POVERTY, INEQUALITY AND NATURAL RESOURCE DEGRADATION:

AN INVESTIGATION INTO THE SMALL-SCALE FISHERY SECTOR OF SOUTH KERALA.

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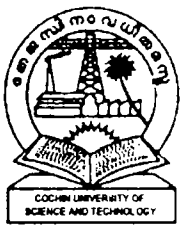

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Certified that the thesis entitled 'Poverty, Inequality and Natural Resource Degradation: An Investigation into the Small-Scale Fishery Sector of South Kerala' is a record of bonafide research work done by Shri R. Mahesh, in fulfilment of the Degree of Doctor of Philosophy in the Department of Applied Economics, Faculty of Social Sciences, the Cochin University of Science and Technology under my supervision. It is further certified that the thesis is not previously used for any Degree, Diploma and Associate Fellowship or for awarding other similar title or recognition.

D. Rajasenan
Supervising Guide

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CHAPTER - I
INTRODUCTION

The present study is an attempt to understand the link between natural resource degradation and poverty among people dependent on these resources. This is done by examining the impact of depletion of marine resources on the livelihood and socio-economic condition of the small-scale marine fishing community in South Kerala.

1.1 BACKGROUND OF THE STUDY

1.1.1 Dependence of poor on natural resources

Degradation of natural resources such as land, forest, marine and fresh water, bio-diversity, etc. threatens the livelihoods of people, especially the rural poor. The poor people depend mainly on these freely available natural resources for their livelihood and survival strategies. They fish from ponds, rivers and the sea, gather fuel wood from woodlands, forests and roadside trees, collect fodder, graze their animals and hunt in the forests. They also collect non-timber products like gums, resins, wild fruits and berries, etc. from forests. These resources provide them a range of goods for household use in various capacities as consumer durables, production inputs, and capital assets. They also perform an important safety net function and safeguard against exogenous stresses and shocks. Even when the poor have access to other resources, these natural resources provide a cushion to them during periods when income from other sources declines or becomes unavailable; and natural resources are sometimes the only asset to which the poor people have access (Shyamsundar, 2002). It is these groups that are the most impacted due to the declining natural resource environment, especially in the absence of any successful process of regeneration. According to the World Development Report 2000/2001, referring to Amartya Sen, "poor people live without fundamental freedoms of action and choice that the better-off take for granted. They often lack adequate food and shelter, education and health, deprivations that keep them from leading the kind of life that everyone values. They also face extreme vulnerability to ill-health, economic dislocation, and natural disasters. And they are often exposed to ill treatment by institutions of the State

and society and are powerless to influence key decisions affecting their lives" (World Bank, 2001). In this present study an attempt is made to understand the way in which natural resource degradation affects poor people with special reference to small-scale marine fisheries of Kerala. Before discussing the link between natural resources and poverty, it is necessary to discuss the concepts of natural resources and poverty.

1.1.2 Concept of natural resources

Classical economists used land as a generic term to describe natural resources. Broadly defined natural resources include all the 'original' elements that comprise the earth's natural endowments of the life support systems: air, water, earth's crust, radiation from the sun, etc. The natural resources may be broadly classified into 'renewable resources' and 'non-renewable resources'. Renewable resources are natural resources capable of regenerating themselves within a relatively short period provided the environment in which they are nurtured is not unduly disturbed, e.g. fish, forests, soil, etc. The renewable resources are further classified into biological and flow resources. (Examples of flow resources are solar radiation, wind, tides and water stream.) Non-renewable resources are resources that exist in fixed supply or are renewable only on a geological timescale, where regenerative capacity can be assumed to be zero, for all practical purposes. These may be classified into recyclable (e.g. metallic minerals) and non-recyclable (e.g. fossil fuels). The term 'environment' generally means a natural resource base that provides sources (material, energy, resources, etc.) and performs as a sink functions (such as absorbing pollution). The term also includes resources that people have relied on and no longer do so, either because the resources are depleted or because they have been replaced by some other resource or technology (Bucknall et al., 2000).

In economic analysis, the difference between a natural resource and an environmental resource lies primarily on the focus of analysis. In natural resource economics, the emphasis is on the inter-temporal allocation of extractive non-renewable resources and the harvest of renewable resources. In other words, natural resource economics is mainly concerned with rates of

exhaustible resource depletion and the determination of optimal harvest rates for renewable resources. Environmental economics, on the other hand, focuses on pollution; and the primary focus is as how to use or manage the natural environment as a valuable resource for disposal of waste.

What does environment degradation mean? The term 'degradation' can be interpreted in different ways. As a working definition the term 'environmental degradation' can be used to imply (i) depletion (the damage to a natural resource system, which affects present or future human needs negatively) and (ii) pollution (leading to a damage to human health or decline in the capacity of the environment to sustain natural systems). Environmental degradation is a sub-set of environmental change.

The main causes for natural resource degradation are (i) market failure, (ii) policy failure, (iii) institutional failure, and (iv) population growth. Market failure happens when clear or values for natural resources do not exist or when markets function poorly or distorted relative prices result in miss-allocation of resources, excess resource exploitation and subsequent degradation by private and public users. Policy failure manifests itself when inappropriate government policies, or absence of required policy result in market distortions for natural resource use, aggravated market failures, and natural resource degradation by private and public users. Institutional failure takes place when a country lacks the necessary government structures, environmental legislation and regulations, or when a decline in traditional land-use management processes result in natural resource degradation. Population growth intensifies pressure on the land base in excess of its carrying capacity. Population growth is commonly cited as a major contributor to environmental degradation on the ground that it leads to increased consumption and higher demand for natural resources.

1.1.3 Poverty and natural resource degradation

The link between poverty and natural resource degradation has been the subject of many studies, most of them relating to rural livelihoods. Poor people depend for their livelihood, on various activities which include farm and non-farm activities, petty trade, wage labour, etc. Majority of them, especially those

in rural areas, tend to depend on natural systems, directly or indirectly, for income generation, subsistence and shelter. Therefore, a declining resource base affects their well-being and in turn some times forces them to degrade the environment resource base even further. It is widely hypothesised that there is a spiral or circular relationship between poverty and environmental degradation. In other words, the hypothesis suggests that environmental degradation leads to poverty which in turn leads to further degradation. Some authors argue that poor people extract more natural resources and cause greater environmental degradation than others due to excessive reliance on the natural resource base and the placing of high discount rates on future returns. On the other hand, there are several studies which point out that since poor people depend more heavily on a limited natural resource base, they attach greater value to its conservation and so have developed sustainable management strategies (Reddy, 1999). Poverty is sometimes associated with environmental degradation; but there does not necessarily exists a direct causal relationship between the two. The poverty trap thesis implies that the poor lack the ability to forgo present subsistence in favour of savings for future consumption or environmental quality. This handicap coupled with their high degree of resource dependence, leads to preoccupation with short-term results, thus generating environmental degradation (During, 1989). However, there is little empirical evidence to conclude with certainty the causative link. Some cases support the theory; others disprove it.

The present study is an attempt to examine the impact of natural resource depletion on the livelihood of the poor in the small-scale fishing community in the case of the coastal fishery sector of Kerala. There exists little empirical evidence on the nature and extent of poverty in these communities and on the relative importance of different causes of poverty.

1.1.4 Resource degradation in open access fishery

The depletion of marine fishery is a phenomenon experienced the world over and many people are concerned about this phenomenon. Several causal factors underlie it. Economic considerations and the existence of an open access fishery, may presumably provide a possible causal link.

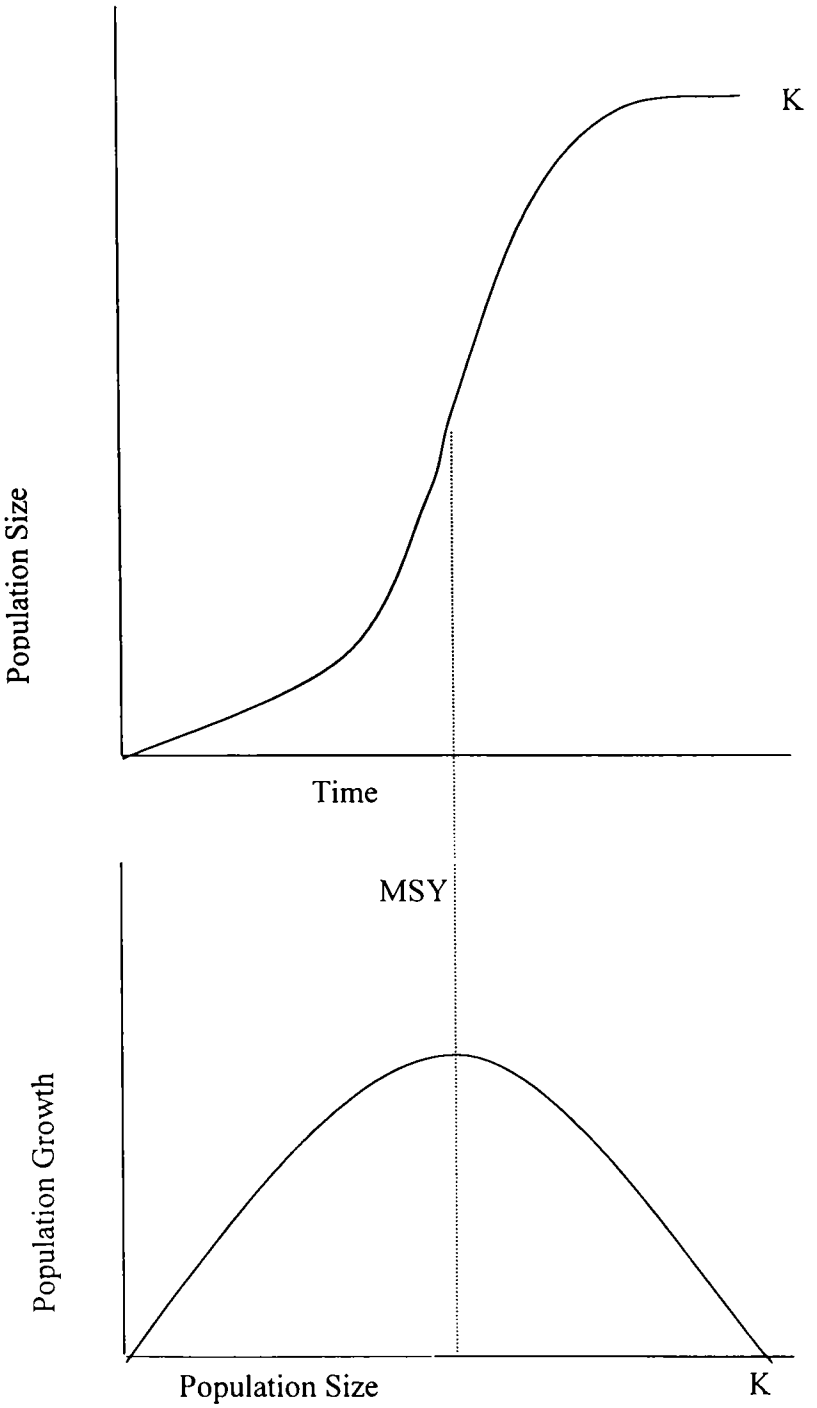
The economic theory of fish resource exploitation has been built up on the basis of relatively simple biological and economic models[1]. One of the biological models is known as the Schaeffer growth model developed by Schaefer (1954). The model postulates that the growth of a stock of fish depends on the size of the standing fish stock. At a small size, the growth rate is small, but it increases as the stock becomes larger until a point is reached beyond which growth declines with further increase in stock. This implies an inverted U-shaped curve as shown in the lower panel of the Figure 1.1.

The curve in the upper panel of figure 1.1 is the logistic curve, which shows the size of the population at different points of time. The implication is that in a stable and unmanaged ecosystem, over time, the biomass of the fish population tends to rise towards the definite maximum size of K, which is the carrying capacity that can be supported in a particular area. It also shows that because of the self-regenerative capacity, within certain limits, it is possible to harvest the resources while maintaining the size of the underlying population. As shown in the upper panel of the Figure 1.1 the maximum productivity corresponds to the inflection point on the population growth curve.

Fishing effort is introduced into this model in the form of human intervention causing fishing mortality in addition to natural mortality. It follows that there exists an inverse relationship between fishing effort and the size of standing stock. When this relationship is looked in conjunction with the relationship between natural growth and stock, we obtain an inverted relationship between effort and growth. Since sustainable catch exactly equals the growth at the corresponding level of effort, the sustainable catch-effort relationship is identical to the growth-effort relationship. In the initial stages of exploitation of fishery, expansion of effort brings about more or less proportional increase in catch; but as effort expands the rate of increase of catch declines, until a point referred to as the maximum sustainable yield (MSY) is reached, beyond which additional effort reduces sustainable catch.

[1] During the fifties, the fundament of modern fisheries research was laid by the biologists Schaefer and Beverton and Holt, and by the economists Gordon and Scott (See Schaefer, 1954; Beverton and Holt, 1957; Gordon, 1954; Scott, 1955). Gordon's seminal paper still provides the essentials for understanding the problems with fisheries. The model he developed, based on the logistic growth model extensively used by Schaefer, is commonly referred to as the Gordon-Schaefer model.

Figure 1.1 Logistic Curve and Schaefer Curve Illustrating the Formulation of MSY



Fishing takes place because fishing is profitable to fishermen. In considering the effect of fishing on a stock of fish, it is necessary to examine the economics of fishing from two points of view: first the economics of the whole fishery, i.e. the economics of the industry and secondly the financial consideration of the individual fishermen, i.e. the economics of the firm.

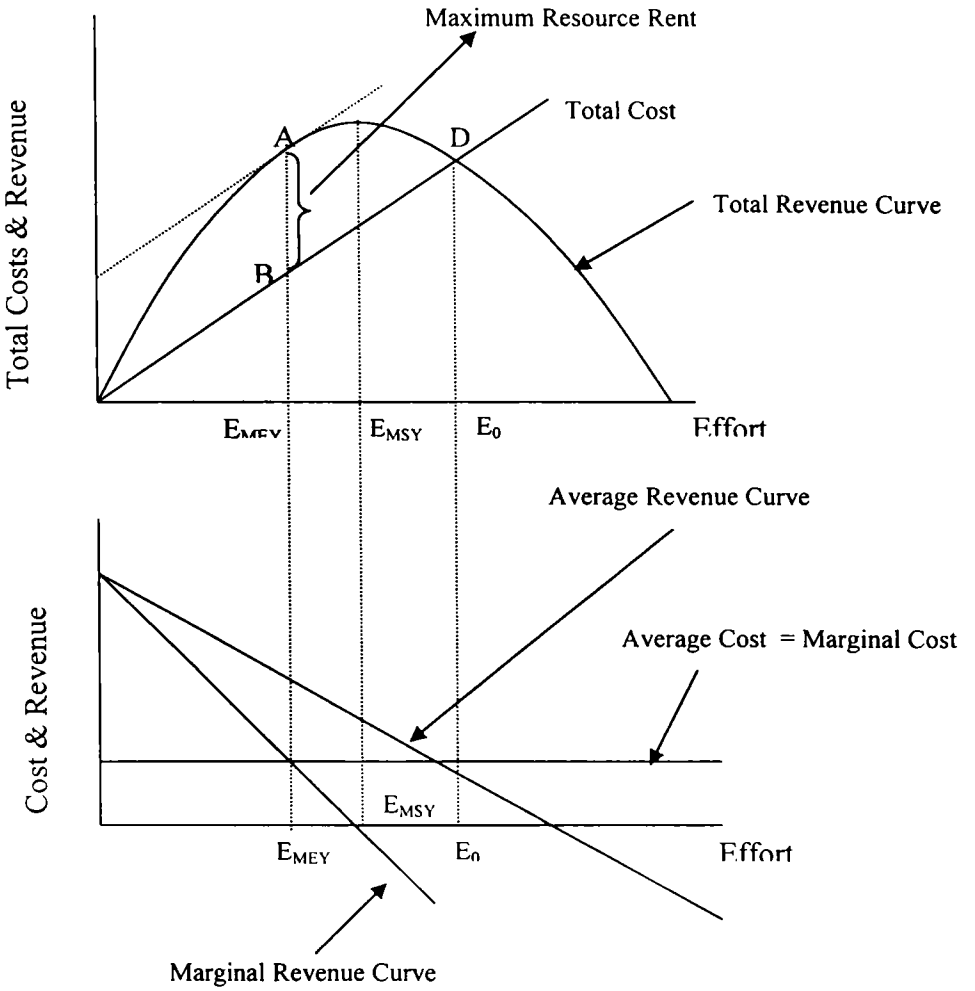
Figure 1.2 is a standard figure for explaining the economics of fishery exploitation as developed by Gordon (1954). As in most economic models, it is assumed that price of fish remains constant, the cost per unit of fish caught remains constant for all quantities caught, there exists a single species fishery and finally fishers operate in perfect competitive conditions.

Under these assumptions, the total revenue (TR) curve has the same shape as the sustainable yield curve given in Figure 1.1. Assuming a constant average cost per unit of fishing effort, the total cost (TC) is graphed as a straight line as given in Figure 1.2. Putting revenue and cost together, we obtain a complete bio-economic model, in which the net economic yield or resource rent is obtained as the difference between total revenue and total cost. The maximum resource rent is obtained at E_{MEY} level of effort where the marginal revenue of effort equals the marginal cost of effort. This level of effort however, is not tenable in an unregulated open access fishery, and gravitates towards a much higher level of effort at E_0 where all resource rent is dissipated.

Under an open access regime, access to the fishery is unregulated and is free and open to any person who has the capability and the desire to harvest. Its exploitation will then result in over-fishing and the resource rents will dissipate over a period of time[2]. The free access equilibrium is then reached at E_0 where total cost is equal to total revenue, that is at point D in Figure 1.2.

[2] Resource rent, defined as the surplus value over and above the opportunity cost for all the factors of production, arises from the ownership of, or access to, a valuable resource in limited supply.

Figure 1.2 Resource Rent in Open Access Equilibrium



Fisheries in the open access system is a classical example of a common pool resource (CPR) that can be exploited by anyone and is sensitive to over-exploitation. One of the methods of classification of resources followed in resource management is that of the properties of 'exclusion' and 'subtractability'. Exclusion refers to the degree to which access to the resource could be restricted. Subtractability deals with whether or not one person's appropriation of a resource reduces the availability of that resource for others

(Randall, 1983; Hussen, 2000). These two properties lead to the generation of a two-by-two typology of resource as given in Table 1.1.[3]

Table 1.1 Resource classification by subtractability and exclusion

Excludability	*Subtractability*	
	Low	*High*
Difficult	Public goods	Common pool resource
Easy	Toll goods	Private goods

As will be seen, the types of resources to which access cannot easily be denied are 'public good' and 'common pool resources' (CPR). The boundary between public goods and CPR is not, however, clearly fixed. This is due to the property of subtractability cross-cutting the four types of goods. Public goods are considered low in subtractability, while by definition CPR is high in subtractability. Marine fishing which supports a few fishers using traditional fishing methods, has almost no subtractability. The commons is then a public good. However, when the commons is appropriated by a large number of fishers and that also using modern fishing technology, it becomes unequivocally a CPR. The difficulty of exclusion (referred to as the free rider problem) combined with high subtractability can lead to the CPR dilemma referred to as Hardin's (1968) 'The Tragedy of Commons' if no effective mechanisms exist to regulate access to the resource and its use[4]. Gordon's (1954) basic argument is that in an open access fishery, resource rents will dissipate over a period of time.

In short, open access regimes result from the absence of well-defined property rights. Access to the resource is unregulated and is free and open to everyone (Feeny et al., 1996). Rent is completely dissipated at open access equilibrium.

[3] There are other classifications of resources that have different problems and appropriate solutions.

[4] When Gordon (1954), Scott (1955) and Crutchfield (1956) found that the core problem in fishery was open access and that many stocks were in serious decline, their recommendation was to restrict access.

1.2 STATEMENT OF THE PROBLEM

Kerala State with a coastline of 590 kms has plenty of marine resources with a predominance of oil sardines, mackerel, anchovies and prawns. The potential of marine fishery resources of the State within a depth of 200 m range is estimated at 7.51 lakh tonnes. (See Table 1.2)

Table 1.2 Marine resource potential of Kerala

Depth zone	*Area (Sq. kms)*	*Potential Resources (tonnes)*		
		Pelagic	*Demersal*	*Total*
0 – 50 m	15993	342000	229000	571000
50 – 200 m	23146	124000	56000	180000
0 – 200 m	39139	466000	285000	751000

Source: Dept. of Fisheries, GOK, 2002

The fishing activity in the marine sector, however, is largely concentrated in the inshore areas within a depth range of 0-50 m. Against the optimum sustainable yield of 5.7 lakh tonnes, the fish landing from this inshore area is now around 6.0 lakh tonnes thus leading to a resource depletion crisis Govt. of Kerala (GOK, 2004). In Kerala, the marine fishery sector is *de jure* under state ownership, but *de facto* it is unregulated and is open access in nature. Against this background, the development programmes undertaken by the government in the sector, which included modernisation of country crafts, popularisation of new generation crafts, and subsidised distribution of suitable complements of fishing gear, have led to an enormous increase in fishing pressure. Increase in fish prices due to increased demand both in the domestic and the export markets, has also promoted large-scale investments in craft, engine and gear leading to over-capitalisation. High price and high demand for prawns in foreign market are responsible for the anarchic growth of the number of mechanized boats in Kerala (Rajasenan, 1987). The fishery resource forecast based on 'auto regressive moving average' (ARMA) shows stagnation with reference to most of species in Kerala (Rajasenan, 1987). The enormous increase in the number of fishing crafts especially in the number of motorised country crafts and the use of ring seine, a prohibited fishing gear, are considered to be the main causes of resource depletion. Indications are that large potential resource rents are lost in fisheries because of over-fishing.

Marine fishing is a traditional activity of certain communities in the coastal area of the State. It is estimated that in Kerala about 8.4 lakh fisherfolk depend on marine resources for their livelihood[5]. Modernization ideologies in the early sixties aimed at increasing the extractive capacity of the fisheries sector and access to investment funds, led to a dualism in the form of coexistence of large-scale mechanized fisheries side-by-side with small-scale artisanal fisheries. In the years that followed the rapid expansion of the mechanized sector cut into the harvest of artisanal fishermen. The artisanal fishers responded to the new developments by going in for motorising their country crafts. The expansion of motorisation was very fast; and in order to cope with intensive competition new types of gears like ring seines were also introduced. Of the initial stages while these changes enabled the fishermen to fish more efficiently and to expand their activity space, the continuation of the process led to stagnation in fish production. Further, with about 50 percent of the fish output cornered by the large-scale sector and another 40 percent by operators of large seines in the motorised sector, traditional fishermen especially those in the non-motorised sector found themselves marginalized (Yohannan *et al*, 1999). As more and more fishermen motorised their crafts, fishing pressure increased on the limited fishery resources, which led to resource depletion. Individual catches and income began to level off and non-motorised operations lost ground. At the same time, increasing cost of operating motorised crafts reversed their initial advantage over the non-motorised crafts. The income distribution has thus become highly skewed since the mechanized trawlers and those using large seines account for only a small percentage of active fishermen.

It is believed that with modernization of fishing technology, economic and social stratification and inequality in the fishing communities have increased. The costs of resource degradation are disproportionately borne by the poor who are the primary users of the commons and environmental resources. For many fisherfolk in the small-scale sector, daily earnings from fisheries are low, fluctuating and often uncertain, affecting their livelihood security. For them

[5] The sector provides direct employment to 1.8 lakh active fishermen during 2001-02 (GOK, 2004). The population figures are estimates provided by the Directorate of Fisheries, Government of Kerala.

outward movement to non-fishing activities is difficult because of lack of knowledge of opportunities and lack of skills. To understand their plight, poverty has to be seen not only as income-poverty, but also in its wider sense to encompass low levels of achievement in education, health, sanitation and socio-political status. Some anecdotal evidence exists to show that fishing communities have above-average poverty rates, but few hard data and analyses are available on the nature and extent of poverty in these communities, and on the relative importance of different causes of poverty and on the most effective actions to alleviate poverty (FAO, 2001). The real benefits of fisheries development policies followed by Government and the general trends of economic growth do not seem to have reached the people in the lower strata of the fishing community. In order to evolve policy initiatives for sustainable improvement in the living conditions of the fisherfolk, it is essential to have a clear understanding of the nature and extent of poverty in all its different dimensions and also to find out its causes and consequences.

1.3 REVIEW OF LITERATURE

In this section we present an overview of poverty-environment linkages, poor peoples' dependence on common property resources and concepts of poverty and inequality, and its measurement based on the available theoretical literature as well as empirical studies carried out in different parts of the world.

1.3.1 Environment and natural resources

Natural resource and environmental degradation, and the resulting economic and social impacts are often viewed as a problem unique to developing countries. Deforestation, soil erosion, siltation of rivers and urban pollution are serious barriers to sustainable development in most of the low income countries of the world. However, degradation of natural resources and the environment is common to some degree throughout the world, across different economic and political systems and touching both the rich and the poor countries.

Natural resources, both renewable and non-renewable play a central role in the development of an economy. Renewable resources naturally regenerate themselves within reasonable time. These resources include forests, fish,

wildlife, water, agricultural crops, and even soil. Stocks are not fixed but can be increased or decreased. Renewable resources take many forms. Some, like forests, can be stored in the sense that the harvesting decision can occur at various times over the life of a stand of trees. Economics can help producers understand the optimal age to harvest a forest. Property rights in forestry for managed commercial stands are often efficient. Other renewable resources such as communal forests and fish however, tend to occur under less efficient property rights regimes. While biological growth functions in the case of both forests and fish are basically similar, the economics of their harvesting are slightly different from each other.

A major question relating to natural resources of a region is: how long and under what conditions can natural resources continue to support economic and social development? If natural resources are managed properly, they can contribute to development over an extremely long time period; some would argue for an indefinite time period. One among the major causes for natural resource degradation is the intervention of human activity in natural systems. Most human activities comprise the transformation of resources into products and services that are useful to human beings. Despite the income level and the stage of development, any economic activity would alter the state of the environment in one way or another and has the potential to cause a number of negative impacts in the form of unsustainable depletion of natural resources. Thus, degradation of natural resource bases is having a substantial negative externality impact on developing economies. It is apparent that the intensity of suffering of the poor from the adverse impacts of environmental shocks is much higher than that of rich. Owing to lack of proper assets, the poor are less capable of coping with those impacts.

All over the world, in the course of economic growth and development, the nature, the content and the quality of environment undergo changes. This environment-economy nexus is of great concern to all societies. The manner in which these two are related to each other is also a question posed by development thinkers. Based on a similarity between an inverted U shaped curve developed by Simon Kuznets (Kuznets, 1955) showing how income inequality changed as per capita income in a country increases, Panayotou

(1993, 1995) noted the similarity between the two patterns and it is considered. It was probably Panayotou who first coined the term 'Environment Kuznets Curve' (EKC) as in environmental studies. Panayotou investigated the EKC hypothesis for sulphur dioxide, nitrous oxide, suspended particulate matter and deforestation. All the fitted relationships were found to be consistent with the EKC hypothesis. This relationship was also explored by Stern et al. (1996) who also critically reviewed the literature on the existence of meaningful EKC relationships.

'Environmental Kuznet Curve' shows how environmental quality or pollution change with changes in income in a country. The interpretation of EKC is that an increase in economic activity is accompanied by deterioration in environmental quality, but that beyond a turning point, as income increases the demand for a cleaner environment reduces the level of pollution.

Recently, many studies have made evident the existence of an inverted U-shaped relationship between environmental quality and per capita income level (See Torras and Boyce, 1998; Grossman and Krueger, 1996; Beckerman, 1992). Data analysis seems to demonstrate that in the early stages of the economic growth process (the transition from agricultural to industrial society), environmental quality falls, but then, as income exceeds a threshold level and the economic structure moves from industry to services, it starts to rise. However, it is worth noting that rural environment, urban centres, and industrial location face quite different environmental problems. Rural population is more concerned with the use, control, accessibility, and management of natural resources. The problems in urban centres relate much more to air, water and noise pollution, and waste disposal (sewage and solid waste) (Ahmed, 1995).

Environmental conditions often have a major influence on the livelihoods, health, and security of poor people. It is widely accepted in the literature that natural resources are crucial to the routine functioning of poor households providing them sources such as materials, energy and water as well as performing sink functions such as absorption of pollution. These items could be public or semi-public goods such as open access watersheds or common property grazing lands; or private goods such as air inside a house or

household drinking water. It is often stated that poverty and environmental degradation are intimately connected, so that poverty is seen as both a cause and an effect of natural resource depletion, in a downward spiral. If the environmental resource remains a common pool resource in nature, the tendency to become degraded is all the more strong.

1.3.2 Poverty-environment linkages

In the late 1980s, the World Commission on Environment and Development (WCED, 1987) known as "Brundtland Commission" drew attention to some important links between increasing poverty and environmental degradation. The report pointed out that "many parts of the world are caught in a vicious downward spiral: Poor people are forced to overuse environmental resources to survive from day to day, and the impoverishment of their environment further impoverishes them, making their survival even more difficult and uncertain" (WCED 1987:27). This hypothesis was later called as the "poverty-environment hypothesis" and was presented by the Brundtland Commission in the context of making proposals for "Sustainable Development" (SD).

The poverty trap thesis specifies a circular or a spiral relationship between poverty and environmental degradation; in other words, it suggests that environmental degradation leads to poverty, which in turn leads to further degradation. It is widely viewed that poverty is the main cause of environmental deterioration, because the poor are not in a position to use natural resources sustainably (Duraiappah, 1996; Prakash, 1997).

"Environmental deterioration hurts the poor more than the rich" (Dasgupta, 1996; Kadekodi, 2001). In primary rural areas where people live in a local biomass-based economy it is plausible that environmental degradation or lack of natural productivity in the environment leads to poverty due to the lack of surplus, the thinness of markets, the absence of institutional developments, etc. However, the second aspect of the poverty trap namely that poverty leads to degradation has not been adequately demonstrated (Prakash, 1997). It is argued that environmental degradation is a negative externality whose causal roots, as well as solutions lie in institutional and policy issues rather than in poverty itself. There has been much controversy surrounding poverty-

environmental degradation nexus. However, a rising trend is in evidence in economic literature which disputes the conventional theory and argues that simple generalizations of this multidimensional problem are erroneous and that a more complex set of variables are in play (Leach and Mearns, 1995).

The actual effects of and responses to poverty-environment interactions for particular groups of poor people depend on three things. First is the availability of environment resources. Second, are the factors that determine the ability of different groups of people to gain access to and make effective use of environmental resources. Third, are the changes in environmental entitlements over time. Environment entitlements are one among several kinds of livelihood sources for the poor; they are especially important in their livelihoods, largely because of lack of alternative choices.

It is usually stated that environment is an income-elastic commodity. In the later stages of development, environmental quality improves because people become more environmentally conscious and can afford to build up political pressure for the enforcement of environmental regulations and for increasing budgetary expenses for the protection of the environment (Panayotou, 1995; Grossman and Krueger, 1995). The assumption is therefore that individual demand for environmental quality rises with income.

With the goal of better understanding of the relationship between poverty and common-pool stocks of natural assets, Gupta et al. (2005) investigated the extent to which rural households use and depend on common-pool natural resources for their daily livelihood. Using survey data collected from 550 households in 60 Indian villages, they estimated the contribution that natural resources make to rural household incomes. Like other previous studies, their also established that resource use increases monotonically with income. In their sample, poor households use fewer resources than do rich households. Unlike previous studies, however, it does not find that resource dependence necessarily decreases with income: poor households are not necessarily more dependent on natural resources than are the rich. Instead, they found evidence that dependence follows a U-shaped relationship with income: dependence declines at first but then increases with increase in income, especially in areas

where forests are abundant and grasslands are well stocked. This result suggests that households in rural areas do not turn to the environment only in times of desperation. Richer households, which tend to have broader sets of options to choose from to earn a livelihood, turn to the environment as a profitable source of income.

The study conducted in 29 villages of the Shindi ward in southern Zimbabwe shows that environmental resources account for roughly 35 percent of the average total household income and that the poorer the household, the greater is the share of income from environmental resources. However, even though the poor are more resource dependent, they generally use less of these resources than the better off. The poorest households use three to four times lower in quantity terms than the richest (Cavendish, 1999a). Cavendish also attempted to quantify the contribution of environmental resources to household welfare, where most standard household budget surveys omitted this source. His study showed that incorporating environmental income in household accounts resulted in dramatic and significant reduction in poverty by 50 percent or more than conventionally measured. (Cavendish, 1999b)

The study carried out by Cardenas (2001) deals with inequalities in the commons by drawing some lessons from two sources of field evidence from different regions and villages in Colombia. The following four sets of results emerged from the empirical evidence: i) land inequality increased the negative effect of population pressure over the conservation of the village commons; ii) lower exit options outside the use of the experimental commons induced greater cooperation by those with poorer private options and higher dependence on the conservation of the commons; iii) actual assets inequality in a group of experiment participants induced greater wealth distance which reduced the possibility of cooperation via self-governed mechanisms; and iv) familiarity with commons dilemmas and lower levels of private assets were associated with higher levels of cooperation in the experiments. The results provide some parallels and methodological complementarities that could contribute in a rather inconclusive way on the literature, and also a revisit to the relation between poverty, inequality, and conservation of natural resources.

The 'vicious circle' hypothesis links poverty with degradation. The vicious circle of poverty perception lies in the fact that in developing or relatively poor economies the poor depend directly on the natural resource environment for their livelihood. Since these poor who are dependent on nature for livelihood, they are the vulnerable to natural calamities, environmental degradation and ecological disasters (Nadkarni, 2000). As noted by Bina Agarwal, the first victims of any environmental degradation are the women among the poor. A fuel wood shortage as result of deforestation would force village women to travel miles in search of firewood (Agarwal, 1986). Women's vulnerability to health and environmental degradation has been well documented by Nadkarni, (2000).

Some studies, on the other hand, have also pointed out that since poor people depend more heavily on a limited natural resource base, they attach greater value to its conservation and so have developed sustainable management strategies (Reddy, 1999). Dependence on common property resources is more crucial for poorer households since environmental degradation substantially increases the survival risk of the poor (Jodha, 1990).

Dasgupta (1993) describes how closely poor people depend on their surrounding environmental resource base for their livelihood, and how poverty can be a driving force to environmental degradation. Based on theory and some empirical evidence he argues that poverty is both a cause and an effect of resource degradation or lack of access to resources, including natural capital. To exemplify the above arguments, he describes how poor nomadic dryland herdsmen often are excluded from formal credit, capital and insurance markets and are forced to invest their capital in cattle, resulting in non-sustainable herd sizes and overgrazing.

Reardon and Vosti (1995) took issue with "the narrow focus of the current poverty-environment debate" and argued that the strength and direction of the poverty-environment links in rural areas vary according to the composition of the assets held by the rural poor and the types of environmental problems they face. Some other researchers and policy makers however have used the

poverty-environment hypothesis as if it asserted a permanent link between increasing poverty and environmental degradation.

For analysis of the poverty and environmental resource degradation (P-ERD) links, Reardon and Vosti (1995) suggest the use of a 'investment-poverty' measure, the cut off point of which is defined as the ability to make minimum investments in resource improvements to maintain or enhance the quantity and quality of the resource base – to forestall or revise resource degradation. The notion of poverty is examined in the context of categories of assets and categories of environmental change. The most effective way to simultaneously reduce poverty and enhance resource base is to understand what categories of assets poverty and conditioning variables are driving households behaviour and focus effort on these variables.

The nature of property-rights regimes and the pattern of distribution of access to natural resources not only affect levels of poverty in any specific region, but in the long run, they also affect the quantity and quality of the environmental resource-base (Dasgupta and Maler, 1991). It is therefore argued that appropriate property rights allocation is one of the major determinants of long term economic and ecological sustainability of the commons as well the social sustainability of people depending upon these resources. Poverty can lead to a high dependence upon, and consequent degradation, of natural resources. Exclusion from crucial resources following changes to property right regimes acts as the main catalyst for increasing deprivation and vulnerability of poorer households.

The linkages between poverty and environment are complex, they require local-specific analysis to understand, and there exists no simple causal link. In many areas, the non-poor often causes the majority of environmental damages through land clearing, agro-chemical use, polluting water, and air. In some cases, the privileged groups force the poor on to marginal lands, where they would be unable to afford conservation and regeneration measures; and their land use practices further damage an already degraded environment. The relationship between poverty and property-rights over natural resources is complex. In the words of Hayes, "it is important to understand the fuller range

of empirical poverty-environment links than those entailed in the poverty-environment hypothesis; to understand the boarder social, political and economic conditions which determine how these conditioning factors and poverty-environment links can be used in fashioning better policies aimed at poverty reduction and environment management" (Hayes, 2001).

Markandaya (2001), while discussing the linkages between poverty and environment, writes: "there are two broad questions: does the poverty damage the environment or does the environmental degradation hurt the poor? At the cost of some loss of accuracy, the broad answer to the first question is 'no,' and the answer to the second question is 'yes'. Of course there are complex issues and these simple answers will not always hold." In many cases natural resources may be the only asset to which the poor people have access and hence they are the most affected in the face of resource degradation. But the way in which natural resource degradation affects the poor and the extent to which it affects individual groups depend to a large extent on the types of 'poverty' of such groups and their asset portfolios.

Thus, as mentioned earlier, 'poverty-environment linkages' are dynamic and context-specific – reflecting both geographic location and economic, social and cultural characteristics of individuals, households and social groups. Different social groups prioritize different environmental issues. In rural areas, poor people are particularly concerned with secure access to, and the quality of natural resources – arable land and water, crop and livestock diversity, fishery resources, forest products and biomass for fuel. For the urban poor, water, energy, sanitation and waste removal, drainage and secure tenure are key concerns. Poor women regard safe and physically close access to potable water, sanitation facilities and abundant energy supplies as crucial aspects of well-being, reflecting their primary role in managing the household (Brocklesby and Hinshelwood, 2001).

1.3.3 Poors' dependence on common property resources

Common Pool Resource (CPR) is defined by Ostrom (1990) as "a natural or man made resource system that is sufficiently large as to make it costly (but not impossible) to exclude potential beneficiaries from obtaining benefits from its

use." The critical distinction between 'open-access resources' and 'common property' is that open-access is a free-for-all, while common property represents a well-defined set of institutional arrangements concerning who may make use of a resource, who may not make use of a resource, and the rules governing how the accepted users shall conduct themselves Bromley, (1991).

Common property is frequently confused with open access property, in which the resource is available to anyone who can access and use it. Swaney (1990) and others suggest that the Latin term *res nullius* be used to describe open access or non-property and that *res communes* be used to describe common property. The confusion between the commons and open access has led to notable misunderstandings within contemporary natural resource users.

Some salient distinguishing characteristics of private property resources (PPR), common property resources (CPrR), open access resources (OAR), and common pool resources (CPR) as summarised by Singh (1994) are given in Table 1.3. The principal difference between CPrR and CPR is that in the former case the holders have well defined property rights, but in the latter case such rights may or may not exist. The distinction is very fine, but it is important when considering those natural resources used in common by identifiable groups of people, for example fisheries. In this sense CPrRs constitute a subset of CPRs.

Table 1.3 Some principal distinguishing characteristics of Private Property Resources (PPR), Common Property Resource (CPrR), Open Access Resources (OAR), and Common Pool Resources (CPR)

Characteristics	*Type of resource*			
	PPR	*CPrR*	*OAR*	*CPR*
Property rights are well-defined	Yes	Yes	No	Yes & No
User / User's group is identifiable	Yes	Yes	No	Yes
Resource is accessible to everybody	No	No	Yes	No
Resource is used in common	No	Yes	Yes	Yes
Rules, regulations, and conventions governing the use of resource exist	Yes	Yes	No	Yes & No
Exclusion of free-riders is difficult	No	Yes	Yes	Yes
Use of resource is subtractable	Yes	Yes	Yes & No	Yes & No

Source: Singh (1994), p: 6

According to the economic definition, a common good is located between a 'pure private good' and 'pure public good'. The difference resides in the concepts of jointness and exclusion. A pure private good is a good with the property of exclusivity, which means that the consumption of the good in question by one individual will prevent another from consuming it as well. The owner of such a good can dispose of it as desired and can deny other people access to the good. On the other hand, a public good can be jointly consumed with others and is therefore non-exclusive. Any individual can freely consume it without denying others the ability to benefit from it. Most fisheries are open access or common property resources and hence arises the problem of market failure. In open access fishery property rights are not well-defined or not at all defined; such situations often leads to over use of the resources.

Public goods have two characteristics, non-rivalry in consumption and non-excludability. Non-rivalry in consumption means that two or more persons can use the good simultaneously without interfering with one another's use of the good, while non-excludability means that no one can be excluded from using the good. Whereas fisheries in the open access system is a classical example of a common pool resource sensitive to exploitation. CPRs are resources that have high subtractability and where exclusion from the resource is difficult. (Table 1.1 shows resource classifications by subtractability and exclusion). Subtractability means that a use of one unit of the resource removes that unit from anyone else's use. Exclusion is on whether it is easy to limit access or impossible to do so.

Bardhan (2000) discusses a general model of collective goods; he introduces a distinction between public goods and the commons. When the positive spillovers from the provision of these collective goods outweigh the negative spillovers associated with common use, it is a case of public goods. When negative spillovers dominate the positive ones, then the collective good is a common-pool resource. Positive spillovers include the benefits to third parties such as unpolluted air that results from a pollution-abatement technology. The negative spillovers are the classic congestion externalities of common-pool resources: when more fishers exploit an open-access fishery, for example, it raises costs for all fishers.

Common property resources are inefficiently allocated because users cannot earn rents by conserving them from other users--a violation of the 'exclusivity' principle of property rights. In his influential article, "The Tragedy of Commons," Hardin (1968) explained why a scarce resource open to all is subjected to overexploitation. He explained the situation with an example of a pasture open to all herdsmen for grazing cattle. He pointed that eventually the pasture will become over-grazed because each herdsman tries to capture all the benefits by adding more cattle. Since all herdsmen are assumed to behave in the same way, the carrying capacity of the land will eventually be exceeded, resulting in degradation and loss for all. Hardin saw over-exploitation as an inevitable outcome of the use of common goods, even when individuals sharing the benefits of such resources acted in an economically rational way. He called this phenomenon 'the tragedy of the commons'. The concept has been used to explain over-exploitation in fisheries, forests, overgrazing, air and water pollution, abuse of public lands, population problems, extinction of species, misallocation in oil and natural gas extraction, ground water depletion, and other problems of resource misallocation (Stevenson, 1991). Hardin's arguments have been formalized in the form of a 'Prisoner's Dilemma Game' (Runge, 1981).

The prisoner's dilemma in game theory represents problems of social cooperation, free-riding and public goods provision. It is largely responsible for the negative view economists and policy-makers have toward commons management and social cooperation. Why this is so is described in the outcomes of a prisoner's dilemma game. The best outcome is free-riding - enjoying the public good, but not contributing to its sustenance. The second best outcome is enjoying the public good and contributing one's share. The third best option is doing without the public good. The worst case is one of having others' free-ride on one's contribution (Hausman and McPherson 1996).

Critics argue that Hardin's tragedy of commons is applicable only to open access resources where no property rights are assigned, and not to commons i.e. common property resources (Ciriacy-Wantrup and Bishop, 1975; Runge, 1981; Bromley and Cernea, 1989). Hardin's tragedy of the commons often results, not from any inherent failure of common property management, but

from institutional failure to control access to resources, and to make and enforce internal decisions for collective use. Given that fisheries are usually either open access or common property resources fishers have the tendency to over-fish beyond the MSY and is a case subject to the Hardin's tragedy of the commons Since open access fishery management exhibits many characteristics of public good, it is difficult to manage.

There exists lots of empirical studies showing the poor people's dependence on CPR and the manner in which their livelihoods evolve around them. There are also studies showing different views where the poor or the rich over exploit these resources as well as in cases in which the community itself manages the CPR. One of such studies by Jodha (1986) found from a survey of 82 villages in India that the poor obtained 66 to 84 percent of fodder from CPRs in some states. Moreover, the CPRs provided 137 to 196 days of employment per household and 14 to 23 percent of the income of the poor. Poor people are commonly bound to reside in areas with poor environmental quality. According to another study, the area under CPRs has declined by about 33 percent over a period of 20 years (Pasha, 1992). The literature has repeatedly stressed on the need for effective people's participation in preventing over-exploitation of the CPRs by the better off and in protecting forests in particular. Defining "the poorest" as the poorest 20 percent among the total population of all developing countries, Leach and Mearns (1991) have shown that 60 percent of them live in 'ecologically vulnerable areas', including rural areas of low agricultural potential and squatter settlements within urban areas.

The study conducted by Gowda and Savadatti (2004) in four villages in Dharwad district of Karnataka attempts to determine the contribution of common property resources to the biomass requirements of the rural people. Their findings are that overexploitation has resulted in the degradation of the CPRs, which are increasingly unable to meet the needs of the rural communities. Measures to ensure retention, regeneration, and sustainable utilization are needed if a CPR crisis is to be avoided.

Field observations on CPRs have shown that traditionally they have been subject to some form of collective management or the other, an arrangement

which ensured their sustainable management. In the Indian context the existence of institutions of sacred groves and *Van Panchayats* which have evolved over the years to restrain indiscriminate use of forests, and that of *Pani Panchayats* for managing irrigation tanks and canals is proof that rural people in developing countries had the necessary vision and resourcefulness to promote sustainable and equitable use of resources. Case studies of such institutions have been fairly well documented (Wade, 1998; Singh and Ballah, 1996).

Since fishery is a natural resource, the depletion of fish by one group of fishermen creates externalities for another group (Grima and Berkes, 1989). Under an open access management regime, resources that fall into this category are subject to use by any person who has the capability and desire to harvest or extract the resources. Their exploitation will then result in symmetric or asymmetric negative externalities. The rivalry in consumption of a common pool resource indicates that extraction by one user of the resource precludes another user's possession. Like public goods, CPRs are low in the property of exclusion and they create 'free rider problem'.

Among the resources typically creating a commons dilemma, living marine resources are a classical example (Gordon 1954; Berkes 1994). In many parts of the world access to them is open, and fish stocks are heavily over-exploited. However, many argue that despite the simplicity with which the tragedy of the commons seems to explain environmental degradation and despite their widespread use, the tragedy of the commons model is seriously flawed both theoretically and empirically. Scholars primarily from the disciplines of cultural anthropology and institutional economics also have severely criticized the model for ignoring the historical contexts which created specific resource-use situations (e.g. McEvoy 1986; McCay and Acheson 1987; Berkes et al. 1989; Feeny et al. 1996). In most indigenous cultures in the Pacific (as well as in other parts of the world), however, complex and sophisticated systems of managing them either directly or indirectly have been established and proven to be efficient over long periods of time (Campbell, Menz and Waugh 1989; Ruddle and Johannes 1990; Hviding, 1996).

When the distribution of access rights is so unequal that it loses its legitimacy, relations between the poor and the rich users tend to be unstable and hostile with the consequence that the latter do not feel any more secure about the future state of their rights. They may then react by exploiting the resource as intensively as possible without any regard for the viability of the resource base (Boyce, 1994; Baland and Platteau, 1996).

1.3.4 Poverty and inequality

Poverty may be approached from objective or subjective viewpoint. The objective perspective, which is also referred to as the welfare approach involves normative judgements as to what constitutes poverty and what is required to move people out of their poor state. The subjective approach places a premium on people's preferences, on how much they value goods and services.

The traditional approach to poverty is characterised by the fact that poor people are identified according to a shortfall in a monetary indicator. The theory implicitly underlying this assumption is the utilitarianism theoretically based on the criteria of utility and practically on the use of income or expenditure as proxy of well-being. Henceforth, the criterion of poverty reckoned in terms of income and poverty is defined as lack of economic welfare, i.e. income. In the case of the absolute poverty approach, poverty is lack of income required to satisfy the essential requirements for physiological survival. In the case of the relative approach of poverty, poverty is lack of income in order to reach the average standard of living in the society in which one live.

Most conceptions of poverty are concerned with flows of income, where poverty implies low levels of per capita income/expenditure. That is to say people whose income/expenditure is below a threshold level are defined as poverty stricken. The World Development Report 2000/2001 of World Bank (2001) enlarges this traditional conception of poverty to encompass both low levels of income/expenditure and low levels of achievement in education, health and nutrition status, with two other dimensions, namely vulnerability and powerlessness. Dercon (2001) defines vulnerability, as "well-being and poverty are the ex-post outcome of a complicated decision process of individuals and

households over assets and incomes, faced with risk. Vulnerability to poverty is the ex-ante situation, i.e. before one has knowledge of the actual shocks that will occur. Vulnerability is determined by the options available to households and individuals to make a living, the risks they face and their ability to handle risk."

It is difficult to find a single measure for this multidimensional concept of poverty, and most studies take each dimension separately. In some studies, the various dimensions have been grouped into homogenous categories. For example, one approach takes a fivefold 'asset vulnerability framework' which considers labour, human capital, household assets, household relations, and social capital (Moser, 1998). The "World Development Report 2000/2001" groups the different dimensions of poverty as opportunity, empowerment and security; and recently capabilities (human capital) has also been included as a separate category.

It is also recognized that poverty is not a static condition but a dynamic process. Large numbers of people move into and out of poverty during given time periods. Distinctions therefore may usefully be drawn between the 'always poor', the 'sometimes poor' ('tomorrow's poor'), and the 'never poor' (DFID, 2001). In most countries, the 'sometimes poor' exceed in numbers the 'always poor'.

Asian Development Bank's (ADB) *Participatory Poverty Assessment in Kerala, 2002* as cited in Srivastava (2004) differentiated among the characteristics of the 'poor', the very poor' and 'the poorest'. "Although the poor may have small plot and huts to live in, they do not have basic amenities and physical assets. The very poor... are those who do not have more than one source of income, however irregular that income might be. The very poor are frequently engaged in casual coolie jobs which do not yield steady income. The very poor include those who have lost everything on account of fire or other disasters. This type of poverty... could be a temporary state, provided the victim has 'social capital' to leverage government and community resources to rebuild their lives. The majority of these communities [poorest] belong to various tribes who live in remote forest areas. There is also a significant proportion of Scheduled

Castes... who depend excessively on the forests for their livelihood. Families where the head of household is either mentally or physically challenged, or too old or chronically sick to work would fall into the category of the poorest. There are some women-headed households where the dual task of earning a livelihood and managing the family erodes the earning capacity of women. Then we have beggars who are totally destitute and are categorized as the poorest"

This wider conception of poverty appears to be particularly well-suited for small-scale and artisanal fishers (FAO, 2001). In the FAO report on "Code of Conduct for Responsible Fisheries in Poverty Alleviation," poverty has been portrayed thus: "the nature of poverty is usually associated with low income and consumption, low attainment levels in education, health and nutrition, high vulnerability, and powerlessness". Whilst there are many characteristics of poor households that are typical, there is no one established, and accepted, theory or conceptual framework that can explain the causes of poverty in all situations. However, evidence points to several interrelated and re-enforcing causes including (i) poor economic performance, (ii) weak asset base and landlessness or land-poor, (iii) political instability and conflict, (iv) poor and inadequate public service delivery, (v) income and gender inequality and (vi) erosion of traditional safety nets. Additional factors that could play a particular role in small-scale fisheries include (i) the high risk nature of fishing activities, (ii) the geographic remoteness of many communities, (iii) the frequent low socio-political status of the fishing occupation and fishing communities, (iv) unfavourable conditions for organizing (absence from home; remoteness; geographic spread), (v) insecure access to natural resources, especially fishery resources and land; and (vi) the proneness to depletion and dissipation of resource rents because of open or quasi-open access to fishery resources."

Poverty is thus a complex and multi-dimensional phenomenon, which goes beyond the notion of income, and encompasses social, economic, and political deprivations. Lack of opportunities limits the abilities of the poor to secure gainful employment and bring about improvement in their lives. Since poverty is a multidimensional problem, solutions to poverty cannot be based exclusively on economic policies, but require a comprehensive set of well-coordinated

measures. Individuals and families can be said to be in poverty when they lack the resources to obtain the type of diet, participate in the activities and have the living conditions and amenities which are customary, or at least widely encouraged or approved, in the societies to which they belong. Their resources are so seriously below those commanded by the average individual that they are, in effect, excluded from ordinary living patterns, customs and activities."

Recent academic and policy debates concerned with attacking poverty reflect a growing awareness of (a) the importance of lack of assets as both a symptom and a cause of poverty and (b) the value of the livelihood concept in understanding how the poor call upon a range of different assets and activities as they seek to sustain and improve their well-being (Dorward, et al., 2001). However, well-being is a complex notion with many different dimensions whose definition is disputed. What are the most important characteristics of poverty and well-being and how are they best measured? What characteristics does a 'good' poverty or well-being indicator exhibit? The term 'well-being' denotes that something is in a good state. The term does not specify what that something is and what is considered 'good'. A dictionary defines well-being as "a good or satisfactory condition of existence; a state characterized by health, happiness, and prosperity; welfare."

Poverty has essentially three closely interrelated aspects, namely, 'poverty of money', 'poverty of access', and 'poverty of power'. These three aspects of poverty make the working, living and social environments of the poor extremely insecure and severely limit the choices or the options available to the poor to improve their lives.

A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (Chambers and Conway, 1992). In recent debates on poverty alleviation the sustainable livelihood approach (S L Approach) has gained much importance. A livelihood comprises the capabilities, assets and activities required for a means of living. The approach lays emphasis on capabilities and assets; and distinguishes five categories of such assets namely, human capital, natural capital, financial

capital, social capital and physical capital (DFID, 1999; 2001a). Subject to the 'vulnerability context' of particular groups these assets are to be transformed by means of various structures and processes into livelihood outcomes. Poverty can be considered as an inadequate livelihood outcome.

In this sense, poverty is defined by the lack of those resources, goods, activities and services that allow the individual to participate in the general standard of living of the community to which he belongs: it is a state of relative deprivation, strictly linked to the examined society. It is important to stress that non-monetary indicators are specifically related to material deprivation, based on lack of financial resources. So, persons who are unable to take part in the customary social activities because of poor education or ill health, can be said to be 'marginalized' and 'socially excluded'; but they will be termed as 'poor' only if their difficulties are caused by material and financial deficiency.

Even though income and consumption are important indicators for addressing poverty-environment interactions; they are also equally important for improving the asset base of the poor. Assets include natural capital (land, water, forest, minerals, fish, etc.), physical capital (basic infrastructure), human capital (skills, knowledge, health, ability), social capital (relationships of trust, groups, networks, customary laws), and financial capital (monetary resources). With improved access to and control over different types of assets, the poor are better able to meet basic needs and to create different livelihood options. In his seminal study Robert Putnam uses social capital to refer to dimensions of social organization that generate multiple horizontal linkages and foster the development of social trust, collective reciprocity, and tolerance (Putman, 1993). Social capital consists of the stock of active connections among people: the trust, mutual understanding, and shared values and behaviours that bind the members of human networks and communities and make cooperative action possible (Cohen and Prusak, 2001).

Numerous poverty definitions and manifold possibilities of poverty measurement exist. These include indirect, direct, relative, absolute, income-based, deprivation-based, consumption-based, budget-standard based, primary, secondary, tertiary, consensual, political, subjective, and objective

poverty lines, to name a few. This list of poverty definitions, while incomplete, shows that the questions such as "what is poverty and how could/should it be measured?" cannot be answered unambiguously.

Inequality is often studied as a part of the broader analysis concerning poverty and welfare and is sometimes used in composite measures. Poverty and inequality are usually measured using quantitative indices. For example, when policies are implemented to reduce poverty, it becomes important to measure the evolution of these indices, and especially the decomposition of the observed variation, in order to evaluate the contribution of potential explanatory factors. Since Atkinson (1970), economists have been sensitive to the welfare assumptions embedded in an inequality measure. One of the most important assumptions is the Dalton principle (more commonly referred to as the Pigou-Dalton transfer principle), which requires that inequality measure falls when a transfer is made from an upper to a lower part of a distribution. Sen (1976) ushered in a parallel scrutiny of poverty measures, likewise driven by the Dalton principle. The literature on inequality and poverty has however seldom converged completely on a common set of assumptions.

The term 'inequality' suggests a departure from some idea of 'equality'. In mathematical terms, 'equality' represents the fact that two or more given quantities are of the same size, and inequality merely relates to the differences in the quantities. But from the social point of view, the term 'equality' has overtones as a standard, which a society can attain. Indeed the concept is difficult to define; but perception of inequality affects economic choice and political decisions. There has been much debate on whether inequality should cover ethical concepts such as the desirability of a particular system of rewards or simply reflect the difference in a particular attribute (or attitudes) such as income, wealth, etc.

With the recent resurgence of interest in equity, inequality, and growth, the possibility of a negative relationship between inequality and economic growth has received renewed interest in the literature. Policymakers addressing the impact of inequality on growth should be more concerned about households' access to assets - and to the opportunities associated with them - than about

the distribution of income. Asset inequality - but not income inequality - has a relatively great negative impact on growth and also reduces the effectiveness of educational interventions.

'Utilitarianism' is an ethical theory which asserts the goodness of a state of affairs in terms of the sum total of the utilities accruing from that state to individuals in the society. Conventionally, it is assumed that each person's utility function defined in terms of his income is increasing, concave (which guarantees that the marginal utility is non-increasing) and indefinitely differentiable. Maximisation of the social welfare function implies that the optimal distribution of income is one in which each person's marginal utility is equal to each other person's marginal utility. Clearly, equality of marginal utility will translate into equality of income only in the special case of all persons sharing the same utility function (Sen, 1973).

Another ethical theory is Nozick's 'entitlement' theory, in which for distributive justice, the rules governing acquisition, transfer and rectification (of past injustice) should be such that they are not volatile of anybody's rights. The emphasis here is on 'equal rights' (Subramanian, 1997).

The Rawlsian theory of justice focuses advantage in terms of an index of 'primary goods', which includes rights, liberties, incomes, opportunities, and the social bases of self-respect. Rawl's first principle of justice demands that each person is to have an equal right to the most extensive basic liberty compatible with a similar liberty for all. The second principle requires that priority be given to maximising the advantage of the worst off person (Rawls, 1971).

Sen's theory of capabilities focuses on the capabilities of people to function. A functioning is a state of being or doing (e.g. a state of being in good health, or a state of being able to move). A list of various states of being and doing (referred to as a functioning n- tuples) together with a capability set (collection of functioning n - tuples) define the freedom available to a person. Sen is concerned to argue for equality on the space of capabilities (Sen 1980, 1984).

Cowell (1995) sets out three ingredients of principle of inequality measurements:

1. Specification of an individual social unit such as a single person, the nuclear family, or the extended family.
2. Description of a particular attribute (or attributes) such as income, wealth, land ownership, or voting strength.
3. A method of representation and / or aggregation of the allocation of the attribute among the individual units in the population.

The preceding brief discussion on the notion of inequality indicates that each theory is concerned with a demand for equality on a different space or domain; and the pursuit of equality in one space may well promote inequality in some other space (Sen, 1992).

So far we have been discussing the poverty environment linkages, poor people's dependence on common property resources, concepts of poverty and inequality, and their measurement based on existing literature. Even though there exists abundance of literature related to these areas we have limited the review to concepts and areas appropriate to the study and cited from literature only extracts quite relevant to the research focus of the present study.

1.4 STUDY GOAL

The overall objective of the study is to understand the economic condition of fisherfolk in the small-scale sector in the context of change in access to and depletion of marine resources.

1.5 RESEARCH QUESTIONS

1. What is the extent of income inequality among the small-scale fishing community? What are the causes of this inequality? Which are the groups in the lower strata?
2. How poor are the small-scale fishery households and who are the poorer?
3. What are the characteristics of the poor that distinguish them from the non-poor?
4. What are the determinants of poverty? Depending on these factors, what is the risk of a household being poor?

5. To what extent do the different groups depend on fishery resources for livelihood?

1.6 HYPOTHESIS

The inequality in the distribution of household income is closely related to inequality in the distribution of fishing assets.

1.7 CONCEPTS AND DEFINITIONS

1.7.1 Concepts

Inequality

The overall level of inequality in a population group, in other words the distribution of income, consumption, or assets, is an important dimension of well-being of that group. The concept is based on the idea that the way individuals or households perceive their position in the society is an important aspect of their welfare. Some commonly used measures of inequality are 'Gini coefficient' and 'Theil Index'. In the present study, we use a monetary measure of well-being and the choice is between using income or consumption as the measure. Most analysts argue that detailed consumption expenditure data obtained from a household survey, if available would be a better indicator of well-being than income[6]. In the present study, we use data on monthly percapita consumer expenditure as the indicator of well-being.

Poverty

Poverty implies pronounced deprivation in well-being. It is usually considered as an economic or social condition without direct reference to environmental or natural resource parameters, except in a generalised way. Traditionally poverty used to be defined on the basis of household income or consumption, taking this as the best proxy for welfare. People whose household income or expenditure lies below a threshold level, defined as the poverty line, are categorised as poverty stricken. The use of such a narrow indicator to determine poverty levels has been widely criticised. Of late, mainly in response to these criticisms, definitions of poverty have moved beyond this single dimension, to include utility and capability based concepts. The concept of

[6] For more details see Lipton and Ravallion, 1995; Coudouel et al., 2002; Deaton, 2004.

poverty thus becomes multi-dimensional. All of these measures do not necessarily be relevant in every context, but in general, each is needed to capture something missing in others (Ravallion, 1996).

Poverty may be viewed in absolute and in relative terms. Absolute poverty refers to subsistence below minimum, socially acceptable living conditions, usually established based on nutritional requirements and other essential goods. In other words, absolute poverty is a level of poverty at which certain minimum standards: for example nutrition, health and shelter - cannot be met. The people in this condition earn incomes lower than that required as the minimum amount required per person. The term "absolute poverty" is perhaps slightly misleading, since there is no "absolute" standard that defines absolute poverty. The level of income necessary for maintaining this minimum standard is often referred to as the poverty line, a line which different institutions and individuals define differently. Relative poverty is on the other hand a poverty measure based on a poor standard of living or a low income relative to the rest of society. Unlike absolute poverty, it does not necessarily imply that physical human necessities of nutrition, health and shelter cannot be met; instead, it suggests that the lack of access to many of the goods and services expected by the rest of the contemporary society leads to social exclusion and damaging results for the individuals and families in relative poverty. Relative poverty compares the lowest segments of a population with the upper segments, usually measured in income quintiles or deciles. Absolute and relative poverty trends may move in opposite directions. For example, relative poverty may decline while absolute poverty increases if the gap between the upper and the lower strata of a population is reduced by a decline in well-being of the former at the same time when additional households fall beneath the absolute poverty line.

One of the consequences of using relative poverty to judge societies over time is that the poverty line tends to rise as incomes rise. This may be desirable if it reflects a changing social consensus about minimum acceptable standards of living. However, it would be less desirable if it leads to social and economic policies which give undue emphasis to reducing inequality keeping the incomes

of the poorest at levels lower than what they might have had, were absolute poverty measures used to guide policy.

Most concepts of poverty are derived from perceived causes of poverty. A 'physiological deprivation' approach focuses on the non-fulfilment of basic material or biological needs such as shelter, nutrition, health, etc. A 'social deprivation' approach focuses on a lack of resources required to participate in activities and enjoy living standards that are customary. The 'capability' concept of poverty focuses on expanding people's opportunities and spans both the psychological and the sociological realms of deprivation. Thus, poverty is "not merely in the impoverished state in which the person actually lives, but also in the lack of real opportunity – due to social constraints as well as personal circumstances - to lead valuable and valued lives" (UNDP, 1997).

Various concepts and definitions exist on poverty. However, the main focus has been on whether households or individuals possess enough resources or abilities to meet their current needs. The concept is based on a comparison of households/individual's income, consumption, assets, or other attributes with some defined threshold below which households/individuals are considered poor in that particular attribute.

Further, vulnerability defined as the probability or risk today of being in poverty (or falling deeper into poverty) at some point in future is also a key dimension of well-being, since it affects individual's behaviour (in terms of investment, production pattern, coping strategies) and their perception of their own situation.

In the present study, the focus is on an objective quantification measure of poverty. In order to compute a poverty measure one needs (a) an indicator of well-being, (b) a threshold to which each individual's/household's welfare can be compared (referred to as the poverty line) and (c) a poverty measure. Poverty is proposed to be estimated using a monetary dimension using per-capita household consumption expenditure as an indicator of well-being. The next step is to define a poverty line, which is a cut-off point separating the poor from the non-poor on the basis of the chosen indicator. There are two main ways of setting this poverty line – relative and absolute. The relative poverty

line is anchored in relation to the overall distribution of income or consumption in the population group. On the other hand, an absolute poverty line is defined on the baseline of some absolute standard of what the household should be able to extend in order to meet their basic needs. For making a monetary measure, the absolute poverty line is usually based on estimates of the cost of basic food needs, and to this measure a provision is added for non-food needs. Since a sizeable proportion of the fisher folk is considered to be surviving with the basic minimum or less, an absolute rather than a relative poverty line is considered to be more relevant in this study. Most popular poverty measure have used the nutritional norm and defined the poverty line in terms of a determined minimum calorie requirement (Green and Thorbecke, 1986; Ravallion and Bidani, 1994). An alternative method is to set the poverty line on the basis of subjective perception or self reported measure of poverty. Of course, self-reported measures have important limitations; in general, the observed perception of poverty need not provide a good basis to establish priority public action.

1.7.2 Definitions

1. Small-scale fishery: In the literature on fisheries, there exists no standard definition for small-scale fisheries. A variety of terms is used, such as traditional, artisanal, subsistence, etc. which, although not synonymous are often used interchangeably to convey the smallness of operations relative to those of industrial fisheries. There are however, certain characteristics common to all of them. By virtue of their limited fishing range and related socio-economic characteristics, they are confined to a narrow strip of land and sea around their community, operate near their home base, are basically dependent on natural resources, and have limited set of options. In the present study, the term small-scale is used to mean both small and traditional in the sense of using traditional gear, including those upgraded. According to this definition, fishermen using crafts with outboard motors are also covered by the term small-scale fishery.

2. Household: A group of persons living together and taking food from a common kitchen constitutes a household. There can be more than one family under the same roof cooking separately; they are considered as separate

households even if they are close relatives. In the household temporary visitors are excluded, but temporary stay away are included. e.g. A son or daughter residing in a hostel for studies is excluded from the households of their parents, but a resident domestic servant is considered as a household member.

3. Household member: A person living in the household for the majority of days during the last reference period is treated as a member of the household. However, a person taking food with his family but sleep elsewhere due to shortage of space, is also a household member. But if a person of the family working elsewhere and has come to the house only once in a while during the reference year is not considered as a household member. His earnings to the house is considered as remittance.

4. Head of household: An adult household member who makes important decisions in the house is considered the head of the household. He/She may or may not be an earner and may or may not possess wealth, but can be a prime decision-maker concerning the household.

5.Usual activity: The usual activity of a person is determined on the basis of various activities pursued by him/her during a reference period of 365 days, adopting a 'relatively longer time' criterion.

6. Reference period: For collecting data on consumption expenditure two types of reference periods were adopted. For food and other items of monthly expenditure, the previous 30 days were taken as the reference period to minimise the recall bias. In the case of items like clothing, footwear, furniture, household utensils, household maintenance, etc; the reference period was 365 days. For determining the occupation and the activity status also the reference period was also 365 days.

7. Household consumer expenditure: The expenditure incurred by a household on domestic consumption during the reference period is the household's consumer expenditure. The household consumer expenditure is the total monetary values of consumption of various items (purchased as well as home grown).

8. Monthly per capita consumption expenditure (MPCE): For a household, MPCE is arrived at by dividing 30 days' total consumer expenditure divided by the size of the household. A person's MPCE is understood as that of the household to which he or she belongs.

9. Fishing assets: In the small-scale fisheries sector the main fishing assets are the craft and the gears. Other fishing assets used for fish-related activities include equipments for processing and fish trade. The value of the assets is determined on the basis of purchase price and subsequent additions and /or alterations effected and allowing for depreciation. Only those equipments that were currently in use would be counted for valuation.

10. Non-fishing assets: Only productive items have been considered as assets in the study. These include agricultural land, vehicles for transport and investment in trade/business. In determining fishing and non-fishing assets, working capital has not been included.

1.8 ANALYTICAL FRAMEWORK

1.8.1 Determination of household well-being

The analysis starts with the perception that the coastal communities use natural resources primarily as an asset for income generation; it follows that increase in income from these resources are one of the principal factors of reducing poverty. It is recognized that environmental resources also provide life-supporting services and confer many intangible aesthetic and cultural benefits (Duraiappah, 2001). But we mainly confine our enquiry to the concept of economic use, i.e. the opportunities to convert resources for the purpose of production, consumption, and exchange.

Income differences between fishermen in the same locality arise mainly due to the differences in fish catch and its price. If prices are treated as 'given' catch can be explained on the basis of technology used, input combination, technical efficiency, and last but not the least by pure luck. (In the short-run, in a specific location, resource abundance may be assumed to be constant.) In order to test whether the catch differentials in the small-scale sector are due to the difference in production techniques and variable input use, an input-output

relationship (referred as the 'fishery production function') may be formulated and applied to a cross-sectional data on a sample of fishery units in the study area. The results would give insight into the ways in which fishing income might be increased.

The next attempt is to understand the well-being of the people in the community. The standard of living is one of the most commonly used indicators of well-being and is represented by household income, from all sources and in all forms (i.e. cash as well as kind). Adjustments are to be made in the gross income for tax payments, receipts of subsidies, etc. to arrive at the disposable income. For comparison across households, age structure, household size etc. are also to be taken into account. Since it is difficult to get reliable data on household income, household consumption expenditure is often used as a proxy variable. While use of income as a measure of standard of living has its own advantage (e.g. extent of contribution of different source of income), consumption expenditure will be a better indicator for the following reasons. In the first place, it can be said that actual consumption is more closely related to a person's well-being in the sense of having enough to meet current basic needs. Secondly, consumption can be better measured than income, especially in the case of poor households whose incomes keep fluctuating, and include non-monetized items (especially when consumption consists of own production goods also). Thirdly, since consumption expenditure reflects the household's access to credit markets or savings at times when current income is low or almost nil or fluctuates widely. Whether income or consumption expenditure is chosen, it is necessary to adjust for differences in needs between households. The standard method is to use the per capita income/expenditure by dividing total household income/expenditure by the number of persons in the household. The implicit assumption is that no economies of scale in consumption exist.

1.82 Measuring inequality and poverty

Inequality of income can affect economic choice and political decisions. It is therefore desirable to assess the inequality in the levels of living of the households in the study area. The percentage of food items computed from

household expenditure data is an indicator of the standard of living; the higher the ratio the poorer the household. Fractiles of income distribution Lorenz ratio, Gini coefficient, and Theil index are more refined indicators of inequality. Once the extent of inequality is assessed, we would like to get an insight into the contributing factors to inequality. If the inequality measure can be decomposed to explain the contribution of different groups with a particular characteristics it will give an insight into the structure of inequality and contributing factors. The Theil Index is amenable to decomposition of overall inequality into (i) a component of inequality between chosen groups and (ii) remaining inequality within groups. The percentage of inequality contributed by the between group inequality to the overall inequality can be considered as an indicator of the amount of inequality explained by the between groups with particular characteristics.

The conventional view is that a society's welfare is contributed by two factors – income and the extent of inequality in the distribution of income. The notions of poverty and inequality are closely related; for a given mean income, the more unequal the income distribution the larger the percentage of people living in 'income poverty'. In the case of fisher households the daily earnings are fluctuating and uncertain. There is some evidence that traditional work-sharing and output-sharing systems of fishing communities provide some insurance for these vulnerable groups against destitution and hunger. In spite of these traditional mechanisms there exists some anecdotal evidence that inequality has increased in fishing communities subsequent to motorisation; but little is known whether poverty has increased. In this context the cross-sectional data collected in the study can be used to assess the extent of poverty among the fisher households, and to assess the risk today of being in poverty.

Three ingredients are required in computing the poverty measure. First, relevant dimension and indicator of well-being has to be chosen. Second, is the selection of a poverty line, that is, a threshold below which a given household or individual is to be classified as poor; and finally a poverty measure to be used is to be chosen.

For the indicator of well-being we will continue the use of monthly percapita consumer expenditure (MPCE). For poverty line, we confine ourselves to the use an absolute measure based on the subjective perception of fisher households on poverty translated into a monetary measure. For measuring poverty, it is convenient to use FGT measure, because of its decomposability and simplicity of interpretation. In order to understand who are the poor and what are the differences between the poor and the non-poor, a poverty profile of different socio-economic groups would be developed[7]. The profile could include information on the identity of the poor in addition to their education, activity, etc.

1.8.3 Determinants of poverty

When the determinants of poverty are identified from the data, their contribution to pushing a household into the poverty group will be assessed using a binary logistic regression model. The probability or risk of being poor in poverty or falling deeper into poverty is a key dimension of well-being. This vulnerability dimension affects individual's behaviour and their perception of their own situation.

(1) $\log (p/1-p) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots \beta_i X_i$

where, p is the probability of the responding variable to the explanatory variables.

1.8.4 Factors influencing household income

Once an assessment of the level and disparity of standard of living is made, and the factors influencing well-being or the absence of it are identified, the next step is to assess how these factors influence the well-being of the households. In the fishing community, income is mainly from fishing and fish-related activities; and production depends on the ownership and utilisation of factors of production and access to natural resources. Non-utilisation or under-utilisation of productive resources or resource depletion affects resource rent.

[7] It is important to note that several correlates or determinants of poverty are not quantifiable. For some other variables, one has to use a proxy, which might not fully reflect the underlying dimension. Here we would use only three dimensions that are quantifiable or for which a proxy variable is available.

A fishery household may receive income from non-fishing activities also. Non-fishing income is derived from ownership of or access to assets such as land, building and vehicles, in the form of rent; from financial resources in the form of interest; from employment in the agricultural, industrial or service sectors, in the form of wages/salaries; and from enterprises in form of profits. Income may also be obtained through government's transfer payments, remittances, social sharing, etc. A suitable model linking household income and explanatory variables will be developed and the parameters will be estimated using the data from the household survey. Since fishery resource in a specified location may be assumed to be constant it can be eliminated from the model.

1.9 STUDY AREA

The geographical area selected for the present study is a fishing village in the coastal area of Thiruvananthapuram District, the southern District of Kerala. This District has a predominant position in marine fisheries, accounting for about 13 percent of the coastline and 11 percent of the continental shelf area of the State. The continental shelf in this part is narrow and the inshore sea steep slopped and surf ridden. Compelled by the oceanographic feature, fishermen of Thiruvananthapuram have developed highly skilled fishing methods.

About one-fifth of the marine fishermen of Kerala is from Thiruvananthapuram District; and about 39 percentage of fishing crafts of the State are from this part (SIFFS, 1999). *Kattamaram* is the predominant craft in the District; in fact Thiruvananthapuram has a large concentration of *kattamaram* accounting nearly 82 percent of the State's total. From the early eighties, consequent on the introduction of OBM, plywood canoes have become a prominent craft in this region. With the advent of motorisation the operation of *kattamaram* units is said to have declined. Fishermen here use a variety of gears which includes gillnets of various sizes and meshes, hook and line, boat seine and shore seine. In terms of number, gillnets rank first followed by hook and line.

In order to collect primary data to seek answers to the research questions Pullivilla, a typical coastal fishing village in Neyyattinkara taluk of Thiruvananthapuram district was chosen. In addition to the typical

characteristics of the fishing villages of the district, the main factors influencing the selection of this particular village were the following:

1. The village has a long history of small-scale fishing;
2. There are a large number of households depending on marine resources;
3. Both motorised and non-motorised fishing techniques and a variety of gears are in use; and
4. Social characteristics typical of small-scale fishing community in the district are present.

The fishing village is a narrow steep of land between the highway and the sea, and the infrastructure facilities available are more or less the same as in the neighbouring villages.

1.10 SURVEY METHOD

The primary data for the study were collected through a sample survey of households in the study area. The frame to select the sample was prepared by listing all the houses in the village. In this enquiry information on household size, means of livelihood, ownership of fishing equipments, etc. was colleted. The households were then grouped into (i) households possessing fishing assets (in the form of equipments), (ii) households without fishing assets but mainly dependent on fishing and/or fishery-related activities and (iii) other households (hereinafter referred to as 'other coastal households'). These categories formed three strata for selection of sample households for the detailed survey. From each stratum a sample of 25 percent of the households were selected by the method of systematic sampling.

From the selected households data on demographic characteristics of household members, details of fishing and non-fishing assets possessed, employment particulars, information on income from different sources, consumption expenditure, etc. were collected through personal interviews using a structured interview schedule (vide Appendix I). In order to overcome the effect of seasonality the interviews were spread over a period of eight months with a break of one month during the monsoon period of June-July. The

reference period for data on employment, income and expenditure was 30 days previous to the date of enquiry. The fieldwork was carried during the period February – December 2004.

Along with the household survey, data on costs and earnings were collected from a sample of 70 fishing units in the village by personal enquiry. The units covered did not constitute a random sample since the data could be collected only from those willing to furnish the details and maintaining the records of the activities. The data collected reflected the fishing activities and earnings during the preceding 12 months. Data in the schedules were entered into a database, cleaned and edited. The exploratory and confirmatory analysis were carried out using SAS, STATA and SPSS softwares.

1.11 LIMITATIONS OF THE STUDY

The linkages between natural resource degradation and poverty are dynamic and context-specific, reflecting the geographical location and socio-economic and cultural characteristics of the individuals/households and the institutional framework in which they operate. In this study we take a static approach in which we assume that the natural resources are already degradated. Further, the study is location-specific and any generalisation from of the findings of the present exercise has to be made with caution. In order to establish that resource degradation is affecting the people depending on it, it is necessary to collect and analyse data on the biological, economic and social aspects of the fishery as well as its past and present institutional framework. The required economic data would include price information by species, cost and composition of fishing effort (number of and size of fishing vessels, gear type, employment, fishing time, etc.), income distribution, etc. Information on social aspects should cover mobility, opportunity for non-fishing work and participation in community activities. Institutional information relates to community organisation, access to the fishery, relationships with other fisheries, organisational production, marketing channels, customary relations etc. The list is only indicative of the items of information needed for a detailed study. A discussion of the methods of gathering this information is beyond the scope of

this study. The present study has been carried out keeping these limitations in mind.

1.12 STRUCTURE OF THE THESIS

This thesis is documented in seven chapters including this chapter. Chapter II deals with the evolution of marine fishery sector of Kerala from the early modernisation era starting from the sixties up to the present. From cross section data, income differentials among fishing units are estimated using production function technique and their details discussed in Chapter III. Socio-economic conditions of the fishing community in the study area based on the household survey data is the topic of discussion in Chapter IV. Measurement and decomposition of inequality and poverty exercises are undertaken in Chapter V along with determination of poverty and a brief discussion on the poverty profile. In Chapter VI the factors influencing household income are analysed and the magnitude of dependence of fisherfolk on fishery resources examined. In the final Chapter VII, we present the summary of the discussions and the broad conclusions emerging therefrom.

CHAPTER – II

THE KERALA MARINE FISHERY SECTOR

2.1 INTRODUCTION

In this chapter the present condition of the marine fishery sector of Kerala state with special reference to the small-scale fishery is discussed based on the available literature and secondary data. In this discussion an attempt is made to assess the economic contribution of the sector to the State's economy in the context of increasing pressure on the limited marine resources and its impact on the economic condition of the small-scale fisherfolk.

Kerala on the South-West coast of India is one of India's leading maritime States with a coastline of 590 kms and a network of inland water bodies consisting of a large number of rivers, lakes and estuaries. Even though the State's coastline accounts for only about 10 percent of the Country's coastline, it contributes to about 20 percent of the national marine fish production and to about 40 percent of the India's seafood exports. The area of the continental shelf off the Kerala coast is about 40000 sqkm and the overlying waters are considered to be among the most productive in the Indian Ocean. Fish and fisheries play a crucial role in the well-being of the people and the economy of the State. About 85 percent of the people here are fish-eaters and fish is an important subsidiary item in the daily consumption of most of the households. According to official figures, there are 223 fishing villages in the State, which makes it one fishing village covering about 2.6 km of the coastal line on the average. An estimated 9 lakh persons depend on the marine resources for their livelihood. The number of active fishermen among them is about 1.85 lakh and approximately an equal number is employed in allied activities like marketing, transportation, processing, etc. The State's unique position in the fishery map of the country is a reflection not only of the rich fishery resource endowments of the State, but also of the skill and resourcefulness of the State's large population. The situation discussed above is examined in more detail in the sections that follows.

2.2 RESOURCE POTENTIAL

The continental shelf off Kerala with an average width of 60 km has a fishable area of over 38000 sqkm. Some of the fishing grounds off the Kerala coast enjoy international reputation. These include the Wadge Bank, about 60 km South off Vizhnjam, well known for its perch fisheries, the deep sea of Kollam in the slopes of the continental shelf reputed for prawns and lobsters and the pelagic fishery resources within the 50m-depth range. The offshore region within 50-75 m depth zone has rich fisheries of catfish, elasmobranches, chorinomes, kalava and seerfish. About 50 percent of the State's, resource potential falls within the inshore region of 50m-depth range. Productivity is the highest in the coastal and inshore waters. As the depth of the sea increases, the less is the production of organic substances on account of unfavourable ecological conditions; the yield rate of fish in the waters between 50-200m depth range is only half of that in the region up to 50m-depth[1]

Marine resources may be broadly classified as pelagic fishes, demersal fishes and crustacea. Pelagic fishes comprise mainly oil sardines, lesser sardines, anchovilla, ribbonfish, carangids, mackerel, sear fish and tuna. These constitute about 60 percent of the total yield potential. Demersal fishes like elasmobranches, catfish, perches, cuttlefishes, squids comprise another 30 percent. The crustacea consisting mainly of prawns cover the remaining 30 percent. The South-West coast has a near monopoly in oil sardines accounting for about 90 percent of it. In respect of white baits and mackerel the share of the region is 70 to 80 percent. About half of the perches and penaeid prawns occur in the waters off the south-west coast. The marine resource potential of Kerala is given in Tables 2.1 and 2.2. Of course these are only estimates which are subject to natural and fishing induced variations.

[1] In fishery, a distinction is often made between inshore and offshore waters, although as the fish in these waters may belong to the same stocks. Waters inside the 50m depth contour line are classified as inshore waters. Most of the existing fishing efforts of Kerala fishermen occur in this zone. For most sections of the coast, depths of 50m is found about 25km from the seashore line. The water within the continental shelf and outside the 50m depth contour is called offshore waters.

Table 2.1 Marine resource potential in South-West coast of India (lakh metric tonnes)

Area	*Kerala*		*South-west coast of India*	
	Demersal	*Pelagic*	*Demersal*	*Pelagic*
0 – 50 m depth	2.29	3.42	3.60	5.89
Beyond 50 m depth	0.56	1.24	1.12	2.49
Total	2.85	4.66	4.72	8.38

Source: Economic Review 2003, GOK, 2004

Table 2.2 Estimated annual catchable potential in 0-50 m depth in Kerala

Category	*Potential (lakh metric tonnes)*
Oil sardines	1.11
Other sardines	0.13
Promfrets	0.02
Mackerels	0.49
Ribbon fishes	0.19
Penaeid prawns	0.64
Cephalopods	0.19
Others	2.94
Total	5.71

Source: Economic Review 2003, GOK, 2004

2.3 FISH PRODUCTION

During the past five decades, Kerala witnessed considerable increase in marine fish production. From around two lakh tonnes in the early fifties, it increased to six lakh tonnes by 2002. However, the rate of increase in marine fish production was not steady; it had its ups and downs, not quite systematically either. From an annual production of around two lakh tonnes in the early fifties, it came down to about 1-lakh tonnes by the mid fifties. From then on production began to recover, and in spite of frequent fluctuations reached a peak of 4.5 lakh tonnes in the early seventies. It remained more or less at this level up to 1975. However, after 1975, production began to decline reaching a low of 2.8 lakh tonnes in 1980. The 1980's saw a recovery, annual production reaching a peak level of 6.6 lakh tonnes in 1990. In the past decade marine fish production declined and hovered around 5.5 lakh tonnes per annum.

Various explanations are advanced for in the fluctuations in marine fish production. Marine fishing is a traditional activity of certain communities in the costal area. Over the centuries, they had developed fishing techniques in tune with local conditions. They used country crafts propelled by wind and manpower and fished in the inshore waters; the resources in the offshore and deep sea remained in were general, out of their reach. The periodical recurrence of abundance and scarcity was mainly the result of natural phenomena. By the mid fifties Government started to intervene in the sector, when the Indo-Norwegian Project (INP)[2] came into being with emphasis on mechanised boats operated from harbours. The project has attracted capital and new technology into this sector. Since the new initiative was applauded as the appropriate system to modernise the fishery sector, the venture gave the required push for growth and development in this sector. But the expectation was belied and the use of alien technology and capital created a wedge among the fisherfolk and sowed the seeds of conflicts in the fishery sector.

In the sixties, penaeid prawns found a lucrative world market which led to the introduction of small costal trawlers capable of catching them. The high market price for prawns and the Government's interest in promoting prawn exports gave a boost to trawling. By this time, the artisanal fishermen had also switched on to nylon nets from the traditional cotton nets; the catch made by trawlers did not seriously affect them. This led to increase in marine fish production reaching a peak by 1973. The profit reaped by trawlers attracted outside investors; and the number of trawlers increased considerably. However, with the increase in the number of trawlers, the total production started to decline, with mechanised boats capturing a substantial share of the declining catches. Thus, 1980 saw a dismal scenario with 30000 country crafts competing with mechanized boats for a declining fish resource.

The period 1980-89 was important in the development of marine fisheries in Kerala. In the first half of the decade, motorization of indigenous crafts with

[2] The government started its attempt to modernise the fishery sector as early as 1953 by introducing the Indo-Norwegian project (INP). INP which was inspired by the United Nations development project for underdeveloped countries, was mainly intended to increase the productivity of the traditional fishery sector. According to various studies which evaluated the project these attempts from the Government were a failure. See Kurien (1985); Galtung (1969).

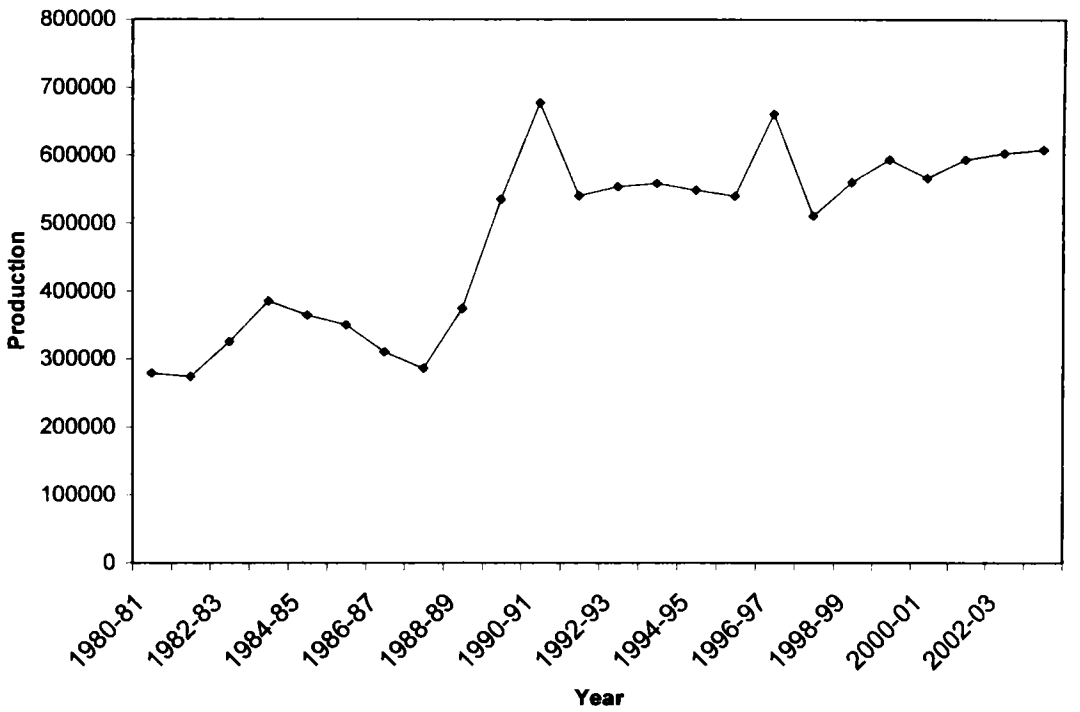
outboard motors (OBMs) made the traditional sector more efficient. The introduction of OBMs conferred superior mobility to the fishermen; also the craft was now much less at the mercy of winds and fishermen could extend the duration of their fishing activities. This enabled the fishermen to fish more efficiently and to extend their activities to more distant offshore and deep sea areas. In the latter half of the decade, a new gear called 'ring seine' became very popular in the exploitation of the pelagic resources. Starting with a few OBMs in 1981, the number of motorised crafts rapidly increased to about 9000 in 1988. By this time about half the country crafts were motorised; but more important by then three fourth of the artisanal fishermen were working in motorized crafts. In the mean time infrastructure facilities provided by the Government helped the fishers to land their catches safely even during the monsoon season. This combined with increase in demand for fish, especially the export demand for prawns resulted in increasing fishing activity and an increase in the quantity of annual catches; but the trend could not continue for long (See Table 2.3 and Figure 2.1).

Table 2.3 Marine fish production in Kerala (in tonnes)

Year	*Production*	*Year*	*Production*
1980-81	279395	1992-93	554124
1981-82	274395	1993-94	559108
1982-83	325795	1994-95	548886
1983-84	385817	1995-96	540537
1984-85	365121	1996-97	660949
1985-86	350826	1997-98	511091
1986-87	310783	1998-99	560328
1987-88	286435	1999-00	593720
1988-89	374924	2000-01	566571
1989-90	535714	2001-02	593783
1990-91	677489	2002-03	603286
1991-92	540850	2003-04	608525

Source: Economic Review, various issues, GOK

Figure 2.1 Marine fish production in Kerala



In some sense 1988 was a transitional year. The commencement of ban on trawling for varying periods during the south-west monsoon with a view to protect the marine resources and the interests of the traditional fishermen was an important event of the year. In the years that followed, the growth of the motorized sector has been quite rapid one. At present it is the most important sector in the fishing scene. The following tables show the number of crafts is different in 1980, 88 and 2003. During this period, the ring seine fishery also witnessed a steady growth. Ring seine is a surface gear and the uncontrolled expansion of its operation significantly affected the catches of other surface gears. The huge size of the new net and the large number of crew needed for its operation necessitated the use of larger boats and more powerful outboard engines. A study by CMFRI showed that during 1993-96, out of an average catch of 5.5 lakh tonnes of fish landed in Kerala, about 50 percent was cornered by the mechanized sector, and another 40 percent by operators of large seines in the motorised sector; the traditional fishermen especially those in the non-motorised sector found themselves marginalized (Yohannan *et al*, 1999).

The marine fishing of Kerala is now dominated by trawls and ring seines. Bottom trawling is a destructive way of fishing; and the ban on trawling enforced during a limited period in monsoon is in a way beneficial to the demersal fish stock. But the pelagic fish targeted by ring seine is in an unprotected condition. The ring seine units fitted with powerful engines are also exploiting deeper waters. Towards the end of the nineties, crafts with inboard diesel engines were introduced in the motorised sector and they started operating. These uncontrolled developments have resulted in over fishing and have affected fish catch. With the spread of motorisation a new motorised sub-sector emerged in the marine fishery sector in addition to the mechanized and the traditional (non-motorised) sub-sectors. The non-motorised crafts are now of importance only in the southern district of Thiruvananthapuram, where neither the trawls nor ring seines operate.

In multi-species fishing, the total fish catch is a function of the total production of the area fished. The decline of one species may help the increase of other species due to ecosystem interaction. The fluctuations may get smoothened in the total, but due to selective exploitation, the valuable species generally decrease and worthless species increase. Such declines represent varying degrees of over-fishing depending on the numbers and reproductive rates of the species, the nature of the ecosystem, and the rates of mortality caused by fishing.

A review of the marine fish production in the background of the changes in fishing techniques suggests the following:

1. A favourable market framework with attractive fish price tends to boost production. For instance a lucrative world market for panneid prawns combined with government initiative in promoting exports, gave a boost to trawling and increased fish production in the mid-sixties.
2. Upgradation of fishing technology finds a quick result in the restoration and increase of fish output; but this cannot be sustained as trawling in the late sixties and motorisation in the 1980's have demonstrated.
3. In an open access fishery, exploitation cannot be expected to be prudent. Gears are used according to their effectiveness without

considering the implication to the resource. Technological advancements, especially those emerged as innovative fishing methods, unleashed unhealthy competition with traditional fishing methods mainly due to the open access nature of the marine resources.

2.4 STATE INTERVENTION IN FISHERY REGULATION

Technological advancements, especially those which emerged as innovative fishing methods, unleashed unhealthy competition with the traditional fishing methods essentially owing to the open access nature of the resources. Traditional fishermen attributed the decline in marine fish production to the detrimental effects of the trawling operation by mechanized boats. The euphoria of modernisation of fishing operations which had started in the early 1960's began waning by the early 1980's. The steady growth of trawler fleet, fishing in the same fishing space where the traditional fishers used to fish, led to a competition for fishing space. In the absence of any space regulations, the mechanized boats were also crowding in this space, noted for its higher productivity. Sporadic skirmishes between the traditional fishers and the trawlers threatened the peaceful life in the coastal areas.

Faced with the explosive situation, Government of Kerala introduced the Kerala Marine Fisheries Regulation Act 1980 (KMFRA) to regulate fishing by vessels in the sea along the coastal line of Kerala[3]. The Government also constituted a committee (known as Babu Paul Committee) to recommend plausible courses of action to ensure equitable distribution of benefits to the stakeholders (Paul, 1982). While the committee was unanimous in respect of the need for conservation and management of fishing resources, in regard to the specific need for adopting closed season for trawling operations, opinion of the committee was divided. Some of the members maintained that there was no sign of biological over-fishing, but there was indication of economic over

[3] Kerala Marine Fisheries Regulation Act 1980 is the first of its kind in India enacted for fishery management. The Act provides power to the Government to regulate, restrict or prohibit fishing in any area by notified classes of fishing vessels, or use of specified fishing vessels, or use of specified fishing gear in any specified area to restrict the number of fishing vessels in any specified area. The Act also stipulates licensing of fishing vessels for fishing in any specified area. Unfortunately, none of the restrictions for management of fishery except the seasonal ban on trawling has been implemented or enforced seriously. For details, see GOK (1980) where KMFRA 1980 is issued under Government Order (MS) 141/80/F& PD, dated 29/11/1980, published in Kerala Gazette Ex. No. 997 dated 29/11/1980 as SRO 1141/80.

fishing. In view of diverse views of the committee and the persistence of unrest in the sector, Government appointed another committee in 1984 (referred to as the Kalawar committee). One of the main references to the committee was to study the need for ban on shrimp trawling in any part of the year in the interest of conservation of resources. The committee after an in-depth analysis of available data recommended that there was no need to ban shrimp trawling during the monsoon season, but the trawling during may be restricted to 'daytime' and beyond a depth of 20 m. (Kalawar et al., 1985).

The recommendation of the Kalawar committee did not go well with the traditional fishers who persistently insisted on ban of trawling during the monsoon months. There were frequent clashes between different sections of fishers, threatening the social harmony in the coastal areas. Government responded to the situation by ordering a ban on trawling throughout the territorial waters of Kerala during the monsoon period. The ban helped only in exacerbating the social discord, forcing government to constitute another committee with almost similar terms of reference. The committee headed by Prof. N. Balakrishnan Nair, 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 utilisation of resources evaluated. In 1989, Government enforced a partial ban of six weeks on trawling during the monsoon, a practice which is being continued year after year.

2.5 THE FISH ECONOMY OF THE STATE

During past five years, the annual fish production in the State anchored around 6.7 lakh tonnes, of which nearly 90 percent is marine output. Even though fishing contributes only to 1.8 percent of the value of the State's domestic production, it sustains an estimated population of about 10 .8 lakh of which about 8.4 lakh belongs to the marine sector. A recent survey carried out by the Government of Kerala, estimates that there are about 2.2 lakh active fishermen in the marine sector (GOK, 2005). There is another 0.80 lakh persons in the sector directly involved in fish-related activities like fish processing, fish peeling, fish vending, etc. The occupational pattern in the marine fishing sector is given

in Table 2.4. It will be seen that among the working population in the sector about 85 percent is in one way or other engaged in fishery related activities, which means that any crisis in the sector could affect most of the households.

Table 2.4 Occupational structure of the fisher population

Occupation	*Percentage*
i) Fishery sector	
Traditional fishermen	23.73
Other fishermen	3.41
Shell/Crab/Seed collection	0.33
Fish vending	2.69
Peeling/fish processing	0.63
Allied workers in fishery sector	0.63
Sub total	*31.42*
ii) Non fishery sector	5.32
iii) Foreign employment	0.61
iv) Not working	62.65
v) All	100.0

Source: Dept. of Fisheries, GOK, 2005

Among the Indian states Kerala is a major exporter of marine products. Annually 7 to 8 lakh tonnes of marine products are exported from the ports of Kerala. This accounts for about one-fifth of the total marine exports from all the Indian ports. Exports from Kerala ports include marine products from the neighbouring states also, but the major contribution is from the fish output of the state. Marine exports during the past five years from the ports of Kerala are given in the Table 2.5.

Table 2.5 Export of marine products from Kerala (in metric tonnes)

Year	*Exports*	*Share of Kerala to all India (%)*
1998-99	70641	23
1999-00	92148	27
2000-01	88852	20
2001-02	72756	17
2002-03	81393	17
2003-04	76627	19

Source: Economic Review, various issues, GOK

It was the export demand for fish and fish products that has attracted investment support and other forms of development assistance to the sector. An export orientation was consciously given to the sector and new fish harvest

and processing technologies were introduced with the express purpose of raising output. The value of output has also witnessed substantial increase over the years. All this was expected to enhance the contribution of the fisheries sector to the state economy and also to improve the standard of living of the fishing community. Official data on the state domestic product indicate that while the contribution of the fishing sector from 1970 to 1985 was poor, the sector contribution slightly improved after 1985, but came down after 1995. (See Table 2.6)

Table 2.6 Percentage contribution of fisheries sector to state net domestic product (at current prices)

Year	*% contribution*
1970-71	2.05
1980-81	2.02
1985-86	1.65
1990-01	3.05
1995-96	2.85
2001-02	1.83
2002-03	1.62
2003-04	1.62

Source: Economic Review, various issues, GOK.

The fish economy of the country prior to independence was essentially a subsistence sector. In the realm of harvesting, the transformation of the living marine resources into products with use and exchange value was mediated by the skills of fishermen and the judicious use of technology. The two hallmarks of these technologies were their appropriateness to the aquatic ecosystem and their inherent limits on the harvesting capability. It was a technology appropriate for fishing as a source of livelihood. The bulk of the catch was exchanged or bartered for basic necessities. The perishability of fish greatly restricted its internal trade flows and the bulk of it was consumed in the immediate coastal hinterland by the rural masses for whom it formed the cheapest source of animal protein. Long distance trade did exist, but with a few exceptions, it was essentially between countries within the region and the fish products were of the low value added type (primarily dried and/or cured) marked essentially to the low-income consumers of the region.

The rapid changes in craft design and the introduction of techniques such as bottom trawling and purse-seining were phenomena which generated momentum in the late sixties and became intense in the early seventies. These changes were fostered by factors which were independent of the socio-economic and technological developments. Like in the agricultural sector, where one speaks of a 'Green Revolution', the modernisation of fisheries was more than just the introduction of a new technology. It is more of a 'package approach'. The new form of technologies in harvesting were accompanied by modern forms of processing and marketing infrastructure, creation of facilities like harbours and freezing plants and emphasis on export orientation as a key objective of the fisheries sector. The earlier priority of providing cheap animal protein to the local population and employment of the rural poor was relegated to the second place. The 'initial conditions' - prevailing fishing techniques, processing and preservation methods, established trade links, forms of traditional organisation and resource management and patterns of local fish consumption-were written off as being 'primitive' and/or 'unscientific' in the face of the glistening prospects of the new development current.

The drive towards modernization was based on the assumption that new technologies as such would help fishermen improve their economic conditions; however, the fact that small fishermen did not have the backing of favourable resource or market conditions was overlooked. This made the technologies introduced largely inaccessible and inappropriate to their long-term capabilities and needs. Hence, by default the technologies came under the control of a powerful minority group of non-fishermen in turn enhancing their economic and political power and creating a technological duality in the sector. It was fisheries development without fish workers development and an ecological and socio-cultural disaster as far as they were concerned (Kurien, 2000).

Artisanal fishermen generally concentrate on harvesting pelagic species while the mechanised boats hauling bottom trawls, fish for the demersal prawns in the same area. When large mechanised purse-seines haul in huge shoals of pelagic fish before the schools get a chance to move inshore, they deprive the shore seine fishermen of their livelihood. The damage caused to marine resources by the use of destructive fishing gears and the deprivation of access

to resources resulted in hardships to majority of the artisanal fishermen who depend on fishing as the sole source of livelihood. It is the market mechanism and the so-called 'invisible hand', which drives it, that underlies the choice of new fishing technologies and the harvesting patterns which they involve in. Conflicts at sea today are essentially conflicts between the few, spurred by the motive of profits, and the many whose objective is survival. The former are largely catering to the ever-increasing demand for seafood of the overfed metropolitan consumer in the developed countries and the latter to the basic protein needs of the rural masses of the region.

It may be said that two clearly demarcated sub-sectors have been created in the fish economy-one which now received all the attention of the State and the enterprising merchant class and another which was left largely to its own survival. The first sub-sector may now referred to as the 'modern sector' made up of the mechanised boats in the realm of production and the more capital-intensive and export-oriented processing and distribution activities. The latter is what we referred to earlier as the 'small-scale sector' composed the motorised and non-motorised country crafts and labour-intensive, internal market-oriented distribution and processing activities. This latter sector employs over 90 percent of all fishermen and has not received adequate attention in the past several decades.

2.6 THE ECONOMY OF THE SMALL-SCALE FISHERY

Fisheries provide livelihoods for some of the poorest and most marginalized groups, and often constitute the main source of animal protein for the poor. Yet, many small-scale fisheries are over-harvested, often by commercial enterprises that do not benefit the poor (UNEP, 2002).

The fishery economy broadly consists of three activities – harvesting, processing and marketing. Harvesting is related to means of production and the production relations of those who are involved in fishing. The means of production are the equipments used for searching and trapping fish, whereas the production relations are concerned with the relation between the equipment owner and the worker in the fishing operation.

In the traditional fisheries sector, there are broadly two types of ownership of fishing units – individual and collective. Individual ownership is found mainly in non-motorised units and units of small crafts with outboard engines. Ownership of the unit by family may also be treated as individual ownership. The crewmembers are usually the kith and kin of the owner, but not always. The collective form of ownership exists mainly in larger fishing units, where a group of persons own the fishing assets. The contribution of individual members of the group to the cost of assets may not always be equal.

In both types of unit ownership, the distribution of earnings from the catch is in the form of 'shares' of the produce. The net income from sales, that is value received after deducting the 'common expenses' (which include operating expenses; sales commission, port charges, customary payments, etc.) is broadly apportioned into (i) equipment share (return to capital) and (ii) crew share (return to labour). The crew share is then divided in accordance with the number of members in the crew. In the case of individual units, the crew share is divided equally. If a particular member, such as skipper or the engine driver is entitled to a larger share, the crew contributed to this by setting aside a portion from their due share. In the units of collective ownership, hired workers are also sometimes included either contract basis or as casual labourer. In some of the villages practicing the ring seine fishery there exists a system of income sharing pattern known as *karanila* in which all the fishermen present in the seashore and who 'touch the craft' at the start of the fishing trip are considered as the crew of the unit 'for that day'. Those who stay back on shore share the income and they fish in turn[4]. The income-sharing pattern has evolved in the context of changes in production relations and technology, keeping community concerns for livelihood and food security at centre stage, and hence has variations among villages. The real problem here is reduction in employment potential.

The interactions of fishing people with the natural asset of the sea have also given rise to rules and norms – that is, institutional arrangements – that circumscribe their actions both on the resources and among themselves. These

4 For details of *karanila* system, see Kurien and Vijayan, (1995).

arrangements have likewise evolved over long periods of time although some have fallen into disuse and neglect in the context of modern legal developments (Kurien, 2003).

The official statistics of fish landing show declining share to the small-scale sector, especially to the non-motorised sector. The major appropriation problem experienced by the traditional fishing sector from the mechanized sector is found to have been the reduction in their share of production, output per craft, share of value and per capita real income. Within the traditional sector itself, the introduction of motorisation and ring seine brought new appropriation and technological dilemmas for the non-motorised and non-ring seine using segment (Paul, 2003). The mechanized and motorised sectors account for 95 percent of the landings in Kerala with respective percentages of 44 and 51, while the contribution of the traditional sector is rapidly declining to less than 5 percent (Nair, 2000). As more and more fishermen motorised and enlarged their crafts, individual catches and incomes began to level off because of the pressure on the limited fishery resources. While for a small minority of owners, the operations still yield surplus, there are many who are not able to cover running costs and also some who have made losses. But since the capital invested in fishing cannot be used in any other sector they continue to hold on to fishing for survival. Because of the pattern of sharing of income, fishermen who are only workers may still realise seasonal earnings for their labour. According to the socio-economic survey of fisher folk conducted by the Department of Fisheries in 2004, 64.1 percent of the families in the marine fishery sector are below the poverty line on the basis of ration card issued by the revenue authorities (GOK, 2005).

The annual income of active fishermen varied from Rs. 10000 to Rs. 35000 depending on the craft operated and catch (Nair, 2000). The higher income obtained during the main season is kept for meeting the lean season expenses. The main fishing season for small-scale fisheries is from June to November; from November onwards the catches become lower and larger crafts are withdrawn since they become non-viable. The number of fishing days in an year is estimated between 200 and 250. In thickly populated villages poor socio-economic conditions prevail due to low income, unemployment and

underemployment. Lack of occupational and geographical mobility is also a cause for some of the socio-economic problems of the small-scale fishers.

Fishing income depends not only on the amount of catches, but also on the unit price at the landing site, as well as the cost of inputs used in the production process. Fish prices are not under the control of fishermen; they are subject to several sorts of constraints. Prices tend to vary in inverse ratio to daily landings in those ports where catches are sold by auction. In the pre-motorisation period, the workforce in processing and marketing was dominated by women. The conjunction of increased production in the mechanised/motorised sector, the emergence of long distance fish trade, and the expansion of consumer demand has effected a transition of marketing structure. The process is accompanied by an expansion of market hierarchy and a shift towards increased importance of wholesale market over local shores as a source of fish for distribution to consumers. The practice of auctioning has come into stay on almost of the shores. With the development of internal and external market for fish trade, a new class of merchants from outside the fishing community has emerged. The catch once landed is taken over by these middlemen and their agents and transported to processors on the basis of commissions. In addition to their function as middlemen between the producers and the consumers they have started to perform the role of financiers also to the producers. To meet larger investments in motorised units, the fishermen are considered to depend on these middlemen for funds. With added investment in the sector, with catch being able merely to keep the fishermen employed, no substantial surplus could be reaped and their level of indebtedness increased. Gradually the merchants got control of fish prices in the market itself, depriving the actual fish workers the benefit of the improved techniques, expansion of consumer market and the rise in fish prices. The workforce on the marketing structure is now dominated by men except in a few southern districts of the State, where women as head-load vendors sell fish to the local markets. Centralised landing of fish due to adoption of modern technologies has affected the participation of

women from traditional fishing communities in post-harvest activities[5]. Thus, the process of modernisation of the fishery industry through the induction of technology changed the labour process by converting the immediate producers into wage-earners and also the depriving and marginalizing of the real fishermen (Rajasenan, 2001).

The fisherfolk in the small-scale sector, consider trawling as the main threat to their livelihood[6]. Trawling affects them in two ways: (i) competition for catch and (ii) reduction of catch due to depletion of near shore resources. Strategy of a section of artisanal folk by innovation of gears has resulted in the development of ring seines which has proved to be equally damaging in over-fishing. While the annual fish catch is stagnating and fluctuates around 5 and 6 lakh tonnes, the increase in fish prices appears to help the fisherfolk to cope with the increased investment in motorised crafts. Stagnation in catches also means reduction in employment potential in the fisheries sector. The initial euphoria of increased harvest enhanced revenues and higher profits was followed by ecosystem changes and resource depletion. At the same time this strategy led to economic marginalisation of coastal fishing communities and reduced their autonomy for participation in the new structure of the fish economy. It ruined the commons and the commoners (Kurien, 1992). In most of the coastal villages artisanal fisherfolk do not work in fishing on a full time basis; their work is seasonal as is fishing. As a result, the daily earnings of artisanal fishers are fluctuating and remain uncertain affecting their livelihood security. Fluctuation in income, which may be unpleasant for the better off, can prove disastrous for the less well-off for whom adequacy and regularity of income are vitally important. Increased investment on fishing equipments has also increased their financial burden leading to indebtness to money lenders.

Another feature affecting the household income of small-scale fishers is lack of occupational and geographical mobility. This may be due to long isolation, low educational level, preference for a particular way of life, caste restrictions or

5 A recent survey report of Dept. of Fisheries indicates that only 9 percent of the working women in the fishery sector are now engaged in post-harvest activities and that also in head-load fish vending (GOK, 2005).

6 Srivastava & et al., (1986) in their study on the impact of mechanisation on small-scale fisheries in some villages found that mechanization in the form of trawling and purse-seiners has contributed to greater disparities in income and ownership of fishing assets.

just inability to liquidate ones assets. A decline in employment opportunities outside the fishery sector reduces the opportunity cost of fishing, increasing the dependence on fishing, discouraging exit and encouraging new entry leading to further resource depletion and hence more stringent resource limitation (Panayotou, 1982).

2.7 CONCLUSION

Fishery is a resource-based industry where open access and resource limitations are faced by all fishers. Small-scale fisheries face more severe constraints. First, their level of technological development confines them to a narrower area. Second, lack of alterative employment makes them particularly vulnerable. Thirdly, they are often 'trapped' in their occupation (since entry is relatively easy, while exit is difficult due to a variety of reasons like lack of alternate employment, indebtedness, socio-cultural characteristics, etc.). Fourthly, processing and marketing have increasingly come under the control of groups with strong economic power and the small-scale fishers tend to become dependent of these groups.

CHAPTER - III

DETERMINANTS OF INCOME DIFFERENTIALS AMONG FISHING UNITS

3.1 INTRODUCTION

In the last chapter we were discussing in detail the concepts, definition and methodology proposed used in the study and the analytical framework. Here in this chapter an attempt is made to explain the income differentials among fishing units by formulating and estimating a production relationship between catch and fishing inputs.

3.2 INCOME DIFFERENTIAL AMONG FISHING UNITS

Pulluvilla is a typical marine fishing village in the coastal Panchayat of Karimkulam in Thiruvananthapuram district situated at the southern extreme of Kerala. The village is located right on the beach; most of the households live well within 200m from the sea. Most of the inhabitants here are connected with fishing or fish trade in one way or the other. Thus there are actual fishers (having own fishing crafts and / or working for wage in fishing), auctioneers, small traders, head load women fish vendors, dealers in ice, kerosene and oil, repairers of outboard engines and plywood boat, etc. The sea is rougher in this part of the State than in the northern districts and hence *kattamaram* is the logical craft for the year round operation. The fishermen of South Kerala who use hook and line and a wide variety of gill nets are one of the most versatile fishers of the country with a range of sea faring and fishing skills. It is these fishermen who started using OBMs, initially in *kattamaram* and later shifted to plank and plywood boats. Plywood crafts with OBM have now evolved as the predominant craft for fishing. The H.P of OBMs has also increased to 25. During the lean season, some fishermen from this village migrate to northern Kerala to tap offshore resources, which local fishermen there do not exploit.

From interaction with the local community during the course of the household survey, we learnt that there existed significant differences in fishing income among the small-scale fishermen in the village. One obvious reason was the difference in the fishing technology used. The two main types of fishing

technology used are the non-motorised *kattamaram* propelled by human power and ply-wood crafts using outboard engines.

The non-motorised *kattamaram* units are confined to opportunistic fishing close to the shore mostly in waters of less than 20 m depth. The number of fishing trips undertaken by these units is also comparatively low; inclement weather and lack of fish are said to be the main reasons keeping away for fishing. Fishermen reported that usually the catch is not more than 10 kg for most of the trips and the annual earnings after meeting the operating expenses were less than Rs. 15000.

The mechanical power for propulsion of the OBMs confers superior mobility to the plywood crafts. Moreover, these fishing units are less at the mercy of wind and current. The capability for hunting and intercepting migratory species at a long distance from the coast improves the chances of higher catch for the skilled and enterprising fishermen, of course at the cost of fuel and other resources. Another advantage is that the greater mobility conferred by motorisation makes it possible to land most of the catch in 'fresher' form, thus fetching better price. From local enquiries, it was learnt that the average sale value of catch by motorised plywood units is around Rs. 3.5 lakh per annum. The actual net earnings however, are far lower this since 30 to 40 percent of the catch value goes to meet operating expenses.

But even among the fishermen operating the same equipment, wide differences in income are observed. A quick enquiry of a sample of *kattamaram* operators and plywood operators yielded the following data given in Table 3.1, which are indicatives of the large variation in fishing income.

For fishermen using the same technology, the income differentials may be attributed to differences in asset profile, and technical and price efficiency, quantity and composition of catch, etc. (Panayotou, 1985). The results given in Table 3.1 show that there exists wide differences in income even among fishermen operating the same type of fishing equipment. These income differentials may be due to differences in quantity of catch or fish prices or both. Because of the multi-species composition of catch and non-availability of prices data for individual species to undertake a causal examination of income

differentials, the effect of difference in catch composition is not attempted in the present analysis, even though such an analysis important. In other words, the attempt here is to explain the difference in fishing income arising from difference in catch, which may be due to the following factors:

(i) differences in the use of fishing inputs,

(ii) difference in technical efficiency, and

(iii) other exogenous factors.

Table 3.1 Percentage distribution of fishing units by sale value of fish catches for a period of one year (in Rs)

Non-motorised Kattamaram		*Motorised plywood boat*	
Sale value ('000)	*%*	*Sale value ('00000)*	*%*
< 10	17	< 2	18
10 – 20	36	2 – 3	18
20 – 30	11	3 – 4	29
30 – 40	19	4 – 5	12
40 –50	11	5 – 6	9
50 & above	6	6 & above	14
All	100	All	100

Source: Survey data

In attempting to explain catch differentials it is useful to formulate a production relationship between the catch and the fishing inputs. This relationship, referred to as the fishery production function can be used to test the hypothesis that the catch differentials among small-scale fishermen is due to differences in the production techniques and variable input use. Although resource abundance is an important factor determining the volume of catch, in a given location the fish stock may be assumed to be constant and hence excluded from the production function.

3.3 FISHERY PRODUCTION FUNCTION: A CONCEPTUAL MODEL

The transformation of wild stock of fish into catch is considered in general to be dependent on the quantity of fishing effort expended in the process of harvesting the catch. The fishery production function combines both biology

and fishing technology; biology is represented by fish stock and technology by 'fishing effort[1]'.

The term fishing effort is used in a way which implies a certain intensity in relation to the activity of fishermen (number of trips, number of fishing days, etc.) and the catching power produced by fishermen by combining the inputs of capital (crafts, gear, engine, etc.) and labour. From a biological point of view, fishing effort is closely related to fishing mortality rate. Fishing effort per craft is usually defined as the product of fishing time and individual fishing power (Beverton and Holt, 1957). Nonetheless, individual fishing power is not clearly defined, because it depends on the technology and the exploited stock characteristics; it is intuitively assumed to be a function of capital and work inputs.

In analysing a fishery production function the well-known Schafer-Gordon model has often been used. This function relates harvest in period *t* to the fish stock and fishing effort, also in period *t*. Harvest is regarded as the output and the fish stock and effort are regarded as inputs. As it is assumed that catch is a function of effort and stock, the general production function as in Clark (1985, 1990) and Conrad and Clark (1987) can be written as in equation (1).

$$(1)\ Y_t = f(S_t, E_t);\ \frac{\partial F}{\partial E} > 0, \frac{\partial F}{\partial S} > 0, \frac{\partial^2 F}{\partial E^2} < 0, \frac{\partial^2 F}{\partial E^2} < 0$$

where, Y_t is the fish catch due to human exploitation, S_t the size of fish stock and E_t is the fishing effort at time *t*. The function is characterised by positive but diminishing marginal output of stock and effort.

The relationship states that the harvest at any point of time depends on the level of effort (E) applied and fish stock (S). Thus the model has a biological component represented by the fish stock and an economic component

[1] Fishing effort is crucially important in economic literature about fisheries management. However, its definition does not usually appear in papers and it is almost always quite different depending on the type of fishery and the objective of the study. From a formal point of view, it is not important to consider the fishing effort or the catch rate as control variables for fisheries analysis. In addition, from an economic point of view, there is a preference for output-price rather than input-price graphs (Gordon, 1954). Furthermore, Clark, Clarke and Munro (1979) and Hannesson (1987) introduce the concept of "fishing capacity." For them, fishing capacity is the same as fishing effort. The maximum fishing capacity is defined as the number of standardized vessels in a fishery at a certain moment or a maximum limit of this number.

represented by effort. Fishing effort itself is a production function of various fishing inputs such as labour (X_1), craft (X_2), gear (X_3), engine (X_4), etc. so that we may write it as

(2) $E = g(X_1, X_2, X_3, X_4...)$

Combining (1) and (2) we can write as:

(3) $Y_t = F[S_t, g(X_1, X_2, X_3...)]$

In a particular fishery, the stock of fish at any given time can be treated as constant. Hence the catch of each fisherman depends not only on his effort but also on the effort applied on the given stock by other fishers[2]. But this aspect may be ignored in the case of large fisheries. This means that the variation in catch for individual fishing units depends mainly on the variation in the effort applied. Each operating unit should use the most efficient production technique so that it does not incur unnecessary production costs. With this assumption, the fisheries production in the neo-classical approach can be formulated as

(4) $Y = f(X_1, X_2, X_3...)$

This function is assumed to be continuous and its first and second partial derivatives exist and are continuous. Logically, the production function is defined only for positive values. Production functions can adopt different functional forms depending on technologies; however, the most efficient technique for each combination of inputs is always assumed to be used.

In this study, the Cobb-Douglas production function is chosen as the specific functional form of the underlying relation between catch and the explanatory variables.

The functional form of the Cobb-Douglas is:

(5) $Y = A K^{\alpha} L^{\beta}$

[2] The optimum income will be obtained under the assumption that the fish stock in the production function remained constant, in the short run. However, the catch depends not only on own effort but also on the effort applied on the given stock by fellow fishermen. The presence of surplus profits would encourage expansion of fishing effort up to a point where all resource rents are dissipated. This is a natural outcome of open access fishery and is analogous to Cournot's duopoly solution argued by Cheung (1974) cited in Ullah (1985).

where, Y is the output, K is the capital, L is labour, A, α, β are parameters.

The advantages in using the Cobb-Douglas production function are that it is possible to calculate both the elasticity of factors and the degree of return to scale. With production functions three elasticity aspects of production can be calculated – the elasticity of labour, elasticity of capital, and elasticity of substitution. The sum of the indices α and β indicate the returns to scale. Further, the coefficient A is a measure of efficiency in the organisation of the factors of production.

3.4 MODEL ESTIMATION AND REGRESSION RESULTS

3.4.1 Econometric model

In the ongoing analysis the underlying relationship between fishing inputs and the catch is specified by the Cobb-Douglas function expressed as

(6) $Y = \beta_0 X_1^{\beta 1} X_2^{\beta 2} \ldots\ldots X_k^{\beta k}$

where Y represents value (rather than the volume) of catch and X_1, X_2, ...X_k the various fishing inputs. Since in most cases the catch is multi-species, for the purpose of aggregation the catch value has been used on the assumption that in a specific location and in the given point of time the prices do not vary significantly. Capital has been broken down into its components namely craft, engine, fuel, and fishing gears based on the special characteristics by which each could be represented. Craft could be represented by its size, engine by horsepower (HP), and gear by weight, mesh size, length, etc. Fuel could be represented by value of quantity used and the labour component by man trips expended in fishing. For estimation of the parameters the production function may be rewritten as

(7) $lnY = ln\beta_0 + \beta_1 lnX_1 + \beta_2 lnX_2 + \ldots\ldots \beta_k lnX_k + U_i$

where U_i is an error term with appropriate properties.

The equation (7) can be estimated using OLS technique, for different types fishing operations. In the estimation of production function the presence of the so-called multicollinearity is often referred to as a problem (Brown and Beattie,

1975; Campbell, 1990)[3]. In the presence of near and high multicollinearity, the OLS estimates of parameters would have large variance making precise estimation difficult. Further, even when the '*t*' ratio of one or more coefficients is statistically insignificant the overall goodness of fit, R^2 may be very high. However, in cases when multicollinearity is not perfect, estimation of the regression coefficients is possible, but the estimates and their *t*'s, become very sensitive to even small changes in the data. Multicollinearity is essentially a sample phenomenon arising largely out of non-experimental data collected in most social sciences (Gujarati, 1995).

3.4.2 Data and methodology

The analysis uses cross-section data (Vide Dataset I, Appendix II) relating to fishing operations of small-scale fishermen in the study area. The required data were collected through personal interviews. Three types of fishing operations namely motorised plywood crafts, *kattamaram*, and shore seines were found to be in operation in the study area. Motorised plywood and *kattamaram* operators use a variety of fishing gears: gill nets of different weights and mesh sizes and hooks of different sizes. Shore seine is essentially a shore-based labour-intensive operation. Here *kattamaram* is a non-motorised craft propelled by human power.

Information on capital employed, number of trips undertaken for fishing, number of persons worked, fuel expenses, value of catches, etc. during a period of 12 months preceding the date of enquiry was collected from fishermen through personal interviews. Although, there were 239 operators consisting of motorised plywood craft operators, *kattamaram* operators and shore seine operators in the village as per initial enumeration, reliable data could be collected from only 70 operators since some of the operators were not quite willing to furnish the required data, while some others could not recollect information on past performance. The shore seine operators were dropped from the analysis since their fishing technique is land-based, with a particular gear - beach seine which differed from that of their counterparts, and since it is

[3] The term multicollinearity even though originally used to mean the existence of a linear relationship among the explanatory variables, today it is used in a broader sense to include cases when the explanatory variables are simply inter-correlated.

well-known that this operation is labour-intensive. There were some fishermen especially those operating motorised crafts maintaining records of daily operation, and in such cases they furnished data based on the records.

Initial analysis of the data indicated that there is positive correlation between catch value and man-days worked for both the types of operations. In the case of motorised crafts fuel consumption was also found to be an important factor. The correlation between the catch value and some of the individual variables worked out from the data collected are given in Table 3.2.

Table 3.2 Correlations between catch value and the variables

Variables	*Non-motorised kattamaram*	*Motorised plywood boat*
Labour (man days)	0.89*	0.90*
Net (wt)	0.07	0.50*
Hook & line (no.)	0.01	0.29
Fuel (Rs)	--	0.90*

Note: * indicates significance at one percent level.

The survey data indicate that in the case of *kattamaram* units labour is the main variable in determining the size of the catch value, while for plywood units the main determining variables are employment, gear and fuel. In the case of motorised operations it was found that all the plywood crafts in the village were approximately of the same size in length and width, hence the craft size was not taken into account in the analysis. It was also found that the horsepower (HP) of OBMs used to propel the plywood crafts were of two types - 25 HP and 10 hp. As regards the gear, the common types were gill nets (with different mesh sizes) and hook and line, also in different sizes. Because of the large variation in length, width and mesh size of the nets the total weight of the gill nets used for fishing irrespective of mesh size was taken as a measure of the variable 'net'. Similarly, for hook and line, the number of hooks was taken as the measure. The two gears were introduced as separate variables in view of the prevailing notion that those possessing hook and line reaped better harvest of fish. Taking into consideration the said factors, the models were re-written in

the form of equation 8 and 9 respectively for motorised plywood units and non-motorised *kattamaram* units. For labour, the measure used is the number of man days worked during the year and for fuel the money value used in the fishing trips during the year were considered.

(8) $ln\ Catch\ Value = ln\beta_0 + \beta_1\ ln\ Net + \beta_2\ ln\ Hook\ \&\ Line + \beta_3\ ln\ Fuel + \beta_4\ ln\ Labour + \beta_5 D_1$

where D_1 = 1 if 25 HP motor is used otherwise 0

(9) $ln\ Catch\ Value = ln\ \beta_0 + \beta_1 ln\ Gear + \beta_2 ln\ Hook + \beta_3 ln\ Labour$

The attempt here is to estimate the production function specified in equation 7 for each type of operation separately assuming that the fishing units were operating in the same place and exploiting the same fishery resource. It is realised that there is a specification error in the production relation due to the omission of variables related to management. Age, education, experience, etc. can be used as proxy dummy variables for management; but this has not been attempted as such a detailed analysis is beyond the scope of the present study.

3.4.3 Estimation results

The results of the regression analysis are given in Table 3.3. For the motorised plywood operation, net, hook and line, fuel and engine were taken as the components of capital and person trip as the labour input. Since engine power has only two values namely, 10 HP and 25 HP it was considered as a dummy. The estimated regression is found to have adjusted R^2 at 89 percent, but estimates of some of the coefficients have small 't' values. For the *kattamaram* units adjusted R^2 was slightly lower at 66 percent and here also some of the coefficients have low *t* ratios. These findings suggest the existence of multicollinearity.[4] It is therefore, necessary to diagnose the severity of the collinearity problem before further examining the regression results.

Since multicollinearity is essentially a sample phenomenon arising out of non-experimental data there is no unique method for measuring its strength. What

[4] This multicollinearity problem is confronted in most production function estimates. In fishery production function estimates too such multicollinearity problem appears. See Frederiks and Sulochana (1985), Tokrisna et al. (1985), Nahrstedt et al. (2002). However, it would be inappropriate to drop the variables from the equations, since by doing so it would downgrade their effects to the disturbance term.

exist are rules of thumb, some formal and some informal. One such rule is based on the 'condition index' (CI) defined as

$$CI = \sqrt{\frac{Maximum\ eigen\ value}{Minimum\ eigen\ value}} = \sqrt{k}$$

As a rule of thumb if the CI lies between 10 and 30, there is moderate to severe multicollinearity, and if it exceeds 30 there is severe multicollinearity. Another measure used to detect multicollinearity is 'variance inflation factor' (VIF). The larger the value of VIF of a variable that variable is more 'troublesome' or collinear. As a rule of thumb, if the VIF of a variable exceeds 10, that variable is said to be highly collinear (Belsley, Kuh and Welsch, 1980). The reciprocal of VIF, termed as tolerance is also sometimes used to detect multicollinearity.[5]

Table 3.3 Estimates of the parameters of the production function for two fishing operations

Variables	*Plywood boat*	*Kattamaram*
Gear	0.103**	0.003
	(2.55)	(0.06)
Hook & line	0.017	0.037
	(1.00)	(1.00)
Fuel	0.322*	--
	(2.01)	
Labour	0.793**	1.002**
	(5.80)	(7.73)
D	0.289**	--
	(2.64)	
Intercept	3.275**	5.006**
	(2.82)	(7.03)
Statistics		
R^2	0.889	0.689
Adj R^2	0.869	0.659
SE	0.156	0.414
F	45.01**	23.61**
N	34	36

Note: ** and * indicate the levels of significance at one percent and five percent respectively. Figures in parentheses are *t* values.

[5] There are also other methods, but each has its own limitations. Multicollinearity is specific to a given sample over which the researcher may not have much control, especially if the data are non-experimental in nature. (Gujarati, 1995)

The SAS output of the Cob-Douglas function contains *Eigen* values and the condition index, which could be used to diagnose the multicollinearity. Examination of the regression results in Table 3.3 using the C.I indicates that for the data of motorised plywood crafts, there esists severe multicollinearity, whereas for *kattamaram* it is moderate. At the same time, the VIF of all the coefficients in both the cases are lower than 10 indicating that the multicollinearity is not severe. In the present situation, where R^2 in both cases is high and the regression coefficients of most of the variables are individually significant, it may not be wrong to conclude that multicollinearity does not pose as serious problem. The regression results are examined below on this assumption.

The results of estimates of coefficients of 'net' and 'hook and line' do not seem to be significant for *kattamaram* because of the wide range of reported values, and also may be due to multicollinearity among the variables. For the motorised plywood crafts the coefficient of 'net' is positive and significant, but that of 'hook and line' even though positive is not significant. The coefficients of labour for both operations were positive and statistically significant. For motorised craft, the coefficient of fuel is positive and significant. So also is the coefficient of the dummy variable associated with engine power. The coefficients are the elasticity of production with respect to the input variable. That is, in the present case the percentage change in the value of catch due to a one percent change in the quantity of input used.

The regression results suggest that, in order to increase output, more labour has to be employed. Here, increasing labour means carrying out more number of trips. Especially for *kattamaram* operations, contribution of labour is the main and only input for increasing catch. The contribution of additional gears, whether nets or hook and line, is almost insignificant. For motorised operations, labour employed, fuel used and engine power is the major influencing inputs. Even though the prevailing notion is that those using hook and line as an additional gear get higher catch, the data do not support this notion. Increasing gear weight has also only a nominal effect in increasing catch. At the same time, by switching over to higher engine power the catch may be increased by one-third (*antilog of the coefficient of D*). It seems that by using engines with

higher horsepower, the operators would be able to go to higher depths and also reach the fishing ground and return to landing places quickly. Increasing fuel use may also contribute to an increase in catch by one-third, may be because of longer fishing time.

As regards returns to scale, motorised plywood operations show increasing returns to scale, while *kattamaram* operations show constant returns. To sum up, based on productivity growth, the following input changes would be beneficial.

i. For motorised plywood crafts, increase in fishing labour (that is the number of trips) and switching over to OBM with higher engine power has positive effect on increasing catch. Increasing the quantity of gear has very little effect on production.

ii. For *kattamaram*, units also increase in the number of trips produces increased earnings, but not to the same extent as for the motorised units. The contribution of additional gears to increase catch is almost insignificant.

However, it must be pointed that these suggested changes are based on productivity considerations alone and are not related to changes dictated by profitability and resource sustainability. But why don't fishermen increase the number of trips, even using the existing equipments? In the small-scale sector the decision, whether to undertake a particular fishing trip is taken by the team is based on the simultaneous integration of a large number of processes of past experience coupled with immediate observation aided by human sense. It is willingness to take risk conditioned by practical knowledge.

3.5 CONCLUSION

It is thus seen from the analysis that the main reason for income differential among *kattamaram* operators is the difference in the number of fishing trips. For the plywood operators also this is one of the reasons for differences. For units with higher engine power there is a chance of getting higher earnings since mechanical power provides higher capability for hunting and intercepting migratory species at greater distances.

From the above discussion it is clear that the difference in catch value earned by fishermen is explained by the difference in technology and the difference in the number of trips operated; in the case of motorised plywood crafts, the difference lies in the engine power and fuel used. Other factors like fishing skills, management efficiency and catch composition have not been considered in the analysis, even though they are also likely to have a major influence.

CHAPTER - IV

SOCIO-ECONOMIC CONDITION OF THE COMMUNITY IN THE STUDY VILLAGE

4.1 INTRODUCTION

The study village Pulluvilla is situated in the southern coastal zone of Thiruvananthapuram in south Kerala. (See Figure 4.3). The coast line of this district is famous for its highly productive waters and the immense diversity of marine resources. The assortment of gear used by the fishermen to harvest these resources is remarkable: small meshed gill-nets, trammel-nets, bottom-set-nets, boat seines and a variety of hook and lines. Traditionally their fishing crafts are *kattamarams;* but in the recent years motorised plywood crafts have emerged as a dominant fishing vessel. Shore seines operations are also common in this part of this district. (See Table 4.1). The fishermen here are well known for their skill and daring. They have intricate knowledge of the sea and the structure of the sea bottom and have developed keen navigational acumen. In this chapter we will be discussing the present socio-economic conditions of the fisherfolk in the village on the basis of analysis of the survey data.

Table 4.1 Thiruvananthapuram district: craft and gear combinations

Craft		*Gear used*	*Crew size*	*OBM used*	*Number of crafts*
Type	Classification				
Kattamaram	4-log	Gillnets (M), BS	2 to 3	NM	7123
Kattamaram	3-log	Gillnets (S,M)	1 to 2	NM	374
Dugout canoe	Small	Gillnets (VS,S)	1 to 2	NM	14
Plank canoe	Small	Gillnets (S)	1 to 2	NM	6
Plank canoe	Medium	Shore seine	35 to 50	NM	673
Plank canoe	Transom	Gillnets (S)	2 to 3	8 HP	41
Plywood canoe	Medium	Gillnets (M,L) H&L, BS	4 to 6	8/9.9/15/25 HP	2854
Total					11085

Note: L – Large, M – Medium, S – Small, VS – Very Small, H&L – Hook & Line, BS – Boat Seine. *Source:* SIFFS (1999)

4.2 HOUSEHOLD CHARACTERISTICS

The study village has a population of about 6200 living in about 1100 houses. Being part of a coastal fishing village it is natural that majority of the households are engaged in fishing or fish-related activities. For the purpose of the study, the households have been classified into three categories on the basis of possession of fishing assets and according to the main economic activity of the household. In fishing activity, fishing craft and gear as well as fishing skills are the main assets. Thus the households have been categorised as those (i) with fishing assets, (ii) without fishing assets but having main economic activity relating to fishery and (iii) other coastal households which are not included in the first two categories. In this study, the first two categories are considered as 'fishery households' and they comprise nearly 86 percent of the households and about 90 percent of the population. In this chapter the analysis is carried out clubbing the first two categories together (that is households 'with fishing assets' and without fishing assets') and termed as 'fishery households'. The rest of the households are treated separately under the category 'other coastal households'. Socio-economic characteristics of these two categories have significant differences.

In view of the fact that the unit of analysis of the study is the household, we focus on the socio-demographic profile of the households to understand their socio-economic condition. The houses in the area are independent structures close to one another situated in small plots of 2 to 3 cents in area. Many of the houses are of pucca or semi pucca type, thanks to the various housing schemes introduced by the State agencies. Of course, there are a large number of *Katcha* houses too. In some of the houses, more than one household reside, usually of close relatives. The infrastructural facilities here are very poor. For drinking water, people mainly depend on public taps and public wells. Only about 14 percent of the households have own piped water and only one-fourth of the houses have own latrine facilities. (See Table 4.2).

Table 4.2 Household characteristics by occupational categories

Description	*Fishery households*	*Other coastal households*	*All*
Sample size	240	42	282
Household percentage	85.1	14.9	100.0
Population	1289	157	1446
Population in %	89.2	10.8	100.0
Average household size	5.4	3.7	5.1
Household size: (%)			
1 – 2	6.7	35.7	11.0
3 – 5	55.8	45.3	54.3
6 – 8	28.3	19.0	27.0
9 & above	9.2	--	7.7
Sex ratio (per 1000 males)	947	1275	978
Average no of workers	1.9	1.0	1.8
Literacy rate (aged 6 and above)	67.2	67.1	67.2
Homestead area (cents)	2.7	3.4	2.8
% Households with:			
Pucca structure	50.8	47.6	50.4
Electricity	82.9	83.0	83.0
Owned piped water	10.8	29.0	13.5
Latrine facility	20.4	42.9	23.4
Monthly per capita household consumption expenditure	1393	1191	1363
Monthly per capita consumption expenditure	1308	1218	1298

Source: Survey data

It is seen that the fishery households, on an average have more members than the 'other coastal households'. The main reason for the larger size of the fishery households seems to be the nature of activity involved. Small-scale fishery is basically a household activity with male members engaged in fishing and female members attending to processing of the catch and often vending fish. Since all these activities are close knit, all the members concerned tend to stay together. In fact, nearly 10 percent of the fishery households studied had 9 members or more. Another reason seems to be the higher rate of out migration from 'other coastal households[1]'. It was found from the survey that about 37 percent of the 'other coastal households' had out-migrants, whereas the

[1] Labour mobility in Kerala fishery is a quite common phenomenon with widespread ramification. Different types of labour mobility are observed in the fishery sector of Kerala: Commutation, circulation, and migration are the three major types. This trend has been well studied by Rajan, 2002.

corresponding proportion was only 22 percent in the fishery households[2]. Further, the average number of migrated persons in the 'other coastal household' category was 1.4 per household as against 1.2 in the fishery households. The higher proportion of out-migration, mostly of male members, has resulted in higher sex ratio in the 'other coastal household' category as compared to the fishery households. However, the overall sex ratio in the area is 978, which is much lower than the State's sex ratio of 1058 according to the 2001 census. Literacy is only 67 percent in the study area as compared to 91 percent for the State, indicating the educational backwardness of the community. (See Table 4.2)

4.3 EMPLOYMENT PATTERN

Since almost all the households in the study area depend on the marine resources in one way or other, all members who are able to work have to engage in some kind of gainful activity to earn a livelihood. It is seen that 34.6 percent of the population do some kind of gainful work and another 4.8 percent are on the lookout for some work. (See Table 4.3). The remaining 60.6 percent are persons outside the labour force consisting of students, housewives, very young and old, disabled and sick persons, etc.

As will be seen from Table 4.3, about half he males and nearly one-fifth of the females in the study area do some kind of work to earn a living. In the fishery sector, since the demand for daily work in fishing is quite seasonal it is likely that even among workers, there may be considerable extent of underemployment. Of the total workforce, about 73 percent are males and 27 percent females. In addition to those who work, there are another 7 percent males and 3 percent females seeking work. In short together about 57 percent of males and 33 percent of females in the study area are in the labour force.

The work participation rate of household members is seen to be around 35 percent in 'fishery households' whereas in the 'other coastal households' the

[2] In the survey, we have considered household members only; those persons who are living together under a roof sharing food from the same kitchen for the last 365 days from the date of the interview. Persons of the house who were away from the household for more than one year were not considered as household members and their details were collected separately. This method was adopted in order to avoid bias in the estimation of the consumption expenditure of the households.

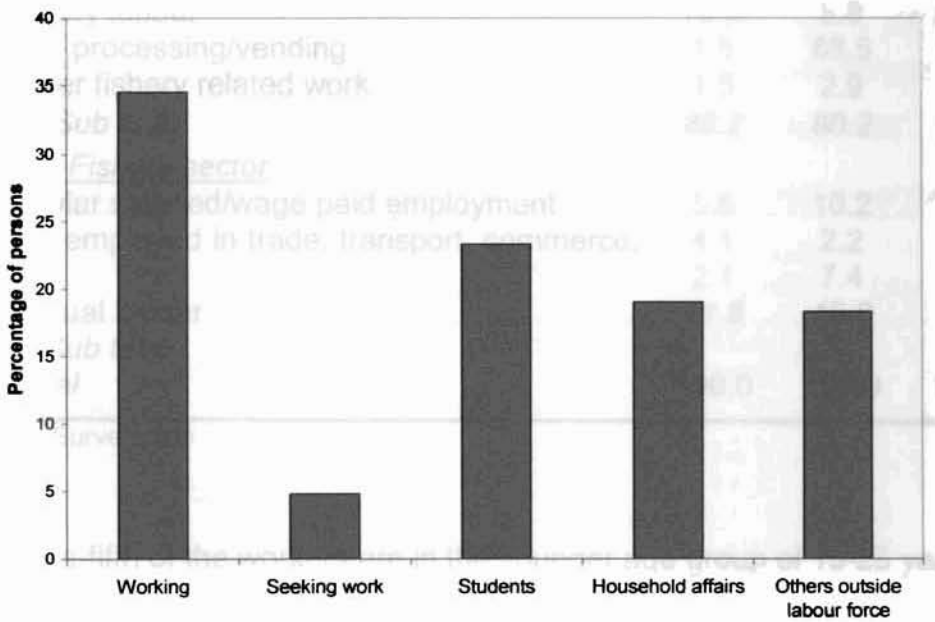
corresponding is only 27.4 percent. (See Table 4.3). The lower participation rate in the latter category seems to be the result of excluding out-migrants from household membership. Most of the out-migrants send their earnings to their families. Unemployment is seen to be higher in the 'other coastal households' sector; probably because most of them are seeking work in activities outside the fishery sector.

Table 4.3 Usual activity status of the population by sex (in %)

Activity	*Fishery households*	*Other coastal households*	*Total*		
			Male	*Female*	*All*
Working	35.5	27.4	50.2 (73.4)	18.6 (26.6)	34.6 (100.0)
Seeking work	4.5	7.0	6.8 (72.5)	2.7 (27.5)	4.8 (100.0)
Student	23.8	17.8	23.3 (50.2)	23.4 (49.8)	23.3 (100.0)
Household affairs	18.6	22.3	0.6 (1.5)	37.8 (98.5)	19.0 (100.0)
Too young and too old, disabled, no need to work	17.6	25.5	19.1 (53.2)	17.5 (46.8)	18.3 (100.0)
Total	100.0	100.0	100.0	100.0	100.0

Source: Survey data. *Note*: Figures in parentheses are row percentages

Figure 4.1 Usual activity status of population



The workforce may broadly be categorised into persons working in the fishery sector and those working in the non-fishery sector. The fishery sector consists of (i) owner workers (persons owning and operating fishing crafts), (ii) fishery labour (mainly crewmembers and helpers in fishing), (iii) persons engaged in fish-processing and vending, and (iv) persons engaged in other fishery related activities. The main non-fishery sector occupations in this area are (i) salaried or regular wage paid employment, (ii) self employment in trade or small business, and (iii) wage labour in the non-fishery sector. It is found that about 86 percent of the workers in the study area are in the fishery sector and nearly 60 percent of them work as fishery labour. Only 4 percent are owner workers. Non-fishery employment is limited to a few salaried jobs in Government or local self-government institutions, repair of fishing crafts and engines, self-employment as traders and small businessmen, and casual wage labour in construction activities and transport, etc. In the fishery sector men mainly work as crew either as owner worker or hired worker in fishing, while women are mostly engaged in fish-processing and vending. Alternative employment opportunities to the fishing community outside the fishery sector are very limited. (See Table 4.4)

Table 4.4 Occupational structure of the work force

Occupation	*Male*	*Female*	*All*
I. Fishery sector			
i) Owner worker	5.6	--	4.0
ii) Fishery labour	79.6	8.8	59.5
iii) Fish processing/vending	1.5	68.5	20.5
iv) Other fishery related work	1.5	2.9	1.9
Sub total	*88.2*	*80.2*	*85.9*
II. Non-Fishery sector			
i) Regular salaried/wage paid employment	5.6	10.2	6.9
ii) Self employed in trade, transport, commerce,	4.1	2.2	3.6
etc.	2.1	7.4	3.6
iv) Casual labour	*11.8*	*19.8*	*14.1*
Sub total			
III. Total	100.0	100.0	100.0

Source: Survey data

About one-fifth of the workers are in the younger age group of 15-25 years, and nearly one-tenth are elderly people of 60 years and above. In fact, about 40

percent of the elderly people continue to work for a living. The pattern is almost the same in all the categories of households except 'other coastal households', where at the lower end of the age group there is only 14 percent of workers and in the 60 and above age group there is 23 percent as workers. It shows that in the other coastal household category entry into the workforce takes place at a later age due to longer years of educational pursuits. Work participation rate is higher among the higher age group probably due to the fact that they are mostly engaged in non-manual kinds of work. (See Table 4.5)

Table 4.5 Age distribution of the work force aged above 14 years by household category (in %)

Age group	*Fishery households*	*Other coastal households*	*All*
15 - 25	21.2	13.9	20.6
26 - 35	27.6	30.2	27.8
36 - 59	42.7	32.6	41.8
60 & above	8.5	23.3	9.8
Total	100.0	100.0	100.0

Source: Survey data

As for educational level, workers in both the categories of households show more or less the same pattern. It may be seen from Table 4.6 that nearly one-half the total number of workers are illiterate and nearly three-fourths do not have more than primary level of education. Only 2.4 percent of the working population has education of the degree level or above; the percentage of such persons is slightly higher in the category of 'other coastal households'.

Table 4.6 Distribution of the work force by educational level (in %)

Educational status	*Fishery households*	*Other coastal households*	*All households*
Illiterate	49.2	46.4	49.0
Literate but no schooling	9.6	14.0	10.0
Below primary	13.8	4.7	13.0
Below secondary	13.4	16.3	13.6
Secondary and higher secondary	12.0	11.7	12.0
Graduation and above	2.0	6.9	2.4
Total	100.0	100.0	100.0

Source: Survey data

The illiterate workers mainly belong to the older generation. In fact, about 72 percent of the workers in the age group 36 to 59 and 80 percent of workers aged 60 years and above are illiterate. Most of them took up fishing at an early age and chose this occupation as their main source of income and employment. It is seen that in the absence of alternate employment opportunities, the younger population also take to fishing, initially in the capacity of helpers along with their parents and later acquire the status of independent workers. Most of the younger fishermen had no other employment before their entry into fishing or fishery related activities. With the passage of time most of the workers in the younger generation have become experts in the use of a wide variety of equipments like hook and line, gill nets, drift nets, etc. As has been already stated, the fishermen in this Southern coastal area are one of the most versatile fishers having a wide range of sea-faring and fishing skills. They work in non-motorised crafts like *kattamaram* and shore seines and also in country boats with OBMs with equal dexterity. More than 90 percent of the male workers are seen to possess high levels of fishing skills.

Women of the fishing communities play vital roles both within the fishery and in the community as a whole. Women work in fish-vending, in the preparation of bait, making and repairing nets, in smoking, salting and drying fish, etc. Many instances have come to our notice in which women have taken to work on behalf of their fishermen husbands in areas such as dealing with financial institutions for credit for fisheries operations and for repayment, dealing with governmental fisheries agencies, and so on. They are almost entirely responsible for the care and nurture of the family. When the men are away fishing for long periods, women run the household all by themselves. They are important actors in the fishing community and are crucial in maintaining social networks and the culture of the community. Often, women of coastal fishing communities take on activities outside the fishery, that give them some form of stable monetary income, since the income accruing from the fishery is inherently unstable and unpredictable. Women start some work that generates supplementary income, such as running a small shop or prepare and sell eateries either individually, or as partners in small groups.

4.4 FISHING ASSETS

The major fishing crafts in the study area are plywood boats with outboard engines, and *kattamarams* propelled by human power. The ownership of fishing units remain strongly individual with household or a member of the household being the owner of the unit. The survey results show that about 14 percent of the households have plywood boats and about 7 percent have catamarans. There are also a few units working with shore seines. Some of the households with plywood boats own shore seines also. The shore seines are mainly owned by comparatively well-off families. The shore seine provides regular employment to a few and part time seasonal employment to many others.

Plywood boats are relatively a new introduction in the traditional sector in the post motorisation phase. The number of motorised crafts has increased substantially in the past ten years. Basically, there are two types of plywood boats – decked boats and open boats. Decked boats are normally used for hook-and-line fishing while open boats are used for gill-net operations. However, fishing methods have not changed significantly; the only changes are in the quantum of gear and that to introduced only to suit the higher capacity of the plywood boats. Majority of the plywood boats have a crew of four persons. The *kattamarams* are the traditional craft for fishing in the Southern district of Kerala. It is essentially a near-shore craft assembled with four logs mainly propelled by rowing and concentrated on near shore fishing. With the introduction and growth of motorised plywood boats, a large number of *kattamarams* are remaining out of use. Even though some of the part-timers still depend on *kattamarams*, it has become part of the marginal fishery.

4.5 RESOURCE BASE AND ITS UTILISATION

As stated earlier the sea on the southern part of the state is rough and has a highly diverse species composition. Traditional fishermen force them to confine their area of operation to a narrow strip of sea often not exceeding a few kilometres from the coast. The occurrence of fish and their migration into this area determine the resource available to the fishers. The abundance of this resource varies according to the environmental condition and the offshore

fishing activity. Local fishermen report that if they can fish during the monsoon, the catch rate would be comparatively high; but the lack of harbour facility and the rough sea conditions often reduce their monsoon trips[3]. The majority of the fishermen complains that their catch and income have been declining in recent years, citing reasons such as the increase in the number of fishing vessels, encroachment of trawlers, low price of trash fish whose proportion in the catch is rising, etc. The indications are that resource constraint is probably binding. The resource base of the small-scale fishery is limited not only by its fishing range and productivity but also by competition for this limited resource with other fishers using more advanced technology. The limited employment opportunities outside the fisheries sector, reduces the opportunity cost of fishing, discouraging exit and encouraging new entry leading to further resource depletion.

Traditional fishermen are engaged in fishing not for profit, but for subsistence; however, since fish is not a subsistence commodity (i.e. it is not a staple food), fishermen's subsistence depends almost entirely on their income whether as owners of fishing equipment or as labourer. The practice in the study area, as in most of the fishing villages of the small-scale fishers, is to share the value of total catch after deducting the operating expenses and taking a small portion of catch for home consumption by all the crew members. A fixed share is set apart for the owner of fishing equipments and the balance is shared among the crewmembers. The owner of the craft meets the repair and maintenance cost from the owner share. Income from fishing is however highly fluctuating and often uncertain. The traditional fishermen and their household members undertake a variety of supplementary activities. Some of these operations such as fish processing, fish vending, etc. are closely related to fishing, whereas activities such as small business, trade, farming, unskilled labour are referred to as non-fishing occupations. Involvement of women in fish marketing is widespread. It is reported that about three-fourths of the fish landed is bought by the women in beach auction and taken to rural and urban squatter markets or directly to households. Some of the women go in groups to places where fish

[3] During the monsoon months, most of the fishermen and fishing units here shift their base to Vizhinjam, in the same district, since it is a natural harbour where safe anchorage is possible during this period.

is available, when fish is in short supply in their own village landings. Non-fishing occupations to some extent absorb fluctuations in fishing activities arising from environmental conditions. They also provide employment for family labour, especially to those not apt to take up fishing, such as female members. Involvement of fishermen and their household members in these activities are related to their need for such supplements, profitability compared to fishing and also their availability in the neighbourhood. However, these land-based occupations require at least some land and market; but they are faced with constraints by virtue of the limited size and productivity of the coastal strip.

4.6 SOURCES OF HOUSEHOLD INCOME AND STANDARD OF LIVING

The main components of fishery incomes are the share received by ownership of fishing crafts, wages, payments received by the heads of households and household members and earnings of household members from fish processing and vending. It is seen that the main source of income of fishery households in the village is from fishery. (See Table 4.7 and Figure 4.2).

Table 4.7 Source wise monthly household income (in percentage) according to sector

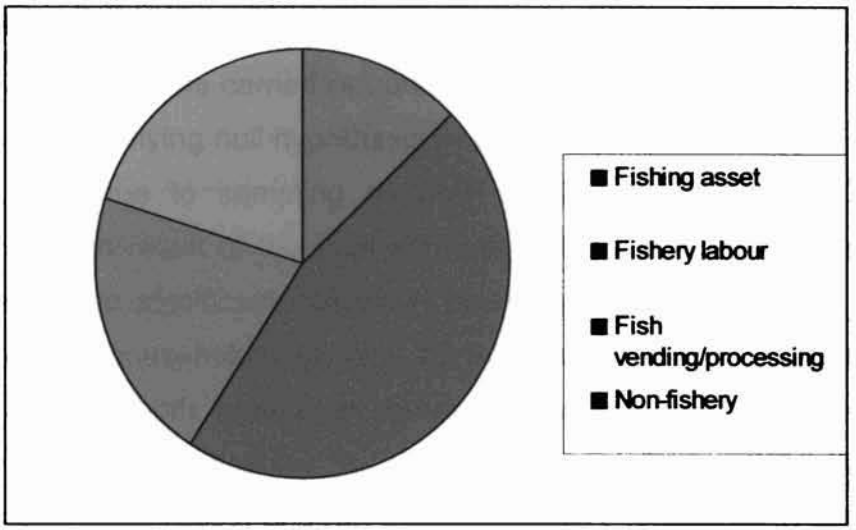
Source of income	*Household categories*		*Total*
	Fishery households	*Other coastal households*	
I. Income from fishery			
i. From fishing asset	14.3	--	12.8
ii. Fishery labour	50.2	13.5	46.5
iii. Fish vending/processing	21.8	12.7	20.8
Sub total	*86.3*	*26.2*	*80.1*
II. Income from non-fishery			
i. From asset/salary/wages	6.5	33.4	9.3
ii. Interest, rent	2.6	12.5	3.6
iii. Pension, remittance, etc.	4.6	27.9	7.0
Sub total	*13.7*	*73.8*	*19.9*
III. All	100.0	100.0	100.0

Source: Survey data

In fact, about 86 percent of the average household income is from fishing and fish-related activities. Income from non-fishery activities accounts for only about 7 percent of their income. Even 'other coastal households' are to some extent

dependent on fishery income by way of fishery labour and fish-processing and vending. Survey data show that their dependence on fishery as measured by income from it is about 26 percent. The overall picture one in which emerges is that almost all the households in the study area depend on marine resources for their livelihood. Their supplementary income is from odd jobs in the non-fishery sector and from remittances by household members who have temporarily migrated to other places. It is learnt that these temporary migrants are also mainly engaged in fishery related activities.

Figure 4.2 Source wise household income of all coastal households



The importance of household income and expenditure statistics for a household has been well recognised as indicators of standard of living of the people. The commonly used measure of the standard of living is household income from all sources and in all forms (cash and non-cash) received by the household members. Since there is reporting bias in income an alternate monetary measure that can be used as an indicator of the living standard is the consumption expenditure. Moreover, consumption expenditure is considered to be more appropriate and relevant than income for the fact that actual consumption expenditure is more closely related to a person's well-being and that it is not affected by seasonal fluctuation in income. It also may come from earnings from assets, debt and dis-savings. Because of this, data on household expenditure were also collected from the surveyed households. The reference period for consumer expenditure was the period of 30 days prior to the date of

enquiry. To adjust for difference in needs among households and in intra-household inequalities per capita consumption expenditure was taken as the measure of standard of living.

The average of monthly percapita consumption expenditure (MPCE) of the households in the study area is given in Table 4.8. The average MPCE is Rs. 1363 for all the households, but it differs between households in the two sectors. The 'fishery households' appears to have a higher average MPCE of Rs. 1393, while that of the 'other coastal households' is Rs. 1191. Since the expenditure data are from a sample, it is desirable to examine whether the difference in MPCE between the two categories is real or is due to chance associated with the sampling method. For this purpose, two-sample t-test for means for MPCE was carried out under the assumption that variances are not equal. The underlying null hypothesis of the test is that the observed difference in MPCE is due to sampling method adopted and that there is no real difference. The result of the analysis is presented in Table 4.9, and it shows that there is no significant difference between the average MPCE of the two categories of households. In view of this finding and also because of the dependency of both groups on fishery resources in remaining part of the analysis the categorisation as 'fishery households' and 'other coastal households' is dropped and all the households are referred to as 'fishery households'.

Table 4.8 Average MPCE for the two categories of households (in Rs)

Household category	*MPCE*	*SD*	*SE*	*n*
Fishery households	1393	860.9	55.6	240
Other coastal households	1191	1001.7	154.6	42
All	1363	885.3	52.7	282

Source: Computed from survey data

Table 4.9 Hypothesis Test for difference of means

Null hypothesis	*Mean 1 - Mean 2 = 0*		
Alternative	*Mean 1 - Mean 2 ≠ 0*		
If Variances Are	*t statistic*	*Df*	*Pr > t*
Equal	1.369	280	0.1721
Not Equal	1.232	52.17	0.2234

For a better understanding of the standard of living of fishing households it is desirable to compare their income levels with those of households in the other sectors of the rural economy. For that purpose comprehensive socio-economic data for the other sectors would be required and such data should be comparable in time. Such recorded information pertaining to most aspects of the economic life was not available for non-fishing sectors for the period of our survey. So, the 55th round of the NSS data on consumption expenditure for various socio-economic groups were taken for comparison. The survey was conducted during July 1999 to June 2000 for collecting information mainly on household consumer expenditure. This information was used to generate the distribution of rural and urban population over different classes of monthly per capita expenditure, separately for persons belonging to specific household types, occupational groups, and size classes of land possessed. Thus, it enables the comparison of per capita consumption for different sections of population demarcated by differing socio-economic characteristics.

NSS has classified a household as 'agricultural labour', if its income from that source was 50 percent or more of its total income. The same criterion was followed to classify a household as 'self-employed in agriculture'. A household was classified as 'self-employed in non-agriculture' if its income from that source was greater than income from rural labour as well as income from all other gainful sources put together. If a household was not one of these three types but its income from total rural labour was greater than that from all self-employment and from other gainful sources, it was classified as 'other labour'. For our comparison average MPCE of agricultural labour and other labour in rural area in the State was taken for consideration. Since the NSS 55th round was for the year 1999-2000, we have inflated the average MPCE by the consumer price index up to the period 2004. Earlier we had taken into consideration the average MPCE per fishery household, but NSS has taken the MPCE of per person. For comparative equivalence, we have also converted the household per capita MPCE into per person MPCE. The average MPCE for the NSS estimates and our fishery household estimates are presented in the Table 4.10. There exists significant difference between MPCE of rural agricultural labour as well as other rural labour and that for all other categories of fishery

households. The estimates indicate that in terms of income as measured by consumption expenditure the fishery households are in a better position than to the rural labour households in the state.

Table 4.10 Per person average MPCE for different household types

Household type	*MPCE*
Fishery households	1363
Rural agricultural labour*	570 (684)
Other rural labour*	656 (787)

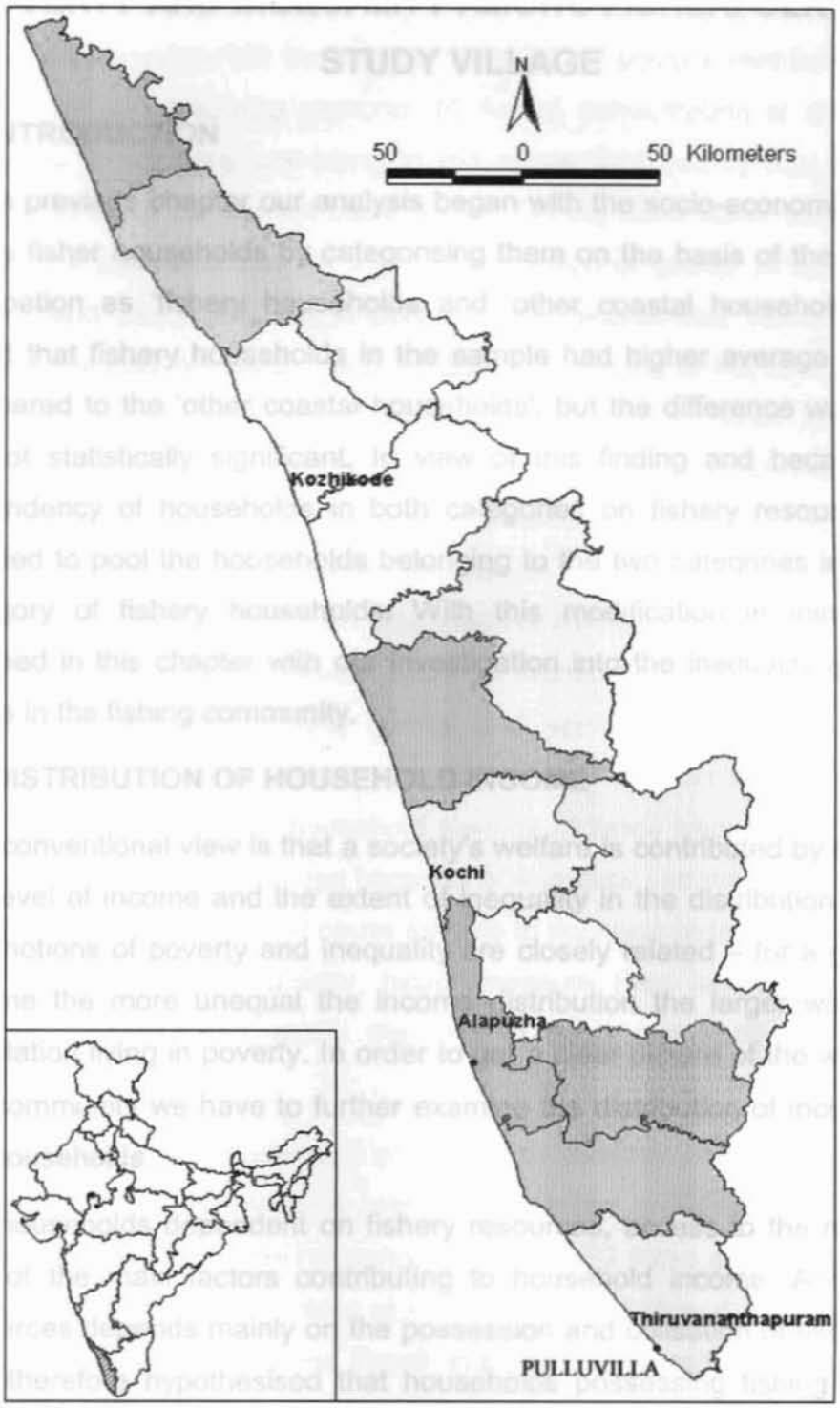
Note: * Data from NSS 55th round 1999-2000 (NSSO, 2001), NSSO Report No. 472. Figures in parentheses are the inflated MPCE for the period 2004 by Working Class Consumer Price Index of Kerala

However, this does not necessarily imply that the small-scale fishers are well-off as compared to the rural labour. The daily incomes of small-scale fishers are uncertain and highly fluctuating. There is also considerable variation in incomes among individual fishermen. Of course, the traditional work-sharing and output-sharing systems of the fishing communities provide some insurance on food security of the poor. In terms of education, health and nutrition status, participation in political decision making and vulnerability, the fishing communities are said to rank lower in the society. They are also often highly exposed to accidents and natural disasters. There is some anecdotal evidence that small-scale fishing communities have above average poverty rates, but there are few hard-core data and analysis on the extent and causes of poverty and on the actions necessary to alleviate poverty.

4.7 CONCLUSION

The socio-economic characteristics of the people in the village reflect the level of poverty and vulnerability of the fisher community. Most of the people live in small houses in plots of 2 or 3 cents with poor infrastructural facilities. Men outnumber women, literacy rate very low, and even aged people have to work for a living. About 86 percent of the household income is from fish related activities. Even though the average percapita household income is higher compared to that of the rural workers, their daily income is uncertain and highly fluctuating. The next step is therefore an analysis of the extent of inequality and poverty in the community and identification of the determinants of poverty.

Figure 4.3 Map of Kerala – location of the study area



CHAPTER V

POVERTY AND INEQUALITY AMONG FISHERFOLK IN THE STUDY VILLAGE

5.1 INTRODUCTION

In the previous chapter our analysis began with the socio-economic condition of the fisher households by categorising them on the basis of the household occupation as 'fishery households and 'other coastal households'. It was found that fishery households in the sample had higher average income as compared to the 'other coastal households', but the difference was found to be not statistically significant. In view of this finding and because of the dependency of households in both categories on fishery resources it was decided to pool the households belonging to the two categories into a single category of fishery households. With this modification in mind we now proceed in this chapter with our investigation into the inequality and poverty levels in the fishing community.

5.2 DISTRIBUTION OF HOUSEHOLD INCOME

The conventional view is that a society's welfare is contributed by two factors, the level of income and the extent of inequality in the distribution of income. The notions of poverty and inequality are closely related – for a given mean income the more unequal the income distribution the larger would be the population living in poverty. In order to get a clear picture of the well-being of the community we have to further examine the distribution of income among the households.

For households dependent on fishery resources, access to the resources is one of the main factors contributing to household income. Access to the resources depends mainly on the possession and utilisation of fishing assets. It is therefore hypothesised that households possessing fishing assets are better-off than to the other households. To verify this hypothesis, households were reclassified as 'with fishing assets', and 'without fishing assets' and the extent of income inequality among the two groups of fishery households and within the various categories was examined. Consumer expenditure is

considered a proxy for income and for the sake of convenience in the discussions that follow, we will be using the term 'income' even though the data used relate to consumer expenditure[1]. According to Coudouel et al. (2002), consumption will be a better indicator of poverty measurement than income for the following reasons: (i) Actual consumption is more closely related to a person's well-being in the sense that he/she has or has not, enough to meet the current basic needs. On the other hand, income is only one of the elements that will allow consumption of goods; others include of access and availability. (ii) in poor agrarian economies, incomes for rural households may fluctuate during the year , according to the harvest cycle. In urban economies with large informal sector, income flows also may be errative. This implies a potential difficulty for households in correctly recalling their income in which case the information on income derived from the survey may be of low quality. Large shares of income are not monetized if households consume their own production or exchange it for other goods, and it might be difficult to evaluate them in monetary terms. (iii) Consumption expenditure reflects not only goods and services that a household can command based on its current income, but also whether that household can access credit markets or household savings at times when current income is low or even negative, perhaps because of seasonal variations, harvest failure, or other circumstances that cause income to fluctuate widely. So consumption is a better outcome indicator, better measure than income, and it better reflects a household's actual standard of living and ability to meet basic needs.

The distribution of households according to monthly percapita consumption expenditure (MPCE) by asset categories is given in Table 5.1. Even though the average MPCE of the households is Rs. 1363 there are about 10 percent households in the lowest class of lower than Rs. 350 and about 7 percent in the upper class Rs. 3000 and above, indicating large variations in expenditure among households. Further, the median expenditure was found out to be Rs. 1139, which shows that the distribution is skewed to the left. This shows that

[1]For poverty calculations expenditure data are more reliable than income data due to several reasons such as biased reporting of the respondents, recall bias, instability of the income, seasonal fluctuations of income, etc. (Lipton and Ravallion, 1995).

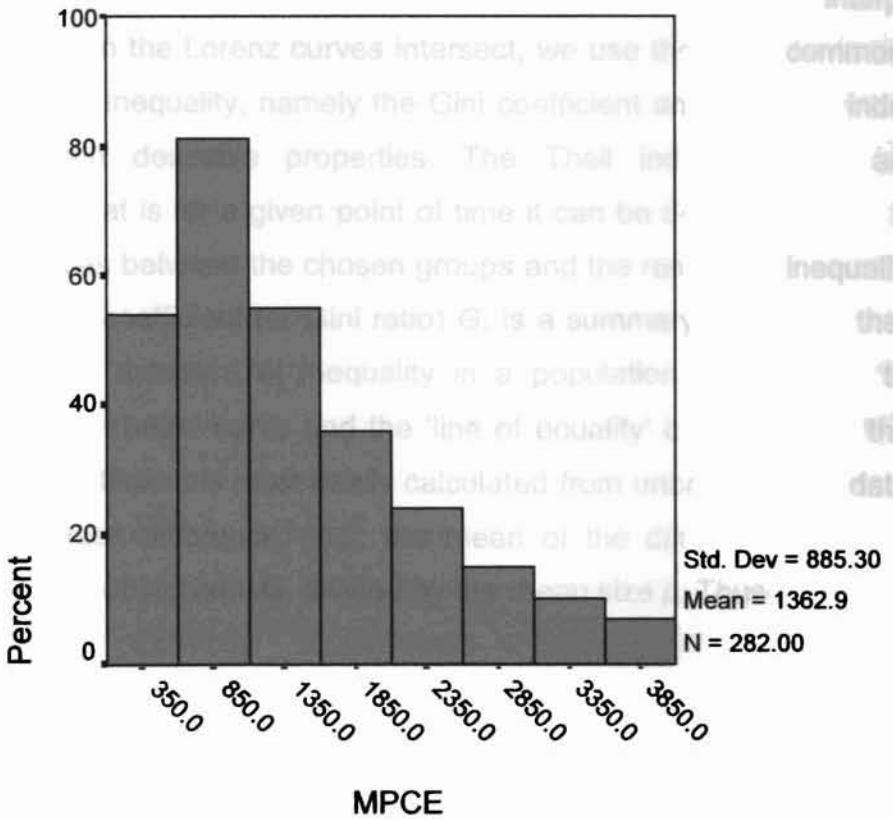
there are a large number of households in the lower income groups. The plotted histogram given in Figure 5.1 also clearly shows that the distribution is skewed to the left indicating large disparity in household expenditure.

Table 5.1 Percentage distribution households by category for each MPCE class

MPCE class (in Rs)	*With fishing assets*	*Without fishing assets*	*All*
< = 350	--	11.7	9.2
351 – 500	3.3	6.3	5.7
501 – 1000	10.2	31.8	27.3
1001 – 1500	27.1	22.4	23.4
1501 – 2000	17.0	10.8	12.1
2001 - 3000	35.6	10.3	15.6
3001 & above	6.8	6.7	6.7
Total	100.0	100.0	100.0
	(1790)	(1250)	(1363)

Source: Survey data. *Note:* Figures in parentheses are mean expenditure

Figure 5.1 Histogram of MPCE for all households



Further examination of the results shows that all the households with MPCE less than Rs. 350 belong to the 'non-asset group'. Moreover, while 13.3

percent of the households in the non-asset group have MPCE of less than Rs. 500, only 3.4 percent of the households in the 'asset group' comes under this class. The average MPCE of the households in the 'non-asset group' is only Rs. 1250 as against Rs. 1790 for the households in the 'asset group'. These figures indicate that households in the asset group are in a better position as compared to their counterparts. To get a clearer insight into the effect of asset ownership on the well-being of the community it is necessary to quantify the extent of inequality.

5.3 INEQUALITY MEASUREMENT

It is worthwhile to quantify the extent of inequality since it can be used to compare the inequalities between and within the two sub groups. In the analysis of inequality the concept of income is defined as the increase in a person's command over resources during a given time period and is considered to represent the person's well being. Income differentials in the population can be shown by Lorenz curve. However, because of interpretation difficulty when the Lorenz curves intersect, we use the more commonly used measures of inequality, namely the Gini coefficient and the Theil index. Both have certain desirable properties. The Theil index has an additional advantage that is for a given point of time it can be decomposed as the sum of inequalities between the chosen groups and the remaining inequality within groups. Gini coefficient (or Gini ratio) *G*, is a summary statistic of the Lorenz curve and a measure of inequality in a population. Graphically, the area between the Lorenz curve and the 'line of equality' can represent the index. The Gini coefficient is most easily calculated from unordered size data as the "relative mean difference," i.e., the mean of the difference between every possible pair of individuals, divided by the mean size μ. Thus

$$(1)\ G = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n}|Xi - Xj|}{2n^2\mu}$$

Alternatively, if the data are ordered by non descending size of individuals, G can be expressed as is given by Dixon et al. 1987, Damgaard and Weiner

2000, correcting the typographical error in the denominator given in the original paper.

$$(2)\ G = \frac{\sum_{i=1}^{n}(2i - n - 1)x_i}{n^2 \mu}$$

where i is the individual's rank order number, n is the total number of individuals, x_i is the individual's variable value, and μ is the population average.

The Gini coefficient ranges from a minimum value of zero, when all individuals are equal, to a theoretical maximum of one in an infinite population in which every individual except one has a size of zero. It has been shown that the sample Gini coefficients defined above need to be multiplied by $n/(n-1)$ in order to become unbiased estimators for the *population* coefficients.

The extent of overall inequality in the population in our study area as measured by Gini coefficient works out to be 0.33. Considering that we are dealing with consumer expenditure rather than income, and given the low levels of consumer expenditure that we have obtained, a Gini coefficient of 0.30 and above must be judged to signal substantial inequality[2]. In the present case since the Gini coefficient of income inequality is more than 0.3 the inequality could be considered as substantial. The Gini coefficients computed separately for the two groups were found to be 0.24 for the asset group and 0.35 for the non-asset group indicating that the inequality is higher in the latter group. When the level of income is also taken into account we see that the 'non-asset' group has a lower level of mean income but higher level of inequality, suggesting that the latter has a larger percentage of population living in income poverty. The inference is that possession of fishing assets significantly contributes to the well-being of the population. Asset concentration is another pronounced feature of the sector. Income is relatively more equally distributed than assets. The Gini coefficient of asset holding worked out to be 0.86 indicating the highly skewed distribution in the value of assets. This is because only one-fifth of the households had any fishing asset

[2] For details see Subramanian (1997)

of substantial value and even here some of them had only low valued assets. (See Table 5.2)

Table 5.2 Distribution of households by value of fishing assets

Value of fishing assets	*% of households*
No fishing assets	78.7
Less than10000	2.1
10000 – 25000	3.2
25001 – 75000	1.1
75001 – 150000	1.4
150001 – 250000	11.3
Above 250000	2.1
All	100.0

Source: Survey data

5.4 DECOMPOSITION OF INEQUALITY

Even though the above analysis is indicative of the difference in the income and inequality levels between households with fishing assets and without fishing assets, it does not provide insight into the contribution of asset holding to overall inequality. This is because the Gini coefficient is not additively decomposable across groups; that is the total Gini of a population is not equal to the sum of the Ginis for its sub-group. Hence, we are continue the inequality analysis using the Theil Index of inequality which has the advantage of being addictive across its subgroups. The Theil index however, does not have a straight forward representation as the coefficient and lacks the appealing interpretation of the Gini coefficient.

The Theil index is a particular form of the Generalised Entropy (GE) class measures given by:

$$(3)\ GE(\alpha) = \frac{1}{\alpha^2 - \alpha}\left[\frac{1}{n}\sum\left(\frac{y_i}{\bar{y}}\right)^{\alpha} - 1\right]$$

where y_i - income of the i^{th} individual, n - number of individuals in the sample, $\bar{y}$ - arithmetic mean of incomes in the sample, α – a number representing the weight given to the distance between incomes at different parts of the income distribution. For lower values of 'α', the measure is sensitive to lower tail values of the distribution. The value of GE ranges from zero to infinite, with

zero representing an equal distribution (all incomes identical) and higher values representing higher levels of inequality.

In particular, when $\alpha \leq 2$, all have

(4) $GE(0) = \frac{1}{n}\sum \log \frac{\bar{y}}{y_i}$

(5) $GE(1) = \frac{1}{n}\sum \frac{y_i}{\bar{y}} . \log\left(\frac{y_i}{\bar{y}}\right)$

(6) $GE(2) = \frac{1}{\bar{y}}\left[\frac{1}{n}\sum (y_i - \bar{y})^2\right]^{1/2}$

GE (1) is the Theil index (Theil, 1967).

GE (2) is half the square of the coefficient of variation (CV).

The Theil index *GE* (1) is mean independent, population size independent, satisfies Pigou-Dalton condition and is decomposable. Theil index[3] varies from 0 to log n.

Decomposition of inequality can give insights into the structure of inequality. It can be used to examine the contribution of particular characteristics (e.g. ownership of productive assets) to inequality. The method is to separate the overall inequality (I) into a component of inequality between the chosen groups (I_b) and the remaining inequality within groups (I_w). When inequality is decomposed at one point of time, it is referred to as static decomposition and when over a period of time, it is dynamic decomposition.

The Theil index can be decomposed as the sum of inequalities explained by with in group disparity (I_w) and with in group disparity (I_b). Thus,

(7) $I = I_w + I_b$

Here,

---

[3] The Theil index can also be computed directly from the distribution of income in certain particular cases. For example, if the distribution is log-normal $L(Y; \mu, \sigma^2)$ then the Theil index is $\frac{1}{2}\sigma^2$ and if the distribution is Pareto form $\Pi(Y; \chi, \alpha)$ then the Theil index is $\frac{1}{\alpha - 1} - \log \frac{\alpha}{\alpha - 1}$ For details see Cowell, (1995).

(8) $I_w = \sum_{j=1}^{k}\left[\frac{Y_j}{Y}\right]GE(1)_j$ - inequality explained by within group disparity.

(9) $I_b = \sum_{j=1}^{k}\left[\frac{Y_j}{Y}\right]\log\left[\frac{Y_j/Y}{n_j/n}\right]$ - inequality explained by between group disparity.

Where Y = total income

Y_j = income of the j^{th} group

n_j – number of individual sin the j^{th} group

$GE(1)_j$ – inequality measure for group *j*

k – number of groups

n – total number of individuals

Thus to calculate I_w, the first step is to calculate GE (1) for each sub group and then to compute the weighted sum of the sub group indices with income shares as weights. The overall inequality I can be expressed as $I = I_w + I_b$; and this can be used to compute I_b, the between group inequality.

Intuitively, $R = I_b/I$ can be considered a measure of the amount of inequality explained by differences between groups with a particular characteristic. This if R = 0.8, it can be concluded that 80 percent of the inequality is explained by the characteristic used for sub group formation.

Here we have calculated the measure directly from the data using the formula (5). In the present case, since the number of units is 1446 the Theil index can range from 0 to 7.3; 0 indicating perfect equality and 7.3 perfect inequality. From the survey data, the Theil index for the overall inequality worked out to 0.18.

As pointed out earlier the main purpose of assessing inequality is to understand the contribution of different categories of households to overall inequality, in this case between households of fishers with and without fishing assets. The income distribution of persons within each category is given in Table 5.1. In order to compute the within group share of inequality the fist step is to calculate inequality measure for each sub group and then to take the

weighted sum of these measures, the weights being the share of income of each sub group. (See Table 5.3)

Table 5.3 Indicators of inequality

Type of household	*Theil index*	*% Income share*	*Gini ratio*
With fishing assets	0.0915	33.2	0.24
Without fishing assets	0.2040	66.8	0.35
All	0.1842	100.0	0.33

Source: Computed from survey data

Since Gini coefficient ranges from 0 to 1, the inequality measured using the Gini coefficient can be better appreciated compared to Theil Index. Both measures indicate that the extent of inequality is less among households with fishing assets as compared to other households. To get an idea of the contribution to the overall inequality by households with fishing assets we have decomposed the overall inequality as shown in Table 5.4

Table 5.4 Decomposition of Theil Index

i)	Overall inequality (I)	0.1842
ii)	Inequality within groups (I_w)	0.1667
iii)	Inequality between groups ($I_b = I - I_w$)	0.0175
iv)	Inequality explained by difference between groups with and without fishing assets ($R = I_b / I$)	0.0950 i.e 9.5%

Source: Computed from survey data

From these figures we get an idea of the amount of inequality explained by the difference between the two groups namely, with fishing assets and without fishing assets. This measure (R) I_b / I is 9.5 percent, which means that only about one-tenth of the inequality is explained by 'possession of fishing assets', the characteristic used for sub-group formation. The inference is that ownership of fishing assets is not the main factor for the observed level of inequality of household income. That is to say, the means of access to fishery resources is not a deciding factor in the variation of household income.

The results show that while possession of fishing assets influences the level of household income, the inequality in income is mainly due to other factors. The reason for this finding seems to be the method of income-sharing in the

fishing activity. From ownership of fishing assets, the owner gets a fixed share of the net sale value of the catch and the remaining catch is shared among the crew. Households with fishing assets and labour thus get a larger share of the income and the variation depends to a large extent on the number of workers contributed by the household.

A disadvantage of both the Gini coefficient and the Theil Index is that they vary when the distribution varies, no matter if the change occurs at the top, the bottom, or the middle. If one is more concerned about the share of income of the people at the bottom, a better indicator may be a direct measure, such as the share of income that goes to the poorest, say 10 to 20 percent. This leads to the concept of poverty.

From the distribution of household income shown in Table 5.1 it is seen that about 42 percent of the households have very low monthly income of less than Rs. 1000 percapita. Further, nearly 15 percent have less than Rs. 500. This points to the prevalence of poverty in the coastal community. The next step therefore is the assessment of poverty in the community.

5.5 POVERTY MEASUREMENT

5.5.1 Estimation of poverty line

Three ingredients are required to compute a poverty measure. First, the relevant dimension and indicator of well-being has to be chosen. Second, a poverty line, that is, a threshold below which a given household or individual will be classified as poor has to be selected. Finally, a poverty measure to be used for reporting for the population as a whole or for a population subgroup only, has to be chosen (Coudouel et al., 2002).

As a measure of indicator of well-being, as in the case of inequality measurement we use MPCE. It is recognised that the term 'poverty' has many dimensions, in addition to insufficient income or consumption, - for instance, insufficient outcomes with respect health, nutrition, and education and with deficient social relations, insecurity and low self-esteem and powerlessness. Applying the tools of poverty measurement to non-monetary indicators requires the feasibility of comparing the value of the non-monetary indicator to

an appropriate poverty line. Because of the insufficiency of data collected in the present analysis we are confining ourselves to the monetary indicator.

Once an aggregate income, consumption, or non-monetary measure is defined at the household or individual level, the next step is to define one or more poverty lines. The poverty line is the level of income below which a person cannot afford to purchase all the resources one requires to live. People who have an income below the poverty line have no discretionary disposable income, by definition. Poverty lines are cut off points separating the poor from the non-poor. There are two main ways of setting poverty lines— absolute poverty and relative poverty. In this study, we concentrate on absolute poverty. Absolute poverty can be approached from objective or subjective perspectives. The traditional approach is the objective perspective. The objective perspective involves normative judgments as to what constitutes poverty and what is required to move people out of their impoverished state. For example, most poverty analysis focuses on nutritional attainments. Subjective approach has emphasised on people's preferences on how much they value goods and services. "Mainly because of mounting recognition with the limitations associated with so called objective indicators and the value of understanding the perspectives of the poor in shaping policies and programmes, participatory poverty assessment methods are gaining ground" (Lok-Dessallien, 2000). Clearly, the two approaches consider the phenomenon from different angles and capture fundamentally different aspects of it; both provide valuable insights to the measurement and analysis of poverty. However, the choice of a poverty line is ultimately arbitrary[4]. In order to ensure wide understanding and wide acceptance of a poverty line it is important that the poverty line resonates with social norms, with the common understanding of what represents a minimum (Coudouel et al., 2002).

[4] For instance Sudhir Anand's estimate of poverty line which he estimated for Malaysia was a compromise between absolute and relative approaches. For details see Anand (1983) "Inequality and Poverty in Malaysia: Measurement and Decomposition".

As per the latest estimates of poverty line[5] for the Indian states for the year 1999-2000 the rural poverty line for Kerala is fixed at Rs 374.79 and the urban at Rs 477.06 (NSSO, 2000). When inflated on the basis of consumer price index for the state as a whole for the year 2005 the figure for the rural poverty line comes nearly to Rs 500. This estimated official poverty line is anchored in a fixed calorie norm and the corresponding consumption basket for the year 1973-74; the line was updated over time for changes in price level relevant to the consumption of the people around the poverty line (Dev, 2005). But this exercise has been widely criticised in terms of methodology.

The official poverty line of India is computed on the basis of a fixed consumption basket of 1973-74, which satisfied the minimum requirement of 2400 calories in rural area and 2100 in urban area. The composition of the consumption basket is based on National Sample Survey data. The estimates of the poverty line for subsequent year are linked to this base year basket. Consumer price indices are used to update the poverty line. The problem is that the updated poverty line for subsequent years which ignores changes in the consumption basket might be an incorrect description of purchasing power that is adequate to buy 2400 calories of food (Dev, 2005). Further, there has been a change in the questionnaire design of the NSS 55th round (pertaining to 1999-2000), which makes the estimate not directly comparable to those of the earlier rounds. Head count ratio based on the estimates from this alternative questionnaire are biased down compared with what would have

[5] In India The Planning Commission estimates the proportion and the number of the poor separately for rural and urban India at the national and State levels based on the recommendations of the Task Force on 'Projections of Minimum Needs and Effective Consumption Demands' in 1979. The Task Force had defined the poverty line (BPL) as the cost of an all India average consumption basket at which calorie norms were met. The norms were 2400 calories per capita per day for rural areas and 2100 calories for urban areas. These calorie norms have been expressed in monetary terms as Rs. 49.09 and Rs. 56.64 per capita per month for rural and urban areas respectively at 1973-74 prices. Based on the recommendations of a Study Group on 'The Concept and Estimation of Poverty Line', the private consumption deflator from national accounts statistics was selected to update the poverty lines in 1977-78, 1983 and 1987-88. Subsequently, the expert group under the Chairmanship of the late Prof. D.T. Lakdawala examined the issue. The Expert Group accepted the definition of poverty line and base year figures but suggested an alternative methodology to calculate the poverty line. It recommended the use of consumer price index for agricultural labour to update the rural poverty line and a simple average of weighted commodity indices of the consumer price index for industrial workers and for urban non-manual employees to update the urban poverty line. The Planning Commission accepted the recommendations of the Expert Group but modified the method for updating the poverty lines. The Commission decided to use only CPI for industrial workers to estimate and update the urban poverty line.

been obtained on the basis of the traditional questionnaire (Deaton and Dreze, 2002). In other words, the true cost of adequate calories in 1999-2000 is not Rs. 374.79 (the official rural poverty line of Kerala), but much higher. There is another quite different problem with the official estimates which does not concern with the changed questionnaire in the 55th round specifically. The source of this problem lies in the use of defective price indices in adjustment of poverty line (Deaton and Dreze, 2002).

In the present study, we have used a combination of the two approaches, the subjective and the objective. First, a 'food poverty line' was developed. This is the cost of purchasing a specific basket of food items. The composition of this basket for a household of five members was determined through a participatory analysis in the local community. At current prices at the local market, this basket of food items for 30 days was valued at Rs. 1900. (See Table 5.5).

Table 5.5 Valuation of the food basket for poverty line

Food items	Value (in Rs.)
Rice/Wheat	410
Cereal substitutes	140
Milk & milk products	210
Fish/Meat/Egg	320
Vegetables & tubers	280
Edible oil, condiments, etc.	205
Beverages, tea, coffee, sugar, etc.	335
Total	1900

Source: Compiled from survey data

From the survey data the amount deemed necessary, to cover essential non-food consumption was estimated at Rs. 1267 and this was added to the 'food poverty line'. The minimum monthly consumption expenditure necessary for a household of five members was thus Rs. 3167, i.e. Rs. 633 per person. The poverty line was thus estimated as Rs. 633 per person per month.

5.5.2 Poverty measure

The poverty measure is a statistical function that translates the comparison of the indicator of household well-being and the poverty line chosen into one aggregate number for the entire group. Some desirable properties of a good poverty measure are listed below:

a. Focus axiom: Poverty measure should be insensitive (other things being equal) to increase in the income of a non-poor person.

b. Monotonicity axiom: Other things being equal, a reduction in a poor person's income should increase the value of the measure.

c. Transfer axiom: Other things being equal, a transfer of income from a poor to a rich person should raise the value of the index.

d. Weak transfer axiom: A weakened version requires that a regressive transfer of the type described above should increase the value of the measure, provided the beneficiary of the transfer continues to remain poor after the transfer.

e. Symmetry: The value of the measure remains invariant with respect to permutation of incomes across individuals.

f. Transfer sensitivity – 1 (TS-1): The increase in poverty attendant upon a regressive transfer between poor individuals, (a fixed number of individuals apart) should be greater, the poorer is the pair of persons involved in the transfer.

g. Transfer sensitivity – 2 (TS-2): As above with the modification "poorer persons" instead of "poorer is the pair".

h. Decomposability: The axiom requires that the measure be amenable to being expressed as a weighted sum of sub-group measures, the weight being the sub-group population shares.

i. Sub-group consistency: Requires that the overall poverty should increase (other things remaining constant) if poverty in any sub-group increases.
The poverty measures commonly used are the Head Count Index (HCI), the Poverty Gap Index (PGI) and the Squared Poverty Gap Index (SPGI).

Head Count Index (HCI): The head count index (HCI) is the proportion of persons or households below the poverty line. HCI measures the incidence of poverty. In other words, it has focus. But it is not sensitive to changes in income among or within the poor.

Poverty Gap Index (PGI): It is assumed that the income distribution has been ordered so that X_1 is the lowest, X_2 is the second lowest and so on. Let the

poverty line be at the level π. Then $\pi - X_i$ is the gap between the poverty line and the income of the i^{th} individual; and $\frac{\pi - x_i}{\pi}$ is the proportionate gap. This averaged over the entire population (not the population of the poor) is the poverty gap index.

$$(10)\ PG = \frac{1}{N}\sum_{1}^{q}\left(\frac{\pi - X_i}{\pi}\right)$$

$$= \frac{1}{N}\sum\left(1 - \frac{Xi}{\pi}\right)$$

where N is the total population and q is the number of persons below π.

PG index indicates how worse off the poor are. The measure, which is often considered as representing the depth of poverty, is the mean distance separating the population from the poverty line, with the non-poor being given a distance of zero. It reflects the total deficit of all the poor households relative to the poverty line (Ravallion and Bidani, 1994). It is therefore, a much more powerful index than HCI because it takes into account, the distribution of the poor below the poverty line. It also reflects the per capita cost of eliminating poverty, that is the resources that would be needed to lift all the poor out of poverty through perfectly targeted cash transfers.

An alternative 'Poverty Gap' is defined as

$$(11)\ PG_2 = \frac{1}{q}\sum_{i=1}^{q}(\pi - X_i)$$

$$= \pi - \frac{1}{q}\sum X_i$$

$$= \pi - a$$

where $a = \frac{\sum X_i}{q}$, the average income of the poor.

This is the average distance (in income term) of the poor below the poverty line 'a' being the average income of the poor. If we want to eliminate poverty

by bringing each of the poor up to the poverty line, a total transfer of $q(\pi - a) = \sum_{i=1}^{q}(\pi - X_i)$ should be made.

Squared Poverty Gap Index: A drawback of the Poverty Gap Index is that it may not fully capture the severity of poverty, since it is not sensitive to transfers among the poor. (It fails the weak transfer axiom). One way to get around is to take a weighted average, with higher weights given to those who are farthest away from poverty line. One such measure is Squared Poverty Gap Index defined as

$$(12)\ PG_3 = \frac{1}{N}\sum_{i=1}^{q}\left(1 - \frac{X_i}{\pi}\right)^2$$

The squared poverty gap takes into account the inequality among the poor. The head count, the poverty gap and the squared poverty gap are the first three measures of the 'Foster-Greer-Thorbecke (FGT) class of poverty measures[6].

The general formula for this class is

$$(13)\ P(\alpha) = \frac{1}{N}\sum_{i=1}^{q}\left[1 - \frac{X_i}{\pi}\right]^{\alpha} \quad (\alpha > 1)$$

When $\alpha = 0$ ---------- $P(\alpha = 0) - PG_1$

$\alpha = 1$ ---------- $P(\alpha = 1) - PG_2$

$\alpha = 2$ ---------- $P(\alpha = 2) - PG_3$

The higher the value of α, the greater is the sensitivity of the measure to the well-being of the worst off. One drawback of the FGT approach is that the interpretation is not obvious expect for the special cases of $\alpha = 0$ and $\alpha = 1$. For evaluation of poverty it is desirable to use the poverty gap and squared poverty gap in addition to the head count, since these two measure different aspects of poverty.

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[6] For details, see Foster, Greer & Thorbecke, 1984 "A Class of Decomposable Poverty Measures", published in Econometrica, Vol. 52.

The FGT measures have a special property which is considered useful namely 'additivity'. This means that we can write the total poverty as a weighted sum of the poverty of the sub groups, the weight being the sub group share of the population (number). This cannot be done with Gini coefficient. Thus, if there are two sub populations of size n_1 and n_2, so that n = $n_1 + n_2$

$$(14)\ P(\alpha) = P_1(\alpha).\frac{n_1}{n_1 + n_2} + P_2(\alpha)\frac{n_2}{n_1 + n_2}$$

The computed FGT indices for the population in the study village are given in Table 5.6.

Table 5.6 FGT Indices

Sub group type	*HCI (Poverty incidence)*	*PGI (Poverty depth)*	*SPGI (Poverty severity)*	*n*
With fishing assets	0.089	0.019	0.004	359
Without fishing assets	0.252	0.092	0.047	1087
All	0.212	0.074	0.037	1446

Source: Computed from survey data

The results show that 21.2 percent of the population is below the poverty line; that is these people cannot afford to buy the basic basket of goods for subsistence. The incidence of poverty as measured by the head count index (HCI) is higher among the non-asset group than among the 'asset group'. While about one-tenth of the population in the 'asset group' is below the poverty line as much as one-fourth of the population in the 'non-asset group' falls in this category. Further, the poverty gap index (PGI) shows that the 'non-asset group' households in general are far below the poverty line than the 'asset group' households. This index can be used as a measure of the minimum amount of resources needed to eradicate poverty, that is the amount one would have to transfer to the poor under perfect targeting to bring them out of poverty. In this case, where the PGI is 0.074 the average cash transfer needed for this is 7.4 percent of the poverty line. Since the mean per capita income of the entire group is approximately 2.2 times of the poverty line the cash transfer would represent 7.4/2.2, that is 3.4 percent of the group's mean income. Of course, such perfectly targeted cash transfer is neither feasible nor desirable. The exercise is meant only to indicate the meaning of

the poverty gap index. The SPGI is also higher among the non-asset group. This index takes into account the inequality among the poor, in addition to poverty depth. The poverty severity index indicates that the income inequality is also higher among the non-asset group. The depth and the severity of poverty are particularly important for policy makers in evaluating the impact of programmes and policies. A programme might be effective in reducing the number of poor, but it might do so by lifting those who are closer to the poverty line out of poverty. Other interventions might better address the situations of the very poor but they may have low impact on the overall incidence, if they bring the very poor closer to the poverty line but not above it.

As per the NSS 55th round (1999-2000), Kerala has poverty figures of 9.38 percent in rural areas and 20.27 percent in urban areas (GOK, 2004). The incidence of poverty in the fishing community is thus seen to be higher that of their counterparts in the rural sector of the state even though the overall average income level of fisher households is higher (compared to rural artisans and agriculture labour).

5.6 DETERMINANTS OF POVERTY

5.6.1 Poverty profile

Once the extent and the severity of poverty are assessed, the next step is to examine the characteristics of the different groups (poor and non-poor) in order to shed light on the correlates of poverty. The choice of the types of groups will have to be based on some ex-ante knowledge of important dimensions relevant to policies. Several characteristics of people and households are known to be more among the poor than the rest of the society. These include old age, sickness, incapacitation, households with large number of children, single parent household, gender of the head of the household, etc. (FAO, 2001). The profile may also include information on the identity of the poor, their access to resources, living conditions, etc. Construction of a poverty profile allows for a better understanding of who the poor are and what the differences between the poor and non-poor are. Some important socio-economic characteristics identifying the poor in the community studied are given in the poverty profile of the households as in

Table 5.7. Since the households are the basic income-sharing units, it appears legitimate for policy purposes to describe the population in poverty in terms of households, rather than individuals. Accordingly, the unit in the poverty profile is chosen as the household, and poor households are those with percapita household income below Rs. 633 per month.

Table 5.7 Poverty profile of households

Selected characteristics of the household	*Percentage distribution among all households*	*Percentage distribution among poor households*	*Percentage distribution among non-poor households*	*Incidence of poverty*	*Relative incidence of poverty*
1	2	3	4	5	6
Ownership of fishing assets					
With fishing assets	20.9	9.8	24.0	10.2	0.47
Without fishing assets	79.1	90.2	76.0	25.0	1.16
All	100.0	100.0	100.0	21.6	1.00
Sex of the head of household					
Male	85.5	85.3	85.5	21.6	1.00
Female	14.5	14.7	14.5	22.0	1.00
All	100.0	100.0	100.0	21.6	1.00
Education of the head of household					
Illiterate	66.3	68.9	65.6	22.5	1.04
Literate but no schooling	15.2	13.1	15.8	18.6	0.86
Below primary	5.0	4.9	5.0	21.4	0.99
Below secondary	8.5	8.2	8.6	20.8	0.96
Secondary and higher secondary	4.6	4.9	4.5	23.1	1.06
Graduation and above	0.4	--	0.5	--	--
All	100.0	100.0	100.0	21.6	1.00
Occupation of the head of household					
Owner	2.8	--	3.6	--	--
Owner worker	16.0	8.2	18.1	11.1	0.51
Fishery labour	49.3	50.8	48.9	22.3	1.03
Others	31.9	41.0	29.4	27.8	1.29
All	100.0	100.0	100.0	21.6	1.00

(Contd.)

Table 5.7 (contd.) Poverty profile of households

Selected characteristics of the household	*Percentage distribution among all households*	*Percentage distribution among poor households*	*Percentage distribution among non-poor households*	*Incidence of poverty*	*Relative incidence of poverty*
1	2	3	4	5	6
Household size					
1	2.1	4.9	1.4	50.0	2.31
2	8.9	6.6	9.5	16.0	0.74
3	10.3	6.6	11.3	13.8	0.63
4	14.5	24.6	11.8	36.6	1.69
5	29.4	29.5	29.4	21.7	1.00
6	14.9	13.1	15.4	19.0	0.88
7	7.5	1.6	9.1	4.8	0.22
8 & above	12.4	13.1	12.1	22.9	1.06
All	100.0	100.0	100.0	21.6	1.00
Number of earners					
0	7.1	8.2	6.8	25.0	1.16
1	41.4	62.3	35.7	32.5	1.50
2	27.7	19.7	29.8	15.4	0.71
3	17.4	9.8	19.5	12.2	0.56
4	3.9	--	5.0	--	-
5 & above	2.5	--	3.2	--	--
All	100.0	100.0	100.0	21.6	1.00
Number of children under age 15					
0	36.3	34.4	36.7	20.6	0.95
1	17.0	9.8	19.0	12.5	0.58
2	18.8	18.0	19.0	20.8	0.96
3	18.4	24.6	16.7	28.8	1.33
4	6.7	6.6	6.8	21.1	0.98
5 & above	2.8	6.6	1.8	50.0	2.31
All	100.0	100.0	100.0	21.6	1.00

Source: Survey data

The following picture of the poor emerges from an examination of the poverty profile:

1. Incidence of poverty is higher among households with no fishing assets. While only one-tenth of the households with fishing assets were found to be poor, among the households with no fishing assets, about one-fifth were poor.

2. Persons engaged in non-fishery activities had 41 percent of the poor households, as against 29 percent of the non-poor. The incidence of poverty among households headed by persons in non-fishery sector is

27.8 percent. The higher incidence of poverty among these households reflects the lack of opportunities for productive employment in the non-fishery sectors.

3. Illiterate persons headed 69 percent of the poor households, while in non-poor households, the corresponding proportion is 66 percent. The survey data do not show significant association between educational level of the household head and the incidence of poverty; still literacy level may be considered as one of the factors contributing to low level of income.
4. The gender of the household head does not indicate any association with incidence of poverty, even though in some studies the relationship was found to exist.
5. The incidence of poverty as an outcome of the household composition shows the following features. (i) Households with no earner or single earner are more poverty prone. (ii) Incidence of poverty is higher for households with more than two children.

5.6.2 Factors determining poverty

The major characteristics that contribute to pushing a household into the poverty group are thus (i) literacy level of the head of the household, (ii) the sector of occupation in which the head of the household is engaged (fishery or non-fishery), (iii) number of children in the household (iv) number of earners in the household, and (v) possession of fishing assets. Having identified the explanatory variables, we move on to set a best fitting and logically reasonable model that would depict the relationship between poverty (the response variable) and the set of explanatory variables. The most common form used in such situations is the linear regression model where the response variable is continuous. But in the instant case the response variable (that is, poverty status) is dichotomous. In this situation one of the natural candidates for modelling is the probability of responding to the explanatory variables. This probability could be modelled using a linear function of the explanatory variables. But before using the model the probability has to be transformed from the range (0, 1) to $(-\infty,\infty)$ and the linear model applied to

the transformed variable (Hosmer and Lemeshow, 1989). The specific form of transformation that is commonly used is the logit transformation, leading to the logistic regression model:

(15) $\log (p/1-p)= \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots \beta_i X_I$

where 'p' is the expected value of the response variable, which in this model is coded as 1 for the poor households and 0 for the non-poor households. In other words, 'p' is the probability of responding to the explanatory variables. The regression coefficients can be estimated using the method of maximum likelihood.

The risk of a household being poor may therefore be said to be dependent on these characteristics; and this is specified in the following logistic model:

(16) $\log (p/1-p) = \beta_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \beta_5 D_5$

where, p is the probability of being poor based on the explanatory variables as given in the code sheets and β's the corresponding parameters. (See Table 5.8)

Table 5.8 Code sheet for poverty data

Variables	*Codes/Values*	*Remarks*
Poverty status	1= Poor; 0 = Non-poor	Response variable
D_1	1 = Illiterate, otherwise 0	Educational status of the head of the household
D_2	1 = Occupation in non-fishery or unemployed, otherwise 0	Occupation of the head of household in fishery or non-fishery
D_3	1 = Number of children under 15 is greater than or equal to 3, otherwise 0	Dependency level of the household
D_4	1 = Number of earners less than or equal to 1, otherwise 0	Earning capacity of the household
D_5	1 = No fishing assets, otherwise 0	Access to fishery resources

The model is estimated using the maximum likelihood method. The results are given in Table 5.9. The estimated model when applied to the observed data

was found to make 68 percent correct predictions and 6 percent tied, indicating a satisfactory level of reliability. The *Wald* scores for D_2 are low, still they are retained because of its socio-economic relevance in the model.

Table 5.9 Estimated coefficients of logistic model

Parameter	*DF*	*Estimate (β)*	*Standard Error*	*Wald Chi-Square*	*Pr > ChiSq*	*Odds Ratio Estimates (Exp β)*
Intercept	1	-3.5713	0.6075	34.5571	<. 0001	--
D_1	1	0.5124	0.3335	2.3602	0.1245	1.669
D_2	1	0.2798	0.3469	0.6506	0.4199	1.323
D_3	1	0.7841	0.3474	5.0943	0.0240	2.190
D_4	1	1.1559	0.3305	12.2346	0.0005	3.177
D_5	1	1.1132	0.4932	5.0940	0.0240	3.044

The estimated coefficients of the dependent variables have a special meaning in assessing the effect of the variable on poverty. The coefficients are related to the concept of 'odds ratio.' In this case, the independent variables are dichotomous 'odds ratio' which may be defined as the ratio of odds of the outcome (poverty) being present among households with D = 1 to the odds of the outcome being present among households with D = 0. Thus in the present case, where the odds ratio corresponding to the variable 'possession of fishing assets' is 3.044, the interpretation is that poverty occurs 3.04 times as often among households without fishing assets as compared to households with fishing assets.

5.7 CONCLUSION

From the preceding analysis it is identified that earning capacity, access to fishery resources and number of dependents in the households are the main determinants of poverty. There may be other characteristics also, which the present study could not capture. When all the characteristics associated with high degrees of poverty are taken together, the chance of being poor becomes high. These persons may not be poor at present but, their livelihoods or the external environmental factors which shape them may have features which increases their susceptibility to poverty. These external factors include resource depletion, growth of fisheries dependent population, seasonality, conflicts, etc.

CHAPTER VI

HOUSEHOLD INCOME AND RESOURCE DEPENDENCE OF FISHERY HOUSEHOLDS

6.1 INTRODUCTION

In this section, we attempt to explain why different households have different levels of income; in other words, the attempt is to identify the determinants of household income.

6.2 FACTORS INFLUENCING HOUSEHOLD INCOME

From the occupational and income structures as given in Table 4.7 it is evident that the main source of income in the households of the village is activities related to the fishery resources. In fact, about 80 percent of the household income is from fishing and fish-related activities. Fishing income is derived from the ownership of fishing crafts, engine, and fishing gear, from employment of household members in their own fishing crafts and / or other crafts for a share of the earnings, from ownership of other fishing assets yielding rent, from employment of household members in fish related activities like fish processing and vending. As regards fishing, the practice in the village is to share the net sale value of the catch on each trip (after deducting common expenses of each trip like cost of fuel, food expense of the crew, marketing charges, etc.) between the owner and the crew. If the crew includes the household members the owner household gets the part of the crew share in addition to owner share. The activities of fish processing and vending are usually attended to by the female members of the household. There are a few instances in which male members are also engaged in fish vending.

Income from non-fishery sources can be broadly classified into income earned from employment in non-fishery activities, from ownership of non-fishery assets such as farm land, buildings, transport vehicles, livestock and poultry, etc. and from sources like pension, remittances, etc. The non-fishery activities mainly relate to self employment in small trade or business, employment as hired labour in construction and repair activities and in few cases as salaried or regular wage paid employment in institutions. It was seen that remittances from

household members or close relatives and pension was a major source of income for some households, but their number is very small. However, this complicated income structure does not exhaust all sources of income. A small-scale fishing household may receive a part of income in non-cash form through consumption of own produce, for example, fish, home-grown vegetables, etc. and through social sharing. However, income from these sources was not considered in the present analysis because of difficulty in getting reliable data.

The above discussions indicate that a fishery a households' income can be expressed as the sum of fishery and non-fishery incomes. Fishery income depends on the utilisation of fishing assets and labour in fishing and related activities. Similarly, non-fishery income comes from the utilization of non-fishery assets, employment in non-fishery sector, and also as unearned income from pension, remittance, social sharing, etc. keeping these factors in mind the total household income may be expressed as in equation (1).

(1) $Y = Y (K_F, K_N, L_F, L_N, S, T)$

where Y_F is fishing income; Y_N is non-fishing income; S is fish stock; K_F and K_N represent the value of fishing and non-fishing assets respectively; L_F and L_N represent fishing and non-fishing mandays worked by family members respectively and T denotes ownership of land. Since the fishery resource (S) is in a specified location it can assumed to be constant and eliminated from the equation. Similarly, ownership of land (T) is dropped from the equation since in the study area its contribution was found to be nominal. Further, since our objective is to identify the main factors influencing household income, the unearned part of the income comprising pension, remittances and social sharing is eliminated form the model. In consequence of this, the definition of household income is modified into earned income. The model is therefore specified as in equation (2).

(2) ln INCOME = $\beta_0 + \beta_1 ln$ FISH ASSET + $\beta_2 ln$ NON FISH ASSET + $\beta_3 ln$ FISH EMP DAYS + $\beta_4 ln$ NON FISH EMP DAYS

where INCOME – monthly percapita consumption expenditure (MPCE)

FISH ASSET – value of fishing asset

NON FISH ASSET – value of non-fishing asset

FISH EMP DAYS – number of days employed in fishing and fish related activities during the last 30 days

NON FISH EMP DAYS – number of days employed in non-fishery related activities during the last 30 days.

In specifying the equation (2) the following limitations have been noted.

(i) There is high level of uncertainty involved in fish harvest, the daily income from fishing is therefore highly fluctuating. However, the monthly income was found to have some degree of stability. Therefore, monthly household income is taken as the dependent variable.

(ii) Income from utilization of fish assets depends on a variety of factors like technology used, management efficiency in the use of inputs, markets access, etc. We have seen that even among households using the same technology there exists wide variation in fishing income. The analysis could have been made more detailed with a finer breakdown of income and explanatory variables to take into account such variations. But data availability posed and insurmountable problem.

(iii) In non-fishery sector land as an asset is often an important component and its value has to be adjusted for quality. However, in the present exercise land as an explanatory variable has been omitted, since for almost all the households the land possessed was only the homestead area which was very small of area two to three cents per households.

The results of the regression estimated with sample cross-section data and treating household consumer expenditure as a proxy for household income employing ordinary linear estimation methods are given in Table 6.1a, 6.1b, and 6.1c[1].

[1] The dataset used for estimation are given in Appendix II as Data Set – II. For computation of inequality and poverty also this dataset was used.

Table 6.1a Estimates of the parameters

Variable	*DF*	*Parameter Estimate*	*Standard Error*	*t Value*	*Pr > |t|*
Intercept	1	5.09275	0.24732	20.59	<.0001
*ln*FISHASSET	1	0.07764	0.01240	6.26	<.0001
*ln*NONFISHASSET	1	0.00613	0.03325	0.18	0.8539
*ln*FISHEMPDAYS	1	0.87205	0.06927	12.59	<.0001
*ln*NONFISHEMPDAYS	1	0.29498	0.04691	6.29	<.0001

Table 6.1b Analysis of Variance

Source	*DF*	*Sum of Squares*	*Mean Square*	*F Value*	*Pr > F*
Model	4	204.24092	51.06023	54.85	<.0001
Error	263	244.81069	0.93084		
Corrected Total	267	449.05161			

Table 6.1c Statistics

Root MSE	0.96480	R-Square	0.4548
Dependent Mean	8.36803	Adj R-Sq	0.4465
Coeff Var	11.52959		

The estimated results were on the whole in line with our expectations even though the model explains only 45 percent of the household income. This seems to be due to the high degree of uncertainty associated with fishing operations. Another reason may be the use of consumption expenditure as proxy for the dependent variable household income. Differences in fishing assets and employment both in the fishery and the non-fishery sectors are statistically significant in explaining household income. Ownership of non-fishing assets was found to be statistically insignificant suggesting that this kind of assets make very little contribution to income. Non / under utilization of the non-fishery assets or the low level of rent may be one of the reasons for this. The most important source of household income is employment in fisheries. Even though the employment in non-fishery sector is also a factor, it does not explain a substantial part of the income variation as does employment in fishery. One explanation that could be offered is that the non-fishing activities available in the study area do not the fit the particular circumstances that favour the fishery households. For instance, such activities if appropriate should fit

well in the prevailing demographic structure and skills of the family labour and they should yield lower than the opportunity cost of labour in the fishery sector. Ownership of fishing assets even though an important determinant of household income has a lesser role in the determination of income levels than employment.

As explained above the estimated value of the parameters denote the income elasticity of the corresponding factors. They tell us the percentage increase in income resulting from one percent increase in one factor of production keeping other factors constant. Thus, a one percent increase in employment in fishery-related activities could increase household income by 0.87 percent; whereas an equal increase in non-fishery activities increases income only by 0.29 percent. As compared to employment, the elasticity of fishing assets is only 0.08, a fact which indicates that a one percent change in fishing assets leads to a change of income only by 0.08 percent. In other words, income elasticity of assets is low suggesting that no significant increase in income would be achieved by promoting additional investment in fishing assets of households.

The results suggest that in order to achieve the maximum effect on the income level of small-scale fishers the policy should be promotion of labour intensive methods of fishing rather than capital-intensive methods. Creation of appropriate non-fishing employment opportunities, which are complementary to fishery activities, may help to augment income of fishery households and also to move a portion of the new entrants to the labour force gradually to non-fishing activities.

Creation of employment opportunities outside fishery would serve three purposes: (i) absorb surplus labour, (ii) promote mobility and (iii) provide a supplementary/alternative source of income and hence security against uncertainty arising from either resource or market fluctuations (Panayatou, 1982). However, in the situation in which fishing has become a way of life as well as a source of living, the psychic and social cost of occupational change and relocation might be high and cannot be ignored. Yet given the new realities of high population densities and advanced fishing technologies there does not

seem to be any alternative to enhance the living standards of the fishing communities.

As explained earlier, nearly 55 percent of the variation is not explained by the model; further in-depth studies are therefore called for. It would also be necessary to examine the socio-demographic variables that impinge upon the earning capability of households; the effects of differences in productivity of various methods of fishing techniques and management skills in input use are also to be examined in depth.

6.3 DEPENDENCE ON FISHERY RESOURCES

The survey data show that almost all the households in the village depend on fishery resources in one way or the other for their livelihood. Some households depend on harvest of fish while others are engaged in activities related to transporting, processing and vending of fish. It is true that there are some households whose cash income is from pension or remittances but they also receive part of the consumption income through social sharing. About 60 percent of the average household income is from fishing and sale of landed fish and another 20 from fish-related activities. Thus, overall 80 percent of the household income comes from marine resources. (See Table 6.2).

Table 6.2 Dependence on fishery of poor and non-poor households (in %)

Source of income	*Poor households*	*Non-poor households*	*All*
I. Income from fishery			
i. From fishing asset	1.7	13.6	12.8
ii. Fishery labour	64.1	45.2	46.5
iii. Fish vending/processing	14.2	21.3	20.8
Sub total	80.0	80.1	80.1
II. Income from non-fishery			
i. From asset/salary/wages	16.9	8.7	9.3
ii. Interest, rent	0.8	3.8	3.6
iii. Pension, remittance, etc.	2.3	7.4	7.0
Sub total	20.0	19.9	19.9
III. All	100.0	100.0	100.0

Source: Survey data

The level of dependence of the poor and the non-poor households on fishery resources is almost the same. But there is some difference across households

belonging to different economic strata. (See Table 6.3). Even though the poor are dependent on these resources approximately at the same level as the better off, in quantity terms the poorest households use three to four times less compared to their richest.

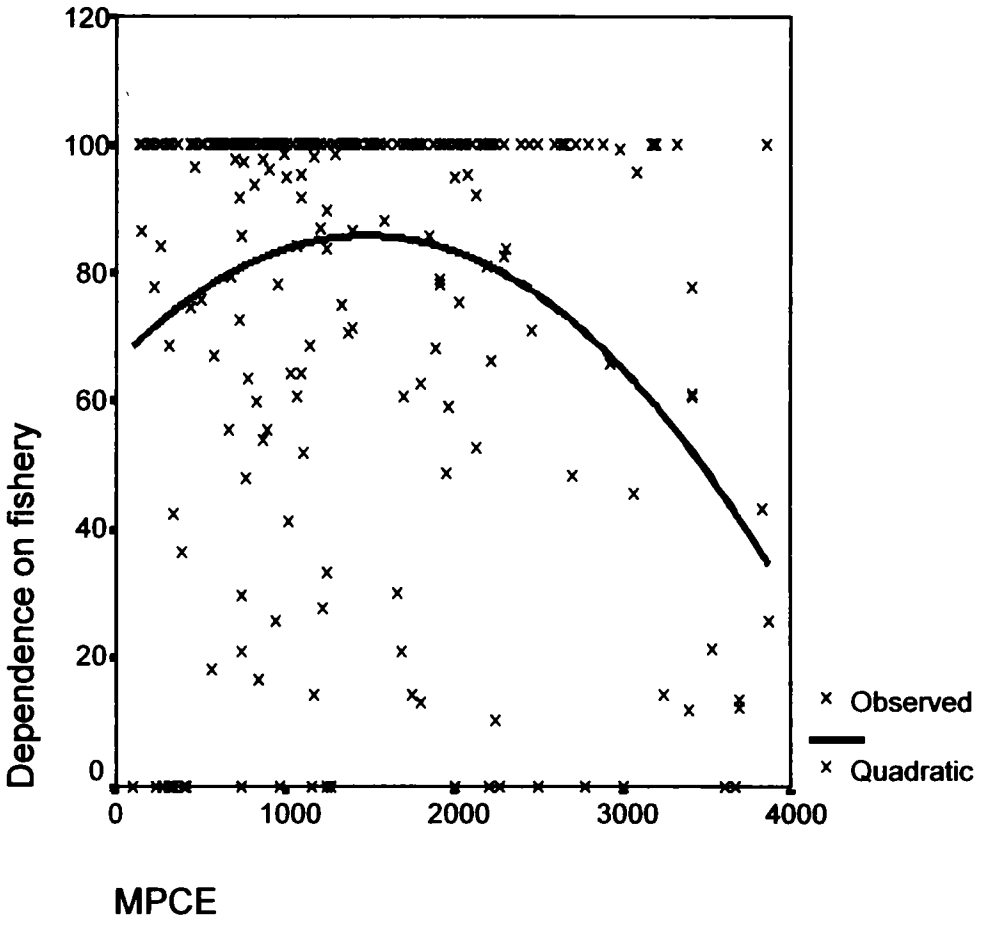
Table 6.3 Income level and resource dependency

MPCE class (in Rs)	*% Income from fishery*
<= 350	74.42
351 – 500	72.23
501 – 1000	85.16
1001 – 1500	85.85
1501 – 2000	84.92
2001 – 3000	82.64
3001 & above	52.16
All	80.13

Source: Survey data

In this connection, it may be of interest to refer to certain studies asserting the existence of an inverted U-shape relationship between environmental quality and percapita income level (Torras and Boyce, 1998; Grossman and Krueger, 1996; Beckerman, 1992). It is stated that in the later stages of development environmental quality level improves because people become more environmentally conscious. The assumption is that individual demand for environmental quality rises with income. The tabulated results that are given Table 6.3 indicates that as the percapita income increases resource dependency increases upto a stage and then begins to decrease. A visual examination of the fitted quadratic curve on the cross-sectional data also indicates that to some extent the relationship holds good. The fitted plot of fishery income against MPCE is given in Figure 6.1. We hasten to add that this is only indicative of the relationship. Further research is needed before any firm conclusion is drawn.

Figure 6.1 Relation between income and use of fishery resource



6.4 CONCLUSION

Almost all the households in the village in one way or other depend on marine resources for their livelihood. The main source of income of most of these households is fishing and related activities; income from non-fishery employment is nominal. As regards income from fishery the main determinant of household income is from employment. The findings from the analysis of data on craft operations (vide Chapter III) are also in the same lines. For fleet owners using the same type of technology the difference in catch earnings were explained mainly by difference in the number of fishing trips. Data from both the household survey and the fleet operations show that higher investments in fishing assets are not worth the returns. Naturally the question that arises is "why do fishermen refuse to increase the number of trips?" The

usual answer from fishermen is "lack of fish". But this answer cannot be taken in its face value. In the small-scale sector the decision whether to undertake a particular fishing trip is taken by the team, is based on the simultaneous integration of a large number of processes of past experience coupled with immediate observation aided by human sense. It is willingness to take risk conditioned by practical knowledge.

Small-scale fisheries face a variety of constraints: isolated location, limited open access resources, multi-gear technology, multi-species catch, lack of control over market, limited mobility and lack of alternative employment opportunities. Traditional barriers to entry have broken down under population pressure and introduction of more efficient technologies. These, combined with limited occupational and geographical mobility reduce the opportunity cost of fishing, increase dependence on fishing, discouraging exit and encouraging new entry. The situation may lead to increasing resource depletion and further impoverishment of small-scale fisherfolk.

CHAPTER VII

SUMMARY AND CONCLUSIONS

7.1 SUMMARY

The varying links between environment and poverty have been extensively documented, particularly regarding rural livelihood. The literature usually focuses on the 'vicious circle' between poverty and environment degradation, but there exists little empirical evidence to conclude with certainty the causal relationships. Poverty may some times be associated with environmental degradation, but there is not necessarily any direct causal relationship. Several local factors influence the extent to which the poor have access to and control over natural resources and the potential to derive income from them. The present study has been an attempt to understand how natural resource depletion affects the livelihoods of the poor by analysing the socio-economic conditions of the small-scale fishing community who are facing depletion of marine resources. The study was conducted in a coastal village of South-Kerala.

In Kerala, nearly ten lakh fisherfolk depend on marine fishery resources for their livelihood. Marine fishing is a traditional activity of certain communities in the coastal area. Starting from the nineteen sixties modernisation ideologies in fish extraction and access to investment funds led to rapid expansion of fishing effort. The introduction of mechanised trawlers and purse-seiners in the mid sixties led to increase in fish catch, but this has affected the share of artisanal fishermen. Their response was the introduction OBMs in country crafts which helped to increase harvest and their share of catch. However, the rapid increase in the number of motorised crafts and the introduction of destructive gears led to over-fishing and stagnation in fish production. Official figures of fish landing show that in spite of the continuance of increase in fishing pressure during the past 15 years, output has stagnated around 5.5 lakh tonnes. Income distribution has also become skewed with mechanized trawlers and operators of large seines getting disproportionately large shares of the catch and earnings. Various studies indicate that the open access characteristics of the marine fisheries and the adoption of powerful fishing technologies are causing

biological and economic over-fishing leading to stagnation in fish production and lower incomes to small-scale fishers.

The study area is a coastal village with a population of 6200; and most of the households have members engaged in fishing or fish-related activities. The houses are mostly small independent structures standing close to one another in plots of less than 3 cents of land; most of them do not have basic amenities like safe drinking water and sanitary facilities. Since the area is congested, water in the wells get contaminated and the use of this water for drinking purposes leads to the spread of water borne diseases.

The overall level of education of the small-scale fishing community is lower than that of the State's rural population, in general. About one-third of the population aged 6 years and above is illiterates, in the sense that they had no regular schooling. It is however, learnt from discussions with the local level people that even among those with primary level education, there are many who could not read or write. The parents however, are eager to provide school education to their children within their means, but there are many drop outs among children in the age group of 5 to 14 years.

The household size of fisherfolk, in general is comparatively large. About one-third of the households have more than six members. The overall sex ratio is unfavourable to females; and this is a situation in contrast to the overall situation in the State.

Almost all the households surveyed, in one way or other, depend on fishery resources for livelihood. Hence, most of the households have members engaged in fishery or fish related activities. Nearly half the males and one-fifth of the females are gainfully employed. About 90 percent of the working males and 80 percent of the working females are engaged in the fishery sector. A large number of elderly persons above sixty years of age work for a living; in fact they constitute only 20 percent of the workforce. Most of the male workers in the area have fishing skills. Women in the community work in salting, drying and vending of fish, in the preparation of baits, repairing nets, etc. In order to supplement household income, some of them take activities outside fishery like running eateries and small shops, etc.

The survey results show that about 14 percent of the households have motorised plywood crafts and 7 percent have *kattamarams*. There are also a few units working with shore-seines. Some of the households owning motorised crafts have also *kattamarams*. Since motorised crafts can go to higher depths and hunt migratory species also, their catch and consequently income are higher compared to *kattamaram* operators. However, fishing methods in both types of operations are more or less the same, of course with changes in the quantum of gear to suit the higher capability of motorised units.

From informal discussions with operators of fishing crafts, it was learnt that even among those operating the same type of crafts, there existed wide differences in earnings. According to them, the major factors influencing the difference were variation in the use of inputs, technical and management efficiency and last but not the least pure 'luck'. To verify and confirm this opinion, a production function relating the catch and the explanatory variables (gear type, fuel used, engine power, labour employed) was specified and estimated using a cross section data gathered through personal interview with local craft operators. The results indicate that for both the motorised and the non-motorised operations that there exists the difference in the number of trips undertaken which is also the main determinant of the difference in catch value. Difference in the quantum of gear also has some effect on catch value. In the case of motorised crafts, power of the engine and quantity of fuel used have positive effect on increasing catch, possibly due to the higher capability for hunting and intercepting migratory species at greater distances. In this exercise, we could not take into account the effect of management efficiency because of non-availability of appropriate data.

The analysis raises two points; (i) why is there difference in number of trips, and (ii) whether increasing fishing assets is profitable. As for the number of trips, fishermen say that the decision to undertake a particular trip is taken collectively by the team of crew members and that this decision is made based on a number of factors like immediate observation aided by human sense, past experience, willingness to take risk, practical knowledge, etc. To the second question, the answer based on the analysis is that, further investments in gear are uncalled for. In the case of motorised operations, enhancement of engine

power has a positive effect, but the inference is not conclusive since the present analysis did not take into account the impact of this on fishery resources. But given the stagnation in fish catch in spite of increase in fishing pressure, it seems that further investment to increase engine power and gear weight is not advisable.

The survey data show that the average monthly per capita income (as measured by monthly consumption expenditure (MPCE)) of fisher households is Rs. 1363. When compared to the income of the rural labour households in the State Rs.787, the fisher households seemed to be better off in economic terms. But this higher income has to be seen against the background of the highly fluctuating and uncertain nature of daily earnings of the fishermen and the risk to accidents and natural disasters they are exposed to. It should be added here that there exists considerable variation in income within the community. Analysis of the survey data shows that for about 10 percent of the households, the MPCE is below Rs. 350, and for about 15 percent it is below Rs. 500. At the other extreme for 33 percent of the households MPCE is above Rs. 2000 and for 7 percent it is about Rs. 3000. These figures indicate that there is wide disparity of income within the community.

To quantify the extent of inequality, the Gini coefficient using MPCE as a measure of well-being was computed. The Gini coefficient ranges from a minimum value of zero when all individuals have the same income to a maximum of one when every individual except one has an income zero. The extent of overall inequality computed was found to be 0.33. Considering the low levels of consumer expenditure that has been obtained from the survey data, the Gini coefficient of 0.33, must be judged to signal substantial inequality. The Gini coefficient computed separately for the sub-groups of households with and without fishing assets showed that the inequality level was lower in the sub-group of households with assets (0.24 for households with assets and 0.35 for households without assets). It was found that the mean percapita household income of the asset groups was Rs. 1790 and that of the non-asset group Rs. 1250. When the two characteristics are taken together we see that the non-asset group has a lower mean income and a higher level of inequality. The inference is that the non-asset group has larger percentage of population living

in poverty. In economic terms, they occupy the lower stratum compared to the group of households with fishing assts. The lower income inequality of the asset group suggests that asset inequality of the population has some relation with income inequality. (The Gini coefficient of asset inequality worked out to be 0.86 indicating the skeweness in the distribution of assets.) In order to confirm this finding, we did an exercise of decomposition of overall income inequality as the sum of inequalities between and within the sub groups. Since Gini coefficient is not addictively decomposable, we used the Theil Index for this. It was found that only less than 10 percent of the overall inequality is explained by the inequality between sub-groups, suggesting that possession of fishing assets does not have a major contribution in explaining income inequality. The cause of income inequality has therefore to be sought elsewhere.

Since the main focus of this present study is on poverty and inequality among small-scale fishery, we turned our attention to examine the extent of poverty and to the identification of the poor and enquire into their characteristics. While it is often stated that the small-scale fishing communities have poverty rates above national averages, clear cut evidence to support such a contention is limited. In recent years the traditional conception of poverty based on low levels of income/consumption has been enlarged to cover low levels of achievement in education and health, and also take into account the dimension of vulnerability and powerlessness. Here poverty is viewed not merely in terms of low-level income but also in terms deprivation of basic capabilities (World Bank, 2000). This wider conception of poverty appears to be particularly well suited for small-scale and artisanal fishers who often live in remote and isolated communities, poorly organised and politically voiceless, and are often highly exposed to accidents and natural disasters. However, in the present study, we have confined our analysis to levels of income and vulnerability and its dimension of poverty.

Three ingredients are required to computing a poverty measure – a relevant dimension and indicator of well-being, a threshold below which an individual will be classified as poor and a poverty measure. The MPCE was chosen as the indicator of well-being. Poverty line, the cut off point separating the poor from the non-poor was then developed based on estimates of the cost of basic food

and non-food needs. The estimates were anchored on what households counted in order to meet their basic minimum needs. This line was estimated as Rs. 633 per capita per month for the year 2004 (the survey period). To measure poverty three indices were used: the head count index (incidence of poverty), the poverty gap index (depth of poverty), and the poverty severity index (squared poverty gap). These indices come under the so called FGT class of poverty measures.

The overall incidence of poverty in the fishing community was estimated as 21.2 percent, meaning that the 21.2 percent of the population could not afford to buy the basic baskets of goods for consumption. When compared to the State's rural poverty figures of 9.4 percent the incidence of poverty is found to be very high among the small-scale fisherfolk. Within the community, the incidence of poverty is much higher (25.2 percent) in the households without any fishing assets as compared to households with fishing assets (8.9 percent).

Another measure of poverty that is of interest is the poverty gap index. This measure captures the mean aggregate income (or consumption) shortfall relative to the poverty line across the whole study population. The overall index of this measure for the entire community was 0.074 and for the sub groups with and without fishing assets the indices are 0.019 and 0.092 respectively. This measure is useful to assess how much resources are needed to eradicate poverty through cash transfers perfectly targeted to the poor. In the present case where the overall poverty gap is 7.4 percent, the interpretation is that the average cash transfer (averaged over the entire population) needed to lift each poor person out of poverty represents 7.4 percent of the poverty line (i.e. 7.4 percent of Rs. 633). Since the mean income of the entire group is Rs. 1363 which is 2.15 times the poverty line the cash transfer would represent 3.5 percent of the group's mean income. Of course, given that perfectly targeted cash transfer to eradicate poverty is neither feasible or desirable, the above explanation is meant only as an interpretation of the poverty gap index.

The severity of poverty is measured by the squared poverty gap index. This index takes into account not only the distance separating the poor from the poverty line but also the inequality among the poor. The overall index was

0.037 and the indices for the asset and non-asset groups were 0.004 and 0.047 respectively.

According to the HCI, the small-scale fishing communities show a very high incidence of poverty compared to the rural population of Kerala, as stated earlier. Within the community, the incidence, depth and severity of poverty are higher for the sub group without any fishing assets as compared to the subgroup with fishing assets. The measures of depth and severity of poverty are important compliments of the incidence of poverty, and would give better insights in evaluating programmes and policies. For instance the programme may be very effective at reducing the incidence of poverty, but might do so only by lifting those who were closer to the poverty line.

Having estimated the poverty line and assessed the extent of poverty the next step is to seek answers to questions such as – 'who are the poor? In which sectors do they work? What are the characteristics of the poor that different from the non-poor?, etc'. In order to examine such questions a profile of poverty identifying the poor in terms of selected socio-economic variables was prepared. Choice of the variables to a large extent, was based on ex-ante knowledge of the major characteristics of poverty, characteristics like single parent households, households with large number of children, incapacitation of earning member, etc. were known to be more common among the poor. The comparison of these characteristics between the poor and non-poor groups can shed light on the correlates of poverty.

An examination of the poverty profile using sample data showed that the incidence of poverty was comparatively higher among households with no fishing asset, with single earner households, depending entirely on remittances or pensions and households with more than two children. Low level of literacy of the head of the household and occupation of the earner in the non-fishery sector were also seen to be characteristics associated with poor households. The gender of the household head however did not indicate any association with poverty.

Interventions for poverty reduction centre around actions to promote economic opportunities for the poor and also reduce their vulnerability to economic

shocks, natural disasters as well as to help them to cope with adverse shocks when they occur. An understanding of how the identified risk factors affected the poor will be useful in the formulation of intervention policies. With this purpose in view, the risk of a household of becoming poor in response to the identified characteristics was estimated using a logistic model. The results indicate that poverty occurs three times as often among households without fishing assets as compared to households with fishing assets. So also, the risk of households with single or no earning member being in poverty is three times that of households with more than one earning member. Households with more than two children also form a high risk group. Illiteracy of the household head and occupation in non-fishery sector are also risk factors, but not to the extent of the other three factors. When all the characteristics are combined the risk of being poor can become very high. The point to be stressed is that all households with these characteristics may not be poor at present, but their livelihoods or the external factors which shape them may have features which increase their susceptibility. These external factors include resource depletion, growth of fisheries dependent population, seasonality, conflicts, etc.

Almost all the households in the study area in varying degrees are dependent on fishery resources for their livelihood. Even though the poor and the non-poor groups dependent on these resources at the same level when measured on the share of income from fishery, in terms of quantity the poorer households use less of the resources compared to the richer.

From the examination of the income structure it was found that the main source of income of the households was fishing and fish related activities. Fishing income is derived from ownership and utilisation of fishing assets and from employment of household members in fishing and related activities. Some of the households receive income from non-fishery resources like wage employment in non-fishery activities rent from non-fishery assets and also from pension, remittances and social sharing. To understand the relative importance of fishery and non-fishery assets and fishery and non-fishery employment on household income a regression model was estimated using the sample cross section data. The estimated results indicate that the main determinant of

household income is labour in fishery followed by labour in the non-fishery sector. Ownership of fishing assets has only a limited role in explaining income differences. This is because over-capitalization has already occurred in the sector. Most of the fishermen make investment decisions on the basis of over-optimistic forecasts of yields judged in terms of past output of good fishing years. Since investments are done independent of one another and since the life span of fishing crafts is long, over-investment occurs. Further, once investment in a fishing craft is made it would be kept operating as long as it covers at least operating expenses. Government subsidies in the past have to some extent lowered the cost of private capital attracting thereby investment beyond optimum capacities rather than assisting in improving the socio-economic conditions of the fishers. Most of this money actually bolstered up fishing capacity and upgraded existing boats (Rajasenan and Mahesh, 2002).

Ownership of non-fishing assets was found to be statistically insignificant suggesting that this makes very little contribution on to household income. However, these results have to be taken with caution since a large part of the variation in household income could not be explained by the model because of the high level of uncertainty involved in income from fish harvest. Still, the results can be taken as suggestive of the lack of opportunities for other source of income especially from land-based activities. This is because most of the fishing communities live in areas where land-based activities are limited and surface transport and communication facilities are poor. Further, most of the fishermen are seaward looking with little knowledge or interest in other activities. Even so income from some of the land-based fish-related activities (e.g. fish processing, fish vending, net making, etc.) carried out by the household members of the fishermen could absorb income fluctuation from fishing.

7.2 CONCLUSIONS

The salient conclusions arising from the study are given below:

i) As per official data, in recent years, the annual harvest of marine resources in Kerala waters has gone up to around 6 lakh tonnes as against an estimated maximum sustainable yield (MSY) of 5.7 lakh

tonnes. If this trend is continued it may lead to severe resource crisis in the marine sector.

ii) The main reason for the increase in fish production is the increase in fishing efficiency achieved consequent on the large scale introduction of motorised fishing crafts, large mechanized vessels and use of destructive gears. This tendency was encouraged by the favourable market conditions attractive prices and export oriented policies of government.

iii) As fishing effort increased, individual catches and incomes began to level off, and the share of the small-scale sector, especially those of the non-motorised craft owners declined.

iv) Within the small-scale sector, incomes of fishermen vary widely. One reason for this variation is the difference in technology used in fishing. Analysis of survey data indicates that apart from technology, the other major determinant has been the number of trips undertaken. Differences in the quantum of gear used have also some influence on catch difference, but not much. This finding indicates that further large-scale investment in gear is not advisable. However, for motorised crafts, increase in engine power has a positive effect, but whether this is desirable or not has to be examined in the face of the declining resource base.

v) The average monthly percapita household income[1] of small-scale fisher households is estimated at Rs. 1363; but there exists wide disparity among households. The extent of inequality in income assessed using Gini ratio was 0.33, signalling substantial inequality.

vi) A closer look at the income data indicates that households with fishing assets have higher monthly percapita incomes. But even among such households wide inequality was observed in the value of assets. However, a detailed analysis showed that the main reason for income inequality is not possession or non-possession of fishing

[1] Here household income is synonymously used for monthly percapita consumption expenditure (MPCE) as we have discussed earlier.

assets. Subsequent analysis of the survey data indicate that the difference in household income is accounted for mainly by employment in fishing and related activities.

vii) Low levels percapita income and high levels of inequality imply the existence of a large proportion of poor people in the community who are vulnerable to external shocks.

viii) In order to quantify the extent of poverty, a poverty line based on basic minimum needs was estimated. Based on this poverty line of Rs. 633 percapita per month, the incidence of poverty was computed and found to be 21.2 percent, meaning that 21.2 percent of the population could not afford to buy the basic basket of goods for consumption.

ix) The poverty gap index and the poverty severity index, which give further insight into the other dimensions of poverty, were also worked out and found to be 0.074 and 0.037 respectively. All the three indices were higher in the case of households without fishing assets.

x) To identify the poor people, a poverty profile was developed. The profile showed that poverty was comparatively higher among households with no fishing assets, with only one earner, with more than two children, and depending entirely on pensions/remittances. All households with these characteristics may not be poor at present but when all these characteristics exist together the chance of being poor are extremely high.

xi) Almost all the households in the small-scale fishery sector in one way or other are dependent on marine resources for their livelihood. Their main source of income is employment in fishing and related activities. Possession of fishing vessels has only a limited role in explaining the income difference among households since over-capitalization has already occurred in the sector. This means that the policy should be one of promotion of labour-intensive methods of fishing and fish-related activities. Creation of appropriate non-fishery employment which is complementary to fishery related activities may help to

augment household income and provide security against income fluctuations.

xii) The study has not provided any evidence to show that poverty in the community is the result of depletion of marine resources. The two may be associated, but it is beyond the scope of this limited study to establish the nature of association between them.

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