners in Ernakulam district in the enforcement of monsoon trawl ban. The second row represents community led initiatives to bring together state and the industry in an informal co management like arrangement to solve management concerns specific to the district fisheries. The last row represents the industry led actions to discuss and resolve management concerns by bringing together state and communities. It is expected that such a detailed examination of the formal and informal interactions engaging state, communities and the industry would disclose the set of all formal and informal institutions for the prudent use of scarce fisheries resources in the study areas.

Table 7.1 Matrix showing interactions involving state, artisanal communities and fishing industry for evolving management institutions

Actors	State	Community	Industry
State led negotiations	Formal state laws, executive orders and enforcement	Monsoon trawl ban	Monsoon trawl ban
Community led informal negotiations	Legalising artisanal mechanised ring seine fisheries	Gear conflict management between communities	Technological innovations/intensification for recouping commons
Industry led informal negotiations	Weak links	collective action against joint ventures	Conflict between native and migrant fishing fleet

7.3.1 Federal system of governance: Implications for marine fisheries management in Ernakulam district

The major facet of hierarchical mode of governance refers to the supremacy of state to craft policies and state laws for the management of resources (Kooiman, 2005; Gray, 2005). By 1980's, state recognized the ecological and socio-economic vulnerabilities of its technology package, deep-sea fishing policy of 1991 and Marine Fishing Policy 2004 which together aimed to bring in "blue revolution" in the Indian fishery economy. Consequently, it enacted rules to reserve territorial waters for the exclusive use of artisanal fishermen through provisions of the Indian

Marine Fishing Regulation Act (IMFRA) 1980. The central government recently proposed a draft bill (The Marine Fisheries Regulation and Management Act, 2009) to facilitate regulation of fishing, fishing activities and fisheries in the maritime zones of India, conservation and sustainable use of fisheries in the maritime zones of India, regulation of all vessels engaged in direct or indirect exploitation of fisheries resources in the maritime zones of India. In another bill published in the same year (The Traditional Coastal and Marine Fisherfolk Protection of Rights Act, 2009) the central government proposed to provide a framework to protect the rights of traditional fisherfolk who have been residing in coastal areas for generations.

Legal instruments of marine fisheries management in Kerala

Following the general spirits of national legislation, the Kerala government introduced the Kerala Marine Fishing Regulation Act, 1980 (KMFR Act) to provide legal protection to the operations of artisanal sector and to diffuse conflicts between traditional fishermen and mechanised trawling/purse seine fishing enterprises. The legislation was a landmark in the history of the fisher folk movement in Kerala as it banned purse-seines from within 22 km of the coast, banned mechanized boats and trawlers from within 20 km of the coast and banned trawling during the three monsoon months of June, July and August. The Act empowered the State to regulate, restrict or prohibit the number of fishing vessels and gears in any specified area and catching in any specified area, the period of fishing or the species caught within its jurisdiction. All mechanised fishing vessels have to procure licenses to

operate in any specified area of coastal waters. Formal rules were crafted under the "Kerala Marine Fishing Regulation Rules, 1980" to regulate, restrict, or prohibit fishing by a ship, or boat fitted with mechanical means of propulsion in the specified areas along the Kerala coast including boats using pelagic/mid water/bottom trawls, purse seines and ring seines. Moreover, every vessel has to register with an authority, procure necessary licenses for fishing in any specified area and inform authorities (port) about the movement of fishing vessel.

Enforcement of Marine Fisheries Regulations

Marine fisheries regulations have been enforced by the Department of Fisheries with the help of specialised agencies, district administration and police. Figure 7.3 and 7.4 shows the administrative arrangements for enforcement of these rules.

Figure 7.3 Administrative arrangements for enforcement of rules

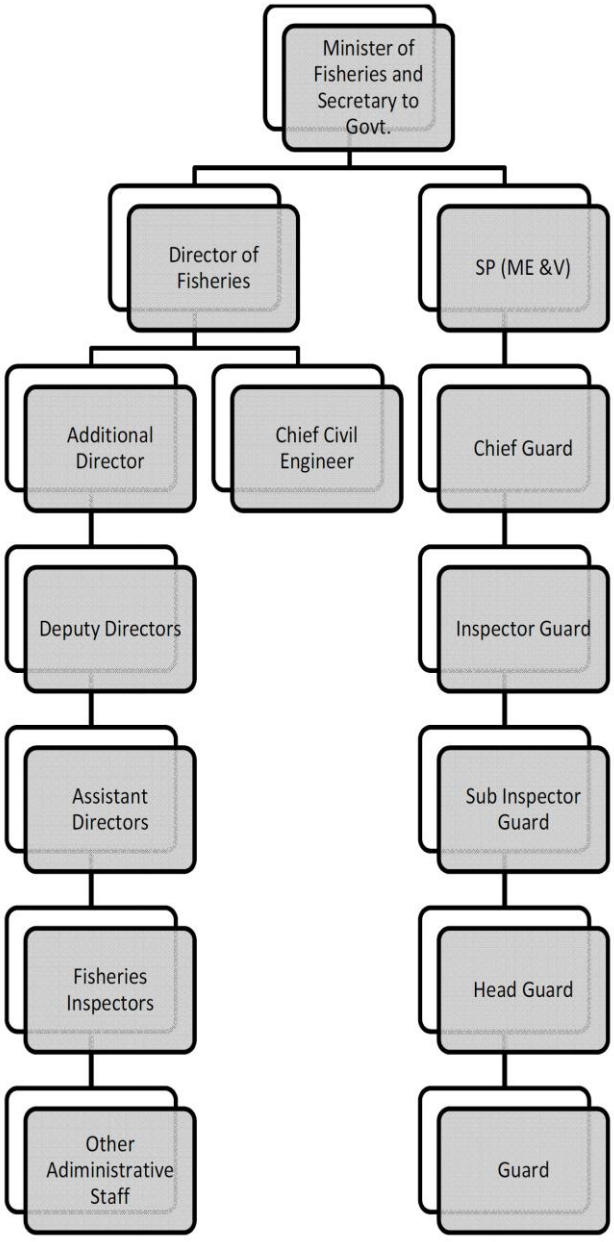
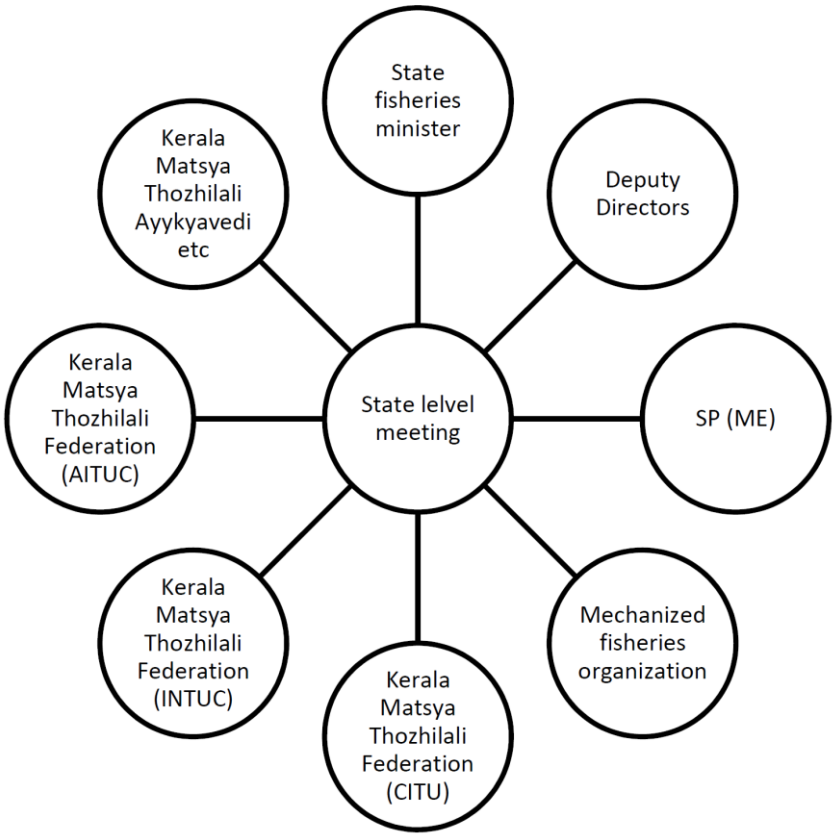


Figure 7.4 Consultation of primary producer organisation and Kerala Fisheries Department



7.3.2 Formal regulations in marine fisheries: The responses of communities and industry

Ever since the endorsement of the Kerala Marine Fishing Regulation Act in 1980, artisanal fishermen had been insisting a ban on monsoon trawling. Although the state was convinced of the theoretical need of regulations, it was worried about the social and economic consequences of trawl ban. To acquire better knowledge on the various consequences of ban on monsoon trawling, the state appointed a committee headed by Babu Paul in 1981 which did not recommend a formal ban due to the conflicting views expressed by committee members. Another committee appointed in 1984, headed by Kalawar also did not formally recommend for uniform ban on monsoon trawling. Instead, it suggested a series of measures for the conservation and management of fisheries. Among others, these included a reduction in the number of trawling boats, motorised boats and non motorised boats, a ban on purse-seines as well as setting up a scientific committee to plan out the total allowable catches on the basis of a resource assessment. The recommendations of this committee were virtually not implemented.

The left democratic government which came to power in 1986 appointed Balakrishnan Nair Commission in 1988 and asked for concrete suggestions on trawl ban. The Committee recommended that a 'total ban be enforced on trawling by all types of vessels in the territorial waters of Kerala during the months of June, July and August and the impact of this measure on the conservation and optimum utilization of the resource be examined in detail'. Based on the recommendations of the committee, the state regulated operations of mechanized trawlers and purse seiners in

1988. Table 7.2 shows the number of days the state enforced ban on trawling and purse seining between 1988 and 2012.

Table 7.2 Duration of monsoon ban in Kerala from 1988 to 2012

Year	From	To	Days	Remarks
1988	2.7.1988	31.8.1988	61	Except Needakara
1989	20.7.1989	31.8.1989	43	Entire coast of Kerala
1990	28.6.1990	21.7.1990	24	"
1991	15.7.1991	13.8.1991	30	"
1992	21.6.1992	3.8.1992	44	"
1993	15.6.1993	29.7.1993	45	"
1994	15.6.1994	29.7.1994	45	"
1995	15.6.1995	29.7.1995	45	"
1996	15.6.1996	29.7.1996	45	"
1997	15.6.1997	29.7.1997	45	"
1998	15.6.1998	29.7.1998	45	"
1999	15.6.1999	29.7.1999	45	"
2000	15.6.2000	29.7.2000	45	"
2001	15.6.2001	29.7.2001	45	"
2002	15.6.2002	29.7.2002	45	Government of Kerala tried to ban artisanal ring seine fishery but it failed
2003	15.6.2003	29.7.2003	45	"
2004	15.6.2004	31.7.2004	47	"
2005	15.6.2005	31.7.2005	47	"
2006	15.6.2006	31.7.2006	47	Supreme court banned above 20 hp vessels
2007	15.6.2007	31.7.2007	47	Monsoon Pelagic protection bill introduced for artisanal fisheries
2008	15.6.2008	31.7.2008	47	"
2009	15.6.2009	31.7.2009	47	"
2010	15.6.2010	31.7.2010	47	"
2011	15.6.2011	31.7.2011	47	"
2012	15.6.2012	31.7.2012	47	"

Source: Compiled from various orders from Government of Kerala

The foregoing discussions reveal that the state led fisheries management concentrated only on regulating mechanized trawlers and purse seiners while ring seine operations of the artisanal sector remained outside the regulatory regime. The mechanized sector alleged that artisanal ring seines are equally responsible for the resource crisis in the state and therefore should be regulated. Rejecting their demands, the state mooted the Kerala Monsoon Fishery (Pelagic) Protection Act, 2007 and legally authorised artisanal fishermen to operate large ring seines within the territorial waters of Kerala. It is observed that the state has taken active interest to craft formal regulatory institutions for the management of marine fisheries in Kerala and has enforced these institutions with the help of its bureaucratic machinery and staff. Despite limitations, state has secured the cooperation of all major artisanal and mechanised fisher organisations to implement its formal management strategies.

The question is whether state led formal management institutions are sufficient enough to prevent resource degradation, sustain local livelihoods and economic profits to the industry. Recent research indicated that communities and industrial enterprises supplement formal management initiatives of the state in many ways (Jentoft, et.al. 2009; Bavinck, 2006; Thomson, 2006; Southhold, 2010; Johnson, 2006; Thomson and Baiju, 2006; 2007). Effective resource management outcomes could only be achieved through informal interactive processes that involve communities' state and the industry (Sen and Nielsen 1996; Berkes 2001; Jentoft and McCay 2003; Symes and Phillipson 1999; Bavinck, 1998, 2003, 2005).

The practice of marine fisheries management as observed in Ernakulam district of Kerala signifies two major informal processes where local communities, state and the industry cooperate to evolve informal institutions for resource management. In the next two sections that follow, we present these informal collaborative interactions in the study district and show how informal institutions are evolved through such interactive processes.

7.3.3 Community- state- industry interactions and Informal marine fisheries management

Primary producers-communities and the industry- recognise the fact that formal management drives are not sufficient enough to achieve livelihood securities, economic profits and resource health. As a normal response, communities organise collective actions that bring together other actors to evolve effective fisheries management. In the first case study we describe how artisanal communities pressurised the state and got the use of large mechanised fishing vessels using ring seines legalised in an attempt to stabilise their livelihoods. Second case study deals with how artisanal fishing communities in the district negotiate and resolve gear conflicts among themselves with the help of the state. In the third case study we examine how traditional communities improved their fishing methods and launched large mechanised ring seine boats which enhanced their competition to the mechanised sector and improved access to pelagic resources.

7.3.3.1 Legalising artisanal mechanised ring seine fisheries

The growth of purse seine boats in the early 1980's has ruined the artisanal fishermen engaged in pelagic fishing. Although motorisation of fishing boats in the 1980's improved their economic standards marginally, they could not sustain these economic advantages for long due to lack of beach landing facilities, coastal erosion, sea wall construction, high operating and maintenance cost of the outboard motors and low power in mechanised purse seiners. In 1998 artisanal fishermen modified their traditional thanguvallams, installed inboard engines and started using large ring seines for pelagic fishing. Although legally prohibited in the Kerala Marine Fisheries Regulation Act 1980, ring seine fisheries had grown systematically and by 2005, sixty two such crafts were actively engaged in marine fishing in Ernakulam district alone, employing around 3100 people. Ring seine units became operational as fishermen cooperatives started financing people to purchase large canoes with inboard engines. Apart from cooperative societies, the Kerala government has also made available liberal credits through its apex cooperative, Matsyafed for the growth of artisanal mechanized sector.

The entry of ring seine boats was vehemently opposed by the mechanized sector and the government finally banned the operations of artisanal mechanized fishing vessels in 2002 during the monsoon trawl ban period. Ban of ring seines was opposed by artisanal fishermen and they protested under the collective banner of the district Artisanal Samyuktha Samithi. Serious tension mounted in the coastal areas of the

district and on June 15th fishermen operating artisanal inboard engines ventured into monsoon fishing by violating state regulations. After this incident, the organisation exerted severe political pressure which finally led to the declaration of Kerala Monsoon fisheries (Pelagic) Protection Act 2007 that granted exclusive fishing right to artisanal fishermen to conduct pelagic fishery during the monsoon season using traditional and modified traditional crafts and gears within the territorial waters. The act aims to provide security of life and livelihood of the traditional fishermen and to ensure their subsistence.

This study reveals how artisanal communities negotiated their demands for livelihood security through a political negotiation which engaged state and representatives of industry. It is interesting to note that these interactive processes could effectively legalise an informal customary practice to a formal state law that permit communities to restore their rights to resources.

7.3.3.2 Intra- community gear conflict management

Mechanisation has made definite impacts on various artisanal fisheries making fishermen livelihoods vulnerable. They have responded to this crisis by adopting a variety of adaptation strategies. Intensification of technology has been the foremost option opened to them to adapt to the pressure imposed by mechanisation. In this case we detail how a section of artisanal fishermen in the northern coast of the district, opted technological intensification as a livelihood adaptation strategy and

show how management institutions are being drawn to sustain such livelihood options locally.

As the availability of fish near the shore reduced due to the impact of heavy mechanization, a section of artisanal fishermen in Ambalakkadavu village started pair trawling in the shallow waters off their coast[3]. It may be mentioned that pair trawling is formally banned by the state due to its destructive capacity to demersal fisheries. As these fishing methods picked up momentum, a section of artisanal fishermen from nearby villages who could not adapt to this fishing practice objected the use of such gears within their territories. These fishers formed an organization called 'Artisanal Anti Pair-Trawling Samara Samithi' and objected to the use of mini trawling by artisanal fishers. The innovators on the other hand formed another organization called the Vypin Artisanal Fishermen Pair Trawling (Swathanthra) Union to defend such uses. This obviously led to conflicts among the members of these organizations over the use of this banned fishing method.

Traditional fishermen of Ambalakkadavu alleged that large "motorized transom canoe" have been fishing within their fishing territories and despite repeated representations and requests made, no actions have been taken by Fisheries Department to regulate these boats in the last

[3] Two kinds of pair trawling are popular in the local area. In the first variant, two traditional boats are engaged in the operation of a traditional trawl net along the bottom of the sea. This is called bottom pair trawling. In the second case, two traditional boats are engaged in pair trawling for pelagic fisheries. This is called pelagic pair trawling. At present about 4700 motorized mini trawlers are in operation, the highest number was recorded from Alapuzha district.

four years. To press their demands, they blocked the office of the marine enforcement wing of Fisheries Department but resulted in no positive steps to regulate illicit fishing operations. However, pair trawling intensified locally and badly affected their livelihoods. Agitating fishermen captured boats engaged in pair trawling and burned the gears in public. Heavy loss was reported and seven fishermen were injured and admitted to hospital. The police registered a case in this issue.

Pair-trawl fishermen on the other hand, formed the Vyppin Artisanal Transom (swathantra) Fishermen Union, declared a public strike under the banner of their organization and detained the Assistant Director of Fisheries. The Union claimed that their members were using thanguvala or 'v' cut gears that do not touch the bottom layer of the sea and demanded official permission to use these gears for fishing as there is no formal ban on them. The dispute over the use of contested gear continued.

As pair-trawling has been officially banned, marine enforcement officers of Fisheries Department searched fishermen houses and captured pelagic trawl nets. House to house search and harassment were strongly protested. Artisanal pelagic trawlers continued their activities in the sea with arms and bombs while anti-pelagic artisanal fishermen formed a squad for capturing pelagic trawl nets. Fisheries Department and marine enforcement wing in particular were pressed by the ruling party and the Government to support pelagic trawl owners. However, the officials

seized transoms and pelagic trawl nets. Despite political pressure to release boats, the officials detained them.

Tension mounted off sea and along the entire Vypin seashore between anti pelagic and pelagic fishermen that finally led to violent clashes. Eleven fishers belonging to the pelagic pair-trawl group were admitted to the hospital and transom fishermen lost nets. To retaliate the loss, seventy transom boats jointly attacked the artisanal landing centre at Ambalakadavu and captured fishing equipments. Anti-pelagic trawl fishermen organized public demonstration against pelagic trawling and physical harassment by officers. They displayed the captured pelagic nets in front of marine enforcement office and burned nets. Transom owners on the other hand asserted to establish their fishing right and demanded to take action against the culprits, to return the nets captured and enforce fisheries laws. However, retaliatory actions of traditional fishers intensified and they captured another gear and burned it in public. They even organized another public harthal demanding their livelihood rights.

Political negotiations and conflict management

Since direct negotiations between rival communities failed to solve the issue, major political parties like Kerala Matsya Thozhilali Congress (I), Kerala Fishermen Union, and Kerala Artisanal Fishermen Samyuktha Samara Samithi Panchayath president, and the Vypin Block Panchayth president intervened and requested Fisheries Department to withdraw all legal actions against artisanal pelagic trawlers. After a series of discussions, the conflict was resolved and territorial boundaries for the

operations of respective gear groups were informally demarcated. It was resolved that the transom pair trawlers could use fishing territories beyond the fishing boundaries used by the fishers of Edavanakkad Panchayath. The rest of the territories could be used by traditional fishermen. It was resolved further that in case of further violations, the parties should approach the Fisheries Department and in no case would fishermen be allowed to self impose regulations. Fishing is now organized under these sets of negotiated institutions. The negotiations revealed that weak enforcement of formal law provided more space to non state actors to develop socially acceptable local solutions.

7.3.3.3 Technological innovations, intensification and recouping commons

In this case study we argue how artisanal fishermen intensified their fishing methods raised tough competition to the mechanised purse seine fishers and regained their lost fishing territories. Ever since the introduction of large mechanised purse seines, the economic crisis and livelihood vulnerability among artisanal fishermen had deepened. In the past traditional fishermen attempted to evict purse seine boats through legal trials. They filed cases against illegal operations of these boats which were not accepted by the judiciary. Purse Seine Boat Shareholders Associations argued that all purse seine boats are registered under the Merchant Shipping Act with MPEDA and that fishing outside the territorial waters of Kerala. They refuted that purse seine boats fish within the territorial waters of Kerala and made a counter claim that the

newly developed inboard engine boats are more productive than their boats and the former is responsible for degradation of coastal fisheries.

Since the legal trails failed, artisanal fishermen knew that the only alternative left to revive and sustain livelihoods was to modify modernise their traditional fishing through local innovations. The motorisation programme sponsored by the state in the 1980's to provide artisanal fishermen the necessary economic advantage did not succeed due to spiralling fuel prices. Those who lost money in the motorisation drive were searching for evolving alternate technologies to compete with the challenges of mechanised purse seine boats. Their effort finally succeeded when a group of fishermen in Thoppumpadi fishing harbour modified the traditional canoe by installing an inbuilt engine by pooling capital. Artisanal fishermen in Ernakulam district opted to ring seine fisheries around the mid 1980's mainly to overcome the competition from mechanized purse seine boats (Boopendranath and Hameed, 2012). Since artisanal mechanised canoes landed good catch and made reasonable profits, many more fishing units entered into the fishery soon. The total number of such crafts in the district is 65 today.

The competition raised by the artisanal mechanised sector weakened purse seine operations and most of the owners left the industry due to the presence of strong labour union and escalation of operational costs. The government policy to open up deep sea fishing territories to joint ventures and big industrial fleets, also led to the collapse of this sector and by 2002, most of the purse-seines were under new collective ownership of workers. Competition between the purse seine boats under

new management and the traditional ring seine fishers for pelagic fisheries intensified and led to a complete collapse of purse seines. Of the 12 boats, only 4 boats operate today.

7.3.4 Industry, community and state interactions: Lobbying for alternative fisheries management

The third category of interactions to evolve appropriate institutions for resource management has been led by the mechanised sector by engaging communities and the state. In the first case study we explore how mechanised industry interacts with the state to evolve management institutions.

7.3.4.1 Weak industry- state interactions

The mechanised sector emphasised its role in national development and demanded a preferential treatment and legitimate space to operate their crafts economically viable. Unfortunately, the state did not yield to these pressures and enforced regulatory institutions that directly affected mechanised fishing operations during monsoon months. Detailed interviews conducted on various fisher organisations representing mechanised sector revealed that the industry has adapted to the enforcement of monsoon trawl ban and cooperate with the state during the period of ban. At the same time, they have been constantly negotiating with politicians and bureaucrats to exempt certain species and regions from monsoon ban. The best example of the political lobbying in fisheries management is the trawl ban exemption granted to Kollam district in the initial stages. Hence we notice that the industry has

accepted the need for scientific management of resources and cooperates with the state to achieve management objectives.

7.3.4.2 Industry-Community Cooperation and Collective Action against Joint Ventures

One of the important issues that the industry raised during discussions with the state has been the need to regulate access to foreign fishing vessels to domestic waters and the protection of national fishing territories by the coast guard. The facilities available for the enforcement of various maritime laws in the country today are extremely weak. Both the industry and artisanal fishing communities pointed out that effective management of fisheries could be achieved only by regulating the entry of foreign vessels into Indian fishing territories. Based on facts and figures, traditional fisher organizations argued that they could produce substantial quantity of fish from deep waters if proper incentives and institutions were designed by the state. For instance, the total catches of the local fishermen alone in the year 1993 was 2.65 million tonnes of which about 370000 tonnes of fish were from the deep seas. They pointed out that the artisanal sector has been constantly upgrading their technologies by introducing more efficient fishing methods, motorization of traditional fishing crafts and multi day fishing. The competition for space and product in the territorial waters and outside could be reduced only by providing incentives to local industry to undertake a competitive fishery into the deeper waters in order to tap the under exploited resources. Therefore the policy that favours chartering foreign deep sea fishing vessels should be discouraged.

Disparaging these arguments, Government of India went ahead with its new deep sea fishing policy and granted permits to foreign vessels and joint ventures into Indian waters. Table 7.3 shows the account of deep sea fishing vessels for which permits were given under various schemes.

Table 7.3 Deep sea fishing vessels having permits under various schemes.

Category	Number
Indian owned deep sea fishing vessels with SDFC assistance	180
Chartered vessels with valid permits	40
Joint venture vessels under new deep sea fishing policy	180
Total number of DSF vessels with valid permits	400

Source: Representation of Kerala Mechanized Fishing Boat Operators Association

The industry supported the views of their artisanal counterpart and organised joint actions to regulate access to foreign vessels pinto Indian waters. Yielding to the pressures of various fisher organisations the state appointed a technical committee to examine the factors which contributed to the sickness of deep sea fishing industry in India. This committee stated that one of the main problems afflicting the industry is the lack of regulation of fishing effort leading to inefficient resource management and the heavy exploitation of a single species group in a limited geographical area. The report further stated that fishing grounds were left open for exploitation without any reference to harvestable potential and sustainability of resources. Further, the fishing efforts were not effectively regulated either by the Industry or by the government concerned. The committee recommended to freeze the overall fishing efforts towards exploitation of shrimp resources at the existing level,

restrict the operation of shrimp trawlers to about half the existing strength and to enforce restriction of the number of fishing days. Following the reports and political pressure to act on the report the ministry imposed restriction to foreign vessels under Joint Ventures.

7.3.4.3 Conflict management between migrant and local purse-seine fishing enterprises

Mechanization of Kerala's marine fisheries has witnessed the entry of mechanized boats from the neighbouring states like Tamil Nadu and Karnataka for fishing (Thomson, 1989). Although communities resisted such migratory practices at various locations, they could not organize such struggles especially in the Ernakulam district due to the specific connections and financial transactions migrants maintained with caste organizations, the church, political leaders and traders. Moreover, there were no state laws which could be effectively used to regulate access of migrant and foreign fishing vessels into domestic waters.

The first organized attempt to evict the migrant boats from Tamil Nadu was organized in Ernakulam by the Purse seine Matsya Thozhilali Union in 1997. The union alleged that the operations of around thousand mechanized trawlers from Kolechel (Kanyakumari district) in the Cochin region have intensified the resource crisis in Kerala fisheries. Most of these boats, without proper license and registration, have been engaged in night trawling which was banned by the state. The motorized plywood boats on the other hand even resorted to dynamite fishing and destroyed natural reefs and related fish habitats.

By late 1990s struggle against the operations of migrant fishing boats intensified further. Organizations participating in the struggle expected that such struggles would resolve the existing resource crisis in Kerala fisheries and would further improve local fisheries, especially pelagic purse seine and ring seine fishery. These organizations formed an all Kerala platform called the "Kerala Fisheries Forum" to organize struggles to evict migrant boats from Kerala waters but could not make significant impacts due to internal rivalries among various organizations. The lobbying of fish merchants and traders further weekend struggle against migrant boats. The state also did not take active interest to resolve the problem. Crisis in the domestic fishery deepened further and by 2003 almost all the pelagic fishing units were facing economic over fishing.

To overcome this crisis and fresh round of resistance was planned by fishermen unions to eliminate the operations of migrant boats. Many organizations which resisted this move in the past also supported this initiative. During the agitation local fishermen attacked, damaged and sunk 12 migrant boats in the sea. The strike was withdrawn due to a settlement between local and migrant fishermen in the presence of the Fisheries Enforcement Department, District collector, Police, religious leaders from Kanyakumari and community leaders. However, mechanized migrant sector is active along the coast of Ernakulam district even today.

7.4 Potential outcomes of marine fisheries management

The cases presented in the above sections detailed a variety of interactions engaging state, communities and the industry and constitute the essential ingredients of an informal form of fisheries governance evolving in the state of Kerala. The basic purpose of detailing these interactions between the formal and informal domains is to highlight the fact that these interactions evolve the necessary forms of organisations and institutions of the practice of fisheries management in the region. We shall now portray the major outcomes of these interactions.

Ostrom (2005) pointed out that action situations are linked through various institutional and organizational linkages which are essential for sustaining complex chains of actions among large number of actors and organizations competing with one another. A detailed examination of the practice of marine fisheries management scenario in Kerala revealed that the formal rules are effectively enforced by the state only for an average number of 45 days during the monsoon months[4]. After the ban is lifted officially, the interacting firms both in the private and artisanal sectors negotiate a variety of informal regulatory institutions for the smooth operations of their entrepreneurial activities on various fishing grounds. These negotiations however, are not done on individual firm level but through an interactive process involving organisations in the artisanal and mechanised sectors. Two institutional outcomes evolved from the interactive processes involving state, communities and the industry that have direct bearing to the ongoing process of informal

[4] Table 7.2 shows the trawl ban periods from 1988-2012

fisheries management in the state of Kerala. First, formal and informal interactive process in Kerala fisheries generated an informal network of organisations. Second, these formal and informal network organisations generate various informal institutions that are essential for the management of marine fisheries in the district. In the ensuing sections we examine the nature and structure of network organisations and the corresponding system of informal institutions evolved as a product of state non state interactions for the management of marine fisheries in Kerala.

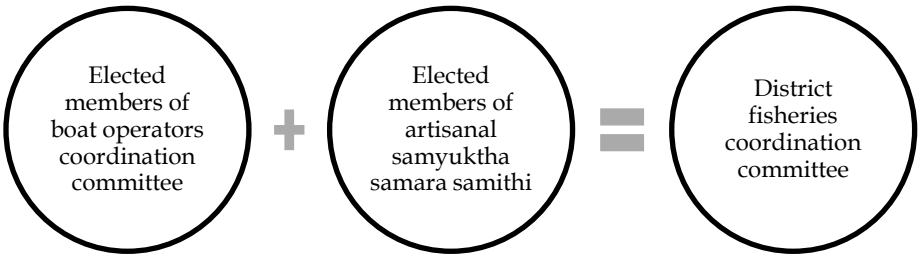
7.4.1 District and State Level Fisheries Co-Ordination Committees

In section 7.3 we analysed the evolution and structure of informal organisations which represented the interests of artisanal and mechanised sectors in the study district. Both these sets of organisations through their practical experience over the last three decades understood that effective management is possible only through dialogues and negotiations among different interest groups. Depending on the priorities attached by the communities and the industry and the scale of issues to be resolved, solutions are derived at the village or district or state or national levels. Consequently, artisanal and mechanised entrepreneurs have given shape to district and state level organisations for the effective crafting and enforcement of informal institutions of management.

District Level Fisheries Co-Ordination Committee

Figure 7.5 shows the structure of the Ernakulam District Fisheries Co-Ordination Committee consisting of elected members from the "Artisanal Samyuktha Samithi" and the "Boat Operators' Coordination Committee".

Figure7.5 District Fisheries Co-Ordination Committee



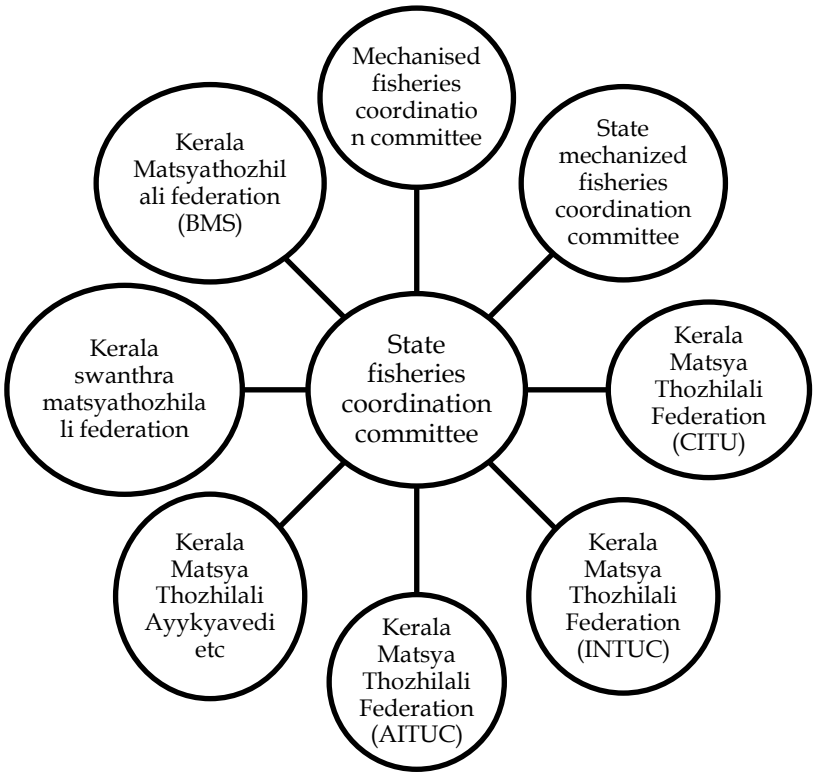
District fisheries coordination committee represents the interests of artisanal and small scale mechanized fisher organizations. The administration is controlled by the president, secretary and an executive body democratically elected from member associations. The main function of the committee is to negotiate and settle conflicts between artisanal and mechanized sectors through political consensus.

State Level Fisheries Coordination Committee

State fisheries coordination committee is the highest level decision making body of fishermen in the state of Kerala. The major function of this body is to negotiate appropriate management institutions at the state level. This body is also constituted through democratic ways and controlled by an executive committee with president and secretary. The

committee negotiates fishing rights to artisanal fishermen and involve deeply to resolve conflicts among artisanal and mechanized fishermen in the state. Figure 7.6 shows the major actors of the state fisheries coordination committee in Kerala.

Figure 7.6 Major actors of state fisheries coordination committee



7.4.2 Crafting Informal Institutions for Marine Fisheries Management

So far we examined the organisational diversity in marine fisheries management and showed how these organisations involved at appropriate levels (village, district or state) to address and resolve the

potential management issues with special reference to Ernakulam district. These organisations crafted many informal rules to ensure sustainable fishing practices. The following table summarises the major kinds of informal institutions evolved during the interactive processes between state, communities and the mechanised fishing industry during the last couple of decades. The classification listed in Ostrom (2005) is followed to document institutional diversity.

Negotiations involving communities, state and the industry resulted in a variety of informal institutions to ensure sustainable fishing practices. The following table summarises these informal rules evolved during the interactive processes between state, communities and the mechanised fishing industry during the last couple of decades.

Member and Access Rules

- *Every fisherman should take membership in any one of the fishermen associations or fishermen development and welfare cooperative societies and renew it every year. Membership guarantees access to fishing territories and livelihoods/social welfare.*
- *Although workers could freely choose any fishing unit, those who borrow money from a fishing unit should work in it until dues are settled fully.*
- *Individual fishing units have freedom to choose their auctioneer (private or cooperative society) in fish marketing.*
- *Cooperative society will charge five percent as commission which is divided as per norms laid down formally* ***(Monayee,2011).***
- *Those artisanal fishermen who are permanently settled in the Vyppin Island are permitted to conduct pelagic pair trawling with transom vallams.*

- *Artisanal fisher groups from neighbouring districts like Thrissur and Alappuzha are strictly prohibited from conducting pelagic pair trawling within the maritime zones of Ernakulam district.*
- *Migrant fishermen who use both mechanised and non mechanised fishing methods from Tamil Nadu are allowed to fish from Ernakulam district.*

Boundary rules

- *Artisanal fishermen redefined their vertical fishing space by fishing at a depth of 60 maaru and in deep sea.*
- *Territorial waters from Munambam to Edavanakkad are reserved to artisanal fishermen using pelagic pair trawling with transom vallams.*
- *Territorial boundary of the state (22 km) is reserved for the artisanal mechanized fishing vessels with inboard engines operating large ring seines.*
- *Mechanized purse seine fishing vessel should operate outside the territorial boundary as per the MPEDA, and Merchant shipping Act.*
- *Mechanized marine fisheries boundary extended to Kanyakumari to Gujarath from Cochin fisheries area.*
- *Multiday fishing system from 10 to 16 days evolved through new migrant fishermen and local mechanized fishing vessel combination.*
- *In marine fisheries movement along the fisheries should follow the resource boundary than administrative boundary.*

Appropriation/withdrawal and provision rule

- *Artisanal Samyuktha Samithi from time to time, prepares and finalise a fishing calendar and all fishing units have to adhere to this schedule.*
- ***Kavaru pani** (Night fishing when the shawl appears) done by the mechanized purse seiners within the Cochin marine area is strictly banned by the Artisanal Samyuktha Samithi.*
- *Artisanal mechanized fishing vessels with inboard engine and large ring seine should use only one carrier canoe.*
- *Artisanal mechanized ring seine fishing vessel with inboard engine should undertake only one fishing expedition per day between 6 a.m to 4 p.m..*
- *Use of multiple engines and gears are strictly prohibited in artisanal mechanized fishing vessels using large ring seine.*

Monitoring and sanctioning rules

- *Monitoring of the above mentioned informal rules is the collective responsibility of all the artisanal fishermen and their associations.*
- *In case of violations of informal institutions individual fishermen/organizations could complain orally or written to the artisanal samyukatha samithi which resolves the issue through negotiations.*
- *Enforcement and punishment rules are determined by the artisanal samyukatha samithi of Ernakulam.*
- *Those who have complaints could approach the Fisheries Department or local police department.*
- *Official period of trawl ban is endorsed by the Samithi also.*
- *Those who violate rulings of the state level boat operators coordination committee are heavily fined to discourage members from repeating such misconduct.*

Collective choice rules

- *District boat operators coordination committee would take care of the district level issues while the state level committee addresses state level problems.*
- *.Artisanal Samyuktha Sasmithi is a flexible governing body elected annually by member associations.*
- *Structure of the Artisanal Samyuktha Samithi is influenced both by party and non party (civil society) politics.*
- *Democratic modes of selection of office bearers at multiple levels enable the form to maintain transparency and accountability in fisheries governance.*
- *Those who are not willing to cooperate could abstain from the agenda of the association.*
- *They could ideally represent their views at the state level coordination committee to seek solutions to the issues raised.*
- *Structure of state level boat operators coordination committee included president, secretary, treasurer and executives are elected through democratic process of coordination committee.*

7.5 Summary and Conclusions

In this chapter we examined how the practice of marine fisheries management in a highly commercialized coastal district in Kerala state got organised through interactive processes that encompass state, fishing communities and the industry. Actions of various actors participating in fisheries management were detailed. The study examined when and where various actors cooperate and collectively involve themselves to resolve fishery crisis and evolve management institutions.

Examining the present levels of community, industry state interactions, the study revealed that coastal fishermen along the Ernakulam coastal district in Kerala, India, evolved strategies that not only regulated fisheries but also delivered sustainable livelihoods to participating fishermen. Formal management institution like the trawl ban has greater social recognition as a regulatory mechanism. However, this formal regulation alone was found to be inadequate to resolve a variety of fishery problems crop up on a regular basis round the year. Moreover, the measure also did not accomplish the long term objectives of fisheries management like resource health, sustainable livelihoods and profits to the participating fishermen and industry. As a result, actors negotiated local, district, and state level solutions to their problems through mutual negotiations, consultations and cooperation and derived a diverse array of informal management institutions. This coalition has definite advantages for delivering sustainable solutions to livelihoods and resource health. The study noted that crafting informal institutions at different levels is an essential process for the success of fisheries management efforts in a fishery that is operated by heterogeneous groups of fishermen operating a wide array of fishing methods.

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Chapter 8
Summary and Conclusion

Marine fisheries management regime in Kerala has been passing through a crucial phase of transition in recent years. Challenging the effectiveness of state-sponsored command and control regularity institutions introduced in the eighties to moderate the bio-socio-economic concerns of modernisation, user groups and academicians alike demanded an alternate system of management to address and resolve the emerging concerns of livelihood vulnerability, economic viability and conservation of resources. Recent theoretical explorations and research on fisheries governance have provided useful insights and directions to evolve alternate management regimes. It was pointed out that collective action by state and various fisher actors would strengthen the growing efforts to redress these issues much better than state centric strategies that lean solely on biological knowledge systems (Gray 2005; Jentoft 2004; Kooiman et al, 2009 Jentoft et al 2009). The response to modernise management regimes however has been quite mixed and varied. Many developed maritime nations have replaced their bio-centric governance strategies with modern economic regulations for achieving reliable and tangible results (Gray2005; Mikalsen and Jentoft 2003; Pomeroy 1995; and 2006). However, India's response to reform management institutions has been relatively slow. From a theoretical perspective, the search for

modern strategies of fisheries management is desirable and the choice to select an appropriate management model to suit local crisis management is difficult to make.

It is in this broad context that the demand for reforming three decades long state sponsored bio-centric governance regime in Kerala's marine fisheries becomes important both in theory and in practice. In this study an attempt is made to explore the rationale for the coexistence of different management systems by examining the institutional dynamics of fisheries management at two selected districts in the state of Kerala India. It specified the nature of major management concerns and portrayed how state and non state actors interacted to evolve institutions and management systems in the marine fisheries of Kerala. The thesis argued that institutional interactions and cooperation between primary producers and the state together determine the practice of marine fisheries management in Kerala. To verify these arguments detailed primary and secondary investigations were conducted during 2003-10 among selected communities in Ernakulam and Kasaragod districts. The results of these investigations are summarised in the thesis.

The first chapter introduced the subject matter, material context, scope and limitations of the study. Two districts, one highly commercialized (Ernakulam) and another artisanal (Kasaragod), were selected for detailed examination. The second chapter reviewed the relevant literature on marine fisheries management scattered in various natural and social science disciplines. Detailed review of biological, economic, ecological, institutional and interdisciplinary studies was conducted and

critically assessed. The review confirmed that an inter-disciplinary approach that assimilates bio-ecological, socio-economic and institutional variables is essential for the success of small scale fisheries management. The survey revealed that although a wide array of management approaches conceptualizing maritime social ecological systems in terms of their inter dependencies are available in theory, very few countries in fact make use of these knowledge systems in fisheries management for various socio-political reasons. For instance, the survey of Indian studies revealed that knowledge producing organizations and governing agencies lag far behind in developing and applying modern approaches to fisheries management. The data needs of bio-ecological-economic approaches are beyond the capacity of management agencies. Evaluation of the empirical studies of maritime communities in India with special reference to Kerala revealed many interesting insights for the development of the conceptual framework used in the thesis. Bio-ecological-economic models of fisheries management could not accommodate the role played by local communities and nongovernmental organizations to address and resolve the fundamental management concerns of the sector. As a result, classical management models could only provide peripheral and sporadic suggestions towards marine fisheries management.

The critical evaluation and review of Indian studies enabled to develop and design a conceptual framework for the management of marine fisheries in Kerala, India. The IAD framework developed by institutional experts, suitably modified and used in the study was presented in chapter three. As already pointed out, this framework enabled to

examine the management concerns in terms of its bio-physical, socio economic and institutional interdependencies, and helped to tailor the required institutions for marine fisheries management in Kerala.

Chapter four analyzed the trends of marine fish landings with special reference to how various groups of fishermen organised their economic activities in Kerala. 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 mechanisation. This finding simply means that the fishing industry has been growing as mechanised boats brought more fish landings from distant fishing grounds which now stretch beyond Kerala's territorial waters towards western and eastern fishing grounds. Increases in fish production have been the result of the blue revolution technology programme introduced into the marine fisheries with active state support. The finding also reinforces the need for managing resources for better use. From management perspective, however, the process has generated two disturbing tendencies. First, mechanisation led to the development of multi-day fishing stretching beyond state's territorial waters where the enforcement of regulations is weak. Second, the process ruined artisanal sector further and later led to economic and technological differentiation of traditional marine fishermen. Finally, mechanisation led to technological intensification and diversification in the artisanal sector which further increased fishing effort and rate of exploitation. These concerns needed immediate attention and were analysed in the chapters that followed.

The analysis of secondary data collected by Central Marine Fisheries Research Institute 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 mechanised 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 mechanised 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 mechanised trawlers operating in Ernakulam district recorded huge economic loss during the study period. 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 mechanised fishing vessels. In other words, the study confirmed that mechanised 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 mechanised artisanal sector. The results also indicated that artisanal fishermen are more vulnerable to such economic and resource crisis.

In order to examine how fishermen address and resolve these issues two intensive case studies were conducted at two distinct social ecological conditions. The first case study conducted in the Kasaragod district of north Kerala confirmed that local communities actively participate in fisheries management even today. Although weak, the sea court (kadakkodi) system of management has been very active to ensure livelihoods, defend common property, mediate fishery conflicts and even negotiate with government and the industry for better space and facilities that improves their economic standards. As already indicated, kadakkodi was a temple centric organisation that later got reformed and incorporated democratic principles for better fisheries management. The system in fact faced severe challenges both from internal and external agents. Cultural foundations and value systems of Kadakkodi made it unattractive to modern fishery managers who wanted to replace community based management systems with market based centralised management systems. Second, community based management institutions targeted local communities and fisheries while modernisation raised the scale and scope of management beyond homogenous communities and local fishing territories. It is not surprising therefore that the system did not outgrow to encompass the management challenges of modernisation in any significant manner. Community based management systems like kadakkodi hence did not receive any formal recognition from political parties, policy makers and state when they formulated fisheries management regimes in Kerala during early eighties for various reasons.

This limitation prompted the need to select a highly commercial fishing region like Ernakulam district for a detailed analysis of the institutional dynamics of fisheries management. Marine fisheries of Ernakulam are characterised by intrinsically diverse and dynamic different multiple craft and gear combinations of artisanal and small scale mechanised fishing vessels, small scale mechanised fishing vessel and artisanal motorised migrant fishers. The characteristics of the fishery were documented as high mobility of multi day fishing fleet, high level of technology compared to other small scale mechanised fishing vessels in other regions of India and high capital cost.

From a management perspective, marine fisheries in Ernakulam district had been regulated by non-state management institutions before modernisation. Access to local fishing grounds was socially regulated and conflicts were managed through mutual consultations and inter-community negotiations. The major shift in the realm of fisheries management occurred during early eighties when the state yielded to the pressures of nongovernmental organisations and artisanal fisher unions decided to implement formal fishery regulations under its direct control. The analysis of formal fisheries management and fisher associations perceptions in Ernakulam district indicated that formal trawl ban alone could not resolve the fundamental problems of the sector today. Livelihood vulnerability of artisanal fish workers persists as an issue unresolved. Fishing grounds considered as commons before mechanisation became the free access property of modern users. The entry of migrant fishermen and enterprises from neighbouring states made access more flexible and liberal. These developments indicated

state's incapability to effectively modulate formal institutions to regulate access to marine fishing territories.

The crisis in formal management strategies intensified year after year which necessitated engagement of artisanal fishermen groups, modern industry and the state together to craft informal management institutions that are mutually acceptable. Chapter 6 detailed how state and non state organisations negotiated various concerns through an interactive process. For instance state and communities negotiated livelihood securities through the politics of livelihoods (Thomson and Baiju, 2005). As part of this settlement, artisanal fishermen got the use of large mechanised fishing vessels with ring seines legalised. Although, the Supreme Court banned the operations of large ring seines operated by artisanal fishermen, state government later brought in legislation to legalise operations. Within the district, gear conflicts are resolved through mutual consultations involving artisanal fisher organisations and state bodies. Issues related to economic profits to artisanal and industrial fishing vessels and resource health have been addressed collectively through informal networks of organisations representing fish workers and industry through the politics of negotiation. In other words, the space necessary for crafting management institutions has been captured by non state organisations and their networks in an attempt to manage the complexities of marine fisheries management in Kerala today. Whether the emerged coalition could resolve the management crisis in the sector however depends on the ability of the state and non state agents to evaluate the relative ecological, economic and social costs and benefits of each decision that they negotiate in future. The practice of

marine fisheries management in Kerala today is therefore set in this dynamics of institutional interactions.

Recommendations and suggestions

The thesis, although limited in its scope, offers pathways that guide state and non state management agencies to cooperate and evolve collective solutions to the fisheries crisis in Kerala, India. In fact, modern social theories on fisheries governance recommend such possibilities as ideal alternatives to state or community centric management methods (Kooiman,2005; Jentoft,et.al.,2009; Bavnck et.al.,2012). The thesis indicated the need for a decentralised system of management that is capable of analysing the challenges of modernisation and liberalisation on marine fisheries in the state. The results of the study indicated that these issues could well be managed through the networks of state and non state organisations at the village, district and state levels where each actor brings in the list of concerns and probable solutions to the negotiating table. Solutions are evolved through consultations and negotiations within the network itself and the emerging institutions are binding on all participating actors. Since management problems crop up at various spatial and temporal scales, the agency responsible for fisheries management should be able to manage them at various levels. The rationale behind this is to bring in the subsidiarity principle in natural resource management, a principle that resolves issues at the lowest level as possible (Berkes,2006; Marshall, 2008). Case studies presented in chapters five and six indicated that these forms are evolved out of communities' initiatives to seek solutions for the problems they

confront in fishing in a world that is fast globalizing. The success of these informal co management initiatives in turn depends on how state and civil society perceive these issues and join hands with local fish workers to attempt solutions to their pressing problems.

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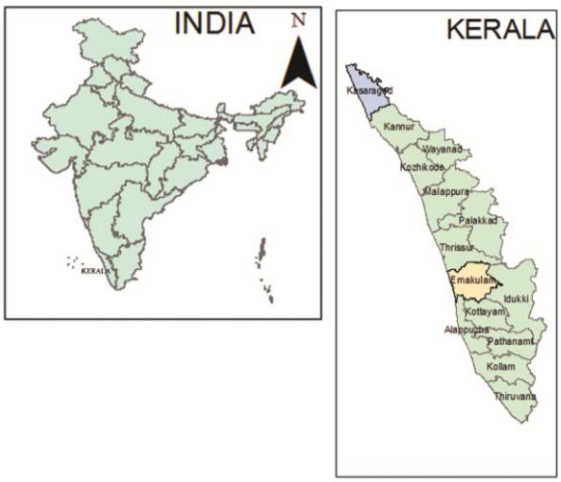
APPENDICES

Appendix 3.1


INDIA
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Alappuzha
Pathanamt.
Kollam
Thiruvana


ERNAKULAM
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Aluva
Chendamangalam
Chennamanad
Cheranallur
Paravur
Chowwara
Paravur
Kunnathun
Kottuvally
Aluva
Perumbavoor
Eloor
Vazhakkala
Ernakulam
Kothamang
Edathala
Kalamassery
Muvattupuzha
National Highway No. 49
Mulavukad
Thiruvankulam
Kochi
Narayanna
Varappuzha
Kochi
Naradu
Muvattupu
Thrippunithura

Appendix 3.2

School of Industrial Fisheries
Cochin University of Science and Technology

Semi-structured interview Guide for Analyzing Livelihoods and Institutions of artisanal mechanised marine fishery

History

Politics

Macro economic conditions

Terms of trade

Climate

Marine – ecology

Demography

Social differentiation

1. Name of the fishermen:
   Address:

2. Number of years in business:
3. History of family in marine fishery

Details of characteristics of artisanal mechanized fishing vessel

1. Size of boat :
2. Type of boat :
3. H.P. Boat :
4. Type of fish :
5. Ownership of boat :
6. Craft cost :
7. Gear cost :
8. Otter board :
9. Accessories :
10. Wire ropes :
11. Others :
12. Total :
13. Depreciation on craft :
14. Depreciation on gear :
15. Depreciation on accessories :
16. Depreciation on wire ropes :
17. Interest :
18. Salaries and wages of the hired staff :
19. Diesel charge :
20. Lubrication oil, compressor oil, grease :
21. Ice, salt :
22. Fish bait :
23. Ration for crew :

24. Repairs of boats and gadgets :
25. Wire rope / nylon ropes :
26. Basket and others :
27. Port charges :
28. Berthing charges :
29. Warfage :
30. Transportation, auctions etc :
31. Any others :
32. Strength of crews, skilled and unskilled :
33. Nature of laborers
34. Number of percentage of migrant laborers
35. Number of voyage in a year :
36. Duration of a voyage :
37. Number of species harvested :
38. Average catch per trip by species wise :
39. Price per species wise :
40. Total income by all species :
41. Problems of artisanal mechanized fishery:
42. Resource information characteristics (or cost) of artisanal mechanized fishery:
43. Information about the accompanying artisanal mechanized fishing vessels:
44. Information about the rival groups/ other groups:
45. Market information characteristics:
46. Organization features mechanized fishers/ fishermen/ fishery:

47. Objectives, structure of organization artisanal mechanized fishery:
48. Norms, conditions, terms, understandings membership, fees, fine etc:
49. What are the major artisanal mechanized fishing vessel problems:
50. Method resolution of artisanal mechanized fishery problems:
51. What are the main reasons of conflicts in artisanal mechanized fishery:
52. Method of solving of conflicts in artisanal mechanized fishery:
53. Did you have idea about artisanal mechanized fishery:
54. Did you went to strikes / agitation for the formulation artisanal mechanized fishery:
55. Monitoring organizational rules, norms, and regulations and agenda:
56. Monitoring and evaluation type of fishing activity of others:
57. Have disputes about fishing style of others, I mean migrant artisanal mechanized fishery:
58. What type of disputes, can you classify that:
59. Type of conflicts, within groups (Inter groups, intra groups, inter region, regional base)
60. Method of resolution and cost of resolution
61. Sanction for rules violation in organization, types of violation etc.
62. Did you aware duties and rights of in fishing
63. What is the major identified rights in fishing grounds
64. Have protection strategy to keep that fishing grounds
65. Did you aware of stocks in every season

66. How do you maintained those stocks
67. Have any cost for those maintenance
68. What is the strategy of maintenance
69. What is the strategy of evaluation
70. How do you share resource stocks
71. Had you experienced of non sharing situation marine stocks
72. Have strategy developed accompanying artisanal mechanized fishing vessel in resource system
73. How do you share that cost between artisanal mechanized fishery and other groups

Livelihood Resources

I The First series of questions will explore sustainable livelihoods artisanal mechanized fishery

1. How are you today?
2. What do you do?
3. How long you have been engaged as a marine fishery?
4. Is everyone in your family engaged in marine fishery?
5. What other professions do you engage yourself in different seasons?

II Natural capital

Natural resource stocks

Soil, water, genetic resources

Environmental Services

Hydrological cycle, pollution sinks etc.

What are the problems related to allocation and resource health in the fishery of the kadavu?

1 Are there signs of resource degradation? What are they and how do stakeholders explain them?
2 Are there signs of ecosystem-shifts? What are they and how do stakeholders explain them?
3 Can changes in CPUE be detected?
4 How do fishing people, communities, government, and civil society respond to these changes?
5 Which changes in fishing practices can be detected with regard to fishing technology, fishing time, fishing grounds, species, marketing and consumption patterns?
6 Are some groups of fishing people more affected than others and in which ways?
7 What are the incentives to overfish?
8 Which barriers of entry exist and how do they function?
9 Are new groups entering the fishery and are some leaving/being excluded? What happens to people who leave?
10 Are there crowding and conflicts over space etc. occurring on the fishing grounds and how are they being expressed and addressed?
11 Are rules being violated, and are they discovered and sanctioned and how?

III The next set of questions will deal with relative importance of various incomes and livelihood activities of artisanal mechanized fishery

1. Who owns the marine fishery crafts and gears?
2. What is your main occupation?
3. When did your family arrive in this area?
4. What is the main source of livelihood and income for your family?
5. How long have you been working? Where? When did you learn to new fishing style?
6. What do you obtain from marine fishery? Income? Resource rights?
7. How many marine fishers are there in the community?
8. Are most of the marine fishers residents of the community?
9. Where/how is fish sold/marketed? How are fish products priced?
10. Who are middlemen? What is their role? Can you suggest names?
11. Have you borrowed money from middlemen/institutions? If so, how much and with what conditions?

IV Human skill

Skill, Indigenous knowledge, ability of labor, health situation, Physical capability etc

V Social capital

Networks, Social claims, Social relations, affiliations, associations

VI Analytical questions: -

1. what are the trends in terms of availability of different types of livelihood resource?
2. How are different capital assets being depleted and accumulated? And by whom?
3. What are the trends in terms of access?
4. What are the new livelihood resources? How many new strategies?
5. Can one type capital investment substitute for new livelihood?
6. Did you receive new strategies, or you accompanied with collective strategies?
7. Did you receive any negative and positive new livelihood?
8. Who is directed new livelihood strategy to you, Community, Church, Friends, others

VII The next set of questions will deal with problems and coping strategies of workers

1 What are the major problems you face in different seasons in marine fishery?
2 What do you do to cope with these adversities?
3 Does the transformation from traditional marine fishery to mechanized fishing affect you?
4 If so, how and to what extent?
5 What other activities are you engaged in?

VIII The next set of questions will deal with role of government and fisheries department (marine fishers, local leaders and government officials):

1 What are the issues that triggered such transformations?
2 What measures do you suggest to improve the situation, if any?
3 How local institutions have been impacted by the change in the marine fishery practices?
4 What is your comment on the role of government institutions in this regard?
5 What measures can be taken to ensure sustainable marine fishery practices and your livelihoods?

Livelihood strategies

This section aims to analyze livelihood strategy portfolio and pathways

I Marine fishery intensification

1 Where did you have new capital for the intensive fishing?
2 What role of government institutions to do new intensive fishing?
3 Have any labor problems in your fishing area?
4 Have any network in new intensive fishers?
5 Did you have any organization? If what s the functions?

II Migration

1 What is the reason for migration?

2 Type of migration

a. Voluntary migration

b. Involuntary migration

c. Seasonal migration

d. Cyclical migration

3 What is the movement pattern of migration for livelihood?

Social Organization of mechanized marine fishery

The second series of questions will explore Marine resource management

I Set of questions will deal with owners, local leaders and government officials

1. Please tell me about the management structures of this marine fishery system.
2. Who are the actors involved in the management process?
3. What role do the government agencies play in this structure?
4. What role do the fishers play in this structure?

II The next set of questions will deal with role of local administrative units (local leaders, marine fishers and government officials)

1 What is the role of Panchayat / Temple / Church (local administrative unit)?

2 What are the conflicts among different actors?

3 How such conflicts are being mitigated?

4 What role do local institutions play in the management process?

5 What role do fishers play in the management structure?

6 Are their opinions given sufficient importance?

7 How frequently you sit together to analyze the situation?

8 What about the representation of the fishers in resource management committees?

9 Do the fishers have a real say in the decision-making?

10 If so, how?

III The next set of questions will deal with resource rights and resource management (local leaders, marine fishers and government officials)

1 How decisions are made regarding the use of local resources?

2 What about the leasing process of the crafts and gears?

3 Who actually have access to such a leasing process?

4 Why do poor fishers fail to get control over the local resources?

5 What is your opinion about the overall performance of the co-management structure?

6 How you have been personally benefited or affected by the co-management structure?

7 What is your opinion for improving co-management structure?

IV The next set of questions will explore co management issues (government officials):

1. Please tell me about your experience of the current centralized management structure in marine fishery.
2. What are the strengths and weaknesses of current structure?
3. When did the process of co management started, if any?
4. Are you aware of the existing co management policies?
5. How co management process is reflected at the local level?
6. Do you think that government agencies handed over both responsibility and authority to the local management structure?
7. If so, to what degree?
8. How do the government agencies mediate in the process?
9. What are the hurdles to implement the existing co management policies?
10. What is your opinion to improve the limitations of the co management process?
11. Do you think co management policies (in practical) are going to work here?

Physical and technical Characteristics of the resource system

Excludability: relates to the coast of preventing others from using the resources

Sub tractability: refers to situations in which use the resource by one individual reduces the amount available to others

Size of the resource system

Flow or supply: described by the predictability in quantity, over time and space

Keys:

Structure:- size, clarity of boundaries

Flow patterns:- Predictability in time, across space and quantity

Condition of the resources

Technology:- For withdrawing resources, For exclusion

Cost of exclusion technology

Characteristics of the group of users

Demand for, dependence on, and knowledge of the resource, organizational experiences or density, time horizon, openness and stability.

Number of members, class of members

Time horizon

Proximity to resource and between users

Extent interaction – individualized or collective action

Skills and assets of leader in different class

Homogeneity vs heterogeneity of interests

Shared norms of behavior / culture

Stability

Location of resource and residence of users

Users' knowledge

Users' demand

Power structure

Mutual obligations

Institutional arrangements

Design principles

- Members access rules
- Resource boundary rules
- Appropriation (withdrawing) and provision rules
- Collective choice arrangements
- Monitoring and sanctioning rules
- Monitoring mechanism
- Recognition of rights to organize by external agents
- Nested enterprises – multiple layers of nested enterprises
- Market conditions for the resource
- Punishment rules

Ability to change rules

Governance structure internally

Governance structure externally

Operational rules

Operational rules divided in to five categories

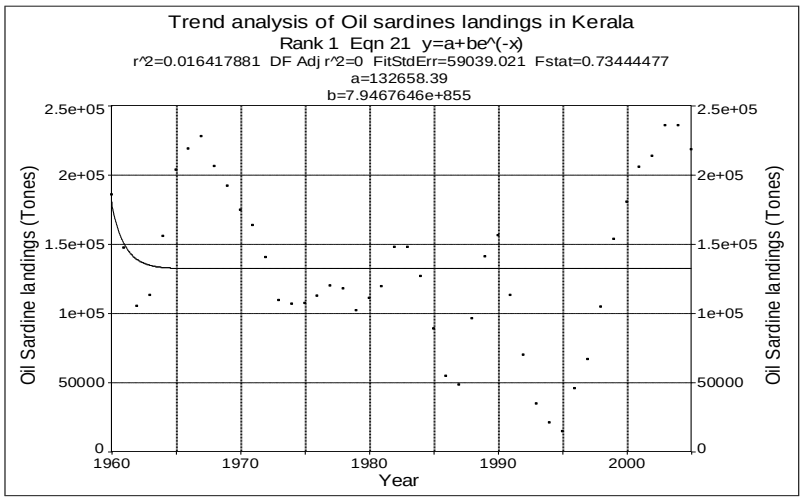
1. Boundary and access rules
2. Allocation rules (who is getting what?)
3. Input rules (in what way users contribute)
4. Penalty rules (monitoring and sanctioning)
5. Conflict resolution rules

Collective choice rules

Constitutional Rules or Formal Rules

Nested enterprises

CHAPTER 4: APPENDICES



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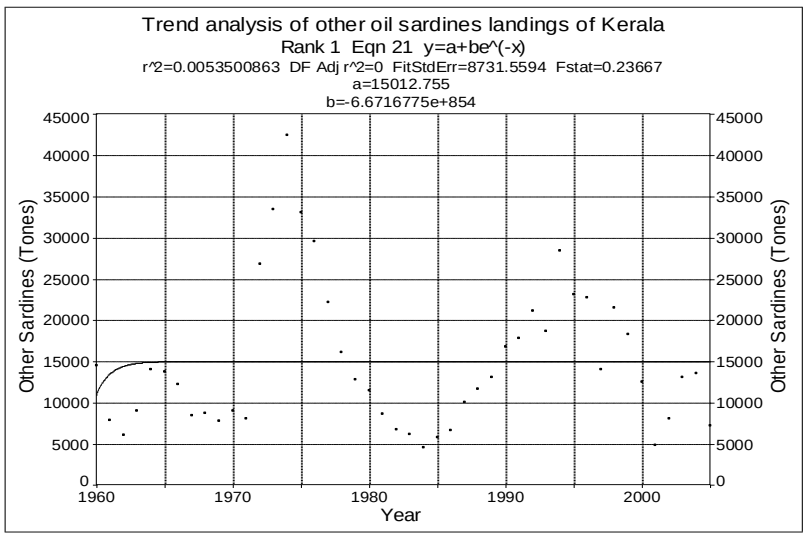

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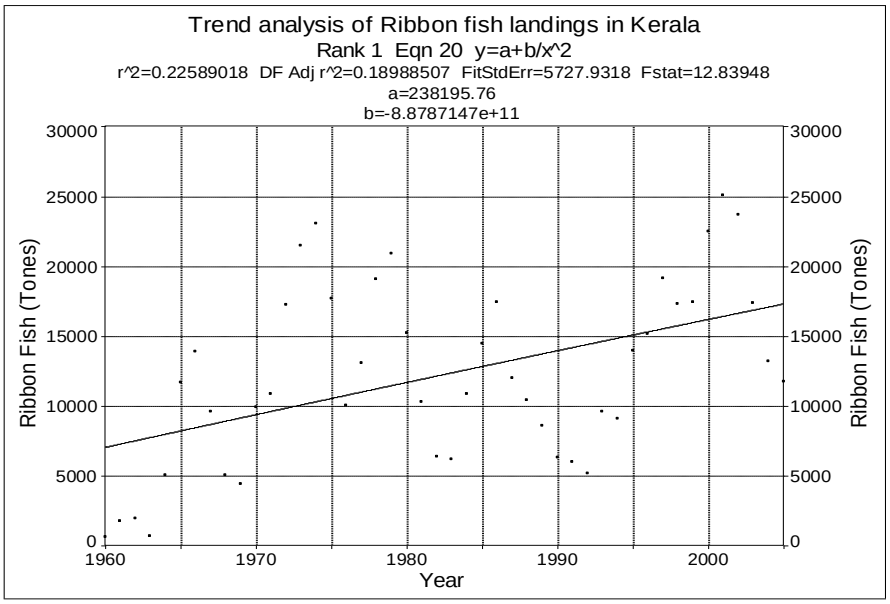

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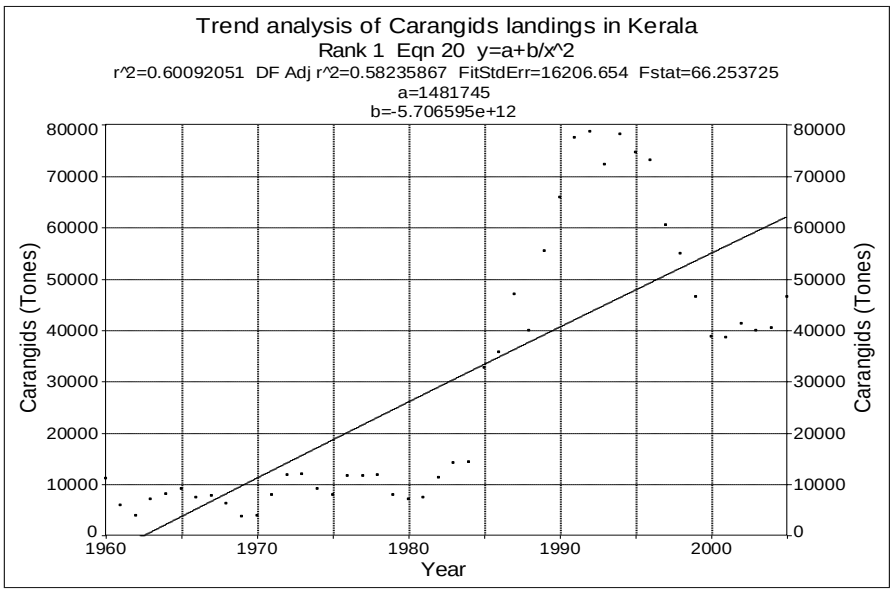

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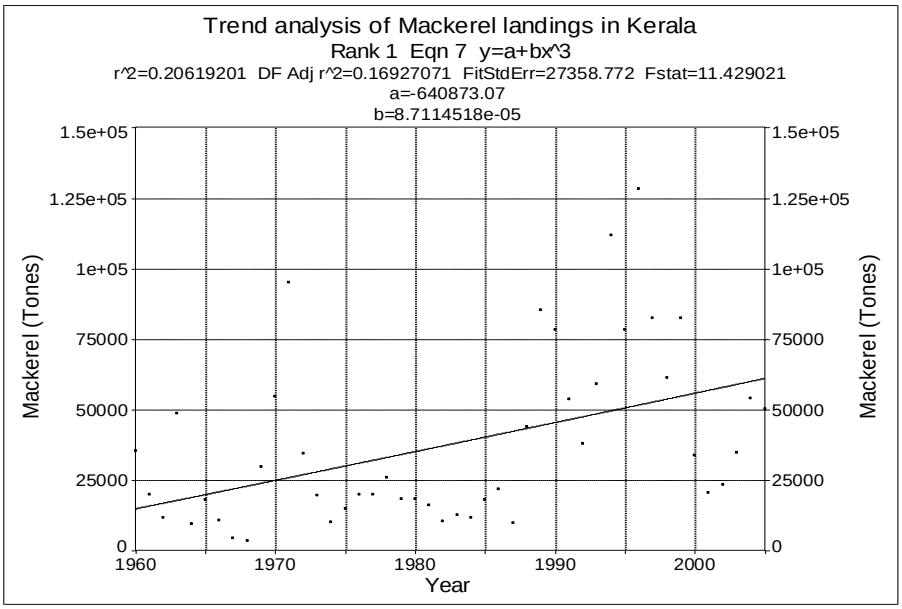

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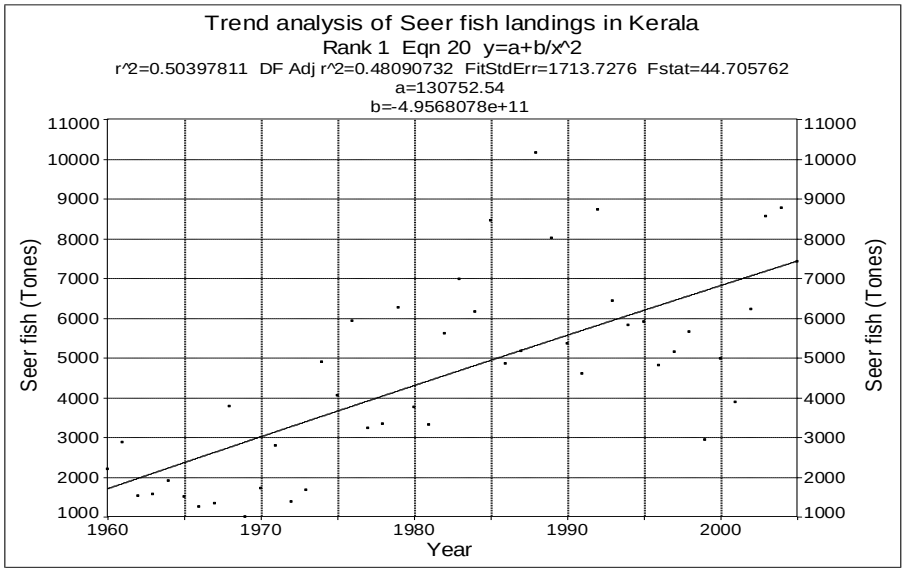

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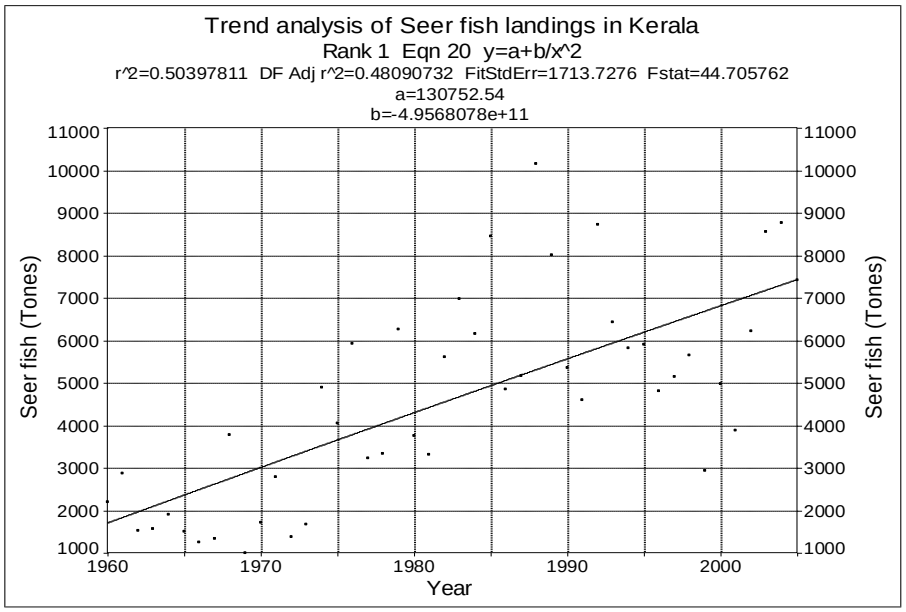

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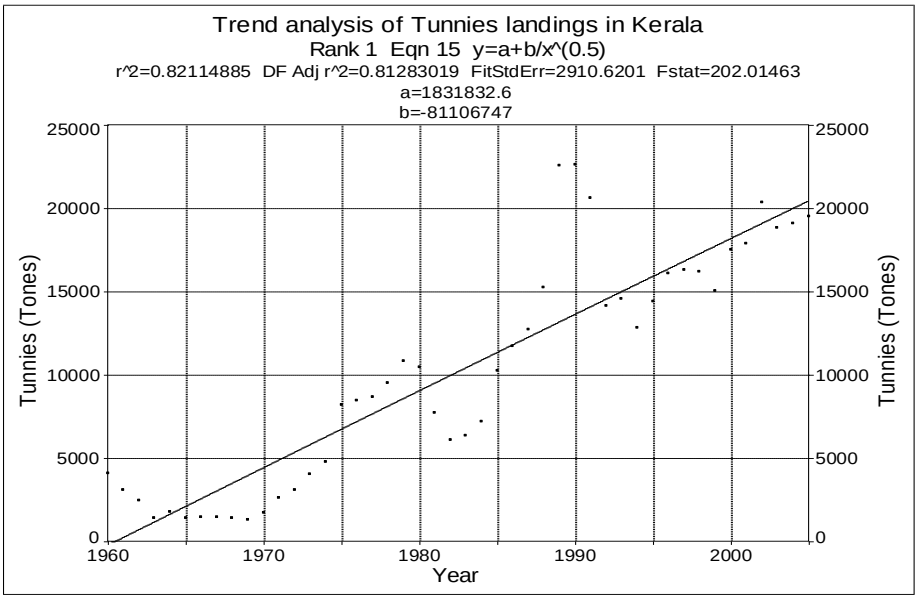

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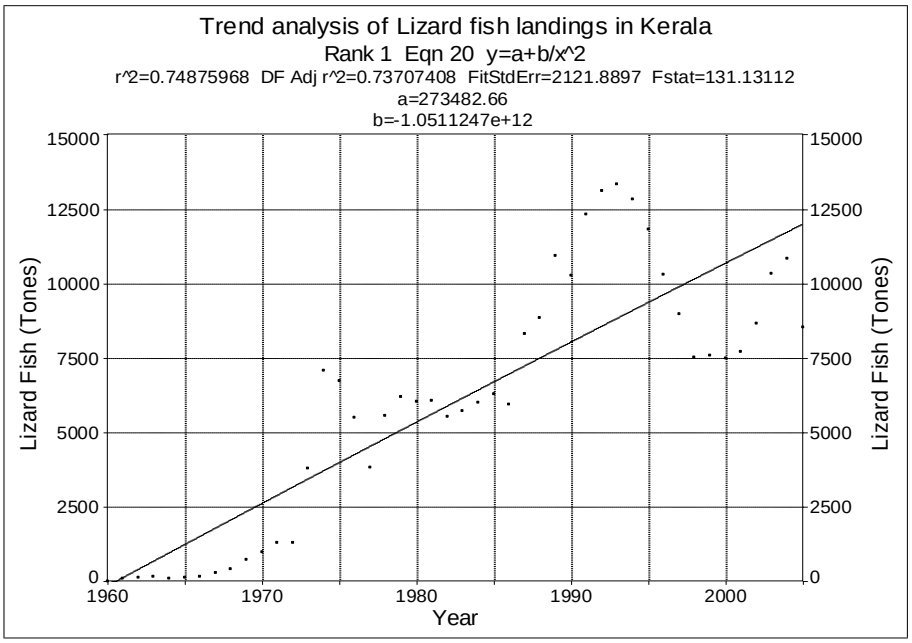

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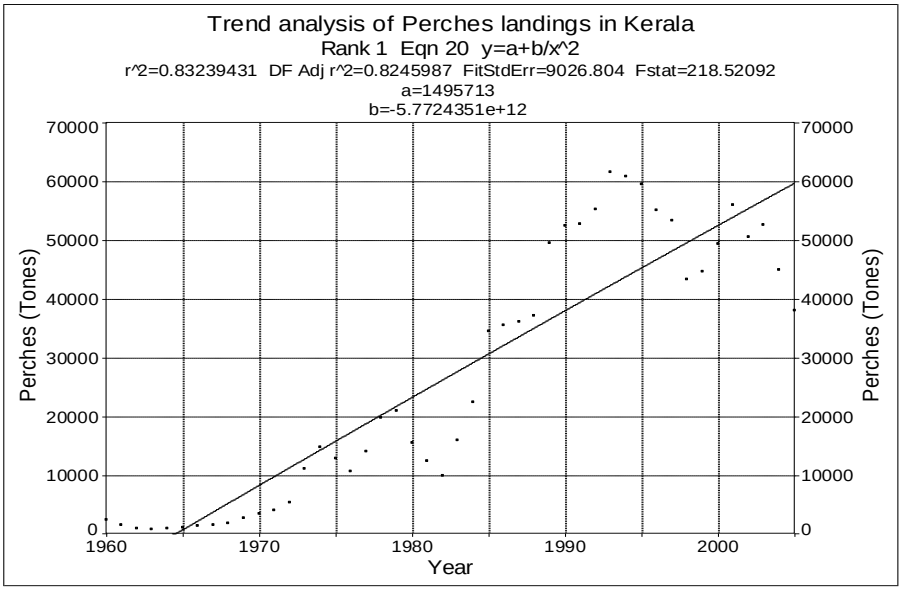

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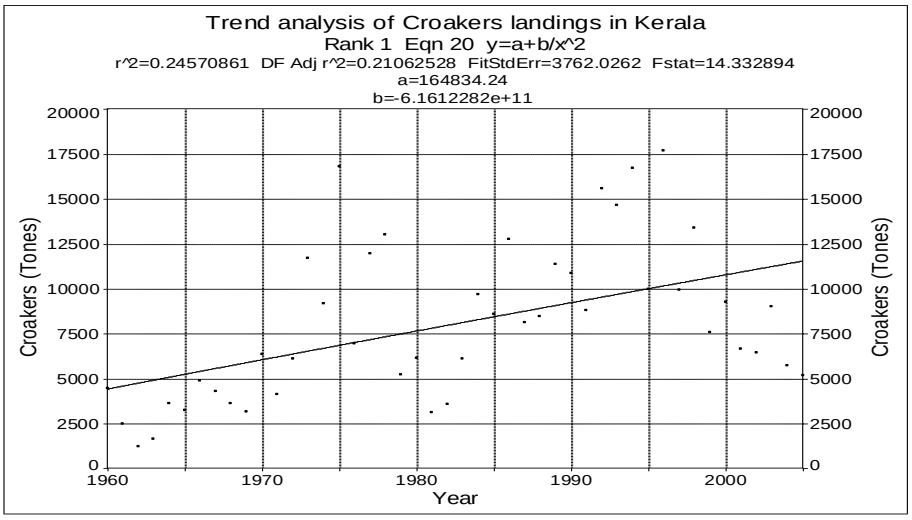

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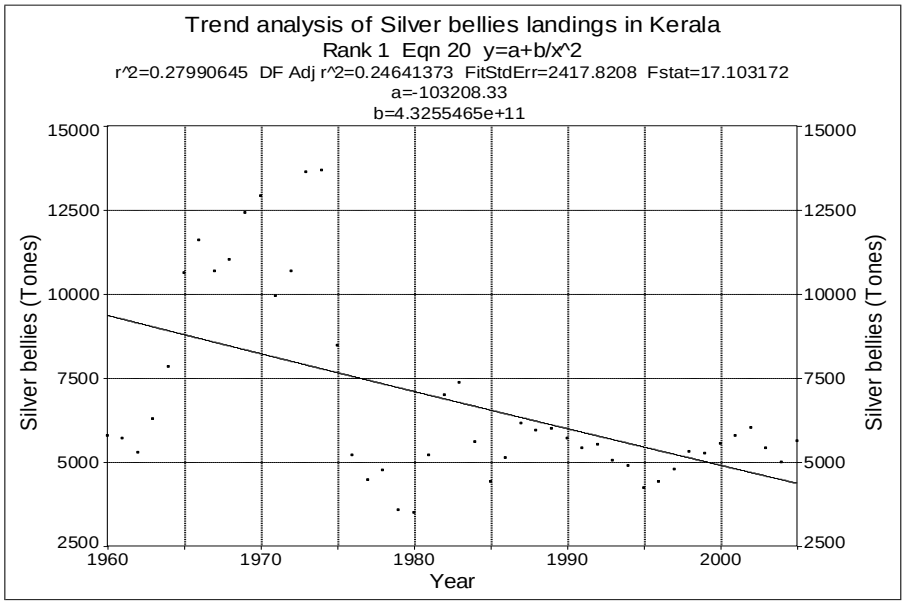

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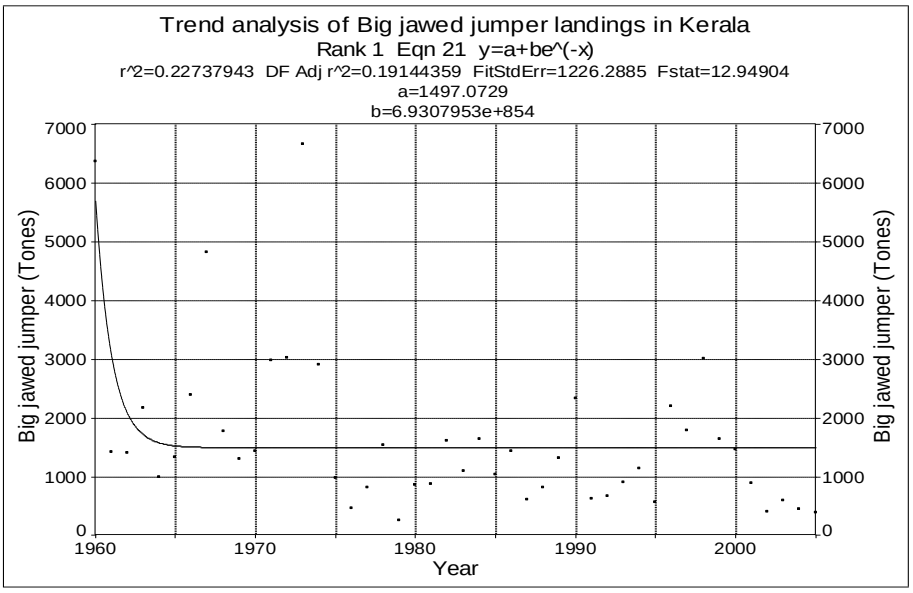

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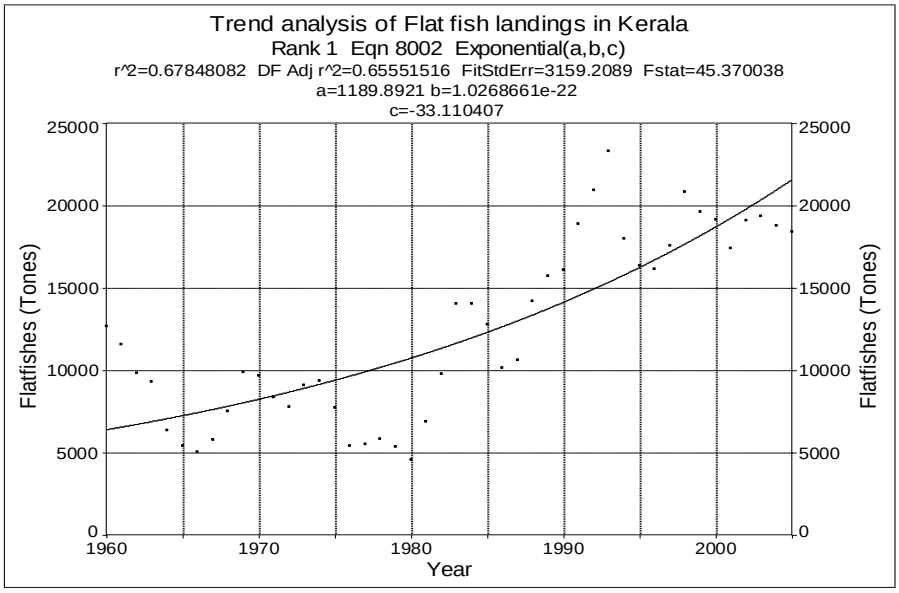

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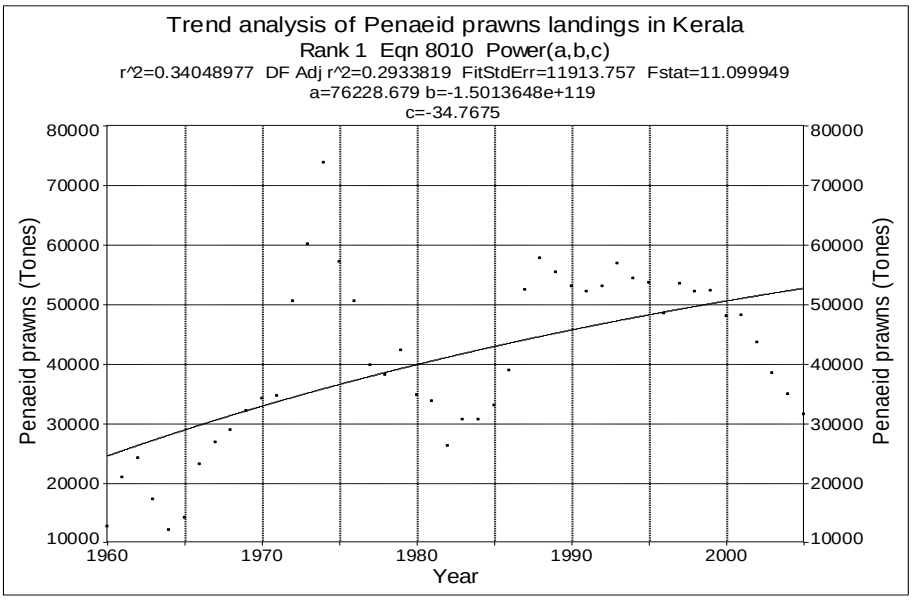

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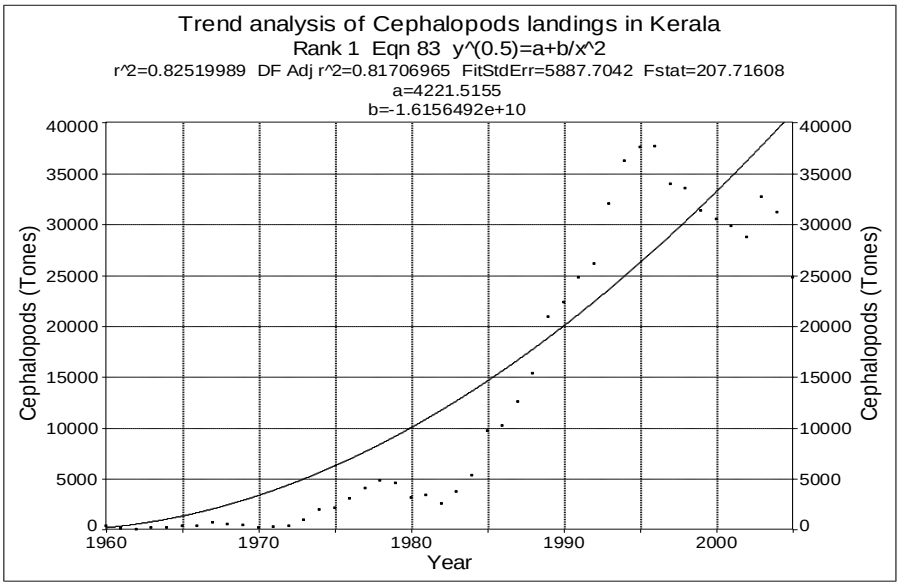

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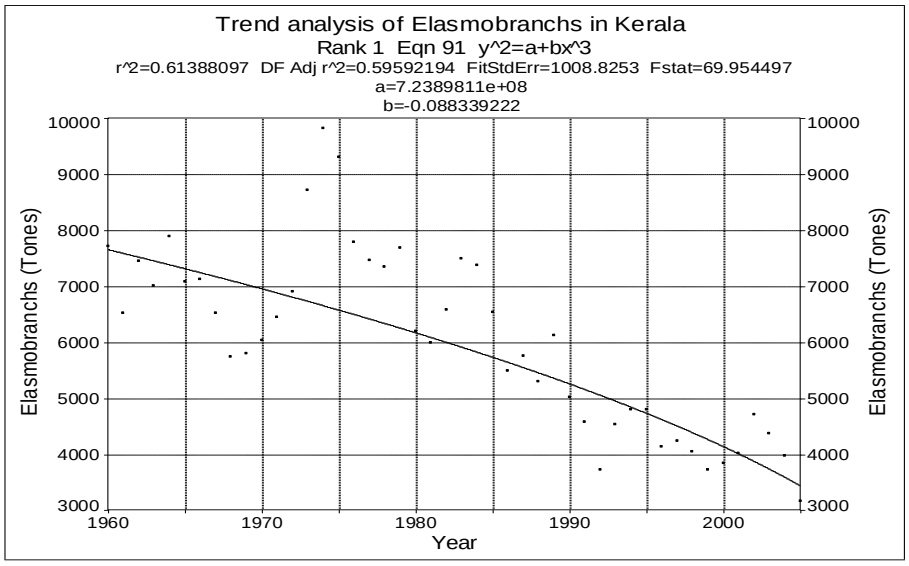

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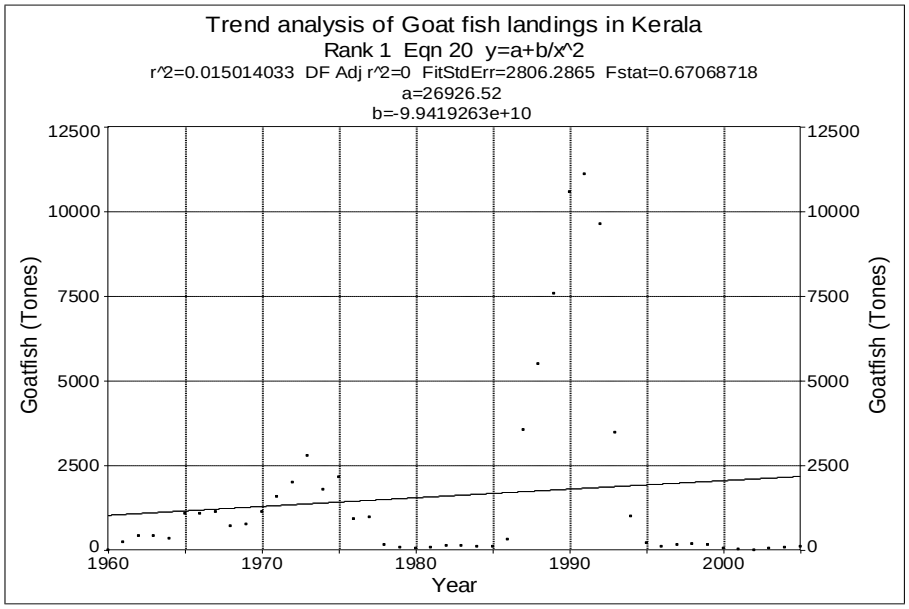

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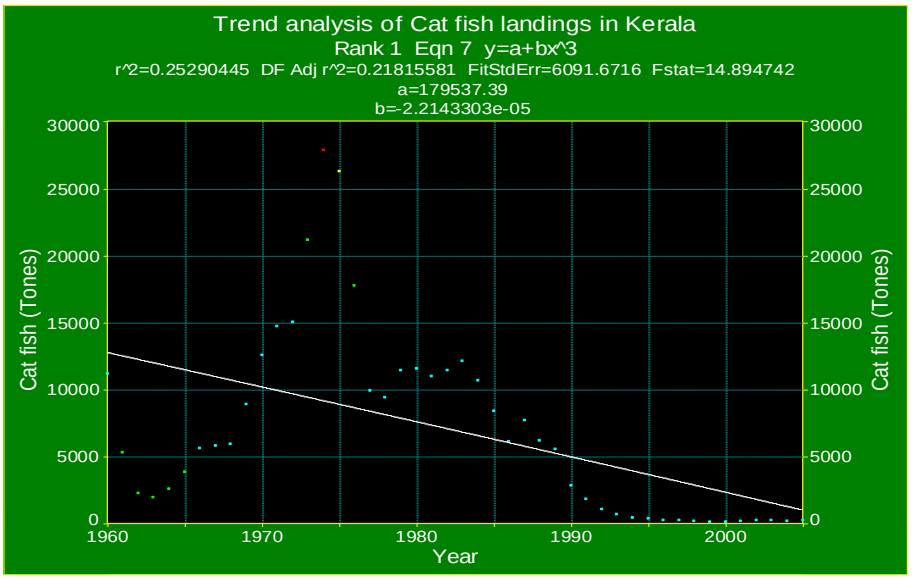

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